

WILDLIFE MANAGEMENT BULLETIN



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PRELIMINARY INVESTIGATION
OF THE BARREN GROUND CARIBOU

In Two Parts

PART I. FORMER AND PRESENT
DISTRIBUTION, MIGRATIONS,
AND STATUS

by
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Wildlife Management Bulletins are produced to make available to wildlife administrators the information contained in reports which are submitted by officers of the Canadian Wildlife Service.

The reports do not, in most cases, cover extensive studies and are not written primarily for publication. Recommendations arising from the studies are not included.

Preface

This account of the barren-ground caribou inhabiting the northern mainland of Canada between Hudson Bay and Mackenzie River is concerned with an investigation by the Canadian Wildlife Service. The writer was assigned to the leadership of the investigation during the initial phase, from 1948 to 1950.

A short popular account of that phase of the investigation was prepared by the writer and published in 1951. The present publication is intended to make available to scientists and game management officers details not included in the popular version, and to present as complete an account of the subspecies as present knowledge permits.

In the preparation of this account the assistance of various officers of the Department, residents of the Northwest Territories, and others in the identification of plants, mosses, and in other matters, is gratefully acknowledged.

As indicated on the title page, this volume deals mainly with history, status past and present, range, and migrations of the caribou. Other aspects of the study including physical description, behaviour, food requirements, vital statistics, and human utilization are dealt with in a second volume published concurrently in this series as Number 10B.

INTRODUCTION

The first explorers to visit the extensive Arctic tundra of northern Canada reported innumerable herds of barren-ground caribou (Rangifer arcticus) which provided food, clothing, and shelter for nomadic bands of Indians and Eskimos. The writings of Hearne (1795), Franklin (1823), Richardson (1829), Back (1836), Rae (1850), and others contain many interesting accounts of the dependence of northern natives and explorers on this important natural resource.

The caribou is still a vital factor in the economy of more than 25,000 residents of northern Canada, including Eskimos, Indians, and European settlers living in the Yukon and Northwest Territories and the northern parts of Alberta, Saskatchewan, Manitoba, Quebec, and Labrador, far from a supply of domestic meat. Caribou meat is important in their diet and caribou hides make winter clothing not yet surpassed for warmth and lightness by a manufactured fabric. The antlers, fat, and sinews are also much utilized for domestic purposes.

In some regions, such as the Ungava Peninsula of Quebec, Labrador, and Baffin Island, reduction in the number of caribou in recent years has brought grave hardships to the native population. With the recent increased development in Canada's Arctic and sub-Arctic regions, fears regarding the status of this important big game species have been expressed. The loss of this natural resource would have grave consequences for the human population in large areas of northern Canada.

The great herds of caribou which roamed the Arctic prairies during the exploratory period were frequently compared in numbers to the bison of the great plains. The bison has been extirpated from its plains habitat except for a few herds in national parks, but the barren-ground caribou still roams the Arctic tundra in numbers comparable to those present under primitive conditions, largely because its range has not yet been fully exploited by civilization.

Because of the nomadic habits of the barren-ground caribou, the vastness of its range which is still largely unexplored, and the smallness and scattered distribution of the human population, there has always been a paucity of accurate information concerning the population and life history of the species. Many legends about the habits and movements of the caribou have sprung up and even today find firm supporters among isolated northern trappers and hunters.

There have been previous investigations of the population of this species in the Arctic steppes and sub-Arctic forests of northern Canada. W.H.B. Hoare was commissioned by the Northwest Territories Administration, Department of the Interior, to undertake a caribou survey during the years 1925 to 1927, the report of which was published in mimeographed form. Dr. C.H.D. Clarke paid particular attention to the status of barren-ground caribou as well as musk-oxen during his investigation of the Thelon Game Sanctuary in 1936 to 1937. These former investigations were handicapped by the geographical magnitude of the problem. The investigators were limited to single parties using the time-honoured means of northern travel, canoe in summer and dog-team in winter.

Cognizant of the urgent need of intensive investigation of this important natural resource, the Eleventh Conference of Provincial and Dominion Wildlife Officials, meeting in Ottawa in February, 1947, passed a resolution recommending

that a thorough investigation into the present status and utilization of the barren-ground caribou between Hudson Bay and the Mackenzie River valley, be commenced. It was recognized that the investigation must be a co-operative project, as it involved the interests of several provinces as well as those of the Federal Government.

Present Investigation

Scope

In accordance with that resolution the present investigation was undertaken by the Canadian Wildlife Service of the Department of Resources and Development, with the full co-operation of the Game Departments of the provinces of Alberta, Manitoba, and Saskatchewan.

The author was instructed to undertake the planning and direction of the field investigation. A scientific advisory committee was appointed. It was composed of Dr. Harrison F. Lewis, then Chief of the Canadian Wildlife Service (Chairman); Dr. C.H.D. Clarke, Assistant Chief, Fish and Wildlife Division, Ontario Department of Lands and Forests; Dr. I. McT. Cowan, Professor of Zoology, University of British Columbia; and A.E. Forsild, Chief Botanist, National Museum of Canada. It was intended that these eminent Canadian biologists would give guidance in the interpretation of data and the presentation of recommendations.

Because of the geographical and historical magnitude of the problem, one of the first steps was to define the scope of the investigation. The currently used classification of caribou (Rangifer) in North America is generally considered unsatisfactory because of the scarcity of representative specimens. The most generally accepted classifications are those of Anderson (1946) and O.J. Murie (1935), who have accepted the work of Jacobi (1931). Within Arctic and sub-Arctic Canada there are four recognized species, one of which (arcticus) is divided into six subspecies. Most of the forms of arcticus are economically important over their ranges, but to study the whole group in a reasonable length of time would not be practicable. Moreover, the caribou of Baffin Island and the Ungava Peninsula were known to be so reduced in number that the management policy of increased protection seemed clearly indicated; those of the high Arctic Islands were still largely unutilized and theoretically unaffected by human agencies; and those of the Yukon had already received the attention of a biologist (O.J. Murie, 1935). The area of study, therefore, was limited to the mainland of Canada west of Hudson Bay as far as the Athabasca, Slave, and Mackenzie Rivers, and from the Arctic Ocean south to the northern portions of the three Prairie Provinces. This area very closely approximates the present range ascribed to the barren-ground caribou (Rangifer arcticus arcticus), which was known to be under heavy utilization and thought still to exist in fair numbers. These geographical boundaries therefore appeared most practical.

It was decided that no taxonomic work on the geographic subspecies ascribed to the region under study would be undertaken. Although specimens

were collected, they are insufficient for study of geographic variation of the animal over the whole study area.

Although the process of gathering new information about any species of animal is an unending one, it was decided, for practical reasons, to limit the preliminary investigation to the years 1948 to 1950. It was thought that by the latter date, sufficient fundamental data to form the basis for initiation of a management program for the subspecies would have accrued.

The objects of the investigation were of two general kinds: those of basic research and those of practical consideration. The main objectives concerned only the race under study and were as follows:

- (a) To ascertain present status, distribution, and movements.
- (b) To determine the current population trend and its causes.
- (c) To investigate life history and ecological relations.
- (d) To analyse human utilization.
- (e) To present a program for future management.

Information Available

There was on hand a considerable amount of information dealing with the race, which had accumulated over a period of almost 200 years. This information, largely dealing with occurrence and life history, was available in the exploration literature. Further information had accumulated in the files of the Department of Resources and Development. Since 1934 mimeographed Caribou Questionnaires had been distributed annually in the Northwest Territories to traders, trappers, travellers, and police. These questionnaires, which were available for analysis, refer to localities and seek information concerning the dates of occurrence of caribou, change in abundance, migration direction, diseases, and utilization. Since 1934, Native Game Returns had been distributed to the Royal Canadian Mounted Police detachments in the Northwest Territories. On these forms the numbers of fur traded and big game killed were reported for each native. The information was collected by direct questioning and by consultation with local traders. These forms also were available for analysis.

Besides these data there were on hand many individual reports dealing with local caribou conditions. These included regular game reports of Royal Canadian Mounted Police detachments and wardens of the Forest and Wildlife Service of the Northwest Territories Administration.

Through the co-operation of the Chief Game Officers of the provinces of Alberta, Manitoba, and Saskatchewan, reports from their field staffs were forwarded for study.

Methods

Plans for the field investigations were drawn up during the winter of 1947-48. It was decided that both extensive and intensive methods of investigation were required.

It was evident that, because of the immensity of the area to be investigated, aircraft must be used extensively as a means of transportation as well as for observation. The extensive field work was to be accomplished by aerial reconnaissance and photography. From this type of observation, data concerning distribution, migration routes, abundance, herd segregation, and effect of predators could be obtained.

Aerial reconnaissance was found to be a particularly useful means of studying the barren-ground caribou. During the months of April and May, when the days were lengthening, there were frequent long spells of clear cool weather, making ideal flying conditions. At that season the caribou were concentrated and in migration, and were easily observed against the snow-covered landscape of the treeless tundra. In the forested regions caribou usually frequented during migration the chains of frozen lakes and bogs, where they were equally well discernible (Fig. 1).

It was found that the type of aircraft best suited for work of this kind was one with the following characteristics: long range, high-wing monoplane, ski equipment, good visibility from the ports, ports which open for photography, generally a low speed, good manoeuvrability and take-off performance. The Norseman proved to be the most suitable aircraft, although the Beaver was also fairly well adapted for this type of work.

The technique employed was to fly at an altitude of 500 feet above the ground on irregular courses over territory expected to contain caribou. Two observers, one of whom might be the pilot, were employed. The investigator carried a map on a clipboard on which the course was plotted. Care was taken to observe and plot distant objects to the side of the flight course at a distance as far as caribou could be observed. This was important in order to obtain the width of the transect covered by the flight. If frequent ground checks of distant caribou bands were made, the altitude of the aircraft was not needed in calculating the transect width. When a caribou herd was sighted the course was altered to follow a large circle in order to ascertain the area occupied by the herd. The location and approximate number of caribou observed were plotted on the map. If a herd was large, an aerial photograph was taken to check the estimated number, and the number of the photograph was recorded beside the record of the herd. The direction of movement, as well as tracks, was also recorded on the map.

Aerial photographs were taken with a Fairchild K20 4 x 5 inch semiautomatic camera. This is a hand-held instrument which takes a roll of 50 pictures. It has a trigger release and the film and shutter are rewound with a single crank. On clear days over the snow most pictures were taken on Super XX films, at f-8.0, 1/500 sec. with K2 filter. If the purpose was only to count the caribou, the picture could be taken at altitudes up to 1,000 feet. If it was intended to classify the herd the altitude could not be much greater than 300 feet (Fig. 2).

Air service was provided in some cases by the Royal Canadian Air Force and the Manitoba and Saskatchewan Government Air Services, and pilots of the Royal Canadian Air Force on northern duty turned in numerous valuable observations concerning the movements of caribou. The greater part of the flying, however, was done by private charter of local air services in northern Manitoba and the Northwest Territories.

Besides extensive aerial observations, intensive research was undertaken at a series of ground stations throughout the caribou range at various seasons in order to supplement and verify aerial observations and obtain as complete as possible an understanding of the various seasonal aspects of the problem. At the ground stations particular emphasis was placed on studies dealing with life history, ecology, pathology, food requirements, predation, sociology, and human utilization.

Information also was gathered by means of frequent interviews with interested persons, by questionnaires, and by co-operative action with other agencies.

Before the field work commenced, detailed plans providing for standardization of data collected by the field parties were drawn up. Standard caribou observation cards and post-mortem cards were designed. On these cards were recorded data extracted from all literature references. Standardized instructions for range studies and collection of parasites and various types of specimens were issued.

Itinerary

Previous to the present investigation, during July and August, 1946, the author travelled down the Mackenzie River to the delta region. Although he was engaged in other wildlife investigations at that time, there arose many opportunities to make observations concerning distribution of caribou, both past and present. The Government reindeer herd on Richards Island was also inspected.

On April 13, 1948, the writer flew from Ottawa to Churchill, Manitoba, and from then until May 24 carried out aerial reconnaissance of the northward migration of caribou in northern Manitoba and southern Keewatin District. Routes, dates, and manner of migration, as well as data on sex and age classification, predation, and pathology of specimens examined, were recorded.

On May 21 1948, A. H. Lawrie and F. M. Mowat arrived at Churchill from Ottawa, and were flown to Nueltin Lake, Keewatin, where they established their base camp. During June they collected information on wolf predation. On July 20, they were flown to a summer camp on Angikuni Lake from which they travelled by canoe westward to Kamilukuak Lake, returning to Angikuni on August 6. They were able to gather pathological and life history information on the forerunners of the summer migration of caribou observed along the route. On August 15 they returned to Nueltin Lake, where the southward-moving caribou were again met.

The writer again left Ottawa on June 25, 1948, was joined by A. L. Wilk in Edmonton, proceeded to Fort Smith and Fort Reliance, N.W.T., by air, and finally established a base camp at Lake Clinton-Colden on July 6. During July a canoe trip was made northward to Muskox Lake on the Back River. In August, after return to Lake Clinton-Colden, a trip was made eastward, down the Hanbury River to Sifton Lake. The party was picked up on September 2 and flown to Fort Smith.

Abundant information concerning caribou summer food requirements and available range forage, and data on pathology and predation were collected.

During the autumn of 1948, Mowat observed the southward migration of caribou from October 13 to the end of December at Brochet, Manitoba. Lawrie remained at Nueltin Lake until December 15 and collected information on Eskimo hunting techniques and caribou rutting behaviour. From November 3 to 20, Lawrie accompanied a group of Eskimos by dog-team to Cognac River and back to Nueltin Lake. He made valuable first-hand observations on Eskimo hunting methods and caribou utilization along the route.

W. E. Stevens obtained data on caribou during a flight from Aklavik to Fort Good Hope and eastward across the Anderson and Horton Rivers in October, 1948.

From November 13 to December 13, 1948, through the co-operation of the Manitoba Department of Mines and Natural Resources, the writer observed the southward migration of caribou along the Hudson Bay Railway. A base camp was established at Ilford, Manitoba, and frequent trips were made by gas-car as far as Churchill. D. Peterson joined the field staff at this time and remained at Ilford, making observations and field patrols. From January to April, 1949, Lawrie and Peterson operated from Ilford, carrying out both ground surveys and aerial reconnaissance through the co-operation of the Manitoba Air Service, covering the winter range of caribou in Manitoba and visiting many northern settlements.

During the period January 20 to February 10, 1949, the writer carried out reconnaissance flights over northern Saskatchewan through the co-operation of the Saskatchewan Department of Natural Resources and the Saskatchewan Government Air Service. Much useful information on caribou pathology, movements, and utilization was gathered.

During the winter of 1948-49, W. A. Fuller was able to observe wintering caribou herds between Great Slave and Athabasca Lakes. During the period March 20 to 23, 1949 he carried out three reconnaissance flights in northern Alberta and Saskatchewan and southern Mackenzie District, in the area north and east of Lake Athabasca, and observed caribou movements.

Extensive aerial survey of the Mackenzie District caribou herds was undertaken by the writer during the period April 16 to May 6, 1949, from bases at Yellowknife and Fort Reliance. Long reconnaissance flights were made north and east of Great Slave Lake. Large numbers of migratory caribou were observed and information on migration routes, wolf predation, calf survival, and caribou behaviour patterns was gathered.

After a short stay at Churchill, Manitoba, Lawrie and Peterson proceeded northward to Baker Lake on May 16, 1949, by air. On June 1, they were transported westward to Beverly Lake, where they established a camp and observed caribou on their summer range. On August 2 they were flown south to Nueltin Lake, where they completed range studies and Eskimo utilization observations. Their field studies concluded at Churchill on September 1, 1949.

On June 18, 1949, the writer and A. L. Wilk again arrived at Fort Smith. Due to the lateness of the season, delay in reaching the caribou on their summer range was experienced. The period June 25 to July 11 was spent in carrying out vegetation studies on the winter range in the vicinity of Fort Reliance and the Lockhart River. On July 11, transport by air was provided to Bathurst Inlet, where much valuable information concerning Eskimo utilization of caribou, as well as data concerning caribou on the grounds, was gathered. During the latter part of July, the United States Fish and Wildlife Service provided an opportunity to observe caribou concentrations north to Arctic Sound, as well as on a reconnaissance flight eastward to the Perry River. The period August 1 to 20 was spent at Contwoyto Lake where interesting data dealing with Eskimo hunting techniques and caribou utilization during the summer migration were collected. The writer concluded his field investigations at Fort Smith on August 23, 1949.

In February, 1950, J.P. Kelsall joined the staff of the investigation and made an aerial survey of herds in northern Manitoba and southern Keewatin District from a base at Churchill, his flights extending as far north as Chesterfield Inlet and as far west as Wholdaia Lake. He also gathered valuable information on caribou utilization at Duck Lake Post, Manitoba.

The routes travelled during the investigation, including reconnaissance flights and canoe trips, as well as the ground stations where intensive research was carried out, are indicated in Figure 3.

General Description of the Physical Environment

The present range of the barren-ground caribou is confined to the Northwest Territories and the northern parts of Alberta, Saskatchewan, Manitoba, and Ontario. In the Mackenzie District it extends east of the Mackenzie River; in Franklin District, on Boothia Peninsula and Victoria, Baffin, Southampton, and Coates Islands; and in Keewatin District, throughout the District.

On the mainland the range is fairly well delineated by the limits of the Precambrian Shield. Caribou are common on the Archean acid rocks, composed of granite, granite-gneiss, and granitized sedimentary rocks. They occur less commonly on Proterozoic sedimentary rocks, and infrequently on volcanic metamorphosed rocks, such as are found in the immediate vicinity of Flin Flon, Manitoba, and Yellowknife, Mackenzie District. Occasionally during the winter months caribou bands reach areas underlain by early Palaeozoic rocks beyond the Precambrian Shield in the Mackenzie District.

This vast area is generally of low relief. There is a gradual slope to the north. Numerous low wet prairies interspersed by rock outcroppings occur. There are some regions of rugged mountainous terrain, with elevations up to 2,500 feet, and still other regions of rolling terrain. Lakes are exceedingly numerous and occupy a large part of the total area. The land is criss-crossed by eskers of sand and gravel and many old beach lines are found. The soils are, in general, poor. Over the Precambrian Shield the soil layer is shallow or lacking entirely. In other areas it is primitive in nature, being composed of poorly differentiated rock materials. Humus in association with the coniferous forests is generally shallow and acid in reaction. Because of the underlying permafrost or rocky substratum there are numerous bogs.

The climate is characterized by long rigorous winters, with extremely low temperatures and moderate to light snowfall. The vegetative growing season is confined to the short summer period, which is moderately warm and dry. Frosts and snow may be expected during any month of the year. Since extremes of climate and not average conditions determine the distribution of organisms, these extremes have been examined and recorded in connection with the caribou distribution.

The average annual extreme low temperatures for northern stations have been plotted in Figure 4, and isotherms have been drawn. The average annual extreme low temperature over the caribou winter range was found to vary from -60°F. to -45°F. There is a tendency for caribou to desert during the winter the central tundra, around which the -60°F. isotherm is drawn. Small bands, in the winter, occur along the coasts in the region of the -55°F. isotherm.

Average annual extreme high temperatures are indicated by isotherms in Figure 5. Most of the caribou are north of the isotherm of 80°F. in early summer when this temperature may be reached. The range of temperature tolerance for this species is, therefore, at least 140°F.

The average yearly rainfall is indicated in Figure 6. During the period when rain falls the caribou are generally to be found north of the line indicating an average rainfall of six inches. The summer range is characterized by light rainfall, five inches or less.

The average annual snowfall is indicated in Figure 7. During the winter months the snowfall is heavier on the central tundra than on the coasts or in the forested belt. At this period most of the caribou are to be found in the forested regions, where the average snowfall is 45 to 55 inches.

The whole distributional range is cut by timber-line which indicates a fundamental division in the environment. The timber-line roughly approximates the permafrost line. On the tundra side of the timber-line the vegetation is characterized by lichens, shrubs, and herbaceous plants; on the other side lies the continental spruce forest.

When the ecological associations of the barren-ground caribou are considered, it is found that the form is not confined to any one major biotic formation. Bands of caribou may be found in different biotic units depending on the season, year, or herd under consideration. Caribou cannot be used as an indicator-species of any biotic unit unless the conditions are carefully defined. Being an exceedingly mobile species it may cross the boundaries of several ecological units.

According to Merriam's Life Zone concept this species must be considered as a member of both the Arctic and the Hudsonian Life Zones. Occasionally during winter incursions it may even penetrate the Canadian Life Zone indicated on the map presented by Anderson (1937b).

If we adopt Shelford's biome concept, the species is a transient member of the Tundra and Taiga Biomes. Tundra is the ecological term correctly applied to the zone beyond timber-line. The term is of Siberian origin and is synonymous with the North American popular term, "barren-grounds". Taiga is similarly of

Siberian origin and refers to the coniferous forest belt adjacent to the tundra on the south (Allee, W. C. et al. 1949). More particularly the species is a transient member of the spruce-fir association of Shelford and Olson (1935), of the Taiga Biome.

There is some confusion in the use of the word taiga. Most European authors use it in describing the structure of the park-like spruce communities near timber-line. Allee et al. (op. cit.) give it a floristic interpretation referring to the northern coniferous forest. The latter interpretation is followed in this report.

If we follow the nomenclature of Dice (1943), the barren-ground caribou is a member of the faunas of both the Eskimoian and the Hudsonian Biotic Provinces. The seasonal aspect of this problem is treated under Present Distribution.

Historical Records of Barren-ground Caribou

The first reference to barren-ground caribou was probably that of Martin Frobisher in 1576, as recorded by Purchas (1625). Speaking of Frobisher Bay, Baffin Island, Purchas writes "Hauing entered threescore leagues, hee went on shore and was encountered with mighty Deere, which ran at him with danger of his life". Another early popular account of the species was given by Pennant (1784).

The earliest detailed account of the life history, migrations and utilization of the race was given by Hearne (1795), in describing his trip overland from Fort Prince of Wales (Churchill) to the Coppermine River. The subspecies was first described for science by Richardson in 1829. He based his description on data gathered during the First Franklin Expedition. The type locality chosen was Fort Enterprise, at the headwaters of the Snare River, north of Great Slave Lake. He also presented much information on the life history and native utilization of the species, which formed a basis of knowledge of this animal and to which little was added for more than 100 years.

During the 19th century the journals of the explorers of northern Canada contained numerous references to the species, usually in the form of casual locality records and observations. Some of the more important of these are contained in the writings of Franklin (1823, 1828), Back (1836), Richardson (1829, 1851), Lyon (1824), Rae (1850, 1852, 1888), Gilder (1881), J. B. Tyrrell (1896, 1898), J. W. Tyrrell (1902), Parry (1824), Simpson (1843), Ross (1835), and Collinson (1889).

During the latter part of the 19th century there appeared several popular accounts of Arctic fauna which were written by naturalist hunters and contained caribou observations. Some of the more important of these are by Schwatka (1885), Pike (1892), Hanbury (1904), J. W. Tyrrell (1908), Russell (1898), Seton (1911), Munn (1932), Critchell-Bullock (1930-31), and Whitney (1896).

In the early years of the present century biological investigations in northern Canada were carried out by trained observers. Their reports contain much valuable information on caribou distribution and movements. Under this heading are such publications as: Stone (1900), Preble (1902, 1908), Anderson (1913b), Stefansson (1913), and MacFarlane (1905). Recently there have been several reports by scientists on expeditions supported by the Canadian Government, which have presented caribou data. Such reports were made by: Jenness (1922), Hoare (1930), Porsild (1929, 1945), Blanchet (1930), Burwash (1931), and Clarke (1940, 1944).

From these and numerous other reports it is possible to obtain a fairly complete picture of the distribution and movements of the barren-ground caribou in northern Canada at the time of the first visits of Europeans to the area. The range of the species at the time of first exploration is discussed in the following paragraphs.

Former Summer Range

Northwest Arctic Coast.- On Richards Island, at the mouth of the Mackenzie River and about the Eskimo Lakes to the eastward, caribou were once abundant during the summer months (Franklin, 1828). Porsild (1929) interviewed in 1927 an old Eskimo who stated that he hunted caribou in the Eskimo Lakes area when he was first married. Porsild noted the species to be fairly numerous in the area and observed deeply worn trails indicating a larger population in the past. McFarlane (1905) recorded that large numbers of caribou spent the summer on the tundra around the mouth of the Anderson River about 1858. Caribou bands reaching the Arctic coast in May at Franklin Bay were reported by Stone (1900). They were reported from Liverpool and Darnley Bays during August, 1848, by Richardson (1851). Stefansson (1913) reported scattered bands during the summer of 1911 on the tundra bordering the Horton River. There is a gap in the observations from Pearce Point (Stefansson, 1913) to Dolphin and Union Straits in the Bernard Harbour region. Here Stefansson records numerous bands crossing the straits to Victoria Island on May 1, 1911. He travelled among them across the straits, and on May 12, south of Prince Albert Sound, was still in the midst of moving herds. This was an annual movement also observed from 1915 to 1919 by Hoare (1927) who estimated the herds to number in the millions.

Great Bear Lake.- Bell (1901) recorded that summer ranges extended from the Coppermine River to 60 miles west of Fort Confidence on Dease Arm of Great Bear Lake. According to Preble (1908) small bands of caribou were reported to spend the summer in the vicinity of Great Bear Lake. He also mentioned that there were a few on Leith Point during the summer months, but that the main range was on the tundra east of the lake.

Coppermine River.- The Coppermine River drainage was first reported as the summer home of large herds of caribou by Hearne (1795). Franklin (1823) also reported herds in this area during his first expedition. Porsild (1929) found caribou fairly numerous in the Dismal Lakes region in May, 1928.

Central Arctic Coast.- During July and August, 1821, Franklin's party observed numerous bands of caribou along the south shore of Coronation Gulf from Tree River to Cape Turnagain on Kent Peninsula, including Detention Harbour, Arctic Sound, Hood River, Western River, and Melville Sound. They also observed caribou on the islands in Bathurst Inlet. Hanbury (1904) saw frequent small groups on Kent Peninsula on May 30, 1901. From Kent Peninsula large herds crossed the ice to Victoria Island during the early summer. Collinson (1889) reported large herds in the vicinity of Cambridge Bay during October, 1852, awaiting the freezing of the straits. During the spring of 1901, Hanbury (1904) travelled north from Aberdeen Lake to Ogden Bay, Queen Maud Gulf, amid northward moving caribou. On May 11 he reached the coast and observed scattered bands. Proceeding west, he encountered other bands.

Eastern Mackenzie District.- Inland in eastern Mackenzie District, Back (1836) observed large concentrations of caribou along the Back River in the early summer of 1834, especially in the vicinity of Lake Beechey. Franklin (1823) reported caribou on the upper Yellowknife River in August, 1820. Munn (1932) observed a concentration of many thousands of caribou on the shores of Artillery Lake in July, 1892. Lakes Aylmer and Clinton-Colden were reported as summer range in 1856 by Anderson and Stewart (Clarke, 1940-41). Large numbers of caribou were reported along the Hanbury and Thelon Rivers during July by J. W. Tyrrell (1902), Hoare (1930), Critchell-Bullock (1930-31), and Clarke (1940). The last-named observed a movement of an estimated 100,000 to 200,000 animals at Hanbury Lake. J. B. Tyrrell (1898) encountered a herd estimated at 100,000 to 200,000 animals on the shores of Carey Lake of the Dubawnt River system on July 29, 1893.

Keewatin District.- On August 14, 1894, Tyrrell observed a large herd at Ennadai Lake, Kazan River. Farther north, near Yathkyed Lake, he noted a caribou crossing point where the natives speared them. Porsild (MS.1930) reported scattered bands of caribou along the Kazan River in summer. Downes (1943) reported them from Nueltin Lake. Farther north, on the lower Thelon River, caribou were reported by Hanbury (1904) to be plentiful in the summer near Aberdeen, Beverly, and Baker Lakes. On the lower Back River caribou were recorded by Back (1836) and Schwatka (1885). The latter explorer also observed small groups in the Wager Bay district in the spring of 1879.

Northeast Arctic Coast.- On the eastern Arctic coast, Adelaide Peninsula was recorded as summer range in 1856 by Anderson and Stewart (Clarke 1940-41). Schwatka (1885) observed large herds on King William Island during the summer of 1879. During the autumn, herds numbering several thousand were observed crossing Simpson Strait to the south on the first solid ice. The Eskimos told Schwatka that there was usually a second movement from Boothia Peninsula. On that peninsula Ross (1835) recorded great numbers, which arrived from the south in April and May. MacFarlane (1905), writing of the period about 1857, reported that the barren-ground caribou crossed Bellot Strait to spend the summer on Somerset Island, where they were recorded by Ross (1835). The summer movement of caribou to Melville Peninsula was recorded by Rae (1850) at Repulse Bay and also as far north as Fraser Bay on the west side of the peninsula.

Hudson Bay Coast.- Along the north-western coast of Hudson Bay caribou were recorded in summer from Chesterfield Inlet to Igloolik by Lyon (1824) and Parry (1824). They were reported in summer at Wager Bay and Winchester Inlet by Schwatka (1885), at Chesterfield Inlet by Lyon (1824), at Rankin Inlet by Hanbury (1904), and at Eskimo Point by Preble (1902). A few caribou were reported to remain on the tundra east of Churchill, Manitoba, during the summer months by both Preble (1902) and Hanbury (1904).

Hearne (1795) stated that the southern limit of the barren-ground caribou range was the Churchill River. He spoke of large herds of "woodland caribou" which spent the winter months in the vicinity of the Nelson River. These herds travelled east in spring, crossing the Nelson and Severn Rivers in May, to spend the summers on the low shores of Hudson Bay east of Fort Severn. In the autumn they returned inland and migrated northwest, crossing the Hayes River about forty miles above York Factory. Preble (1902) gave the same account and reported Cape Churchill as the northern "fringe" of bands which migrate to the southern Hudson Bay Coast in spring, crossing the Nelson and Hayes Rivers.

On the other hand, J. W. Tyrrell (1908), giving an account of a trip by dog-team from Churchill to the Nelson River in November, 1893, wrote of observing bands of barren-ground caribou along the route. J. B. Tyrrell (1913), during his exploration of northern Patricia District, Ontario, in 1912, reported that barren-ground caribou spent the summer on the Hudson Bay shore west of Severn River and migrated west to the Hayes River, Manitoba, in the autumn. He quotes David Thompson as observing a herd of barren-ground caribou crossing the Hayes River eastward in May, 1802.

H. Conn of the Indian Affairs Branch, Department of Citizenship and Immigration, has stated that older Indian hunters at Fort Severn and Winisk, Ontario, remember hunting migratory barren-ground caribou in the autumn as they migrated southwest from the narrow tundra strip along the southern coast of Hudson Bay. Robert Smith, U.S. Fish and Wildlife Service, Klamath Falls, Oregon, has reported that during a waterfowl survey of the west coast of James Bay in 1944 he discovered antlers of the barren-ground type at Cape Henrietta Maria.

At present it is generally believed that woodland caribou (Rangifer caribou) do not undertake wide-ranging migratory movements, such as are characteristic of the barren-ground caribou. It therefore seems probable that the range of the barren-ground caribou formerly extended eastward along the shore of Hudson Bay as far as Cape Henrietta Maria and that Hearne and Preble erroneously believed these to be woodland caribou.

Individual caribou were sometimes reported during the summer in areas usually considered winter range and were considered as stragglers. The few caribou observed on the coast of Hudson Bay east of Churchill, Manitoba, may be considered in this classification. J. B. Tyrrell (1896) reported killing a barren-ground caribou on the north shore of Cree Lake in Saskatchewan in July, 1892.

Former Winter Range

Summer was the period when early explorers did most of their travelling, therefore there are relatively few winter accounts of the caribou.

Northern Mackenzie District.- The timbered areas on the east bank of the Mackenzie River north of Arctic Red River were described as former winter range by Porsild (1929). Caribou were reported to winter in large numbers in the upper Anderson River valley by MacFarlane (1905). In the Great Bear Lake region, Stefansson (1913) reported large numbers spending the winter in the vicinity of Dease Arm; and Franklin (1828) reported herds in winter in the vicinity of Fort Franklin. Stefansson (1913) reported that about 50 years previous to 1908 herds of caribou used to migrate in winter as far west as the Mackenzie River in the vicinity of Fort Norman.

Great Slave Lake.- Large herds were reported by Russell (1898) to have migrated westward through Fort Rae in 1887 to spend the winter west of the north arm of Great Slave Lake. Preble (1908) also reported herds wintering in the vicinity of Fort Rae and that the area west of the Camsell River was a winter range of the species. Small numbers of the caribou were reported by Franklin (1823) as spending the winter on the lower Yellowknife River. During the winter 1833-34, when Back wintered at Fort Reliance, Great Slave Lake, caribou were so scarce as to cause extreme hardship to Indians and Europeans. He received reports, however, that they were fairly common near timber-line north of MacLeod Bay and also along the upper Thelon River, far to the southeast. Hoare (1930) reported that herds carried out nomadic counter-clockwise movements in the vicinity of the timber-line between Artillery Lake, McKay Lake, Snowdrift, Eileen Lake, and Fort Reliance, during the winter of 1928-29. Critchell-Bullock (1930-31) reported winter movements in the Ptarmigan River area.

Southwestern Range.- Preble (1908) reported that herds spent the winter of 1900 about a day's journey east of Fort Smith. Harper (1932) reported that the caribou regularly frequented the Talston River valley in the winters up to 1911 but not subsequently, because the timber had been burnt off. He also stated that every ten years or so caribou crossed Lake Athabasca near Burntwood and Bustard Islands, to winter on the south side of the lake. Preble (op. cit.) reported that Indians told him that the species used to reach Fort McMurray, Alberta, in winter. J. B. Tyrrell (1896) stated that the winter range extended as far south as the southern tip of Reindeer Lake, and west to the Mudjatick and Foster Rivers and Cree Lake in Saskatchewan.

Southeastern Range.- Hearne (1795) reported that in Manitcha herds of barren-ground caribou occurred along the Churchill River in the winter months. The winter occurrence of herds of caribou in the Nelson River drainage was also described by Hearne (op. cit.) and Pennant (1784). J. W. Tyrrell (1908) told of hunting wintering herds of caribou between Churchill and York Factory during November, 1893. Preble (1908) gave the dates of appearance of the migrating caribou at Brochet, Reindeer Lake, as recorded by Joseph Hourston from 1873 to 1890.

Tundra.- Although it seems that most of the caribou crossed the timber-line and entered the spruce forests for the winter, small groups were reported by the early explorers on the barren grounds during winter months. Schwatka (1885) observed scattered groups during his winter crossings from Winchester Inlet, Hudson Bay, to the mouth of Back River in the years 1879 to 1880. He also reported that scattered groups were found regularly in winter along the Hudson Bay coast from Chesterfield Inlet north to Wager Bay. Hanbury (1904) reported herds of caribou in the vicinity of Schultz and Aberdeen Lakes on the Thelon River during the winter. On the Arctic coast, wintering bands of caribou were recorded on Kent Peninsula by J. W. Tyrrell (1902). The natives told him that none wintered between Cape Barrow and the Coppermine River or eastward from Kent Peninsula to Ogden Bay.

Caribou Crossing Points.- The location of well-used migration crossing points was of great importance to natives and European explorers relying on the barren-ground caribou for their existence on the tundra and in the sub-Arctic forests. These favourite crossing points have been recorded in the writings of explorers and naturalists. Some of the most important references to crossing points were as follows: Anderson River (MacFarlane, 1905), the upper Dease River (Stefansson, 1913), Dolphin and Union Straits (Stefansson, 1913), Kent Peninsula to Cambridge Bay (Collinson, 1889), Bathurst Inlet (Hoare, 1927), Contwoyto Lake (Hearne, 1795), Fort Rae (Russell, 1898), Point Lake (Hearne, 1795), Athabasca Lake (Harper, 1932), Fond-du-lac (J. B. Tyrrell, 1896), Dubawnt River (J. B. Tyrrell, 1898), Kazan River (Hearne, 1795), Lac Brochet (Preble, 1908), Camsell River (Preble, 1908), Churchill River (Hearne, 1795), Nelson River (Hearne, 1795), Repulse Bay (Parry, 1824), Isthmus of Boothia (Ross, 1835), Simpson Strait (Schwatka, 1885), Bellot Strait (MacFarlane, 1905).

Estimates of the Population.- It is difficult to estimate the number of caribou which existed upon the arrival of the first explorers, but their descriptions lead to the conclusion that it was larger than exists today. Many of the earlier naturalists estimated the total number of barren-ground caribou in the area of the present investigation. One of the most popular estimates was made by Seton (1929), who estimated a population of thirty million caribou in the central barren grounds of northern Canada in 1907. Most writers grossly over-estimated the herds of caribou observed during massed migration, and introduced a second error into their calculations by assuming an equally dense concentration of caribou beyond the field of view.

The most reliable previous estimate was that of Anderson (1938) who based his calculations upon the carrying capacity of the Arctic tundra and his knowledge of the total caribou range. He estimated a total population of approximately two and one-half million on the continental barren-grounds west of Hudson Bay. Clarke (1940) accepted this estimate as a result of his investigations of the Thelon Game Sanctuary.

The former summer and winter distribution, as gleaned from published reports and interviews with old residents, have been indicated in Figure 8. From this map the former winter range has been estimated at about 350,000 square miles. Based upon intensive range and feeding studies in Alaska, Palmer (1944) estimated a population density of five to ten caribou per square mile of

their environment. If a former concentration of five caribou per square mile of winter range is assumed, the estimate is 1,750,000 for the former population of barren-ground caribou. Considering that the carrying capacity of the winter range probably limited the total population, and that no allowance for areas of water and uninhabitable areas in the range has been made, this seems to be a fair estimate of the population at the time of the advent of Europeans.

Present Distribution

During the decade preceding 1950, there appeared several papers containing caribou distribution records made during expeditions in that period. These publications of Clarke (1944), Soper (1942), Porsild (1945), Manning (1943 and 1948), Harper (1949), Gavin (1945), and Croft and Gunn (1946, MS) have been used in the preparation of the present distribution analysis. To these published data have been added the information available on the caribou questionnaires since 1940, in Royal Canadian Mounted Police reports, and in the records obtained during the present investigation from the observations of the field staff and from interviews with northern residents and travellers. The exposition of the present distribution is based on the known movements of caribou during the decade 1940 to 1950.

Winter Ranges

Small herds and scattered bands of caribou remain all winter on the tundra, usually on the Arctic and Hudson Bay coasts or on the shores of large lakes, such as Baker and Clinton-Colden Lakes. The tundra wintering grounds are usually undulating areas with slopes frequently blown free of snow.

Aside from these scattered herds and small bands, in the winter most of the caribou are found distributed in the transcontinental taiga belt from the Mackenzie delta to extreme eastern Manitoba and rarely into northwestern Ontario. Generally the caribou remain in the northern spruce-fir association (Shelford and Olson, 1935) of the larger Taiga Biome, or the Hudsonian Zone of Anderson (1937b) and others. Locally the more southerly taiga associations, or the Canadian Zone (Anderson, op. cit.) of the Mackenzie-Athabasca valley and central Saskatchewan and Manitoba, may be invaded during certain winters. During mild seasons the herds often congregate in the vicinity of timber-line. During mild spells they may retrace their paths to the tundra, only to re-enter the forested belt on the return of severe winter conditions.

The herds do not return each winter to the same areas. Usually a herd returns for several successive winters to the same locality, then abandons this area and spends several winters in an area fifty to several hundred miles away. The reasons for this are not clearly understood. Factors such as weather and forest fires must be considered, but it is probable that failure of the food supply upon a frequented winter range necessitates movement to another area.

The present winter distribution of caribou is shown in Figure 9. The areas currently supporting heavy winter populations, indicated by cross hatching, are surrounded by other areas frequented by scattered bands, or areas only irregularly invaded by caribou herds.

In the Mackenzie District the regular taiga winter range extends from the forks of the Anderson River in the extreme northwest and includes Colville Lake; the north shore of Great Bear Lake, including Dease and Smith Arms; the Dease River basin; Fort Franklin district and the Bear River; Hottah Lake; the Camshell River valley; Lac Taché; Lac la Martre; the lower Snare River; the northeast and southeast shores of Great Slave Lake, including the Wecho, Yellowknife and Beaulieu River systems; and Nonacho Lake and the Talston River system and eastward to the upper Dubawnt River, Wholdaia, and Selwyn Lakes.

In Alberta, the winter range lies along the eastern bank of the Slave River from Fort Fitzgerald to Fort Chipewyan, rarely extending west of the Slave River and to the south shore of Lake Athabasca, the Athabasca River, and Lake Claire. In Saskatchewan, it extends from the northern shore of Lake Athabasca southward, including Black and Wollaston Lakes, the southern tip of Reindeer Lake, the Foster Lakes, Cree Lake, and the upper Clearwater River. In Manitoba, the winter range extends eastward from the Cochrane River and Reindeer Lake, and includes the Upper Seal River drainage, the Churchill River system, Nelson House, the Nelson River as far south as Cross Lake, the Hayes River, Gods Lake, and the Ontario boundary.

During the winter months scattered bands of caribou occur on the timber-line in the vicinity of the Horton River, Coppermine River, Lockhart River, upper Thelon River, Dubawnt River, Kazan River, and Nueltin Lake.

The extreme distances that the caribou have penetrated the taiga belt in recent years are as follows: 30 miles east of Fort Good Hope (1946-7); the Mackenzie River crossed in the vicinity of Norman Wells (1945-6); ten miles east of Fort Norman (1946-7); Johnny Hoe River (1938-9); Willow Lake River, 40 miles north of Fort Simpson (1949); Yellowknife (1941); Wood Buffalo Park (1939-40); Lake Claire (1938-9); Embarras Portage (1942-3); Clearwater River (1936-7); Churchill River, Saskatchewan (1943-4); Stanley, Saskatchewan (1946-7); The Pas, Manitoba (1946-7); Cross Lake (1945-6); Island Lake (1943-4); and Little Sachigo Lake, Ontario (1947).

The tundra regions frequented by caribou during the winter months are as follows: in Mackenzie District, the upper Horton River, Coronation Gulf coast, the islands in Bathurst Inlet, the upper Thelon River; in Keewatin District, the mouth of the Back River, the base of Boothia Peninsula, Wager Bay, Winchester Inlet, the lower Thelon from Aberdeen Lake to the eastern end of Baker Lake, the western coast of Hudson Bay from Rankin Inlet south to Nunalla; in Franklin District, the western and eastern coasts of Melville Peninsula (Manning, 1943).

The area delineated on Figure 9, which may be considered the normal winter range, has a total area of approximately 295,000 square miles.

Summer Ranges

During late winter, in April and May, with the lengthening of the daylight hours and the fine weather which generally occurs at that season in the Arctic and sub-Arctic areas, there is a general movement of caribou to-

wards the tundra. During the "summer" months of June, July, August, and September, all but a few of the caribou inhabit the tundra, in Mackenzie, Keewatin, and Franklin Districts of the Northwest Territories and in Manitoba.

Throughout these months the herds are generally in movement. In June and early July the movement is away from the timber-line. In late July or early August the direction is reversed and by the first of September, most of the caribou are again in the vicinity of the timber-line. With the approach of the rutting season in autumn there is a second movement out on the tundra. These movements will be considered in more detail in a later section.

As in the case of winter ranges, the same summer ranges are not frequented indefinitely. For several years a large herd may spend the early summer in a certain area only to desert it in subsequent seasons. Again it seems that forage requirements necessitate the utilization of different ranges.

The areas which generally support large concentrations of caribou during the summer months along with marginal areas inhabited by scattered groups or only occasionally frequented by large numbers of caribou, are indicated in Figure 10.

Not all the caribou, however, reach the tundra in the summer. W. Macdonald, of Yellowknife, reported observing a small group of caribou on the southeast shore of Lake Athabasca during the summer of 1935. The same summer caribou were reported to Clarke (1940) from the Fort Fitzgerald area, Hill Island Lake, and north of Goldfields. Saskatchewan residents reported to the author that occasionally small groups of caribou spend the summer on the islands in Wollaston and Reindeer Lakes. The most logical explanation of these facts is that these animals were stragglers in the spring movement and were isolated behind large bodies of water at the time of the spring break-up.

In Mackenzie District the tundra summer range extends from the Eskimo Lakes in the extreme northwest along the Arctic coast to Liverpool and Darnley Bays, thence inland to the Horton River basin, Richardson River, and the Coppermine River valley; and on the Arctic coast from Tree River to Western River, with adjacent inland areas, including the Hood and Burnside River valleys. To the eastward scattered bands occur in the vicinity of the Ellice and Perry Rivers. In southern Mackenzie District, caribou range during the summer months in the valleys of the Lockhart, Thelon, and Back Rivers. They reach the headwaters of Snowdrift River in late summer.

In Keewatin District the greatest summer concentrations are in the lower Thelon, Dubawnt, Kazan, and Ferguson River systems. To the northward lesser bands frequent the Arctic coast in the vicinity of Queen Maud Gulf, Committee Bay, Sherman Inlet, the lower Back River, and Wager Bay. In southern Keewatin large concentrations occur in late summer from Kaministiquia Lake south to Nueltin Lake and on the coast southward to Nunavut. In Franklin District barren-ground caribou summer range occurs on Adelaide Peninsula, the southeast coast of Boothia Peninsula, and the east central and west central coasts of Melville Peninsula.

During the late summer, bands of caribou may occasionally reach extreme northeastern Saskatchewan in their southward drift.

The most southerly regular summer range of the race is on the narrow coastal strip of tundra east of Churchill, Manitoba, to Cape Churchill and south to the mouth of the Owl River. During late summer bands of caribou may travel down the western coast of Hudson Bay as far as the Churchill River.

From Figure 10 the total area of the normal summer range has been calculated to be about 300,000 square miles. It seems that the area occupied is approximately the same size in summer as in winter.

Herd Distribution

Barren-ground caribou are not evenly distributed over the range in summer or in winter. It is possible to fly long distances over the tundra in summer or the taiga in winter without observing caribou; yet in a short flight many thousands may be observed. The greater number of caribou are found in large herds, which may include from several thousand to 100,000 or more. Each large herd has a general area in which it carries out its annual movements. The ranges and routes of migration may vary within limits from year to year. All the individuals in the herd carry out the same general patterns of movement, although the herd may be compact or spread out. These large herds seem to be population entities and further investigation may prove that certain herds are of geographic subspecific rank. Large herds may thrive independently or be decimated independently by human utilization. Occasionally a large herd may approach the summer range of another large herd and there may then be an exchange of peripheral bands.

Between large herds may be smaller, more or less independent, bands. At times these bands may be increased by stragglers, or they may join a nearby herd. The greater part of the range is inhabited only by such scattered bands, whose annual movements are less regular than those of the main herds. These facts are best explained by considering the food requirements of a herd of 10,000 compared with those of a band of 25 on similar ranges where the forage production is limited. It is evident that the large herd would be forced to keep in motion in order to obtain forage, whereas the small band could do so with minimum local movement.

It has been the general experience during the past century that where herds of caribou decreased drastically in numbers from over-utilization, the remaining scattered groups ceased regular obvious movements and instead carried out only local wanderings.

Population Data and Estimates

Information on caribou distribution and density derived from the survey flights is listed in Table 1. The flight routes are shown in Figure 3. Flights numbered 1 to 50 were flown by the writer, flights 51 to 53 by W. A. Fuller, flight 54 by W. E. Stevens, flights 55 to 81 by A. H. Lawrie, and flights 82 to

87 by J. P. Kelsall. Data provided in the table include: date, route, length of flight, transect area in the caribou herds, number of caribou seen, and density of caribou in the transect areas.

It may be noted from Table 1 that local caribou densities were as high as 284 per square mile during migration. On a crowded summer range at Bathurst Inlet, the density was 68.3 per square mile. Densities on the winter range in Saskatchewan varied from 0.25 to 2.62 caribou per square mile.

The calculations of herd numbers estimated from aerial data are shown in Tables 2 to 14. The flights usually crossed more than one migrating herd. These herds were assigned names. The flight observations were plotted on large scale maps. The boundaries of the area occupied by each moving herd were fixed, and the area calculated in square miles by the use of a planimeter. Often several flights had been made across a migrating herd and several sets of transect data were available for various sections of the route. The population estimate was then made using the average transect density, assuming an equal concentration in the areas not covered by the transects.

The most nearly complete analysis of this kind was made on the herds which winter in Manitoba, during the spring migration of 1948. The complete routes of these herds were divided into several sections and independent estimates were made for each section. An exceptionally good count of the Rae herd was obtained when it was concentrated in a narrow corridor during migration.

Following the preliminary work of Clarke (1940) and utilizing all available information on the herd routes, 19 herds have been distinguished in this study. Their ranges and estimated numbers are shown in Table 15. Population estimates for the majority of the herds were based on data obtained by the aerial surveys during the spring migration. However, it was recognized that there was large possibility of experimental error in the calculation from such surveys. On the tundra the transect counts were believed to be fairly accurate, but in the taiga groups hidden among the trees may not have been enumerated. Bands of stragglers probably remained unobserved on the winter range. Also, the herd boundaries were drawn conservatively through peripheral animals or fresh tracks and the areas actually occupied may have been larger than calculated. All these sources of error tend to make the estimates conservative. In order to compensate for them, the figures were revised upward to the next even 5,000 in the larger herds and to the next even 1,000 in the smaller herds.

The Athabasca and Duck Lake herds were covered only in part by aerial survey. A good estimate of the Athabasca herd was obtained by Lawrie during the summer of 1949. W. Guymer of the Manitoba Game Branch obtained a good estimate of the Duck Lake herd during a survey of the winter range.

Other small herds inhabiting the periphery of the range were not studied by the writer. The population estimates of reliable observers were accepted for these herds.

The total population of barren-ground caribou, (except those of Baffin Island), is estimated in Table 15 to be approximately 670,000. This estimate is probably conservative since there may be other bands not enumerated. The average density of caribou is estimated to be 2.3 per square mile on the winter range and 2.2 per square mile on the summer range.

The methods used to arrive at these estimates do not lend themselves to strict mathematical calculation of probable error. It is thought that they are probably accurate to within 20 per cent.

Migration Routes

The word migration has come to have so many specialized meanings that it is considered expedient to define its use in this report. Migration is here used to describe wanderings or movements of caribou bands over long distances. It is not meant to imply that these movements are necessarily comparable to bird migration, for instance.

The caribou herds travel from summer ranges to winter ranges over distinct migration routes, marked by deep parallel trails which may run long distances across the tundra and adjoining taiga. These trails are a characteristic feature of the tundra clearly observable from aircraft. They usually follow the line of least physical resistance, extending up long draws, along the ridges of eskers, through natural defiles along rock faults, and beside lake shores, and they lead to river and lake crossings at fords, rapids, and narrows (Figs. 11, 12). Such trails are useful to the hunter and the traveller, as they are paths on which walking is easy. They are generally six to 12 inches wide and clear of vegetation, and are sometimes worn as much as four inches deep through the hummocks and surface debris by constant use of herds over a period of many years. As many as 12 parallel trails one to three feet apart, have been counted on one route.

The route taken by a herd during seasonal migration depends upon several factors, the most important of which are the location of the range which the herd is leaving, and the location of the range to which it is proceeding. If a new winter range is sought, the spring migration route will probably be different from previous ones. Other factors, such as local topography, areas burnt by forest fires, overgrazed or unproductive areas, and excessive hunting, may determine the route taken.

During the spring migrations the routes lie along frozen watersheds in the direction of migration. During summer and autumn migrations the animals tend to follow heights of land and to cross the watersheds. The different directions of travel cause much criss-crossing of the caribou trails.

The residents of the caribou range are familiar with the routes generally used by caribou during migration. The hunters congregate at well known lake crossings or defiles to secure their supplies of meat and hides. Since they are unable to forecast with certainty the appearance of the herds, if the caribou fail to use

the favourite route, the hunters may suffer, as Back did in 1833-4. Unless the hunters happen upon the new route, they are likely to conclude that the caribou herds have been decimated. Now that air travel has increased in northern Canada, the residents are often advised by pilots of the whereabouts of migrating caribou.

Spring Migration

Both the time and the duration of the spring migration depend upon a number of factors, the most important of which are the severity of the preceding winter, the kind of spring, and the depth to which the herds penetrated the taiga during winter migrations. The effect of weather upon the movements of caribou will be dealt with in a later section. It is sufficient at this point to state that the earlier the season, the earlier is the spring migration, and the later the spring season, the more migration is delayed.

Periods of spring migration through certain northern communities are indicated in Figure 13, which is based upon questionnaires, reports, and observations and illustrates periods of occurrence of caribou throughout the year. The place names refer to hunting and trapping areas in the general vicinity of posts. Dotted lines indicate periods when caribou are known to have been present at least once. Heavy continuous lines indicate average dates when the caribou occurred locally and relative numbers are indicated by the thickness of the lines.

During April and May there is a general movement of the large herds from the winter ranges of the taiga towards the tundra summer range. The usual routes followed by the herds in spring are indicated in Figure 14, and the routes used by some individual herds are described in detail hereunder. This information has been derived from personal observation, from the reports of police and wardens, from questionnaires, and from interviews with trappers. The routes shown were those used during the seasons of 1948 and 1949. Deviations from these routes may be expected.

Colville Lake Herd

From the area about Colville Lake the route leads northeast to the headwaters of the Anderson River. Turning north it follows the Anderson River valley as far as timber-line at latitude 69°N. Here the route divides and the larger bands turn eastward and cross the tundra towards the mouth of the Horton River. The migration may extend eastward along the Arctic coast as far as Cape Lyon, east of Darnley Bay. From the Anderson River small bands may swing northwest and reach the coast in the vicinity of Liverpool Bay or as far west as the Eskimo Lakes.

Great Bear Herd

From winter ranges in the vicinity of Fort Franklin, Great Bear River, and Brackett Lake the spring migration route leads northward to Smith Arm, Great Bear Lake, which may be crossed or circumped. The route then turns eastward

along the north shore of Great Bear Lake to Dease Arm. A second route from Fort Franklin leads northeast along the western shore of Keith Arm and across Deerpass Bay. The lake is crossed from Etacho Point to MacDonnel Point and Dease Arm reached. From Dease Arm the route turns north, the headwaters of the Horton River are crossed, and the caribou bands reach the tundra. The movement usually extends northeast to the headwaters of the Richardson and Rae Rivers and the Dismal Lakes area. From Dease Arm bands may ascend the Dease River to the tundra.

Radium Herd

Smaller herds of caribou spend the winter on the eastern shore of McTavish Arm, Great Bear Lake. The range may extend as far as Hottah Lake or the Johnny Hoe River. In spring these herds travel northeast along the eastern shore of Great Bear Lake to Hornby Bay, then turn eastward, ascending rivers such as the Sloan, and reach the Coppermine River. The movement generally extends to the tundra east of the Coppermine in the vicinity of the September Mountains.

Rae Herd

From winter ranges west of Lac la Martre, in the regions of Lakes Tache and Grandin and Willowlake River, the routes converge at the southern end of Lac la Martre. Here the route turns northeast and ascends the Emile and Snare Rivers to Ghost Lake, where it turns easterly up the Ghost River towards timber-line in the vicinity of Jolly and Winter Lakes. The Yellowknife River is crossed in the vicinity of Lake Providence. The route extends northeast past Yamba and Ajax Lakes to the south end of Contwoyto Lake and continues to the headwaters of the Western River and the head of Bathurst Inlet. After reaching the Arctic coast at Bathurst Inlet the route turns northwest along the western shore of the Inlet, and continues across Burnside and Hood Rivers. The greater part of the herds find summer pasturage in the vicinity of Arctic Sound but some movement may continue west as far as Gray Bay and the mouth of Tree River. From Contwoyto Lake, the herds may reach the coast by a second route leading down the Burnside River.

Yellowknife Herd

From winter ranges along the northeast shore of Great Slave Lake, spring migration routes of this herd lead northeast via the river valleys of the Wecho, Yellowknife, and Beaulieu Rivers towards the headwaters of the Lockhart River, near Courageous and MacKay Lakes. Frequently there is a northward movement of caribou across Great Slave Lake from Rocher River to Gros Cap via the Simpson Islands and up the Beaulieu River. On the tundra these herds continue their northeast direction towards Muskox Lake and the upper Back River as far as Lake Beechey. The Back River may first be reached at Sussex, Muskox, or Regan Lakes. Occasionally bands of caribou may use winter ranges north of McLeod Bay, Great Slave Lake. The spring migration route of these bands is directly east, crossing Artillery Lake, until the Hanbury River is reached. Then they turn north towards the Back River.

Hanbury Herd

From winter ranges between Great Slave and Athabasca Lakes, in the drainages of the Talston, Tazin, and Snowdrift Rivers, spring migration routes lead northeast, ascending the Talston and Snowdrift Rivers, across Nonacho, Eileen, and Whitefish Lakes. On the tundra east of Whitefish Lake, the route turns north to the Hanbury River, which is crossed between Sifton Lake and Dickson Canyon. The route continues north, passing to the east of the rock country north of Lake Clinton-Colden. The Back River is reached in the vicinity of Malley Rapids and is followed northward to Beechey Lake. Here the route swings east and may continue down the middle reaches of the Back River or across it and north to the unexplored region east of Bathurst Inlet. Smaller bands occasionally reach the headwaters of the Ellice River and Melville Sound.

Athabasca Herd

A spring migration route extends northeast along the northern shore of Lake Athabasca from Fort Chipewyan. North of the 60th parallel of latitude the route turns east across Scott and Selwyn Lakes, then north, descending the Dubawnt River, which is crossed at Carey Lake or Barlow Lake. The route then turns north and follows the western shore of the Dubawnt River, around Lake Dubawnt until the lakes on the lower Thelon River are reached. The herds may spend the early summer there or continue north into the region beyond these lakes.

Occasionally bands from south of Athabasca Lake may cross at Fond-du-lac and Stoney Rapids and continue north to Dubawnt River.

Saskatchewan Herd

From winter ranges in the vicinity of Cree and Foster Lakes, the spring route leads northeast down the Cree and Geikie Rivers, and crosses the Fond-du-lac River between Wollaston and Black Lakes. The route continues northeast, ascending the Cochrane and Porcupine Rivers and reaches the tundra in the vicinity of the headwaters of the Kazan River, which is descended as far as Angikuni Lake. Thence it runs northward to the area surrounding the junction of the Dubawnt and Thelon Rivers. Smaller herds may cross Beverley and Aberdeen Lakes and continue northward.

In Saskatchewan a second route extends northeast between Wollaston and Reindeer Lakes, across the Cochrane River and north along the Brochet-Nueltin Lake portage. The route continues along the western shore of Nueltin Lake, across Windy Bay, and gradually turns northeast, crossing North Henik Lake and continuing towards the Ferguson River area.

Brochet Herd

The spring migration route of this herd leads north from wintering grounds east of Reindeer Lake, sometimes extending as far south as the

Churchill River and east to Granville Lake. The route lies along the east shore of Reindeer Lake past Lac Brochet, ascending the Cochrane River and then turning northeast to Nueltin Lake. It continues along the eastern shore of that lake, crossing the Thlewiaza River between Nueltin and Edehon Lakes. The route then turns abruptly east, passes south of South Henik Lake, and reaches the main coastal migration route about 50 miles inland from Eskimo Point. Here the herds turn northward and join other herds migrating towards Chesterfield Inlet.

Duck Lake Herd

From winter ranges in the vicinity of Nelson House and the upper Nelson River in central Manitoba and from South Indian Lake, the spring migration route leads north to the Seal River. The Seal River is descended to the junction with the Wolverine River, which is ascended past Duck Lake post. North of Nejanilini Lake the route turns eastward and joins the Hudson Bay migration route inland from Nunalla.

Churchill Herd

The main body of this herd frequents winter ranges in the valleys of the Nelson and Hayes Rivers as far southeast as Gods Lake. The spring migration routes lead north, crossing the Hayes and Nelson Rivers. The Hudson Bay railway is crossed between Ilford and Gillam and also between McClintock and Lamprey. The Churchill River is crossed between the Canyon and Long Island. The route then turns northwest and crosses the Knife and Seal Rivers near the coast. From there it continues north, parallel to the Hudson Bay coast, but at a distance of about 25 miles inland, until the Maguse River is reached north of Eskimo Point. In the meantime the coast herds have generally been augmented by herds of caribou which have followed the Brochet and Duck Lake migration routes. The caribou herds turn northwest and ascend the Maguse River, cross Kaminak and Kaminuriak Lakes, then turn westward to reach the lower Kazan River in the vicinity of Thirty Mile Lake. There is a smaller herd of caribou which regularly spends the winter in the marginal taiga southeast of Churchill, Manitoba, and north of the Nelson River. During the spring migration these bands travel eastward to the Hudson Bay coast in the vicinity of the Owl River. They then turn north and follow the coastline north to Cape Churchill, then west, passing Churchill along the shore ice. They cross the mouth of the Churchill River and Button Bay on the bay ice. Then they turn inland at the mouth of the North Knife River.

Aberdeen Lake Herd

The largest herd which regularly spends the winter on the tundra frequents the immediate vicinity of the large lakes on the lower Thelon River, from Aberdeen Lake to Baker Lake. In spring there is a northwestern migration from this drainage system towards the Back River, which is crossed in the vicinity of the Buchanan River junction. The route continues north toward the Perry River and a large unnamed river to the west. Frequently the movement reaches the Arctic coast in the Queen Maud Gulf area. It may even extend to the numerous offshore islands.

Hudson Bay Coast Bands

Along the Hudson Bay coast there are scattered bands of caribou during the winter months at such locations as Nunalla, Eskimo Point, Maguse River, Tavanni, Rankin Inlet, Winchester Inlet, and Wager Bay. In spring these bands move northwest. Those bands south of Chesterfield join the herds migrating north along the Hudson Bay coast. The movement sometimes extends as far as the Arctic Coast in the area about Pelly Bay and at the mouth of the Back River.

The movements of other scattered bands of caribou on the tundra are too irregular to describe in detail. There is some northward drift of animals in Adelaide, Boothia, and Melville Peninsulas.

Midsummer Migration

Clarke (1940) was the first author to describe the regular midsummer movements of the caribou. He referred to this migration as a "backwash" from the spring migration. Previously this return towards timber-line was thought to be an early autumn migration to the winter ranges. It is not surprising that the early explorers failed to note the regularity of this movement, since their observations were limited. The use of aircraft has made possible extensive simultaneous observations of caribou movements.

The impetus of the spring migration seems to be spent by the middle of July and the animals have reached the limit of their travels upon the tundra. As has been shown, this takes many bands to the Arctic coast or even to the coastal islands a short distance offshore, as in Bathurst Inlet and Queen Maud Gulf (Gavin, 1945). Other large groups do not go as far as the sea, but reach their maximum penetration of the tundra in the Richardson, Back, and Thelon river systems.

By late July or early August there is a general retracing of the routes towards timber-line. This movement is undertaken by all herds from the Eskimo Lakes to Hudson Bay. The cause of this general movement is discussed later under migration behaviour. It loses its impetus during late August, when the herds are mainly on the tundra, in the vicinity of timber-line. At this time the population is scattered, and some bands have penetrated the taiga for a considerable distance. The herds are not segregated at this time, and are made up of both cows and bulls.

During September, the herds move away from the timber-line again and retrace their spring migration routes on the tundra. This time, however, the movement does not go so far and the herds do not reach the extreme penetration of July. The rut occurs upon the tundra after the impetus of this movement has been lost. This migration is concluded in October or early November when the first severe snowstorms occur. Midsummer migration routes are indicated in Figure 15.

Colville Lake Herd

During the midsummer migration there is a westward drift of caribou

bands from Darnley and Franklin Bays towards timber-line on the Anderson and Horton Rivers. The backwash takes the herds again to the tundra on the hills beyond the river valleys.

Great Bear Herd

There is a general southwest movement towards the headwaters of the Dease River. Stragglers generally reach Dease Arm and Hornby Bay of Great Bear Lake. The backwash takes the herds to the vicinity of the Dismal Lakes and Coppermine River.

Radium Herd

During this period, herds move west into the taiga east of Great Bear Lake. Later the movement is reversed and the animals drift east to the Coppermine River valley.

Rae Herd

In late summer the herds move southward down the western coast of Bathurst Inlet. Opposite Burnside Harbour they turn inland, crossing rough terrain until the east branch of the Burnside River is reached. This river is ascended and the herds turn west and pass around the south end of Contwoyto Lake. The route continues southwest to the Coppermine River, which is crossed in the vicinity of Lake Providence. The movement loses its impetus in the vicinity of the headwaters of the Snare River. The backwash carries bands of caribou northeast as far as Contwoyto Lake.

Yellowknife Herd

In late July the caribou follow up the Back River, crossing in the Muskox Lake area or at the Back River portage. The bands continue south past Aylmer Lake and turn southwest, crossing the Lockhart River. The limit of movement is near timber-line in the McKay Lake region. The reverse migration takes the animals north to Aylmer and Muskox Lakes.

Hanbury Herd

The movement during this period is at first south from the Back River, passing to the east of Lakes Aylmer and Clinton-Colden. The western edge of the herds crosses the Hanbury River at Deville Lake. Some bands turn southwest, travelling along the shores of Ptarmigan and Artillery Lakes and reaching Great Slave Lake at the mouth of the Lockhart River. The main herd continues south from the Hanbury River to Lynx Lake and reaches timber-line southeast of Nonacho Lake. The return movement later takes caribou bands north to Aylmer Lake and the Thelon and Hanbury Rivers.

Athabasca Herd

The movements of this herd are probably similar to those described

above. Its greatest penetration of the taiga is probably in the upper Dubawnt River valley.

Saskatchewan Herd

During midsummer large herds of caribou move south, ascending the Dubawnt River. The limit of their drift is Selwyn Lake, in northern Saskatchewan. In autumn, the drift is reversed and bands move north to the tundra beyond the timber-line in the Dubawnt River valley.

In midsummer there is a large-scale eastern movement of caribou in the region of the large lakes on the lower Thelon River. Large herds reach the western end of Baker Lake and pass southeast along its south shore. The Kazan River is reached in the vicinity of Thirty-mile Lake. Here the majority seem to follow the shoreline to the southwest and ascend the Kazan on the western side of Ennadai Lake. This movement may continue as far south as Sunrise Lake, Saskatchewan. The northward drift in September takes the bands north at least to Ennadai Lake.

Brochet, Duck Lake, Churchill Herds

From summer ranges south of Baker Lake and east of the Kazan River these herds drift south in the Kaminuriak-Ferguson River regions. The route leads past Maguse Lake and Padlei. At this point the routes diverge. The Brochet herds show a southwest trend, passing down the western shore of Nueltin Lake and continuing south until the leaders reach the big bend in the Cochrane River. The Duck Lake herds continue south, crossing the Tha-anne and Thlewiaza Rivers, and reach their maximum penetration of the taiga at this season in the Nejanilini Lake region.

From the Kaminak Lake area the Churchill herds drift southeast towards the coast. They pass south inland from Eskimo Point and cross the Thlewiaza River near the coast. The stragglers on the left flank of this movement are on the Hudson Bay coast. The movement continues south, crosses the timber-line, and enters the taiga in the lower Seal River drainage basin. Before the impetus of the movement is spent the leading bands may reach the vicinity of the Churchill River about the first of September. During the month of September the backward drift commences and the herds retrace their paths northward to the timber-line region about Nueltin Lake, Thlewiaza River, Henik Lakes, and the Hudson Bay coast.

The location of the northern limit of autumn drift may often be ascertained by the number of southbound autumn migrations. At Baker Lake and Padlei there is only one such migration. At Nueltin Lake there are two. This places the limit between Nueltin Lake and Padlei. Similarly at Bathurst Inlet there is usually a single early autumn movement while on the upper Coppermine there are two movements, which places the limit somewhere in the vicinity of Contwoyto Lake.

Other Herds

For the remaining herds the midsummer movements are less well known.

It is known that in late July there is a southerly drift of caribou bands from the Queen Maud Gulf area. This movement continues southeast through the region of the large lakes on the lower Back River. Whether there is a later reversal of this drift in the area north of Aberdeen Lake is not known.

Similarly the Hudson Bay bands drift in midsummer from the regions of their maximum northwest penetration towards the Wager Bay and Winchester Inlet areas.

These midsummer movements are not characterized by the concentrated movements of large herd groups, but rather by the movements of small bands or herds of 500 to 2,000 animals; nor do all the caribou take part in them. As a result, by late summer and early autumn small bands of caribou are dispersed widely from the northern fringes of the taiga to the Arctic Ocean. It was during the southward movements of the midsummer migration that the greatest slaughters were carried out by natives at crossings of the Burnside, Coppermine, Hanbury, Thelon, Kazan, Thlewiaza, and Seal Rivers.

Autumn Migration

During late autumn, associated with the termination of the rut and the first severe blizzards on the tundra, the large herds commence the annual migration towards the winter ranges in the taiga or near timber-line. This movement usually commences in late October or November, but occasionally, during unusually mild winters, it may be delayed until December.

The autumn migration is first characterized by a withdrawal of the scattered herds from the extreme summer range near the Arctic coast or the tundra ranges of the Back and Thelon Rivers. As the bands congregate upon the tundra, the movement becomes precipitate and finally the herds migrate down well-worn trails in dense masses towards timber-line. It is at this season that the most spectacular migrations have been observed by northern trappers and a few explorers, such as Russell (1898) at Fort Rae and Stefansson (1913) at the headwaters of the Horton River.

If the weather remains rigorous the great columns of caribou continue swiftly towards their winter ranges. If the weather moderates the pace slows down and the herds are delayed in reaching the wintering grounds. These are usually reached in December, but occasionally not until January. The autumn migration routes currently in use are indicated in Figure 16.

Colville Herd

During the autumn migration, bands travel eastward from the Eskimo Lakes and westward from Franklin and Darnley Bays to meet near timber-line on the Anderson River. The Anderson River is ascended to the winter range. The western limit of the route is at the junction of the Anderson and Wolverine Rivers. A second route of migration ascends the Horton River and turns southwest across the middle reaches of the river.

Great Bear Herd

From the Dismal Lakes area the movement is southwest in autumn, leading down the Dease River to Dease Arm of Great Bear Lake. The route then follows the north shore of the lake to Smith Arm. Here the main route divides. Occasionally the herds turn northwest towards Colville Lake or towards Fort Good Hope on the Mackenzie River. More commonly they turn south around Smith Arm and reach the Great Bear River. The westerly limit of the movement is usually in the Brackett Lake area.

Other bands from the Coppermine River, travelling west, reach the southern shore of Dease Arm and cross the Lake from MacDonnel Cape to Etacho Point, if the migration is late enough to find the lake frozen. The bands then continue southwest, crossing Deerpass Bay and reaching the vicinity of Fort Franklin.

Radium Herd

From timber-line on the Coppermine River bands of caribou travel west to McTavish Arm. Here the route follows the eastern shore southwest to the lower Camsell River and Hottah Lake. It may continue as far as Johnny Hoe River.

Rae Herd

From the tundra about Contwoyto Lake massed herds travel southwest across the Coppermine River south of Point Lake. The route continues west to the headwaters of the Snare River, which is generally descended, and continues across Emile River and around Lac la Martre, either to the north or to the south. Beyond these points bands may turn northwest to Lake Grandin, or southwest towards Willow Lake.

Yellowknife Herd

From the tundra about the upper Back River, caribou herds migrate southwest towards tree-line in the vicinity of Courageous Lake, continuing until the headwaters of the Wecho, Yellowknife, and Beaulieu Rivers are reached. Scattered bands usually reach Gordon Lake.

Occasionally a different route is used. The Lockhart River is crossed at Thanakoie Narrows between Aylmer and Clinton-Colden Lakes. The trails lead southwest, west of Artillery Lake. Reaching McLeod Bay, Great Slave Lake, the bands turn west along the shore to the Beaulieu River.

Hanbury Herd

Within the past several years this herd has followed several migration routes. Originating upon the tundra between the Back and Thelon Rivers, the route leads south. Some herds travel towards the southwest, past Clinton-Colden, Ptarmigan, and Artillery Lakes, reaching Great Slave Lake at the mouth of the Lockhart River, then follow the southeast shore

of the lake to Snowdrift. A second route leads west from the upper Thelon River, across Whitefish Lake to the headwaters of the Talston River, which is descended as far as Rocher River. East of Fort Smith the direction of migration is northward in autumn.

During the winter of 1948-9, the herd continued directly south from the Hanbury River east of Lynx Lake, crossed the upper Thelon, and spent the winter months near timber-line on the headwaters of the Talston and Dubawnt Rivers.

Athabasca Herd

From the main migration route described above, certain herds continue southwest, ascending the upper Dubawnt River valley towards Tazin Lake, and moving along the north shore of Lake Athabasca to Fort Chipewyan. Occasionally the lake is crossed via Burntwood and Bustard Islands and bands reach the Athabasca River region. In other years the herds continue west of the Slave River, reaching Lake Claire and the lower Peace River.

A second route from Wholdaia leads directly south, past Selwyn Lake, around the eastern end of Lake Athabasca at Stoney Rapids and Fond-du-lac, and south to Black Lake and Cree River.

Saskatchewan Herd

A well marked migration route leads up Kazan River, past Ennadai Lake, to the northeast corner of Saskatchewan. Some herds turn southwest, descending the Porcupine River valley, and cross the Fond-du-lac River between Black and Wollaston Lakes. From the northeast corner of Saskatchewan other herds continue south, ascend the Cochrane River to Wollaston Lake, go down the eastern shore of this lake, and ascend the Geikie and Wathaman Rivers to Foster Lakes. Occasionally this movement may continue as far as the Churchill River, near Stanley and Snake Lake.

Brochet Herd

From the vicinity of the Henik Lakes, Keewatin District, the autumn migration route of this herd extends southward across Windy Bay of Nueltin Lake and along the western shore of the lake, across the portage, and down the Cochrane River to Reindeer Lake. Then it leads south along the eastern shore of that lake to winter ranges near Southend. Frequently the migration continues south down the Reindeer River to the Churchill River valley; or midway down the lake, the herds may turn southeast and reach Lynn Lake.

Duck Lake Herd

These herds move south, crossing the Tha-anne and Thlewiaza Rivers of Keewatin District. The route continues south through north-central Manitoba, passes Duck Lake, crosses the Seal River, and reaches the Churchill River at Southern Indian Lake. The winter range extends from there south to Nelson House. Occasionally the herds continue to Herb Lake and Cross Lake.

Churchill Herd

From southern Keewatin District herds of caribou travel rapidly south in the autumn, generally a short distance inland from the Hudson Bay coast. The movement passes inland from Eskimo Point and crosses the Thlewiaza, Seal, and Knife Rivers. The route then generally turns southeast and crosses the Churchill River above the head of navigation, reaching the Hudson Bay Railway near Lamprey and Back. The caribou frequently appear to be reluctant to cross the track and continue for some distance south along its western side. The route then divides. Some herds cross the track and continue southeast towards the lower Nelson River, the Hayes River, and Shamattawa; others continue south and cross the tracks and the Nelson River near Gillam. Still other bands, upon reaching the Nelson River, which may still be open in early December, turn west and cross the river at Split Lake. These bands then continue south to winter in the upper Nelson and Hayes River valleys and near Oxford House. Since 1945 the herds have penetrated as far south as Knee Lake and Gods Lake, Manitoba.

Other Herds

The autumn movements of the other herds are not well known. The scattered bands of the Hudson Bay group migrate southeast towards the Hudson Bay coast of Keewatin. The Aberdeen Lake herd moves southeast from the Back River region to the lower Thelon. There is a general southward trend in the scattered groups on the northern peninsulas. The Boothia bands move towards the isthmus. The Adelaide bands move towards the mouth of the Back River. In Melville Peninsula there is probably a southern movement towards the coastal districts about Lyon Inlet and Committee Bay.

Human Influences upon Migration

Use of Firearms

Hoare (1927) described the establishment of trading posts along the Arctic Coast in the Coronation Gulf region during the period 1910 to 1920. He noted that the gradual diminution of the caribou migration from the continent to Victoria Island was associated with the introduction of firearms and the fur trade among the Eskimos of the region. He speculated whether the coal smoke from the stoves of the new posts discouraged the caribou. However, it has been observed that the caribou often ignore human habitations during their migrations. Russell (1898) reported a migration through Fort Rae when the animals passed between buildings. Caribou bands have migrated through Fort Chipewyan and Fond-du-lac on several occasions. During the spring migration of 1948, caribou bands migrated through the camp and the outskirts of the village at Churchill on April 24 and 25, and on May 5 delay was experienced in landing on the airstrip because of caribou bands migrating across it. The advent of firearms and the fur industry would seem to be a more probable cause of the diminution of the herds than the effect of coal smoke.

The locale of the spring crossing of Coronation Gulf moved eastward during the same period. Hoare reported that the last large scale crossing of Dolphin and Union Strait from Bernard Harbour took place in the spring of 1917. A small crossing of Coronation Gulf from the Tree River region occurred in the spring of 1920 and the spring crossing from Kent Peninsula was discontinued soon after 1920.

Instances where several hunters camped at a favourite crossing point had turned a migration from its route by excessive hunting were reported. A former crossing of the east end of Baker Lake was cited as an example.

It seems likely that excessive hunting also influences the movement of caribou by decimating herds to the point where they need no longer travel great distances in search of fresh fodder.

Forest Fires

The most important influence exerted by man upon the movements of caribou is through the destruction of forage by forest fires. Lichens, upon which the caribou rely for winter forage, are exceedingly slow-growing plants. It has been ascertained from investigations in Alaska by Palmer (1926) that it may take a burnt-over lichen area as long as 25 years to regenerate. If the humus is destroyed the loss is, for all practical purposes, permanent. Lichens must be considered as a long-term crop, comparable to trees. Thus, fires under sub-Arctic conditions may be even more damaging than at lower latitudes. Harper (1932) and Clarke (1940) have previously pointed out how forest fires may reduce greatly the number of caribou that can be supported on the taiga winter ranges.

During the present investigation factual information which would indicate an actual desertion of a burned area by the caribou was sought. Such evidence was obtained in abundance from the aerial reconnaissance flights.

It was observed that caribou and their tracks were almost always absent from the recently burned areas, even at times when tracks were abundant in adjacent "green" areas. Occasionally the winter distribution of caribou was observed to be delineated by the boundaries of "green" taiga. In Figure 17 the observations made on flights in northern Saskatchewan during January, 1949, are shown. From the figure one can note the presence of caribou bands in the unburned areas and their absence from the burned areas. Similar observations were made on several flights in Manitoba, Saskatchewan, and the Mackenzie District, Northwest Territories.

It was observed that the routes travelled by the migrating animals lay in "green" corridors between burned areas. Such was the case at Ghost Lake, Mackenzie District, on April 24, 1949, where the route lay eastward along a narrow "green" corridor between two extensive burns at Mattberry Lake and south of Ghost Lake. Large burned areas were practically devoid of winter caribou tracks in the snow. Small burns were occasionally crossed by single trails but there was no evidence of feeding.

The tundra and the northern fringe of the taiga are largely unaffected by fires, but there have been many large destructive fires in the heart of the taiga winter caribou range. In the Mackenzie District, there were large burned areas in the Mattberry - Indin Lake region. A large area east and northeast from Yellowknife was useless as caribou range because of the destruction of the vegetation by numerous recent fires. There were also large burns in the lower Talston River region. The winter range south of Fort Reliance was still largely intact.

There have been damaging fires about Tazin Lake and Camsell Portage, Saskatchewan. Large areas of former caribou winter range in northern Saskatchewan, south of Wollaston Lake and west of Reindeer Lake, have been destroyed. Throughout this area no caribou were observed during reconnaissance flights in January and February, 1949. Large burns north of Fond-du-lac and Stoney Rapids have probably deflected migration routes away from these crossing points. It is estimated that 30 per cent of the winter range in Saskatchewan has been devastated and will not be productive for many years.

Similarly in northern Manitoba there have been large burns recently in the caribou winter range. Large areas north and west of Southern Indian Lake, as well as areas in the Angling River drainage south of the Nelson River, have been destroyed. It seems probable that recent destruction of winter forage in the Southern Indian Lake region may have been a contributing cause of the recent southward movement of caribou herds into central Manitoba in winter.

It is difficult to assess the full effect of recent burns upon the population of the species. Hitherto it has meant a shift of the caribou herds to other areas, which have usually been available. It is probable that were the larger part of the winter range destroyed by fire, the population of caribou would be reduced by starvation.

Railways

The Hudson Bay Railway, built in 1925 to 1930, invades the winter range of the Churchill herds and lies across the migration routes of the Churchill and Duck Lake herds. Approximately 75,000 caribou cross the railroad tracks annually in migration. The railroad, however, has not caused the dire effects on the herds that were forecast.

The herds cross the tracks during the months of November, December, April, and May, and suffer some losses. The engineers of the two trains per week exercise caution at the favourite crossing points during this period. While investigations were being carried out along the route in November and December, 1948, only three animals were reported killed. On a trip from Ilford to Churchill and return in December by gas car no signs of excessive mortality along the track were noted.

The track influences the behaviour of the migrating bands. Caribou parallel the track for some distance before crossing it in single file and striking off in the direction of travel. Usually a few individuals may be observed walking down the roadbed. The chief influence of the railway has been through the presence of work crews, stationed along the route, and the increased accessibility of the herds to hunters. However, it also provides a good means for warden patrols.

Changes in Caribou Range, Status, and Migrations

The former and present distribution have been described. It is intended here to discuss the changes in range and populations that have occurred.

A serious problem arises because the historical accounts cover a period of approximately 140 years, from 1780 to 1920. In order to facilitate matters, the historical data will be considered to apply to conditions about 1900. It is unlikely that European culture had greatly affected the caribou range at the beginning of the present century. Although the fur trade was in full swing along the Mackenzie River, the vast tundra and timber-line areas to the east were still unexploited. The Eskimos were generally without fire-arms. During the period about the beginning of the present century several excellent exploratory accounts, which give a good picture of caribou distribution under relatively primitive conditions, were published.

The present status applies to the year 1950, so that there is a span of 50 years during which major changes in caribou population took place, which was a period of rapid exploration and exploitation of this northern region.

Summer Range

There has been a great shrinkage in the range, and reduction in population from the Mackenzie Delta to Coppermine. The large herds reported from the delta by Franklin (1828) and Simpson (1843) have been absent for many years (Porsild, 1929). The writings of Richardson (1851), MacFarlane (1905), and Stefansson (1913) also indicated a large population along the Arctic coast to Coppermine. At present only small groups of caribou remain in this region.

From Coppermine to Kent Peninsula, present conditions seem little changed from those described by Franklin (1828) and Simpson (1843). In recent years few caribou have reached the Queen Maud Gulf coast although Gavin (1945) reports fair numbers in certain years. Aerial observations indicated fewer animals south of Queen Maud Gulf than were observed there in 1901 (Hanbury, 1904).

Simpson (1843) observed great herds of caribou in summer along the Arctic coast from Sherman Inlet to Boothia Peninsula, and on King William Island, as did Schwatka (1885). At present there are indications that caribou are either extirpated or reduced to low numbers on the island, while on the adjacent mainland they occur in very small groups.

Along the Gulf of Boothia and on Melville Peninsula caribou were reported in large herds by Rae (1850) and Lyon (1824); the Melville herds were migratory, leaving the peninsula in winter. Caribou now occur only in small bands on the east and west coasts of the peninsula. Inland from Winchester Sound, Schwatka (1885) encountered many herds of caribou. At present only small scattered groups occur in that region. Along the Hudson Bay coast from Chesterfield Inlet to York Factory, caribou occur in numbers comparable to those described by early explorers, although there probably has been a diminution.

Upon the central tundra summer range there seems to have been less change in numbers. The observation of massed caribou herds by Franklin (1823) on the Coppermine River, Hearne (1795) at Contwoyto Lake and on the Kazan, Back (1836) on the Back River, J. W. Tyrrell (1902) on the Thelon, and J. B. Tyrrell (1898) on the Dubawnt River can be duplicated today in the same areas.

Migration Routes

The great autumn migration of caribou across the upper Horton River, described by Stefansson (1913), has no counterpart today nor have the herds which ascended the Anderson River (MacFarlane, 1905). The caribou have largely forsaken the crossing point at Fort Rae described by Russell (1898). At Fond-du-lac and Stoney Rapids, Saskatchewan, the migrations are reported to be much smaller of late. Lac Brochet, Manitoba, is situated at a major crossing point. Father Eganoff, who has been stationed there for 40 years, reported that he has noted a steady decline in the numbers of migrating caribou. Caribou still cross the Churchill and Nelson Rivers as described by Hearne (1795), J. B. Tyrrell (1913), and Hanbury (1904), but trappers report the present numbers are fewer.

Winter Range

The present winter ranges are generally the same as those mentioned by the explorers. During recent years there has been a tendency for caribou bands to inhabit areas near the southern limits of the range, where they have been absent for several decades.

Caribou no longer inhabit the east bank of the lower Mackenzie River. In recent years they have penetrated to within 30 miles east of Fort Good Hope. However, they regularly occur in winter along the Bear River east of Fort Norman. According to Stefansson (1913), they had been absent from the west side of Great Bear Lake for many years. They seem to be less common at present south of the lake in the vicinity of the Camsell River than was reported by Preble (1908). The situation about Great Slave Lake seems to have changed little from that recorded by early explorers. Herds now frequently penetrate to Fort Smith, where, according to Preble (op. cit.), they were met rarely in the early years of this century. Several years ago bands reached the Clearwater River region of Alberta, where Preble reported they occurred 50 years prior to his investigation. In northern Saskatchewan, the range seems to have changed little from that described by J.B. Tyrrell (1896). The recent southward extension of the winter range in central Manitoba seems to be unprecedented in the period under consideration. Old Cree hunters state that it has been 75 years since the caribou occurred in their country.

The estimated decrease of the population from 1,750,000 to 670,000 caribou indicates a probable reduction of 62 per cent of the primitive numbers. This has resulted from the decimation of certain herds and reduction of other herds. The herds which suffered most were those which formerly occurred from the Mackenzie Delta east to Coppermine, including herds which formerly migrated annually to Victoria Island; herds which formerly inhabited Kent, Adelaide, Boothia, and Melville Peninsulas and King William, Somerset, and Southampton Islands; herds along the Hudson Bay Coast from Winchester Inlet to Repulse Bay; and finally herds which occupied the tundra along the Ontario Hudson Bay coast.

Reasons for Decline

It is to be noted that the above areas are along the periphery of the present range. This suggests that the herds might have been inhabiting marginal territory and that reductions in population might have led to a withdrawal of herds from this marginal range. This theory is difficult either to refute or to support at this date.

The area along the Arctic coast, east to Dolphin and Union Strait, where the caribou were greatly reduced in numbers, is known to parallel very closely the range of the baleen whales in western Arctic waters. Around the turn of the century there was a whaling industry in these waters. Many ships spent the winter at Arctic ports. The crews of the whaling ships depended largely upon the caribou for meat. The natives were provided with firearms and paid in trade goods to secure meat. The number of caribou killed for whaling ships was tremendous in comparison with the resources of the Arctic. Some idea of this slaughter may be obtained from the report of Stone (1900).

"The large whaling fleets in Bering Straits, and as far north as Point Barrow, have created a demand for the flesh of the caribou and they are slaughtered by the thousands for the purpose of barter; now this demand has been extended by this fleet of whalers, along the Arctic coast as far as Cape Parry.

"One winter fifteen vessels wintered at Herschel Island and I am reliably informed that these vessels each used from 10,000 pounds to 20,000 pounds of caribou meat, an aggregate of over 300,000 pounds in one winter, principally the saddles; at the head of Franklin Bay, in the winter of 1897-98, four ships used of the same kind of meat about 90,000 pounds, and at Cape Bathurst, in 1898-99, one vessel used in the neighbourhood of 40,000 pounds."

It is therefore concluded that the annual take of the whaling fleet at the commencement of this century was a factor in the decimation of the herds along the western Arctic Coast.

Along the eastern Arctic Coast from Adelaide Peninsula to Melville Peninsula and south to Winchester Inlet, the decimation of the caribou herds cannot be attributed to the action of whaling fleets. There was a certain amount of whaling in eastern waters, but this influence probably affected only the Hudson Bay coast. Nor can one easily conceive that the reduction in caribou was here due primarily to European explorers and traders, since the region was infrequently visited. The native populations seem to be the only human beings that might have caused the decline.

During the years under consideration there was a great change in the economy of the natives. Under the influence of the fur trade, the Eskimos were persuaded to make long journeys into the central tundra to seek furs. They received firearms which enormously increased their killing power; they were encouraged to trade caribou meat and tongues, as well as furs, for the maintenance of the trading posts; and in order to undertake these necessary new

travels, they increased the size of their dog teams, which were fed caribou meat. All these facts point to the conclusion that the changed native economy caused a great increase in the killing of caribou and led to a gradual diminution in the caribou population.

Caribou Questionnaires

Distribution of Departmental Caribou Questionnaires to northern residents since 1934 has permitted a study of the recent trend in the population. The questionnaire asks correspondents to report whether the caribou have increased, decreased, or remained the same in their region, during the current season. The majority of observations indicate that there has been a gradual irregular decline in numbers in recent years. They also show shifts in populations. In one season caribou may be reported as decreasing in some areas while they are reported as increasing in contiguous areas. This phenomenon occurs annually and is caused by the unpredictable nomadic movements of the caribou.

The total number of observations for each winter, and the percentage of observations reporting a caribou increase that season, are listed in Table 16. The remaining observations reported "no change" or "decrease". It will be noted that there is no clear cut trend in the ratio of the "increase" reports that would indicate a regular decline.

The local movements of caribou are often observed to be influenced by the local weather. It was thought possible that the winter incursions of caribou might be influenced by the general weather conditions. The Monthly Record, Meteorological Observations in Canada and Newfoundland, Department of Transport, Toronto, were therefore consulted for the period 1933 to 1944. The monthly differences from the normal mean daily temperature and the monthly percentage differences from the normal monthly precipitation for the period November to March inclusive, for six regions where caribou occur in winter, are listed in Table 17. The status of caribou as determined from the questionnaires is given in the table for comparison. A statistical analysis of the data showed no significant correlation between caribou occurrence and average weather.

This is not surprising considering the great changes in weather over a five-month period, the general terms of the meteorological records, and the indefinite nature of the questionnaire reports. It seems probable, however, that over short periods of time caribou movements are influenced by weather.

Summary of Part I

The barren-ground caribou is an important renewable natural resource of the Northwest Territories and the northern sections of the three prairie provinces of Canada. In an area of approximately 600,000 square miles it is one of the basic factors in the economy of approximately 20,000 Canadians. In large areas of the Northwest Territories human habitation would be impossible without the caribou.

It has been estimated that during the later part of the exploratory period in northern Canada, about the year 1900, the caribou population totalled about 1,750,000. On the basis of aerial surveys during the present investigation it is estimated that the present population consists of about 670,000 caribou, indicating an apparent reduction of 62 per cent. The areas showing the greatest reduction are: (1) the area north of Great Bear Lake, from Bernard Harbour to the Mackenzie Delta; (2) northern Keewatin District, Adelaide, Boothia and Melville Peninsulas, and the continental area east of the mouth of the Back River and north of Chesterfield Inlet; (3) King William Island; and (4) the tundra adjacent to Hudson Bay from York Factory to the Severn River. In the central portion of the range there may have been a gradual reduction in numbers.

The drastic reduction in area (1) is thought to have been due to the coming of whaling ships along the Arctic coast from 1890 to 1910. The reductions in areas (2) and (3) are thought to have been caused by the increased activities of natives supplied with introduced firearms and ammunition as a result of the introduction of the fur industry. The reduction in area (4) is thought to have been caused by the increase of human population in northern Manitoba, coupled with the introduction of modern firearms. The gradual reduction in the central portion of the range has been due to the increased human population, the introduction of firearms, and the development of the fur industry.

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Table 1. Aerial Survey Data

Flight No.	Date	Route		Length of Flight	Transect Area	Caribou	Caribou per Sq. Mile
		From	To				
				(miles)	(sq. miles)		
1	15-7-46	Edmonton	Aklavik	1,350	--	--	--
2	17-8-46	Aklavik	Edmonton	1,350	--	--	--
3	13-4-48	Ottawa	Churchill	1,250	--	--	--
4	" " "	Churchill	Port Nelson	388	546	3,925	7.19
5	17-4-48	"	Eskimo Point	404	620	1,700	2.74
6	19-4-48	"	Split Lake	548	368	2,600	7.07
7	20-4-48	"	Padlei	692	1,080	905	0.84
8	21-4-48	"	Chesterfield Inlet	812	480	900	1.88
9	24-4-48	"	Brochet	632	643	430	0.67
10	4-5-48	"	Coppermine	1,725	852	1,400	1.64
11	5-5-48	Fort Smith	Churchill	1,628	624	1,200	1.92
12	6-5-48	Churchill	Nueltin Lake	528	944	2,490	2.64
13	7-5-48	"	Nelson River	612	1,194	1,820	1.52
14	8-5-48	"	Cochrane River	792	812	877	1.08
15	11-5-48	"	Baker Lake	464	590	8,645	14.6
16	12-5-48	Baker Lake	Back River	532	928	470	0.51
17	13-5-48	" "	Churchill	475	1,080	4,260	3.94
18	14-5-48	Churchill	Nueltin Lake	530	824	1,400	1.70
19	15-5-48	"	Ilford	572	404	880	2.18
20	17-5-48	"	Kazan River	740	1,058	1,813	1.71
21	2-7-48	Fort Smith	Fort Reliance	228	--	--	--
22	6-7-48	Fort Reliance	Muskox Lake	244	--	--	--
23	2-8-48	Clinton-Colden Lake	Walmsley	120	480	35	0.07
24	2-9-48	" "	Fort Reliance	96	100	10	0.10
25	3-9-48	Fort Reliance	Fort Smith	228	--	--	--
26	27-1-49	Prince Albert	Missi Lake	286	84	105	1.25
27	28-1-49	Missi Lake	Stoney Rapids	258	468	1,224	2.62
28	29-1-49	Stoney Rapids	Fond-du-lac	148	24	16	0.67
29	31-1-49	" "	Prince Albert	462	168	41	0.24
30	2-2-49	" "	" "	462	360	164	0.46
31	4-2-49	Prince Albert	Brochet	394	48	12	0.25
32	5-2-49	Brochet	Prince Albert	482	308	163	0.53
33	21-4-49	Edmonton	Yellowknife	650	--	--	--
34	24-4-49	Yellowknife	Ghost Lake	444	352	100,000	284.
35	25-4-49	"	Fort Reliance	376	36	20	0.56
36	26-4-49	Fort Reliance	Thelon River	512	1,536	31,750	20.7
37	27-4-49	" "	Sid Lake	374	1,216	10,067	8.28
38	27-4-49	" "	Yellowknife	176	60	85	1.4
39	28-4-49	Yellowknife	Ghost Lake	256	160	40,000	250.

Table 1 cont'd

Flight No.	Date	Route		Length of Flight	Transect Area	Caribou	Caribou per Sq.Mile
		From	To				
				(miles)	(sq. miles)		
40	29-4-49	Yellowknife	Gordon Lake	136	---	---	---
41	29-4-49	"	Lac la Martre	428	192	467	2.43
42	1-5-49	"	Fort Smith	200	---	---	---
43	25-6-49	Fort Smith	Fort Reliance	228	---	---	---
44	1-7-49	Fort Reliance	Artillery Lake	52	---	---	---
45	3-7-49	" "	Aylmer Lake	188	208	219	1.05
46	11-7-49	" "	Bathurst Inlet	300	1,032	5,140	4.98
47	24-7-49	Bathurst Inlet	Arctic Sound	232	1,856	126,795	68.3
48	26-7-49	" "	Perry River	416	28	211	7.54
49	1-8-49	" "	Contwoyto Lake	125	80	20	.25
50	19-8-49	Contwoyto Lake	Fort Smith	448	320	350	1.09
51	21-3-49	Fort Smith	Fond-du-lac	264	24	17	0.71
52	22-3-49	Fond-du-lac	Snowbird Lake	384	288	500	1.74
53	23-3-49	" " "	Fort Chipewyan	312	576	120	0.21
54	25-8-48	Aklavik	Paulatuk	880	---	---	---
55	28-1-49	Ilford	Oxford House	80	88	36	0.41
56	29-1-49	Oxford House	Shamattawa	138	---	---	---
57	31-1-49	Shamattawa	York Factory	96	36	33	0.92
58	1-2-49	York Factory	Churchill	176	---	---	---
59	4-2-49	Churchill	Duck Lake	288	---	---	---
60	5-2-49	"	South Indian Lake	234	184	177	0.96
61	6-2-49	South Indian Lake	The Pas	250	---	---	---
62	12-2-49	The Pas	South Indian Lake	260	---	---	---
63	13-2-49	South Indian Lake	Big Sand Lake	254	396	261	0.66
64	16-2-49	" "	The Pas	336	160	28	0.18
65	17-2-49	Lynn Lake	" "	344	36	2	0.06
66	18-2-49	Nelson House	Barrington Lake	220	16	7	0.44
67	28-2-49	The Pas	Island Lake	672	---	---	---
68	28-2-49	" "	Brochet	224	56	32	0.57
69	29-2-49	Brochet	Putahow Lake	416	---	7	---
70	30-2-49	"	The Pas	318	104	72	0.69
71	16-5-49	Churchill	Nueltin Lake	264	72	50	0.69
72	17-5-49	Nueltin Lake	Baker Lake	324	144	750	5.21
73	1-6-49	Baker Lake	Beverly Lake	164	88	3,000	34.0
74	1-8-49	Beverly Lake	Baker Lake	152	---	---	---
75	2-8-49	Baker Lake	Nueltin Lake	298	---	---	---
76	27-8-49	Nueltin Lake	Churchill	265	---	7	---
77	23-5-48	Churchill	Nueltin Lake	265	---	2	---
78	20-7-48	Nueltin Lake	Angikuni Lake	136	---	---	---

Table 1 cont'd

Flight No.	Date	Route		Length of Flight	Transect Area	Caribou	Caribou per Sq.Mile
		From	To				
				(miles)	(sq. miles)		
79	15-8-48	Angikuni Lake	Nueltin Lake	136	--	8	--
80	13-10-48	Nueltin Lake	Brochet	240	--	--	--
81	10-12-48	" "	Churchill	265	--	--	--
82	9-2-50	Churchill	Duck Lake	278	--	--	--
83	10-2-50	"	York Factory	308	96	825	8.59
84	13-2-50	"	Chesterfield	372	168	338	2.01
85	20-2-50	"	Snowbird Lake	810	--	--	--
86	22-4-50	Yellowknife	Port Radium	290	--	--	--
87	24-4-50	Port Radium	Coppermine	610	--	--	--
Summary				36,296	24,695	358,881	14.5

Table 2. Estimate of Churchill Herd - Nelson River Section

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
13	144	3	432	530	1.2
19	90	2	180	50	0.3
Summary			612	580	0.95

Area of Route - 4,460 Sq. Miles
Herd Estimate - 4,240

Table 3. Estimate of Churchill Herd - Cape Churchill Section

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
4	82	5	410	3,790	9.24
8	26	5	130	370	2.85
9	15	5	75	50	0.67
13	38	5	190	160	0.84
Summary			805	4,370	5.43

Area of Route - 225 Sq. Miles
Herd Estimate - 1,220

Table 4. Estimate of Churchill Herd - Caribou River Section

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
10	8	2	16	35	2.2
14	32	2	64	15	0.2
Summary			80	50	0.63

Area of Route - 1,280 Sq. Miles
Herd Estimate - 810

Table 5. Estimate of Churchill Herd - Churchill Section

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
4	34	4	136	135	1.0
6	92	4	368	2,600	7.1
7	60	4	240	500	2.1
9	80	4	320	50	0.2
10	48	4	192	300	1.6
12	80	4	320	425	1.3
13	102	4	408	980	2.4
14	86	4	344	350	1.0
15	18	5	90	195	2.2
17	80	5	400	565	1.4
18	98	4	392	650	1.7
19	56	4	224	830	3.7
20	90	4	360	350	1.0
Summary			3,794	8,130	2.14
Area of Route - 4,500 Sq. Miles					
Herd Estimate - 9,630					

Table 6. Estimate of Churchill Herd - Eskimo Point Section

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
5	124	5	620	1,700	2.7
7	168	5	840	405	0.5
8	70	5	350	530	1.5
15	100	5	500	8,450	16.9
17	136	5	680	3,695	5.4
Summary			2,990	14,780	4.94
Area of Route - 7,050 Sq. Miles					
Herd Estimate - 34,900					

Table 7. Estimate of Duck Lake Herd

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
9	44	2	88	55	0.6
12	52	2	104	195	1.9
13	84	2	164	150	0.9
14	76	2	152	180	1.2
18	44	2	88	85	1.0
20	74	2	148	235	1.6
Summary			744	900	1.21

Area of Route - 12,500 Sq. Miles
Herd Estimate - 15,000

Table 8. Estimate of Brochet Herd

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq. miles)		
9	80	2	160	275	1.7
10	94	4	376	440	1.2
12	130	4	520	1,870	3.6
14	116	2	232	332	1.4
18	172	2	344	665	1.9
20	110	5	550	1,228	2.2
Summary			2,182	4,810	2.20

Area of Route - 17,000 Sq. Miles
Herd Estimate - 37,400

Table 9. Estimate of Saskatchewan Herd

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
26	28	3	84	105	1.2
27	156	3	468	1,224	2.6
28	8	3	24	16	0.7
29	56	3	168	41	0.2
30	120	3	360	164	0.5
31	16	3	48	12	0.2
32	136	3	308	163	0.5
Summary			1,460	1,725	1.18
Area of Route - 17,024 Sq. Miles					
Herd Estimate - 20,100					

Table 10. Estimate of Athabasca Herd

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
51	8	3	24	17	0.7
52	96	3	288	500	1.7
53	192	3	576	120	0.2
11	208	3	624	1,200	1.9
Summary			1,512	1,837	1.21
Area of Route - 10,000 Sq. Miles					
Herd Estimate - 12,100					

Table 11. Estimate of Hanbury Herd

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
36	192	8	1,536	31,750	20.7
37	152	8	1,216	10,067	8.3
Summary			2,742	41,817	15.3

Area of Route - 11,500 Sq. Miles
Herd Estimate - 175,000

Table 12. Estimate of Yellowknife Herd

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
35	12	3	36	20	0.6
38	20	3	60	85	1.4
45	52	4	208	219	1.1
Summary			304	324	1.07

Area of Route - 3,500 Sq. Miles
Herd Estimate - 3,750

Table 13. Estimate of Rae Herd

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
34	88	4	352	100,000	284.0
39	40	4	160	40,000	250.0
41	48	4	192	467	2.4
Summary			704	140,467	200.0
Area of Route - 1,050 Sq. Miles					
Herd Estimate - 210,000					

Table 14. Estimate of Aberdeen Lake Herd

Flight No.	Transect			Caribou	Caribou per Sq.Mile
	Length	Width	Area		
	(miles)	(miles)	(sq.miles)		
16	232	4	928	470	0.51
48	14	2	28	211	7.54
Summary			956	681	0.71
Area of Route - 8,400 Sq. Miles					
Herd Estimate - 6,000					

Table 15. Main Caribou Herds - 1950

	Name of Herd	Winter Range	Summer Range	Estimated Number
1	Colville Lake	Colville L. area	Liverpool- Darnley Bay	5,000
2	Great Bear	Ft. Franklin - Dease Bay	Richardson & Coppermine R.	30,000
3	Radium	Hottah Lake	Tree River	5,000
4	Rae	Lac la Martre	Bathurst Inlet	210,000
5	Yellowknife	N. Shore Great Slave Lake	Upper Back R.	4,000
6	Hanbury	Talston River	Lake Beechey	175,000
7	Athabasca	Lake Athabasca	Thelon Lakes	75,000
8	Saskatchewan	Wollaston Lake	Kazan River	25,000
9	Brochet	Reindeer Lake	Baker Lake	40,000
10	Duck Lake	Nelson House	" "	25,000
11	Churchill	Nelson River	" "	55,000
12	Melville Pen.	Melville Pen.	Melville Pen.	3,000
13	Boothia Pen.	Boothia Pen.	Boothia Pen.	2,000
14	Victoria Is.	Victoria Is.	Victoria Is.	1,000
15	Southampton Is.	Southampton Is.	Southampton Is.	500
16	Coates Is.	Coates Is.	Coates Is.	500
17	Aberdeen Lake	Aberdeen Lake	Perry River	10,000
18	Hudson Bay	H.B. coast, Daly Bay	Mouth of Back R.	3,500
19	Adelaide Pen.	Back River	Adelaide & Sherman Gulfs	500
				<u>670,000</u>

Table 16. Analysis of Caribou Change in Status Reports

Year	Total Observations	No. Reporting Increase	Per Cent Reporting Increase
1933-34	45	20	44
1934-35	35	24	69
1935-36	51	24	47
1936-37	73	33	45
1937-38	67	24	36
1938-39	80	50	63
1939-40	104	39	38
1940-41	89	45	51
1941-42	63	40	63
1942-43	61	21	34
1943-44	85	39	46
1944-45	54	26	48
1945-46	59	27	46
1946-47	64	26	41
1947-48	59	10	17

Table 17. Analysis of Caribou Status and Weather

DISTRICT	1933-34			1934-35			1935-36			1936-37			1937-38			1938-39		
	T.	P.	C.	T.	P.	C.	T.	P.	C.	T.	P.	C.	T.	P.	C.	T.	P.	C.
1.Mackenzie	- 8	- 75	I	- 9	- 35	I	-22	- 10	I	/12	/295	D	/16	/ 75	I	/ 1	/ 90	I
2.Keewatin	-18	-	-	-24	-	I	/11	-	I	/ 4	-	D	/ 8	-	-	- 6	/ 10	D
3.Athabasca, Alta.	-11	/210	-	- 3	/280	-	-21	/115	-	/ 5	- 45	-	/ 2	/ 80	D	/ 9	/ 5	I
4.Churchill, Sask.	/14	/ 30	-	/21	- 40	-	/ 3	/ 95	D	/17	- 75	I	/28	/ 60	-	/16	/205	-
5.Athabasca, Sask.	-15	- 25	-	- 1	-	-	-19	-	I	/ 4	- 55	I	/ 7	- 5	D	-	-	I
6.Churchill, Man.	-21	-315	-	/ 4	-	-	-11	- 60	I	- 1	-210	I	/14	-	D	- 9	- 25	-
DISTRICT	1939-40			1940-41			1941-42			1942-43			1943-44					
	T.	P.	C.	T.	P.	C.	T.	P.	C.	T.	P.	C.	T.	P.	C.			
1.Mackenzie	/37	/ 25	-	/14	/105	I	/20	/ 45	-	-	- 30	D	/38	/120	D			
2.Keewatin	/36	-105	I	/18	/ 75	-	/ 2	/345	I	- 1	-105	D	-	-290	I			
3.Athabasca, Alta.	/29	- 85	I	/ 4	- 15	D	/32	-150	I	-19	/120	I	/35	- 85	I			
4.Churchill, Sask.	/24	/ 70	-	/14	- 5	I	/35	-100	I	-22	/100	-	/28	-115	I			
5.Athabasca, Sask.	-	-	-	-	-	-	-	-	-	-	-	D	-	-	I			
6.Churchill, Man.	/37	/ 40	I	-10	- 10	I	/35	- 65	I	-22	-210	I	/14	-190	D			

NOTES: T.- Sum of monthly differences from normal mean daily temperature Fahrenheit from November to March inclusive.

P.- Sum of monthly percentage differences from normal monthly precipitation in inches from November to March inclusive.

C.- Caribou observations.

I.- Majority of observations indicated increase.

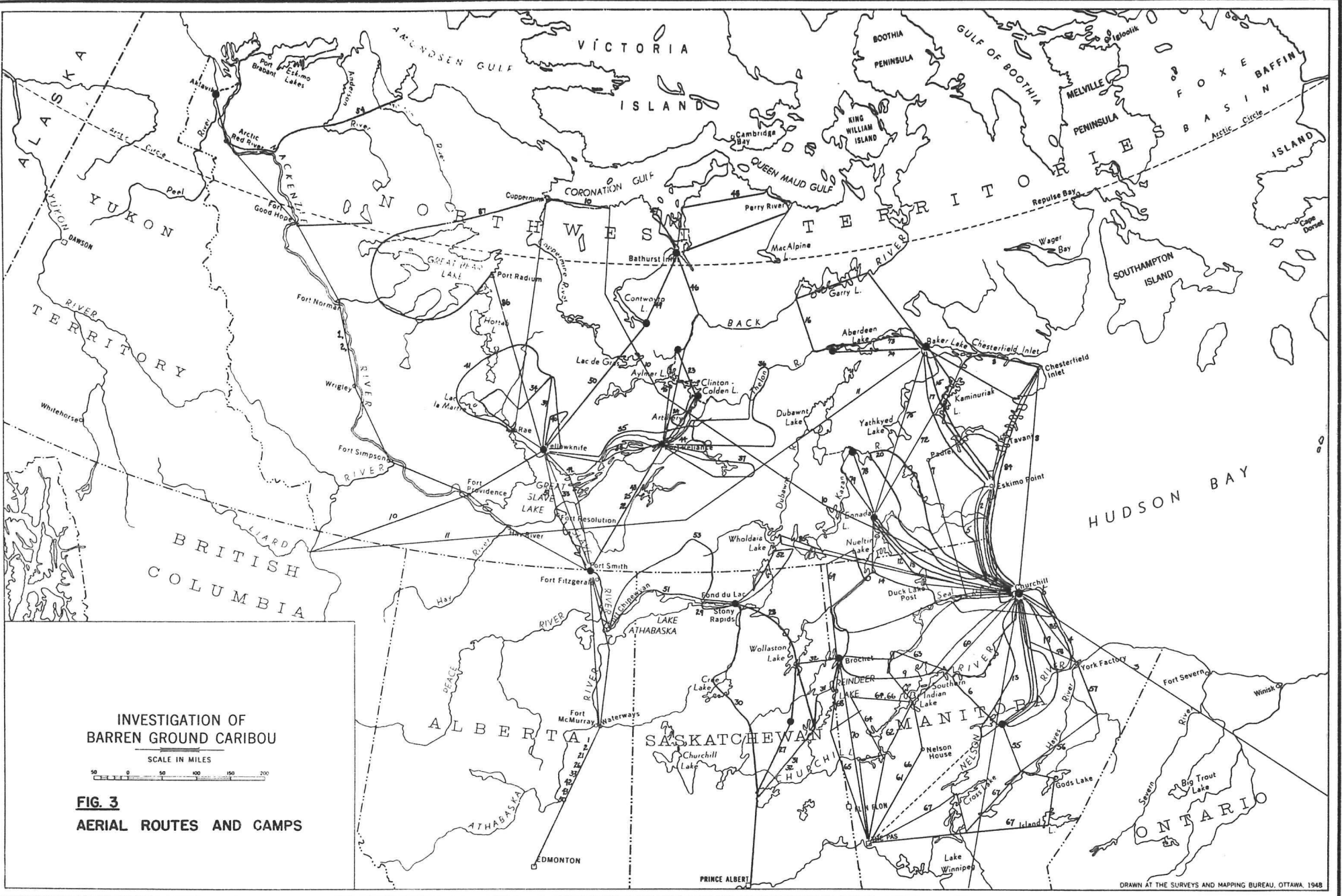
D.- Majority of observations indicated decrease.



Fig. 1. A large herd of caribou resting on Ghost Lake, N.W.T., during spring migration.



Fig. 2. Aerial photography of caribou bands.

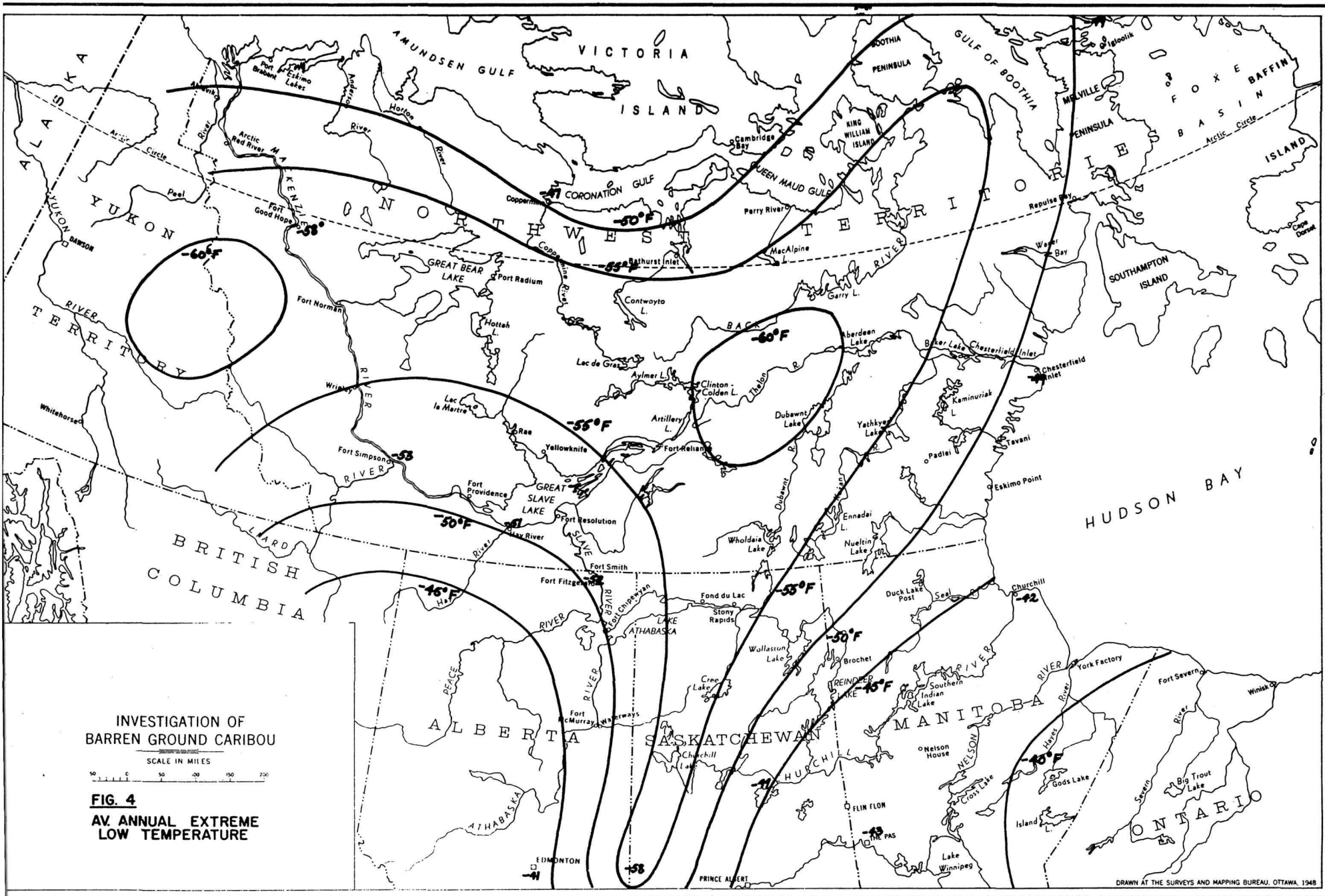


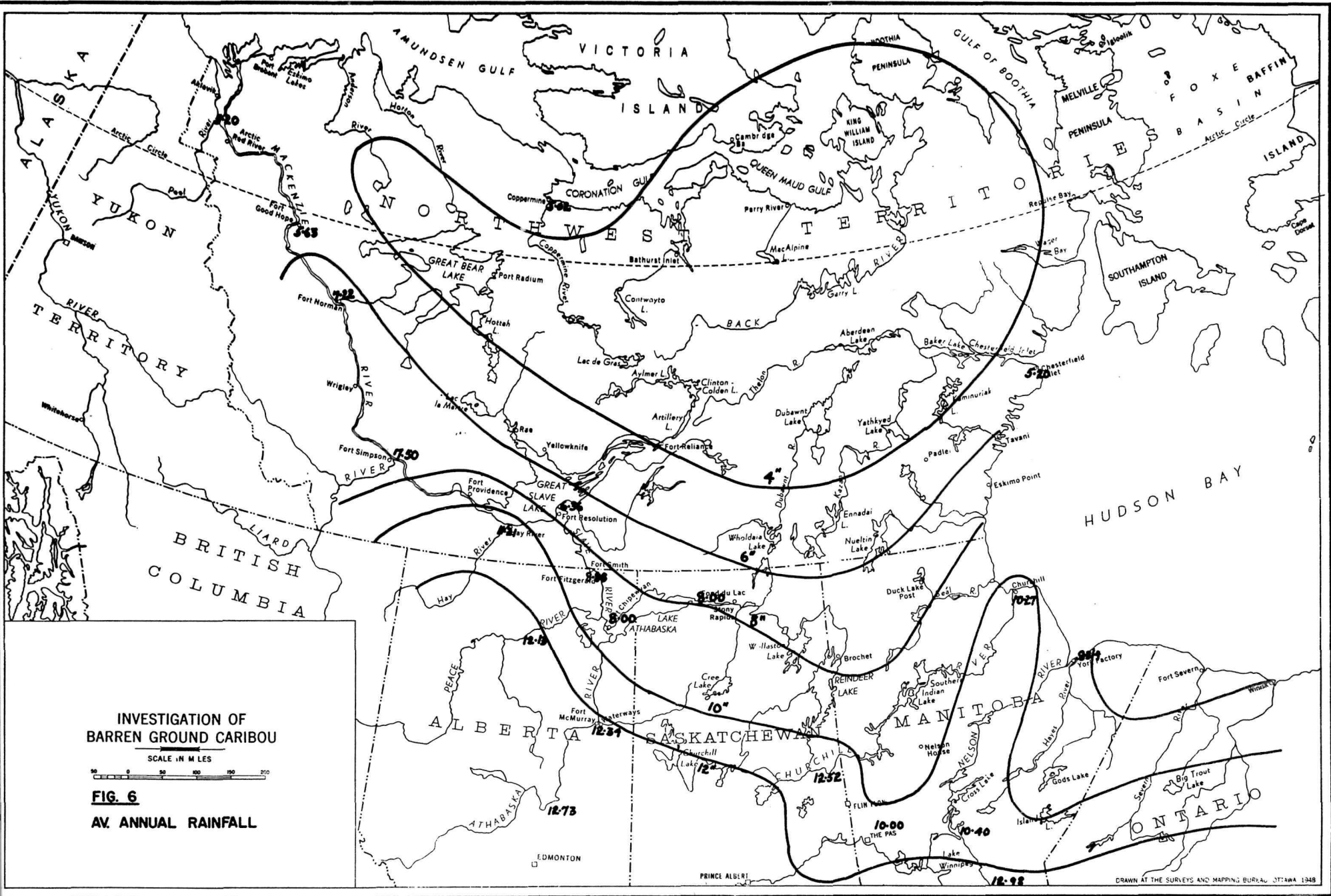
INVESTIGATION OF
BARREN GROUND CARIBOU

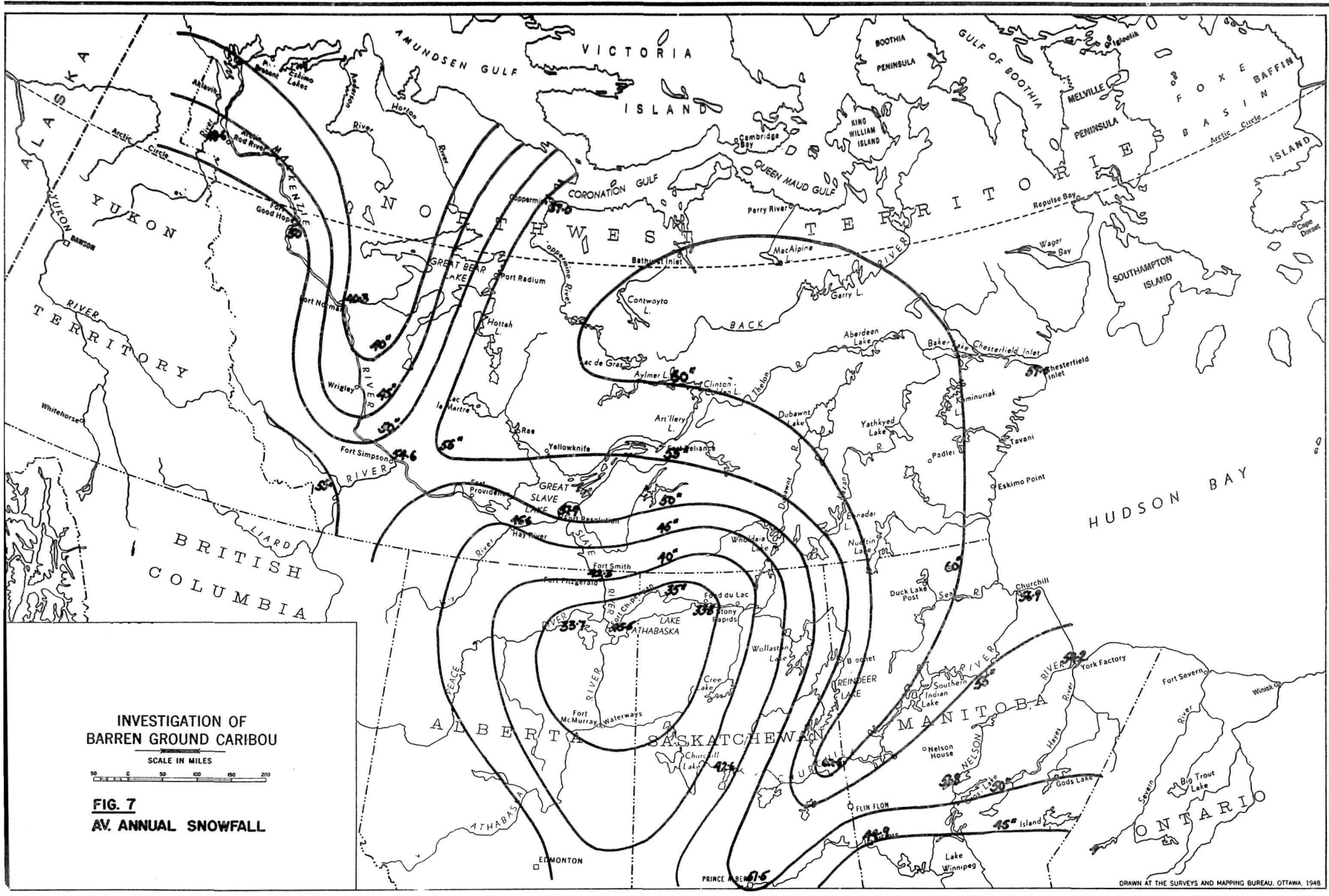
SCALE IN MILES

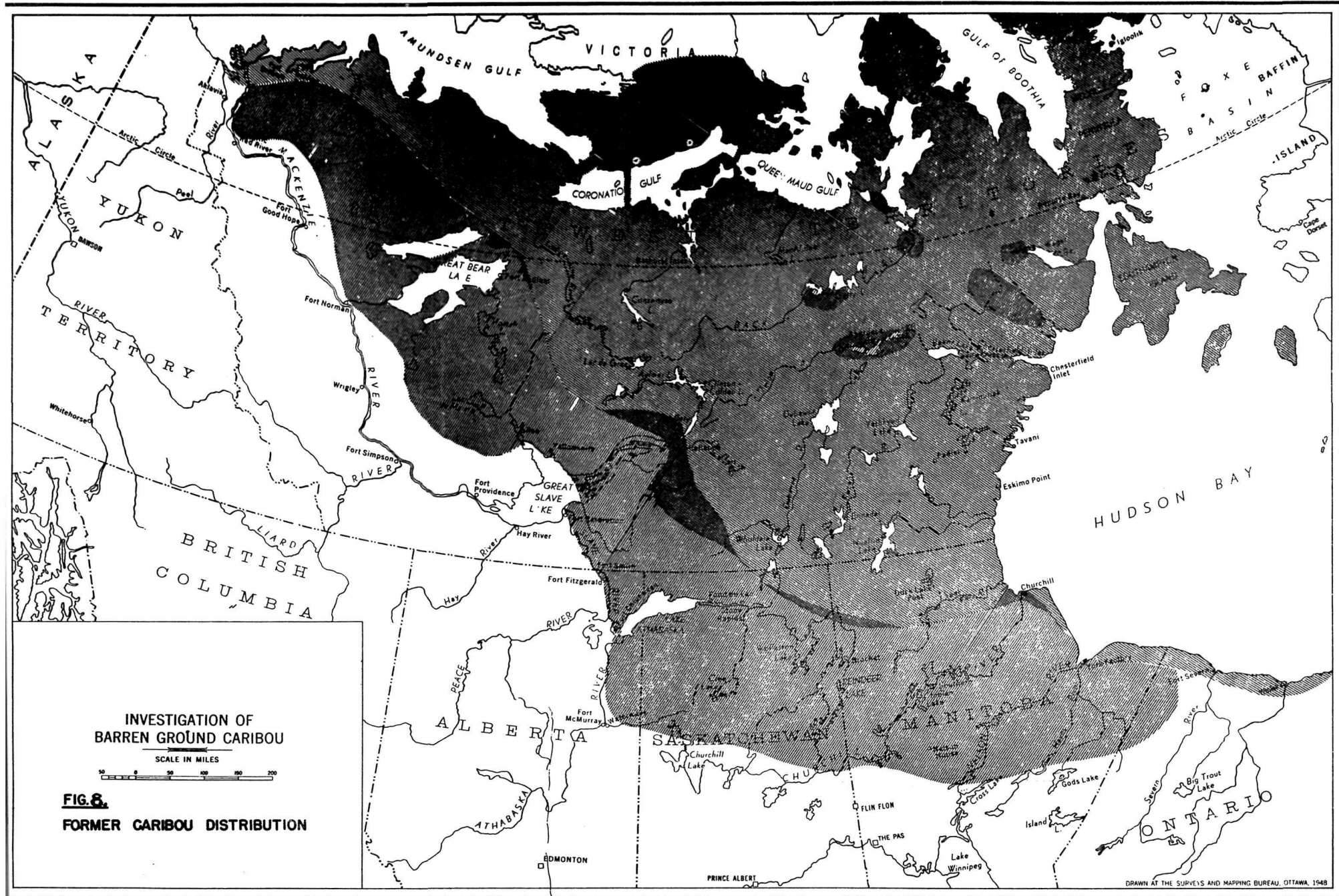
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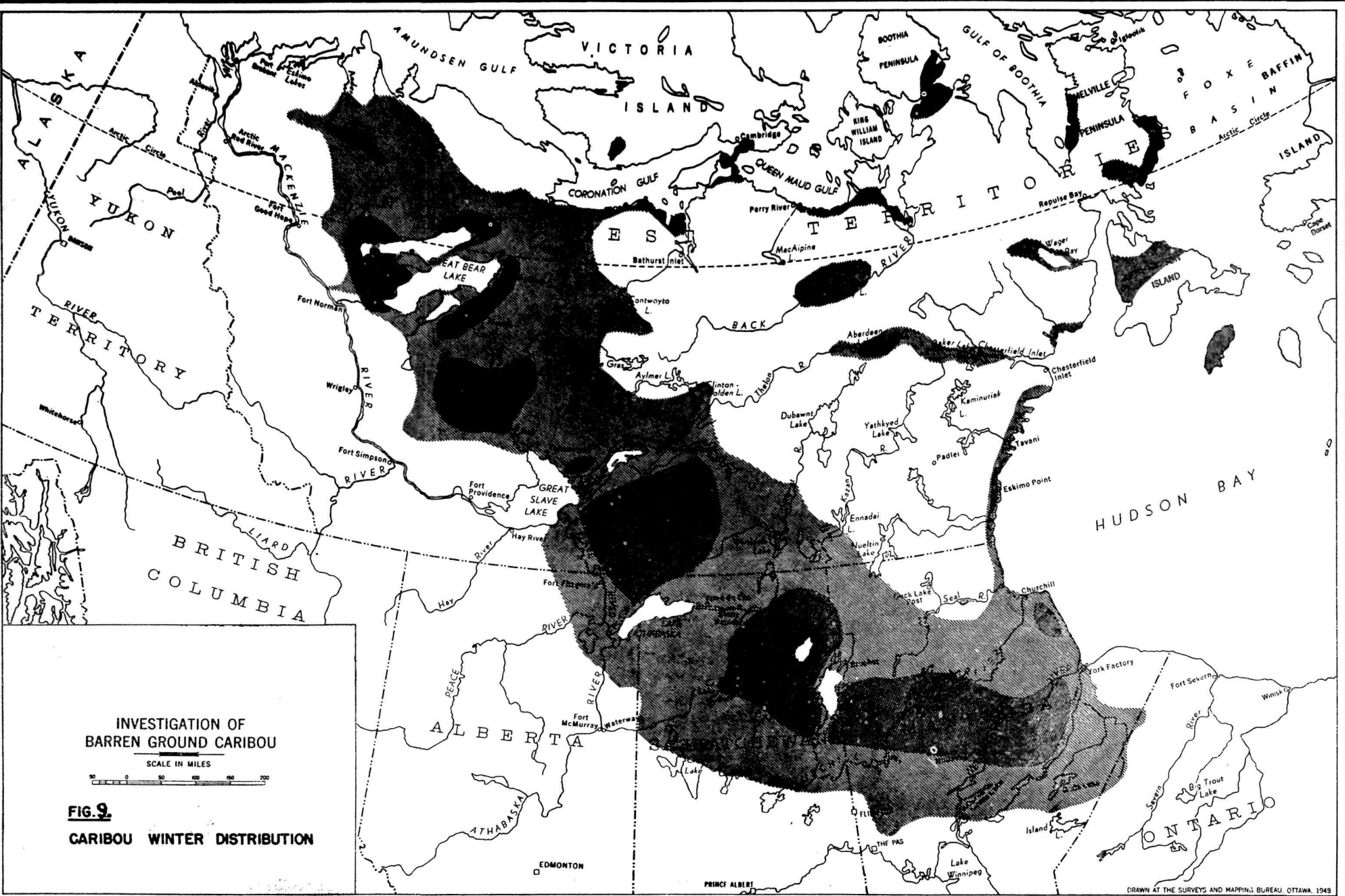
FIG. 3
AERIAL ROUTES AND CAMPS











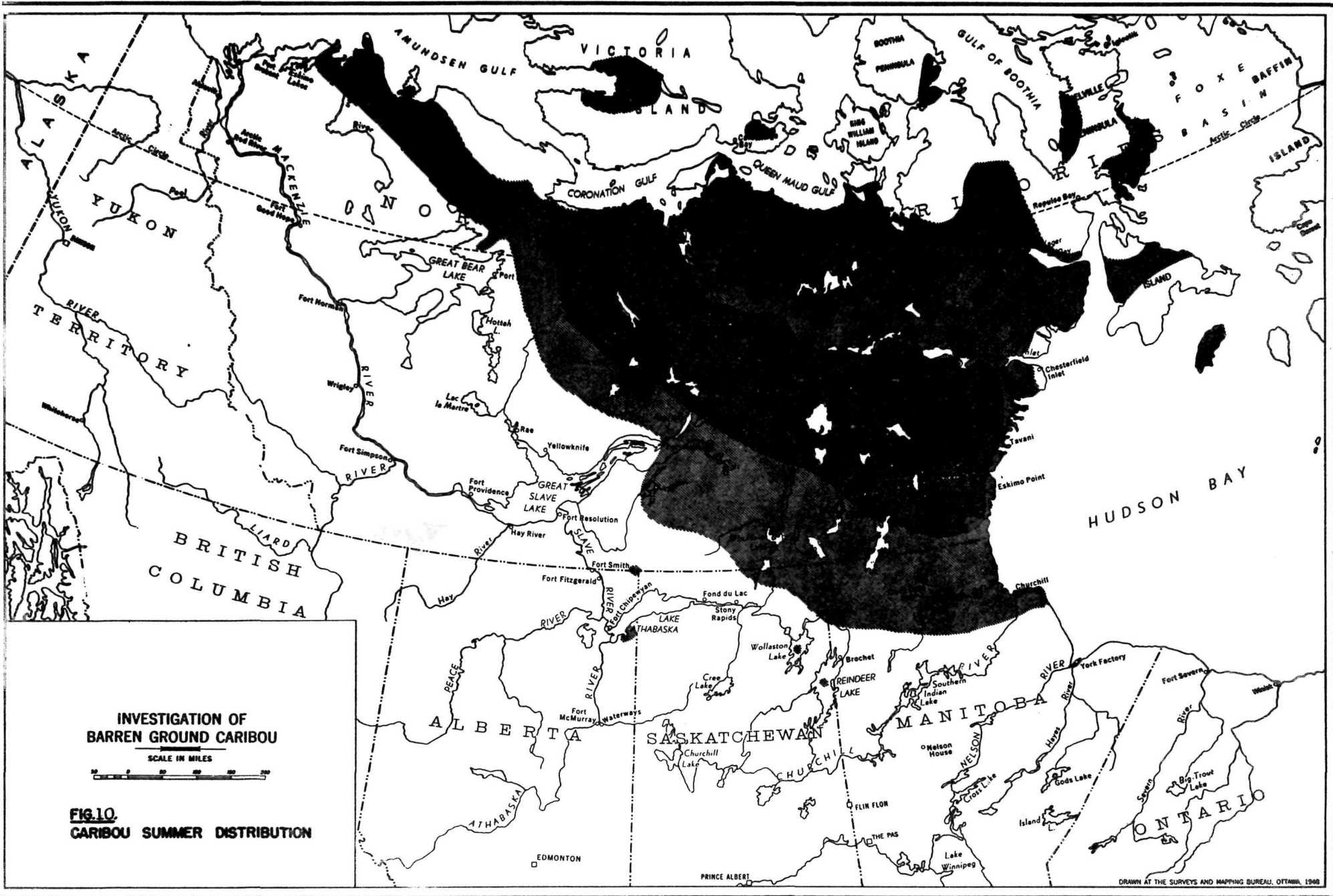




Fig. 11. Caribou trail through taiga near Fort Reliance, N.W.T.



Fig. 12. Caribou trails on the tundra at Contwoyto Lake, N.W.T.

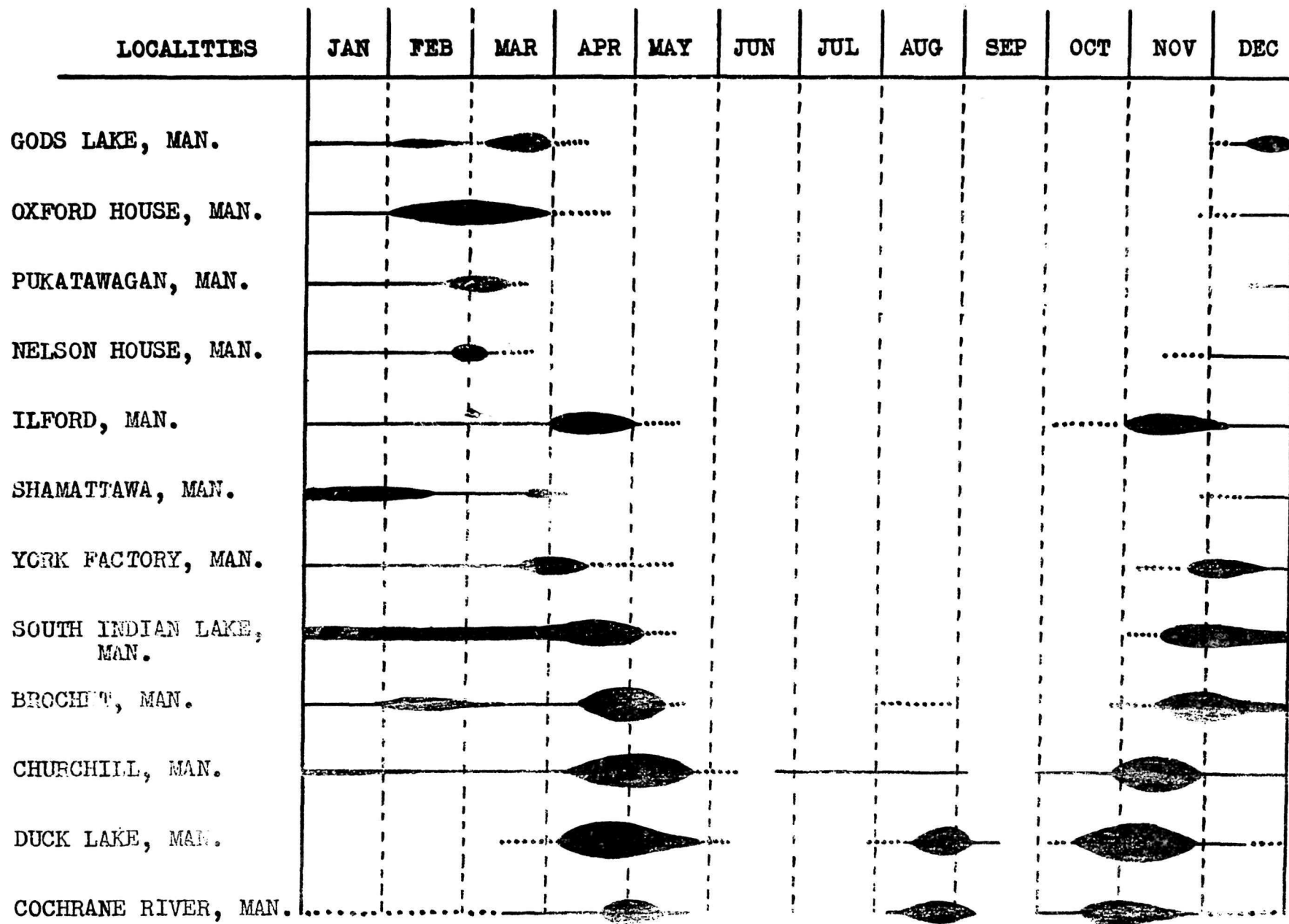


Fig. 13. PERIODS OF OCCURRENCE OF CARIBOU NEAR NORTHERN SETTLEMENTS

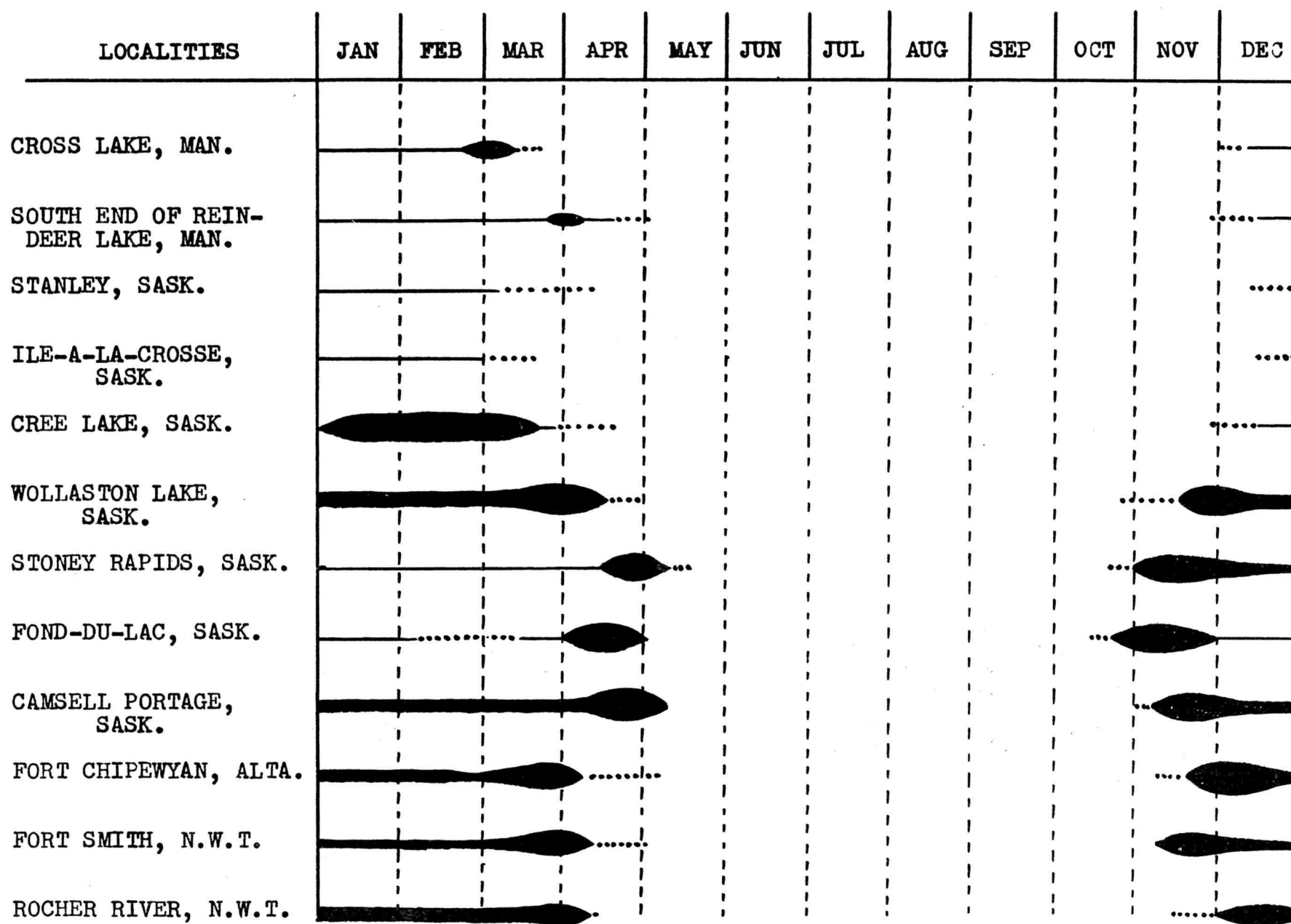


Fig. 13 (cont'd). PERIODS OF OCCURRENCE OF CARIBOU NEAR NORTHERN SETTLEMENTS

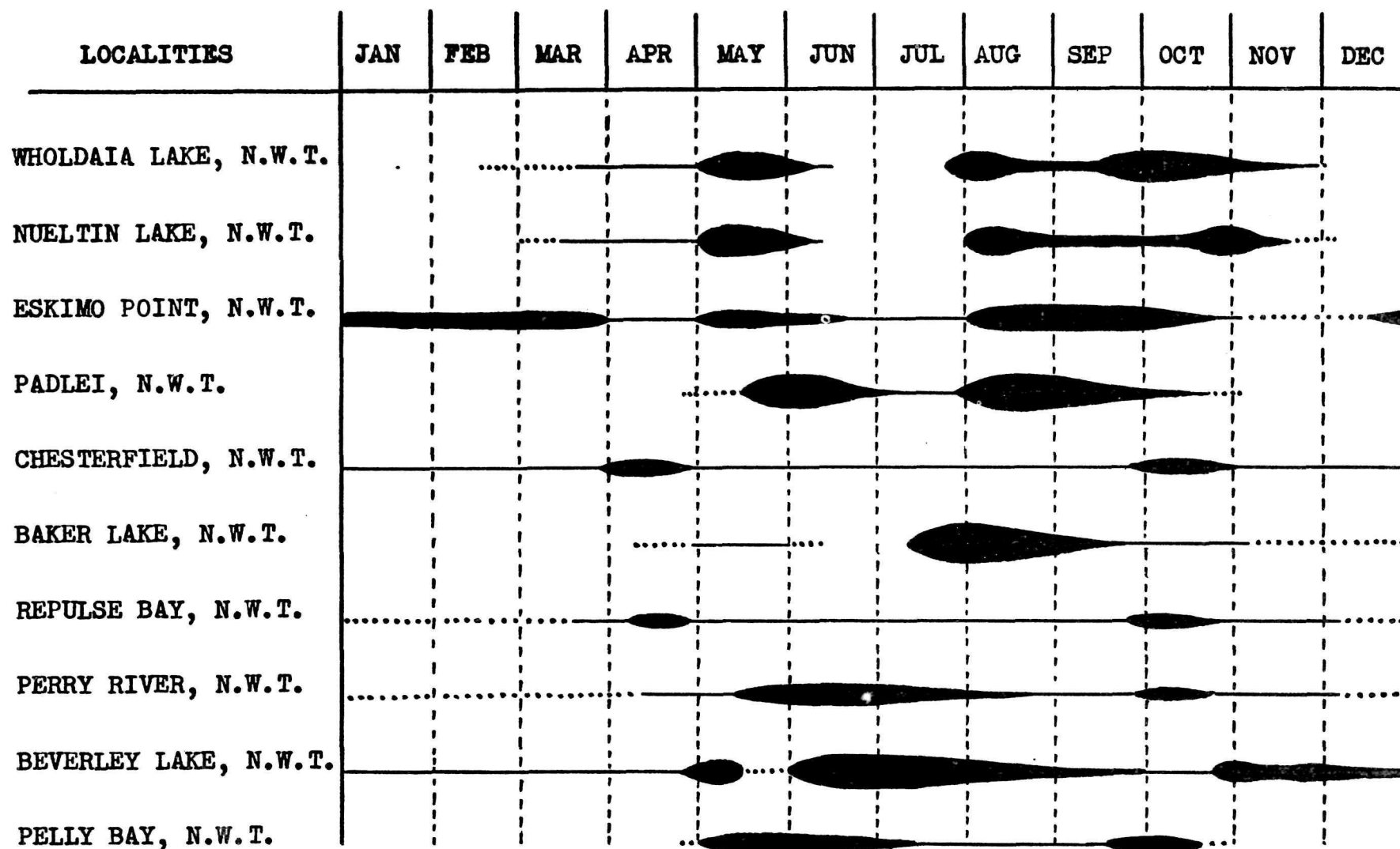


Fig. 13 (cont'd). PERIODS OF OCCURRENCE OF CARIBOU NEAR NORTHERN SETTLEMENTS

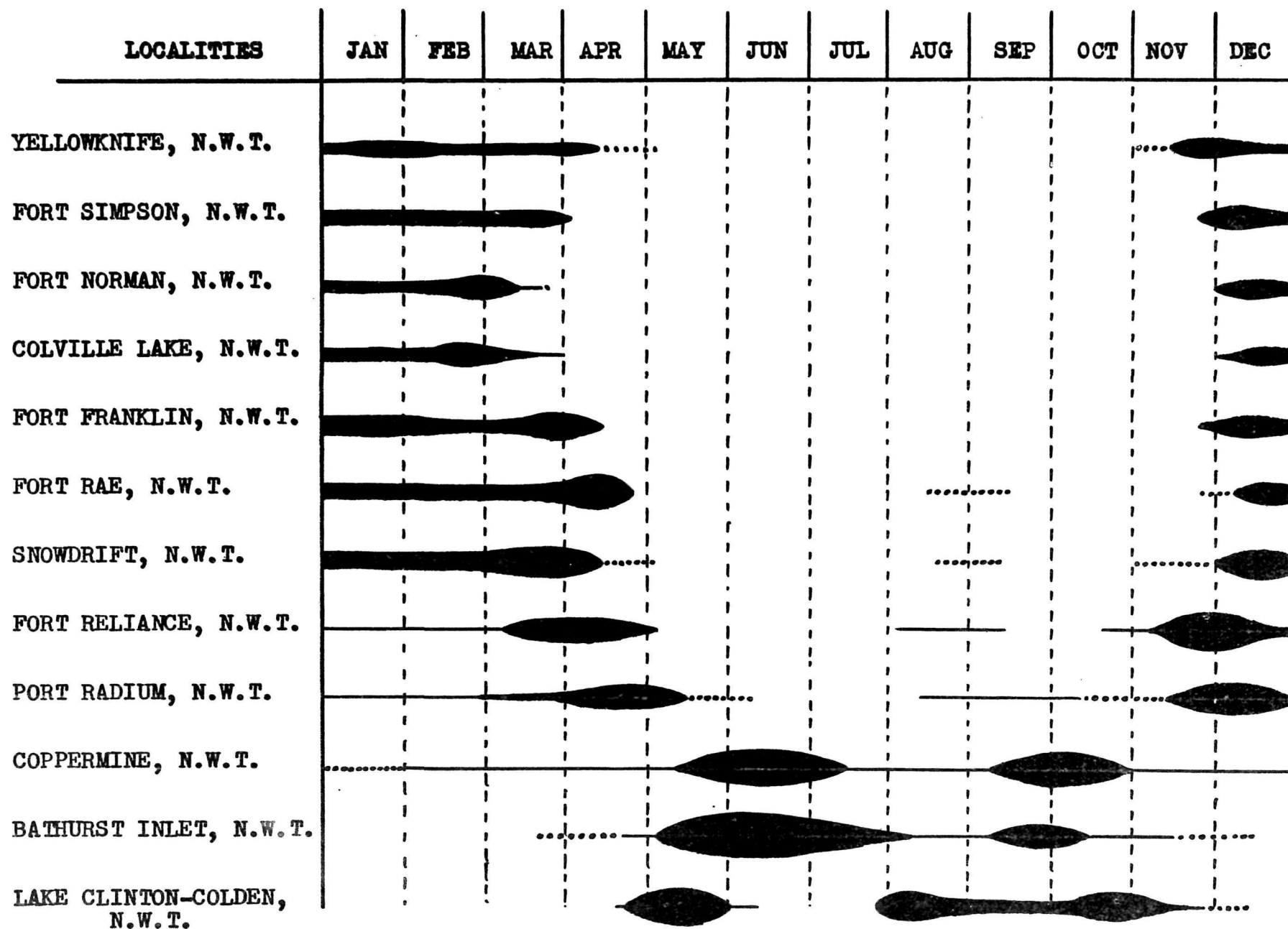
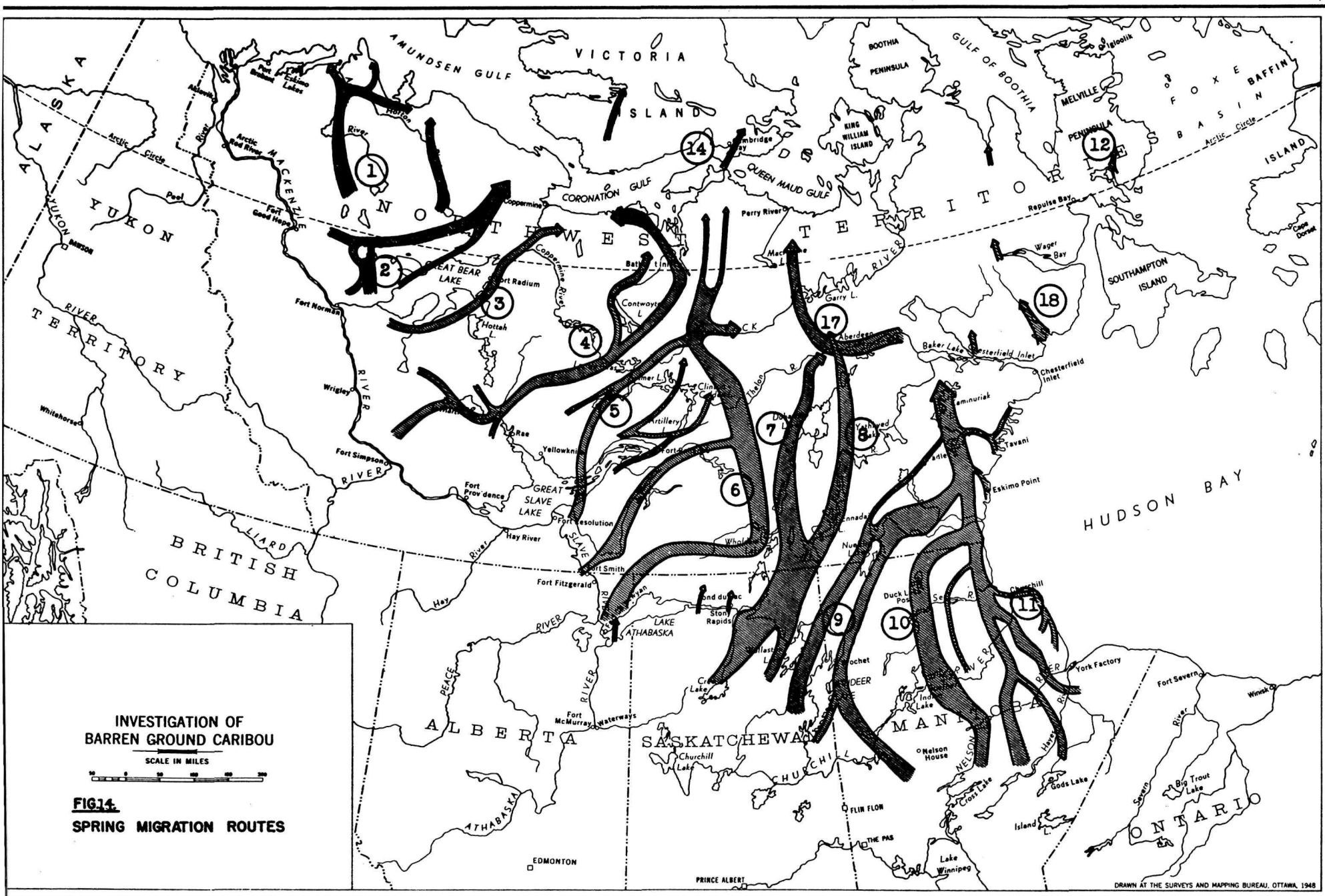
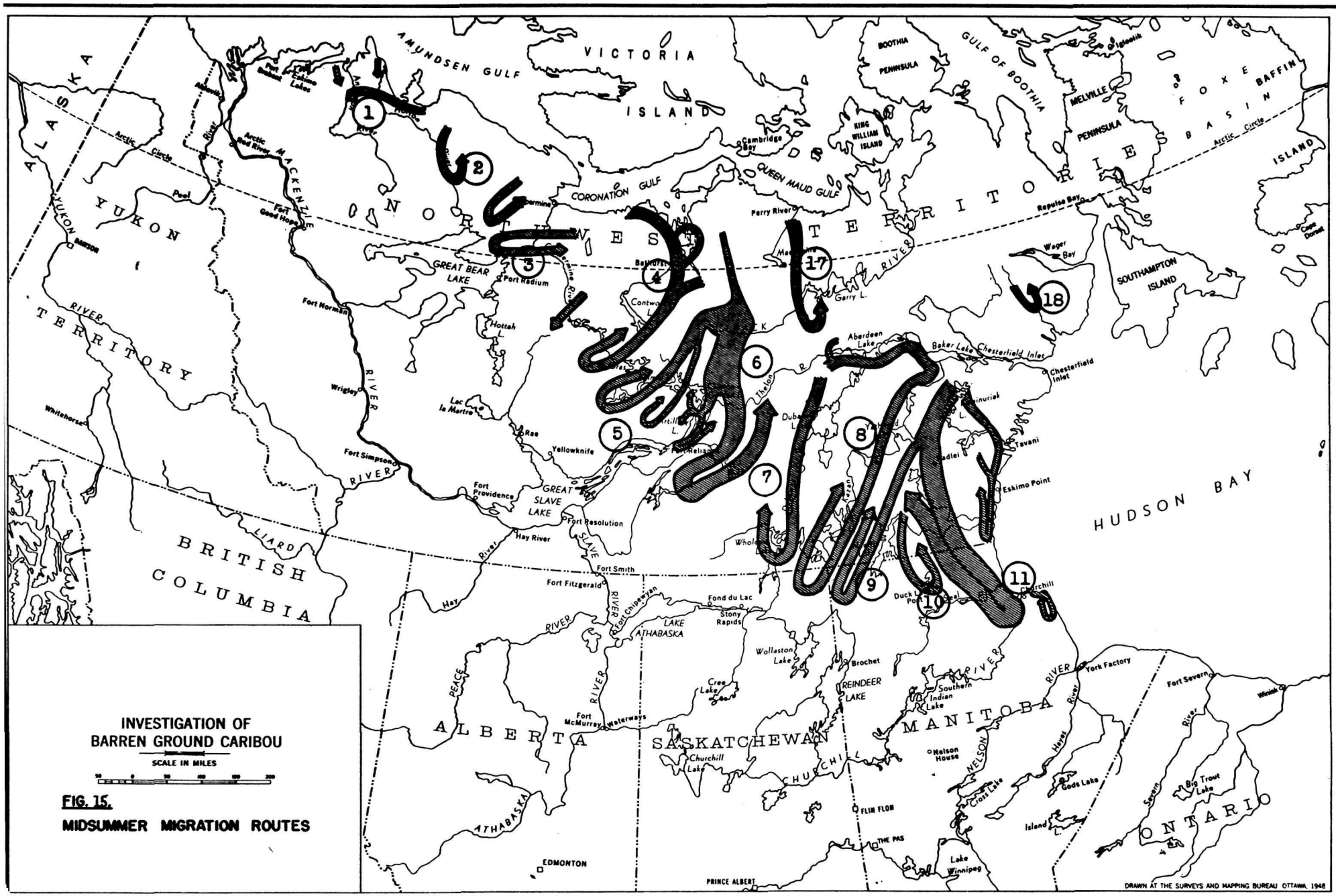
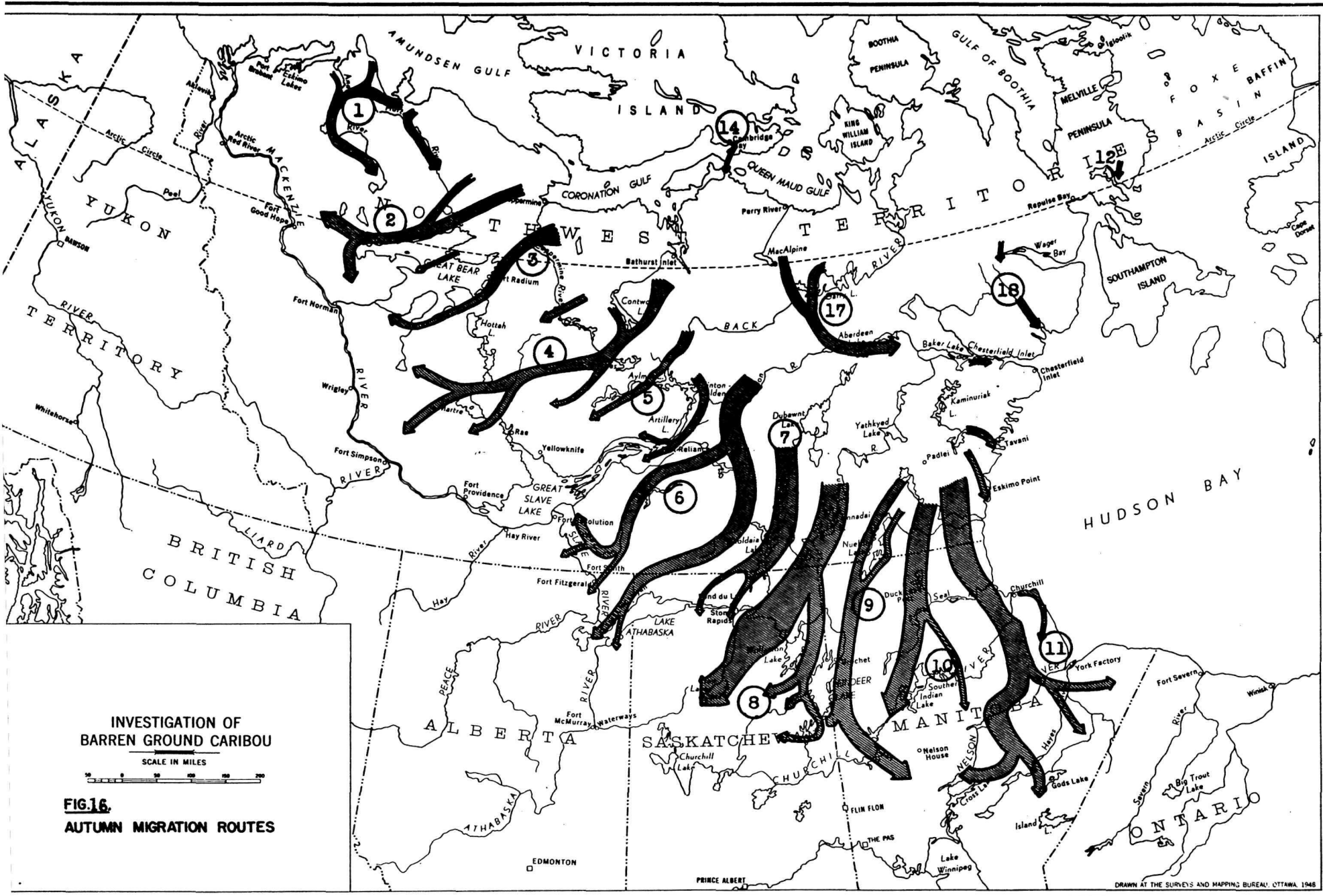


Fig. 13 (concluded). PERIODS OF OCCURRENCE OF CARIBOU NEAR NORTHERN SETTLEMENTS







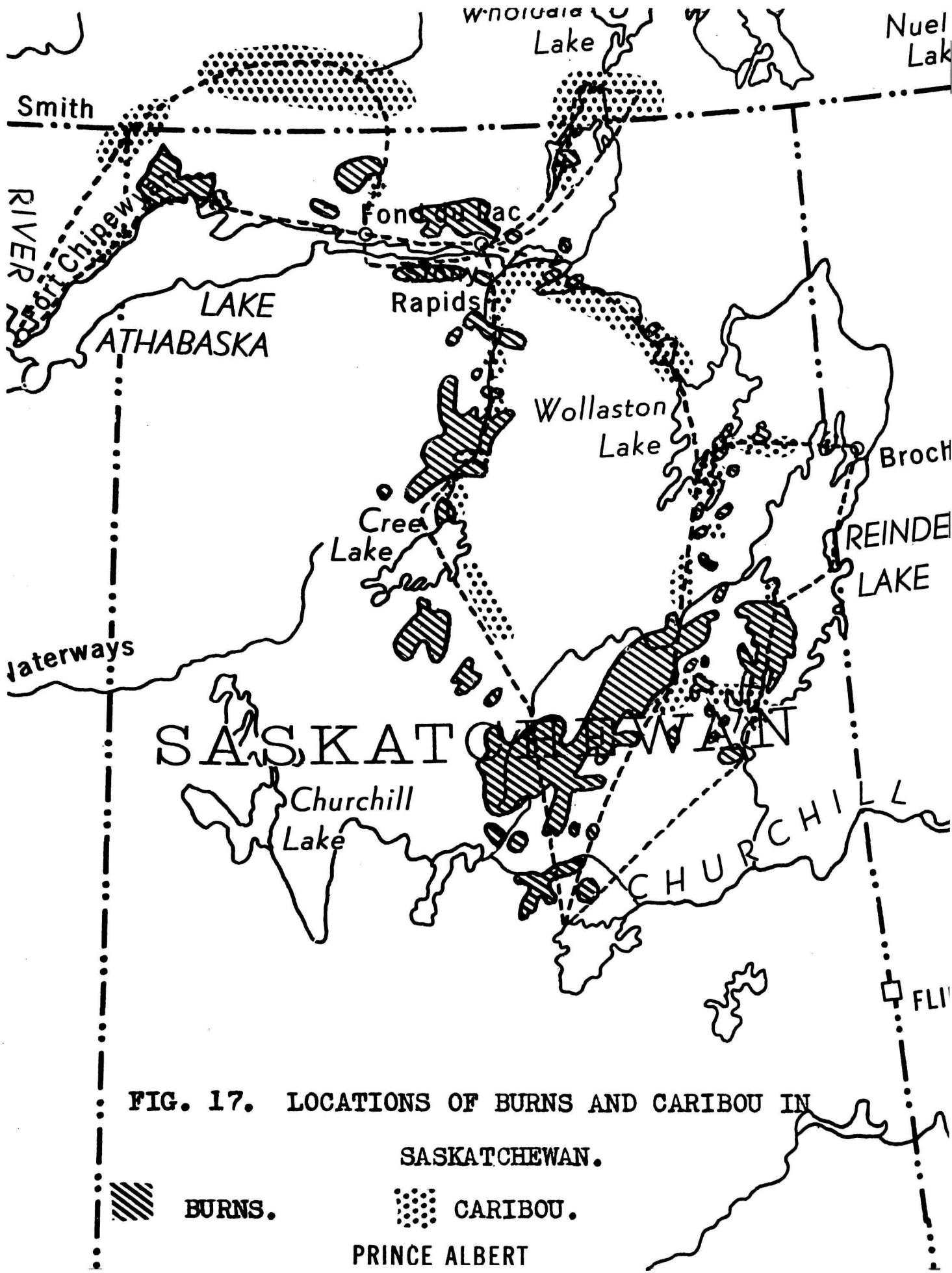


FIG. 17. LOCATIONS OF BURNS AND CARIBOU IN SASKATCHEWAN.



BURNS.



CARIBOU.

PRINCE ALBERT

