# PEARY CARIBOU CALVING AND POSTCALVING PERIODS, BATHURST ISLAND COMPLEX, NORTHWEST TERRITORIES, 1992

Frank L. Miller

Technical Report Series No. 166
Western & Northern Region 1993
Canadian Wildlife Service

This series may be cited as:
Miller, F.L. 1993. Peary caribou calving and postcalving periods, Bathurst Island complex, Northwest Territories, 1992. Technical Report Series No. 166 Canadian Wildlife Service Western & Northern Region, Alberta.

Issued under the Authority of the
Minister of Environment
Canadian Wildlife Service


Catalogue No. CW69-5/166E
ISBN 0-662-20337-2
ISSN 0831-6481

Copies may be obtained from:

Canadian Wildlife Service
Western & Northern Region
Room 210
4999 - 98 Avenue
Edmonton, Alberta
Canada
T6B 2X3

**ABSTRACT.** Peary caribou (Rangifer tarandus pearyi) were aerially surveyed on south-central Queen Elizabeth Islands, Northwest Territories, Canada, in June and July 1991 to obtain data on relative numbers, sex/age composition, distributions, movements, chronology of calving period, calf production, and early survival of calves. The sex/age composition of caribou on Massey Island was skewed and bulls were essentially lacking there. The frequencies of occurrence of caribou on Alexander Island and Massey Island were greater than expected by chance alone ($P < 0.005$) when compared on a relative landmass basis with the other three western major satellite islands and Bathurst Island. Nonsystematic aerial searches yielded sightings of a maximum of 949 different individual caribou between 27 June and 5 July 1991. Most of the caribou were seen on Bathurst Island: mostly on the northern part of the island, north of Polar Bear Pass; and mainly on coastal areas in June, shifting to interior areas in early July. Caribou continued to move counterclockwise around Bathurst Island, beginning some time before May and persisting into, at least, July 1991. Calving peaked during the 3rd week of June, then continued through the last days of June and possibly into the first week of July 1991. By 7 July 1991 there were about 91 and 32 newborn calves seen per 100 breeding cows and per 100 1+ year-old females, respectively. It appears that about 83% of the theoretical average rate of pregnancy was realized for all 2+ yr-old females within the Bathurst Island complex in 1991. Early mortality of calves appears to have been 10% or slightly less. Snow depth measurements ($n = 5751$) were obtained from 639 sample sites at 71 stations during May-June 1991. Snow cover was highly variable and some small patches of snow-free ground existed on exposed sites. Measured snow depths ranged from 1 to 95 cm before snow melt began in early June 1991. Where snow cover persisted on individual sample sites, it averaged 20-22 cm between 24 May and 10 June on the 7.5-km snow/ice course and 18-24 cm between 26 May and 11 June on the 1-km course. Subsequently, ground fast ice accumulated only at 39% of the stations and 34% of the sample sites. Ground fast ice on the 7.5-km course averaged 4.4 cm (± 1.6 cm SD) to 9.8 cm (± 4.6 cm SD) and ranged from 2 to 14 cm in thickness, while on the 1-km course it averaged 4.1 cm (± 2.1 cm SD) to 11 cm (± 1.8 cm SD) and ranged from 1 to 15 cm in thickness. No positive direct evidence was obtained for Peary caribou foraging or even attempting to dig forage craters in the snow cover at any time between 24 May and 1 July 1991 anywhere within the Bathurst Island complex.

**RÉSUMÉ.** On a fait un relevé aérien des caribous de Peary (Rangifer tarandus pearyi) dans le centre-sud des îles de la Reine-Élisabeth (Territoires du Nord-Ouest) au Canada, en juin et juillet 1991 afin d'obtenir des données sur les nombres relatifs, la composition selon l'âge et le sexe, la répartition géographique et les déplacements de cet animal, ainsi que sur la chronologie de la période de mise bas, la reproduction et la survie initiale des faons nouveau-nés. Sur l'île Massey, la composition selon le sexe et l'âge était asymétrique, et l'on a noté une pénurie d'adultes mâles. La fréquence d'apparition de caribous sur les îles Alexander et Massey a été statistiquement plus significative que prévu (P < 0,005) si l'on compare la masse terrestre relative de ces îles à celle des trois grandes îles satellites à l'ouest, et de l'île Bathurst. Lors de recherches aériennes non systématiques, on a dénombré, au total, 949 différentes bêtes du 27 juin au 5 juillet 1991. La plupart des caribous se trouvaient sur l'île Bathurst, surtout dans le nord de l'île, au nord du col Polar Bear. En juin, ils sont restés principalement dans les zones côtières, tandis qu'au début de juillet ils se sont déplacés à l'intérieur de l'île. Les caribous ont continué à se déplacer autour de l'île Bathurst dans le sens antihoraire quelque temps avant mai et ont continué au moins jusqu'en juillet 1991 en partie. La mise bas a plafonné durant la troisième semaine de juin et s'est poursuivie durant les derniers jours de juin et peut-être pendant la première semaine de juillet 1991. Au 7 juillet 1991, il n'y avait environ que 91 faons nouveau-nés pour 100 biches reproductrices, et 32 faons pour 100 biches de un an et plus. Il semble qu'environ 83 % du nombre moyen possible de faons à naître dans le groupe des biches de deux ans et plus du complexe de l'île Bathurst soient nés 1991 et que les faons morts en bas âge se chiffrent à 10 % de l'ensemble, voire à un peu moins de 10 %. On a mesuré (n = 5751) l'épaisseur de la neige à 639 sites d'échantillonnage de 71 stations durant mai à juin 1991. Le manteau nival variait grandement, et il y avait des parcelles de terre sans neige dans les sites battus par le vent. La profondeur de la neige variait de 1 à 95 cm avant le début de la fonte, au début de juin 1991. À certains sites où la neige persistait, la couche moyenne mesurait de 20 à 22 cm sur la ligne de relevés de 7,5 km du 24 mai au 10 juin, et de 18 à 24 cm sur la ligne de relevés de 1 km, du 26 mai au 11 juin. Par la suite, de la glace fixée sur le sol s'est formée à seulement 39 % des stations et 34 % des sites d'échantillonnage. Sur la ligne de relevés de 7,5 km, l'épaisseur de la glace mesurait, en moyenne, 4,4 cm (± 1,16 cm ET) à 9,8 cm (± 4,6 cm ET) et variait de 2 à 14 cm, tandis que sur la ligne de relevés de 1 km elle mesurait, en moyenne, 4,1 cm (± 2,10 cm ET) à 11 cm (± 1,80 cm ET) et variait de 1 à 15 cm. On n'a trouvé aucune preuve formelle directe laissant supposer que les caribous de Peary avaient fourragé ou même essayé de fourrager dans la neige du 24 mai au 1^er^ juillet 1991, à un endroit ou un autre du complexe de l'île Bathurst.

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

## INTRODUCTION

The Peary caribou (Rangifer tarandus pearyi) has been uplisted by the Committee On The Status Of Endangered Wildlife In Canada (COSEWIC) in April 1991 from its 1979 "Threatened" classification to the more dire level of "Endangered". The reclassification is based on an Environment Canada, Conservation & Protection (C&P), Canadian Wildlife Service (CWS) status report on Peary caribou to COSEWIC in 1990 (Miller 1990), resulting from the most recent (1984-89) reevaluation of the status of Peary caribou by CWS. The Peary caribou is unique to arctic Canada and it is a socially important and economically valuable part of Canada's natural heritage.

Peary caribou on the southwestern and south-central Queen Elizabeth Islands (QEI) of the Canadian Arctic Archipelago remain dangerously low in number (Gunn et al. 1979, 1981, Miller 1987a, 1987b, 1988, 1989, 1990). The three major islands of significance for Peary caribou have been, and still are, Melville, Bathurst, and Prince Patrick in descending order (Fig. 1), based on the number of caribou estimated on each compared to numbers on all other QEI in 1961 (Tener 1961, 1963), 1972-74 (Miller et al. 1977a), and 1985-88 (Miller 1987a, 1987b, 1988, 1989). Peary caribou on the two major southwestern QEI of Melville and Prince Patrick remain in apparent continual decline since 1961 (Tener 1963, Miller et al. 1977a, Miller 1987b, 1988). The south-central island of Bathurst, where Peary caribou underwent the greatest proportional loss in number on an island basis during the catastrophic winter of 1973-74 (Miller et al. 1977a), is the only major island where the caribou have shown any sign of recovery from the 1973-74 low (Miller 1987a, 1989). The Peary caribou on Bathurst Island remain significantly below the number estimated in 1961 (Tener 1963), however, and cannot currently be considered a harvestable population, except at a token level and preferably only when restricted to male caribou (Miller 1989, 1991).

Bathurst Island was a principle caribou hunting area for the Inuit of Resolute Bay, Cornwallis Island, prior to the cataclysmic loss of caribou in 1974. As a result of the 1973-74 die-off and the general lack of caribou on Bathurst Island thereafter, the Inuit hunters of Resolute Bay imposed a voluntary ban on caribou hunting on Bathurst Island in 1975 (Freeman 1975, Ferguson 1987). The ban was apparently honoured until 1990 although a desire to reinitiate caribou hunting on Bathurst Island was voiced in 1988 and 1989. Six caribou were reported to have been killed there in winter 1989-90 and four were shot on the small island of Baker, ca. 8 km off the southeast coast of Bathurst Island, in late winter 1990 (G. Eckalook, J. Hunter, T. Manik, Resolute Bay, pers. commun., 1990). An additional 6 or 7 were reportedly shot on Bathurst Island by polar bear hunters out of Resolute Bay, Cornwallis Island, in late winter 1991 (T. Manik, Resolute Bay (pers. commun., 1991).

Bathurst Island and its satellite islands were selected by CWS to continue ecological studies of the relationship between Peary caribou and their environment as (1) the Inuit of Resolute Bay have resumed hunting caribou there (which makes those caribou essentially the only hunted population of Peary caribou on the QEI, except for some limited hunting on southern Ellesmere Island by people from Grise Fiord); (2) the Peary caribou on Bathurst Island are the most accessible within the QEI which also have, at least in theory, the potential for increasing in number to a level that would sustain annual harvests of meaningful sizes; and (3) apparently only the Peary caribou on Bathurst Island (and some smaller satellite islands) are currently experiencing any marked increase in number from their 1973-74 low, while Peary caribou on Melville and Prince Patrick islands (and their respective satellite islands) showed no indication of recovery in 1986 and 1987, when last surveyed (Miller 1987b, 1988).

The following is an annual progress report on the 1991 field season activities for Peary caribou studies on Bathurst Island and some of its satellite islands. This field season was the second operational period for most of these studies, as 1989 was devoted mainly to planning, initial logistics, and establishing a field base camp on northeastern Bathurst Island. Exceptions to the above are studies on (1) spring-summer distributions and movements; (2) aerial sex/age segregation counts; (3) documentation of the chronology of the calving period; (4) a measure of calving success (% calves among all caribou seen and calf:female ratios); and some insight into early calf losses, which were also investigated in 1988 and 1989 (Miller 1989, 1991) and 1990 (Miller 1992).

## STUDY AREA

### 1. Bathurst Island Complex

The study area of the current project is termed the "Bathurst Island complex" (BIC) and for the purpose of this research includes a complex of 26 islands that lie within the south-central portion of the QEI or to the south in the immediately adjacent waters of Viscount Melville Sound and Barrow Strait (Figs. 1-5). The study area lies between 74° and 77°N latitude and 93° and 107°W longitude, and the collective landmass of the 26 islands equals ca. 27 000 km². The islands are mostly low-lying and mainly below 150 m above mean sea level (amsl) in elevation. Geology, topography, and vegetation within the study area have been described in detail (e.g., Dunbar and Greenaway 1956, Thorsteinsson 1958, Savile 1961, Fortier et al. 1963, Tener 1963, Blake 1964, Kerr 1974, Wein and Rencz 1976, Edlund 1983).

The 26-island study area is divided into three levels of importance: (1) one principal island; (2) nine major satellite islands (each island >50 km²); and (3) 16 secondary satellite islands (each island <50 km²).

### 1.1. The principal island

The principal island is Bathurst Island (16 090 km²) which is the largest and most important "game" island within the south-central QEI (Figs. 1 and 2). A "primary study area" for intensive ground studies has been selected on a northeastern coastal site (ca. 100 km²) between the Walker and Moses Robinson rivers (centered at ca. 76°00'N, 97°40'W).

## 1.2. Major satellite islands

The nine major satellite islands of Bathurst Island (Figs. 1-3) are the "five western major satellite islands" of Vanier (1130 km²), Cameron (1060 km²), Alexander (490 km²), Massey (440 km²), and Marc (56 km²) on the northwestern coast; the "two northern major satellite islands" of Helena (220 km²) and Sherard Osborn (60 km²) off the northern coast; and the "two eastern major satellite islands" (in terms of possible movements or migrations of Peary caribou within the BIC) of Cornwallis (7000 km²) and Little Cornwallis (410 km²).

## 1.3. Secondary satellite islands

The 16 secondary satellite islands (Figs. 1-5) are the nine southern secondary satellite islands of Browne, Garrett, Griffith, Hamilton, Lowther, Somerville, and Young in Barrow Strait, and Baker and Moore in Intrepid Passage; the six eastern secondary satellite islands of Crozier, Kalivik, Milne, Neal (Neal Islands are treated as one island), Truro, and Wood in McDougall Sound; and the one western secondary satellite island of Bradford in Graham Moore Bay.

These 16 small secondary satellite islands are known or are likely to receive migrant caribou from Bathurst Island during periods of springtime environmental stress (e.g., Bissett 1968, Miller and Gunn 1978, 1980) and thus are included in the study area. All of these islands are poorly vegetated and none is of a size that could support any significant number of Peary caribou on a year-round basis. Because of their usually exposed nature, however, these small islands could collectively provide, and sometimes have provided, valuable temporary relief for caribou fleeing widespread forage unavailability elsewhere within the BIC. These 16 small islands collectively only total about 390 km².

## 2. General Climate

The climate of the study area is characterized by long cold winters, short cool summers, and low precipitation. Air temperatures average below -17.7°C from December to March. Mean daily temperatures generally do not rise above 0°C until after 1 June on the extreme south of the study area, and 15 June on the north of the survey area (Meteorological Branch 1970). The snow cover usually starts to melt in early June, and often rapidly dissipates to bare ground through mid-June, except for snowbanks in sheltered sites (Potter 1965). Summer is the period when the ground is generally snow-free, and lasts from the beginning of July to the end of August. Winter starts when the mean daily temperature falls below 0°C, usually about 15 September. September and October are the stormiest months and much of the annual snowfall may occur in those months. From December to March, anticyclones dominate the weather causing frequent calms, clear skies, and light snowfall.

A comparison of 1 year's weather data from the Canadian Museum of Nature research station in Polar Bear Pass on central Bathurst Island with data from Resolute Bay, Cornwallis Island, suggests that the differences in the weather between the two locations are the result of the research station's inland site and local topographical effects (Thompson 1971). The Atmospheric Environment Service weather station at Mould Bay, Prince Patrick Island, tends to have cooler, drier and less stormy weather than the weather station at Resolute Bay, Cornwallis Island (Maxwell 1981).

The amount and duration of snow cover, especially in spring, are critical to arctic ungulates, but also critical are the types of snow cover and incidences of freezing rain. Wind removes the snow from exposed slopes and redeposits it as shallow but hard compacted cover and drifts in more sheltered and relatively well-vegetated sites. Freezing rain in autumn that results in ground fast ice before snow cover accumulates, ice layering in the snow cover, crusting of the snow, and the formation of ground fast ice in spring (e.g., Miller et al. 1982) compound the stress of forage unavailability on arctic ungulates. Unfortunately, detailed range-wide information on type of snow cover and the incidence of ground fast ice or ice layering is generally unavailable for the QEI.

## METHODS

### 1. Nonsystematic Helicopter Searches

For the purpose of aerial searches, Bathurst Island was divided into 12 "search zones": (1) northeast coast (NEC); (2) northeast interior (NEI); (3) southeast coast (SEC); (4) southeast interior (SEI): (5) south coast (SC); (6) southwest coast (SWC); (7) southwest interior (SWI); (8) northwest coast (NWC); (9) northwest interior (NWI); (10) north coast, western section (NCW); (11) north coast, eastern section (NCE); and (12) Polar Bear Pass (PBP). All of the land area divisions (search zones) were tied to the three aerial survey strata of Bathurst Island (Fig. 2) used by Miller et al. (1977a) and Miller (1987a, 1989). Zone 12 (Polar Bear Pass) includes all of the lowlands from the middle of the valley north to the crest of high ground and a nearly equal distance to the south from near the head of Goodsir Inlet through the pass to near the head of Bracebridge Inlet. All coastal areas were strips of land that extended about 5 km inland from the sea coast. The middle lowlands of Polar Bear Pass through central Bathurst Island were used to divide Bathurst into north and south sections (the common boundary of survey Stratum (St.) I and St. II, Fig. 2). The northern portion of Bathurst Island was divided into eastern and western halves along the common land and water boundaries of St. I and St. II (Fig. 2). The southern portion of Bathurst Island was divided in half on an east and west basis along about the 99°00'W meridian (passing just west of the head of Bracebridge Inlet at the north end to just west of Dyke Acland Bay on the south coast.

### 1.1. Aircraft

A Bell-206B (Jet Ranger) turbo-helicopter on high skid gear was used as the search aircraft in June and July 1991.

## 1.2. Observers

I used a 3- or 4-person aerial search team: pilot-navigator-spotter (right front seat); navigator-spotter-observer (left front seat); and a left and right or only a right rear seat observer (when a full fuel tank was necessary, weight limitations restricted the crew size to only 3 people). Navigation was carried out by the pilot and the left front seat person. Either the left front seat observer and the right rear seat observer (3-person crew) or both rear seat observers (4-person crew) recorded observations for their respective side of the aircraft: (1) date; (2) location; (3) composition of animal(s) sighted, as bull, cow, calf, juvenile, or yearling (juv. & yr. were separated by sex); and (4) remarks, if any. The animals sighted were circled, if necessary, to determine their number and sex/age composition (all 3 crew members participated in the determinations).

## 1.3. Altitude

Altitude of the helicopter varied between 10 and 90 m above ground level (agl) during the nonsystematic helicopter searches over land and sea ice.

## 1.4. Helicopter air speed

The air speed of the helicopter mainly varied between about 96 and a cruising speed of 180 km $\cdot$ $h^{-1}$ during the searches (usually at cruising speed when searching for animals). Slower speeds were temporarily maintained when examining tracks or animals and the helicopter was sometimes hovered for better inspection of tracks.

## 2. Relative Numbers

Relative numbers of caribou by search zone and by island within the BIC were determined by nonsystematic helicopter searches. The technique does not necessarily provide accurate population estimates on an island basis or for the inter-island population within the entire BIC. The maximum count obtained during a discrete search period can, however, provide some insight into the likely seasonal population levels by island and for the entire BIC.

## 3. Distributions And Intra- Or Inter-island Movements/migrations

Distributions and intra-island movements and seasonal migrations by search zone or an entire island were determined by nonsystematic helicopter searches over land areas of the various islands within the BIC. Evidence for inter-island movements or seasonal migrations of caribou within the BIC was to be obtained by low-level nonsystematic helicopter searches over the interjacent sea ice and adjacent coastal areas of the 26 islands within the BIC.

Direction of travel on trails on the sea ice would be determined and, if possible, exact origins and termini. Animals sighted on the sea ice would be left undisturbed. We would have first back tracked along their trails to find where they left the land (point of origin). Then, we would have subsequently followed the trail in the direction of travel from about where we first saw the animals to determine the terminus.

Comparison of the sex/age structure of caribou on the five western major satellite islands of Bathurst Island vs. that for only Bathurst Island could provide indirect evidence for inter-island movements or migration, and the possible selection of calving areas. The skewedness of the distribution of sex/age classes of caribou among the islands of the BIC also could serve as indirect evidence for seasonal inter-island movements/migrations; and thus, the existence of an inter-island population of caribou. Comparison of the sex/age composition of caribou seen on the various areas of Bathurst Island could allow some indirect evaluation of intra-island movements/migrations, and the degree of spatial segregation of caribou on Bathurst Island, at least at one season of the year.

## 4. Sex/age Composition And Social Groupings

Segregations of caribou seen during aerial activities by sex/age classes (bulls, cows, calves, juveniles and yearlings) were used to determine the approximate sex/age structures of the "precalving" and "postcalving" population segments on an island basis and between and among islands. The overall data base from combined aerial activities allowed approximations of the precalving and postcalving sex/age compositions of the entire inter-island population of Peary caribou within the BIC. These data provide some insight into the current population dynamics and the potential for growth of the caribou population within the BIC.

### 4.1. Sex/age classification

Peary caribou are recognized and classified by sex/age class as follows.

**4.1.1. "Bulls" (mature males, assumed 4+ yr-old)** are recognized in May through mid June by the relatively large size and advanced development of their new antler growth, which is exaggerated by the presence of velvet on the antlers. Diagnostic characteristics are the large diameter of the main beams; the long, posteriorly curved main beams; and the presence of well-developed, anteriorly directed brow or bez tines. Secondary characteristics include large body size, relatively large head size; and new pelage, especially on the lateral parts of the body and on the face. When the caribou under consideration exhibits male-like antler growth, the observer distinguishes mature males from juvenile males by mentally evaluating the length of the new antler growth present in relation to the length of the animal's head (from crown of skull to tip of nose). When the antler growth is longer than the head - the animal is classified as a bull; and if shorter than the head - a juvenile male. By late June the distinction between the larger antlers of bulls compared to those of juvenile males becomes obvious, and there is no chance of confusing the two sex/age classes, with one possible exception. Males just coming of age, "borderline bulls", are classified as "bulls" when their antler growth is characterized by large-diameter main beams that are directed strongly posteriad, and considerable terminal growth on the main beam is yet to occur. When the main beams of the antlers are directed posteriorally but have already begun to curve anteriorally along the middle and terminal portions of the main axes, and the antlers, seemingly, are going to be only slightly longer than the anterio-posteriad axis of the head, from the nose to the back of the neck, the animal is classified as a "juvenile male".

**4.1.2. "Cows" (mature females, assumed to be mostly 3+ yr-old)** are recognized by the retention of hard antlers from the previous year or the absence of antlers and any new growth of antlers. In a few cases, minor new growth on the simple main beams has begun (such new growth most likely occurs among individuals just coming of age or possibly in a few older cows that maintained better physical condition because they did not have the added burden of carrying a fetus to full-term or nursing a calf in the current year). Cows, especially those that calved in the current year, still retain much of their previous winter's pelage and have a faded, lifeless, often patchy appearance about them (relative to other sex/age classes in July). The general drab appearance of a successful maternal cow often remains clearly recognizable into August of the year (individual variation, however, may be important after mid-July). Whenever possible, the presence of a stained "vulval patch" or a distended udder in combination with retained hard antlers in June is noted (cf. Bergerud 1961, 1964). Empirical impressions formed over several years of springtime (May-June) aerial searches indicate that the adult cow-like characteristics ascribed to a "breeding cow" apply to all paturient females regardless of age. Therefore, a certain but unknown, and most likely annually changing, percentage of "breeding cows" in each year would actually be pregnant juvenile or yearling females. On occasion, obviously small-sized "breeding cows" are recognized but consistent comparative size distinctions over time are not currently feasible or possible. Thus, "breeding cows" represent the sum total of all females (1+ yr-old) in the population that have either produced a calf (viable or nonviable) or carried a fetus to near- or full-term in that year.

**4.1.3. "Juvenile/yearling males" (males, assumed 1-3 yr-old)** are recognized in May through mid June by their new pelage, and their relatively small body size (especially that of yearlings), which, when compared to adults, aids in their separation from bulls and cows. (Initially, an attempt is made to separate juvenile males from yearling males.) The advanced, well-developed, but relatively small (when compared to bulls) new antler growth of at least 2 and 3-yr olds is used to separate them from juvenile females. Yearling males are judged by their associations, relative antler development and body size, as well as the absence of a "vulval patch", when possible (cf. Bergerud 1961). By late June and early July there could be some confusion between the diagnostic characteristics of some juvenile male antlers (most likely those of 2 yr olds) and those of some females, especially nonpregnant females and particularly those females just "coming of age". At this time, it appears that the most accurate basis for separation of some juvenile males from heavily antlered females lies in the comparative shapes and priorities of antler growth. That is, the growth of juvenile (and, seemingly, yearling) male antlers is directed to the development of strongly posteriorally curved main beams. When viewed from above (from a low-level helicopter) the two main beams of males are directed both backwards and outwards, the pair giving a posteriorally inclined "V-shaped" appearance from above. Such male main beams are devoid of any terminal growth of lateral tines. Most often, one or more of usually the 1st ("bez") or occasionally the 2nd ("trez") tine(s) are well-developed in an oblique, upwards, anteriorad direction, usually well exceeding 50% of the lineal growth of the main beams in length. The same conditions but on a smaller scale appear to apply to yearling males during the same time period (except that the terminal portion of one or both main beams may be beginning to fork).

**4.1.4. "Juvenile/yearling females" (females, assumed 1-2 yr-old)** are recognized in May through mid June by their new pelage, new antler growth, relatively small body size (particularly yearlings) and the presence, when visible, of a "vulval patch" (and the absence of a distended udder) (cf. Bergerud 1961, 1964). Yearling females are separated from juvenile/yearling males or juvenile females by their new antler growth appearing shorter than the ears and being restricted to small spike-like main beams or at the most, small main beams with simple branching. Antler growth characteristics, together with the relatively small body size and new pelage, separate juvenile/yearlings from cows or bulls. (Initially, an attempt is made to separate juvenile and yearling males from juvenile and yearling females.) In late June and early July, antler growth of some juvenile females vs. some juvenile (and possibly some yearling) males becomes more difficult to separate. It appears that the main diagnostic characters of juvenile females (and nonpregnant cows) with relatively large antlers are more of form and apparently of growth priorities than of size. The main beam of the juvenile female antler tends to be more upright in its earlier stages of growth than that of the juvenile or yearling male. The main beam of a female exhibits initial curvature in an anteriorad direction at a relatively early stage compared to at least juvenile and possibly yearling males. Also, relatively little growth appears to be devoted to the development of proximal (bez and trez) tines in females, with such growth of those tines on females usually being much less than 50% of the length of the main beams. Highly stained pelage in the area of the vulva appears to be essentially characteristic of females only. The occurrence of "scours" in some juvenile or yearling males could lead to possible confusion in a few cases in most years. Group association with "breeding cows" just prior to, during, or immediately after calving, seemingly, strongly favours classification of juvenile/yearling animals of undetermined sex as females (as does association of juvenile/yearling males with bulls, but apparently to a lesser extent for juvenile/yearling males than for juvenile/yearling females associated with "breeding cows").

**4.1.5. "Calves" (male or female, assumed newborn in June of the year)** are obvious by their relatively small size compared to other sex/age classes. No attempt is made to sex calves (cf. Bergerud 1961) during aerial composition counts.

## 4.2. Caribou social formations

A "caribou social group" is composed of two or more individual caribou that are seen in close association (no fixed minimum or maximum distance of separation but usually much closer than 100 m) and apparently spatially isolated from other individuals of the same species at the time of observation. Two or more individuals (of the same species) are considered as one group even if they are more than 100 m apart but moved together when disturbed by the survey aircraft.

### 4.2.1. Mixed sex/age caribou group

A "mixed sex/age caribou group" may be mixed by sex or age or both and contains any possible combination of bulls, cows, juveniles, yearlings, or calves (when bulls cannot be recognized, the presence of both sexes might not be determined with complete confidence).

Mixed sex/age groups can occur as any of 22 possible combinations of designated sex/age classes: (1) cow-only; (2) cow/calf; (3) cow/juvenile; (4) cow/yearling; (5) cow/calf/juvenile; (6) cow/calf/yearling; (7) cow/juvenile/yearling (8) cow/calf/juvenile/yearling; (9) bull/cow; (10) bull/cow/calf; (11) bull/cow/juvenile; (12) bull/cow/yearling; (13) bull/cow/calf/juvenile; (14) bull/cow/calf/yearling; (15) bull/cow/juvenile/yearling; (16) bull/cow/calf/juvenile/yearling; (17) juvenile/yearling; (18) juvenile-only; (19) yearling-only; (20) bull/juvenile; (21) bull/yearling; and (22) bull/juvenile/yearling.

The presence of a calf in a mixed sex/age group without a cow being present would be considered an unstable anomalous social grouping (a temporary gathering) and thus would not be considered as a valid mixed sex/age group. The presence of a calf (female or male) in a male-only group would also be considered an anomaly and would not be considered as a valid male-only group. Such anomalous groupings would be recorded but they would not be used in the calculation of any statistics for either mixed sex/age or male-only groups.

A juvenile or yearling caribou can be either female or male in a mixed sex/age group if at least one cow is present, but can only be female if no cow is present. Two or more juveniles or yearlings in a mixed sex/age group can be either sex or of mixed sex if at least one cow is present, and can be either all females or mixed by sex if no cows are present.

### 4.2.2. Male-only caribou group

A "male-only caribou group" can be composed of mature males only (bulls, assumed 4+ yr olds, relatively large antler size) or juvenile males or yearling males or any combination of bulls, juvenile males, and/or yearling males. In June-July of the year both bulls and immature males (at least 2- and 3-yr olds and possibly 1-yr olds) are readily recognizable by their relatively advanced antler development from other sex/age classes of Peary caribou.

Male-only groups can occur as any of seven possible combinations of designated male age classes: (1) bull-only (2) bull/juvenile male (3) bull/yearling male; (4) bull/juvenile male/yearling male; (5) juvenile males; (6) yearling males; and (7) juvenile male/ yearling male.

## 5. Calving Period

The timing of the calving period, with emphasis on the peak of calving, was determined by the measurement of the percentages of newborn calves present among all caribou segregated over time in June-July 1991. Ratios of newborn calves per 100 breeding cows and per 100 1+ yr-old females throughout the same time period also were used to determine the overall chronology and the peak of the calving period.

The multi-year collective data base of these measures obtained by aerial activities over the life of the project will be used to determine:

(1) timing of calving in relation to yearly variation in snow/ice conditions during the calving period;
(2) whether Peary caribou have evolved a later calving period than mainland caribou in adjustment to harsh environmental conditions during calving, and often, shortly after calving; and
(3) possible between or among-year variation in calving dates, especially the peak of calving.

## 6. Calf Production

Initial calf production (calving success) was measured by the maximum percentage of calves among all individual caribou seen and the maximum ratios of newborn calves per 100 breeding cows and per 1+ yr-old females in grouped samples of different individuals obtained by aerial searches in June-July 1991.

The multi-year collective data base of these measures obtained by aerial activities over the life of the project will be used to determine:

(1) the influence of the previous winter's physical environmental conditions (based on AES weather records);
(2) the influence (importance) of yearly snow/ice conditions during calving; and

(3) the relationship between calving location and the subsequent rates of calves at heel in July of that year.

## 7. Early Survival Of Calves

Early survival of newborn calves was determined by examination of percentages of calves among all individual caribou seen and the ratios of calves per 100 breeding cows and per 100 1+ yr-old females in grouped samples of different individuals obtained by aerial searches in June-July 1991.

The multi-year collective data base of these measures obtained by aerial activities over the life of the project will be used to determine:

(1) the apparent influence of the previous winter's physical environmental conditions (based on AES weather records);
(2) the apparent influence of snow/ice conditions that prevailed during the calving period on subsequent early calf survival in that year; and
(3) the likelihood that the Peary caribou population within the BIC will reach a size within the near future, that would support annual sustained harvests of any appreciable number.

## 8. Snow/ice Measurements

Two pieces of high-quality SPS steel rod (ca. 1.6 cm in diameter) were each cut 103.6 cm in length. One end of one 103.6-cm section was milled and tapered to a blunt point for relative ease of penetration through hard snow layers or ice lenses in the snow cover. A grooved ring was scored 10 cm from the tip of the rod and every 5 cm thereafter for an overall length of 1-m. The last 1.9 cm of the rod was milled down to about 0.6 cm in diameter and threaded so that the second rod (when bored and tapped) could be attached, if desired. The bored hole in the proximal end of the second section of rod was tapped so that it would joint with the threaded distal end of the first section of rod, when necessary. The first grooved ring was scored on the second section of rod so that when meshed with the first section it formed a 5-cm distance from 100 to 105 cm. Thereafter, each 5 cm of the second section was scored off for an overall length of 2 m, when both sections are combined. The last 1.9 cm of the distal end of the second section of rod was reduced and threaded as was the first section so that either section could take a "T" handle. A hole was drilled through the centre of a 22.2-cm section of the same SPS steel rod material so that it would pass over the threaded distal portion of either of the two sections of 103.6-cm rod and could be secured by means of a winged-nut or a standard hex nut. Only the section of rod with the blunt point was used with the "T" handle attached to its distal end, when the snow cover was 1-m or less in depth.

A sampling tarpaulin was designed to permit the use of a systematic grid pattern sampling procedure for measuring snow depths.

Grommets (2.5 cm inside-diameter) were set in the tarpaulin in three rows and three columns at 0.5 m on centre. This design permitted nine point samples (measurements) to be obtained on 1-$m^2$ at 0.5-m intervals.

The nine grommet holes on the sampling tarpaulin were numbered consecutively and snow depths were always sampled in that chronological order (1 to 9) as follows: (1) 1st row, 1st column - upper left corner; (2) 1st row, 2nd column - upper centre; (3) 1st row, 3rd column - upper right corner; (4) 2nd row, 3rd column - centre right side; (5) 3rd row, 3rd column - lower right corner; (6) 3rd row, 2nd column - lower centre; (7) 3rd row, 1st column - lower left corner; (8) 2nd row, 1st column - centre left side; and (9) 2nd row, 2nd column - centre of tarpaulin.

The steel rod was passed vertically down through each grommet hole and pushed to the bottom of the snow cover (ground surface, or top of ground fast ice when present). The thumb and index finger were then placed immediately above the surface of the snow cover and the rod was withdrawn from the hole. Snow depths were measured to the closest whole centimetre. The rod was read directly to the closest 5 cm. The difference, if any, was then measured to the closest centimetre by holding a steel measuring tape against that portion of the rod. Ice thickness measurements were made by chopping a vertical profile to ground level with an axe. Then measuring the thickness of the ice with a steel measuring tape to the closest whole centimetre.

Snow depth and ice thickness measurements were obtained from a 7.5-km snow/ice course and a 1-km snow/ice course. Markers (205-litre empty fuel drums) were dug about one-quarter of the way into the ground for the 7.5-km course in summer 1989. The 7.5-km course ran from about 30 m in from the seacoast at an elevation of ca. 4 m amsl inland in a westerly direction to a point of land on some of the highest ground in the study area (ca. 160 m amsl). The 7.5-km course consisted of 30 1-$m^2$ sample plots called "stations": 16 stations were spaced systematically at 0.5-km intervals along the main axis of the course from 0.0 to 7.5 km; and 14 stations were established in 7 pairs with one marker of each pair placed 250 m north and the other 250 m south of each whole kilometre station from 1.0 to 7.0 km. The 1-m sampling tarpaulin was placed about 5 paces north of each drum-marker so that the 1-$m^2$ sample site fell between 4 and 5 m north of each drum-marker. The 1-km course was located about 2 km inland from the seacoast. The 1-km course ran essentially north-south for 0.5 km from the 2.0-km North Station past the 2.0-km Station to the 2.0-km South Station of the 7.5-km course. Then, it made a right angle turn and ran downslope to the east toward the seacoast from the 2.0-km South Station for another 0.5 km past the 1.5-km Station and in line with the 1.0-km North Station of the 7.5-km course (but not all the way to it). The 1-km course consisted of 41 stations each spaced systematically at 25-m intervals. Stakes (1.2 m x ca. 5 x 5 cm) were driven about 0.3 m into the ground at each station on both snow/ice courses in July 1990 to serve as permanent markers to facilitate repeat sampling at those sites. Each stake was set on the middle point (0.5 m, no. 6 sample point of the 9-hole sampling point pattern) immediately outside the margin of each 1-$m^2$ sample site closest to the marker side of each station. Each stake was identified on two sides at the top end with the station number and the remainder of the stake was spray painted amber yellow and hi-gloss red or orange.

The 1-m² sampling tarpaulin was placed about 2.5 m (3 paces) eastward of each marker on the north-south running 0.5-km leg and 2.5 m northward on the east-west running 0.5-km leg of the 1-km course. Numbering of stations on both snow/ice courses was begun closest to the seacoast.

The hook portions of standard metal coat hangers were snipped off on both sides immediately below the twisted "neck" portion. The remainder of each hanger was then straightened to ca. 78 cm and one end tightly coiled one and one- half turns so that a ca. 15 cm piece of hi-gloss orange flagging tape could be tied to the coil, leaving two ca. 7 cm tails of flagging on a ca. 76 cm shaft. A straight hanger (shaft end first) was inserted and left in the no. 5 and no. 7 holes at each station on both snow/ice courses. This procedure permitted accurate placement of the sampling tarpaulin on subsequent dates.

Patterns of the obliteration of snow cover were obtained by measuring the amounts of snow covered ground vs. snow-free ground over time on each of the 40 25-m intervals between stations 1-2 through 40-41 on the 1-km snow/ice course. A steel measuring tape was placed from the centre (no. 6 sample point) of one station to that of the next for each of the 40 pairs of stations and all segments of snow covered ground or snow-free ground were read to the closest 0.1 m and recorded in consecutive order. The amount of snow-free ground present was compiled for all 40 pairs of stations on each sample date to obtain a composite progression with time of snow-free ground on the 1-km course.

## 9. Environmental Conditions

Environmental conditions, especially any extreme or anomalous ones, were described qualitatively and quantified whenever possible. A general empirical description of snow/ice cover and seasonal conditions on land and on the sea ice were recorded in relation to how they might influence caribou distributions, aggregations, or movements/migrations.

### 9.1. On-site weather and automatic monitoring weather stations

Weather observations at the field base camp were made twice daily at ca. 0700 and 1900. Each set of observations included (1) sky conditions and/or ceiling (100's ft, m = 30.48 x 100's ft); (2) visibility (miles, km = 1.609 x miles); (3) weather and obstruction to vision (brief description); (4) dry bulb temperature (°C); (5) wind direction (at 5° intervals); (6) wind speed (knots $\cdot$ $h^{-1}$, km $\cdot$ $h^{-1}$= (1.852) knots $\cdot$ $h^{-1}$); (7) clouds and/or obscuring phenomena (types, amount); (8) maximum temperature (°C); (9) minimum temperature (°C); (10) precipitation (mm); and (11) remarks. Thermometers were housed in a modified Polar Continental Shelf Project white weather screen at ca. 1.5 m above ground level. A calibrated, transparent plastic rain gauge was mounted upright on a vertical stake ca. 1-m above ground level. Wind speed was measured with a hand-held anemometer and wind direction was approximated in 10° classes with the aid of a fastened streamer (North being known from sun reading). Cloud types were identified from a standard Atmospheric Environment Service cloud chart and cloud cover was visually estimated in amounts by tenths of the sky from horizon to horizon.

Two remote monitoring automatic weather stations are located on the study area. Both weather stations operate on a 14-volt battery pack, supplemented by a solar panel for recharging after the long "polar night". Each station employs (1) an SM192 storage module (192 976 bytes) and a CRID measurement and control module; (2) a Model 207C temperature and relative humidity probe housed 2 m agl in a Model 41004-5 gill multi-plate radiation shield; (3) four Model 107 temperature probes, all ca. 1-cm below ground surface, 2 under vegetation and 2 under bare ground surfaces; (4) an L12005 silicon pyranometer for measuring incoming shortwave radiation; (5) a Model 013A heavy duty wind speed sensor; and (6) a Model 023A net-one wind direction sensor.

The following variables are recorded by both weather stations: average, maximum, and minimum daily values for (1) air temperature and relative humidity, 2 m agl (originally this combination sensor was housed in the radiation shield at 1-m agl but due to polar bear damage was moved up to 2-m agl); (2) soil temperature, ca. 1-cm below ground surface, 2 under vegetation and 2 under bare ground surfaces; (3) average daily incoming shortwave radiation; (4) wind speed, direction, daily magnitude and standard deviation; and (5) battery voltage, Julian day, and Greenwich Mean Time (i.e., Universal or Zulu).

The stations are updated and repaired as needed each spring or summer.

## 9.2. Off-site weather records

Weather records were obtained from the Atmospheric Environment Service (AES) weather stations at Resolute Bay, Cornwallis Island, and Mould Bay, Prince Patrick Island. Only a cursory initial examination of those records was made for the current caribou-year (June 1990 to June 1991). The following variables were included: (1) monthly mean daily maximum temperature (°C); (2) monthly mean daily temperature (°C); (3) monthly average of daily mean temperature (°C); (4) standard deviation of monthly average of daily mean temperature (°C); (5) monthly extreme maximum temperature (°C, for entire period of record); (6) monthly extreme minimum temperature (°C, for entire period of record); (7) rainfall (mm); (8) snowfall (cm); (9) total precipitation (mm); (10) standard deviation of each total monthly precipitation; (11) number of days per month with total precipitation greater than 1-cm; and (12) depth of snow on ground on last day of each month (cm).

Weather records obtained from AES weather stations from July 1989 to July 1993 will be compared to the on-site weather data for that period of time to evaluate the usefulness (representativeness) of the long-term records from those two weather stations.

Weather data will also be obtained from the Canadian Museum of Nature High Arctic Research station located in Polar Bear Pass on central Bathurst Island, if possible. If long-term off-site weather records appear comparable to on-site data the entire data base for the weather station at Resolute Bay and the one at Mould Bay will be analyzed for climatic factors or patterns that appear to significantly influence caribou within the BIC, especially if the conditions appear to detrimentally impact those caribou.

## 10. Fecal Pellet Sampling

Snow-free feeding sites where Peary caribou were observed foraging were subsequently searched on foot and obviously fresh droppings were collected. Also, fresh droppings were obtained by snowmobile-mounted searchers following caribou trails in the snow.

Fecal samples

(1) Twenty, or less if 20 were not available, fecal pellets were collected from each group of droppings.
(2) Feces were preserved in about an equal volume of table salt.
(3) Fecal samples will be analyzed at the "Composition Analysis Laboratory" at Colorado State University, Fort Collins.
(a) Forage plants will be identified by microhistological analysis of plant materials.
(b) Laboratory procedures will include drying, grinding over a 20 mesh screen, making slides, reading slides, calculating the percent relative density, and preparing data tables.
(c) Each sample will be based on 100 fields: 20 fields per slide and 5 slides per sample.
(d) One slide gives a ranked list of items in the sample, while 5 slides yield the percent relative density $\pm$ 5%.
(e) Percent relative density approximates percent dry weight.

The data will be used to gain information on the diets of Peary caribou during the springtime transitional period of restricted forage availability. The results will represent proportions of discerned plant fragments in fecal samples, and will give only estimates of the diets, rather than actual proportions of the ingested diets. Some corrections for mosses, lichens, and forbs can be made from related literature on actual ingested diets.

## 11. Definitions Of Terms Or Style

### 11.1. Values in parentheses

When values are given in parentheses (x + y) in this report, they always equal 1+ yr-old animals plus calves: e.g., caribou (36 + 11) equals 36, 1+ yr-old caribou plus 11 caribou calves.

### 11.2. Measurements and units

The measurements taken and units used are as given in detail in Miller (1987a, 1987b, 1988, 1989). The reader should note that when a reported distance (km), area ($km^2$), or density ($km^{-2}$) is taken to three places to the right of the decimal point, it is done simply to allow conversion to the nearest metre or square meter and is not a reflection of, or a desire to inflate, the apparent accuracy of the measurements.

# RESULTS AND DISCUSSION

## 1. Aerial Activities - Nonsystematic Helicopter Searches

Aerial activities (98 h) within the BIC were carried out between 7 June and 7 July 1991. Nonsystematic aerial searches for Peary caribou were flown on 11 days in June and 6 days in July. Bathurst Island received about 67% (ca. 48.8 h) of the 73 h of overall search effort; the five western major satellite islands of Alexander, Marc, Massey, Vanier, and Cameron received about 16% (ca. 12 h); and the two northern major satellite islands of Helena and Sherard Osborn less than 2% (ca. 1.1 h). The two eastern major satellite islands of Cornwallis and Little Cornwallis were not searched in 1991 because of limited resources. About 15% (ca. 11.1 h) of the search effort was spent on lowlevel flights over coastal and interjacent sea ice areas within the Bathurst Island complex and the secondary satellite islands in McDougall Sound, Intrepid Passage, and Barrow Strait. About 25% (25 h) of the 98 h of flying was lost to aborted search efforts and nonsurvey activities.

Peary caribou within the BIC were surveyed by nonsystematic helicopter searches on 17 days during June and July 1991 (Tables 1-11, App. 1-4). Bathurst Island was aerially searched on 7-9, 16-18, 20, 22, 27, 28, 30 June, and 2, 3, 6, 7 July. The western major satellite islands of Alexander, Massey, and Marc were searched on 4, 7 July; Vanier on 4 July; and Cameron on 5 July. The two northern major satellite islands of Helena and Sherard Osborn were only searched once, Sherard Osborn on 28 June and Helena on 6 July.

Most (56%) of the ca. 62 h of searching Bathurst and the major satellite islands was spent on aerial searches between 7 and 30 June. Bathurst Island received essentially all of the effort; with the sole exception of 13 min spent over Sherard Osborn Island. The remaining 44% of the ca. 62 h spent in aerial searches of Bathurst and the western and northern major satellite islands was expended between 2 and 7 July: 53%

on Bathurst Island; 44% on the five western major satellite islands; and 3% on Helena Island.

About 79% of the overall aerial search effort (excluding coastal sea ice areas) was devoted to Bathurst Island (App. 1). Some zones received relatively little effort because of persistent unfavourable flying and viewing conditions over those zones throughout much of June into the first week of July 1991. Allotment of effort among the 12 zones of Bathurst Island varied between 4 and 14% (mean time by zone = 244.2 ± 117.6 min (SD); Range, 107-405 min). The five western major satellite islands received ca. 19% of the overall effort: of which 29% was allotted to Alexander; 25% to Cameron; 25%, Massey; 17% to Vanier; and 4%, Marc (mean ± SD time per island = 144.4 ± 71.3 min). The two northern major satellite islands received less than 2% of the search effort.

An average of 50.2 sightings of caribou · 100 $min^{-1}$ of search effort was obtained during nearly 62 h of actual helicopter searches (App. 1-3). Rates of caribou sightings on Bathurst Island were lowest between 7 and 9 June 1991 (Table 1). The rate of caribou seen per 100 min of search effort increased markedly on Bathurst Island from only 20 caribou · 100 $min^{-1}$ between 7-18 June to 93 caribou · 100 $min^{-1}$ between 20-30 June. The rate of sightings then dropped to 48 caribou · 100 $min^{-1}$ in the first week of July 1991. This drop reflects the greater effort expended on searching zones where few caribou occurred at that time to better document the locations of bulls and the changes in distributions from calving to the postcalving period.

## 1.1. Relative numbers

The largest (N = 949) and most representative count of different individual caribou by sex/age classes within the BIC in 1991 came from the following composite sample (Table 1): Bathurst Island, 27-30 June (NEC, NEI, NCW, NCE zones) and 2-3 July (SEC, SEI, SC, SWC, SWI, NWC, NWI, PBP zones); Alexander, Marc, Massey, and Vanier islands, 4 July; and Cameron Island, 5 July. Those 949 sightings are believed to all be from different individuals, based on their spatial and temporal separations. Seventy-five percent (713) of those 949 caribou were on Bathurst Island, and 558 of them were 1+ yr-old animals. The remaining 25% (236) of the 949 caribou were collectively on the five western major satellite islands (180 were 1+ yr-olds).

The mean frequency of occurence of caribou on Bathurst Island by grouped samples during the six sampling periods increased significantly from the first to the fourth sampling periods throughout June, then declined during the fifth and sixth periods in the first week of July 1991 ($X^2$ = 603.26, 5df; P < 0.005). Rates of caribou sightings were relatively underrepresented during the 7-9 (1st) and 16-18 June (2nd) periods. Then the rates were slightly overrepresented during the 20-22 June (3rd) period and markedly overrepresented during the 27-30 June (4th) period. The 2-3 July (5th) and 6-7 July (6th) period rates were about as expected by chance alone. The declines in frequencies of occurrence during the first week of July mainly reflect the greater concentration of search effort in zones where, at that time, few caribou occurred (SEI, SC, SWC, SWI, and NWI) in order to verify that fact.

Twenty-three caribou were seen on the two northern major satellite islands: 1 on Sherard Osborn and 22 on Helena. Those 23 caribou might have been recounts from the northeast coast of Bathurst Island, however, so they are not included in the composite sample (27 June-5 July) for the BIC.

The secondary satellite islands of Crozier, Kalivik, Milne, Neal, Truro, and Wood in McDougall Sound were searched by helicopter on 7 June 1991. No caribou were seen on any of those islands. Baker and Moore islands in Intrepid Passage were each searched three times by helicopter. Five caribou (3 cows, 1 bull, and 1 juvenile male) were seen on Baker Island on 8 June 1991; subsequently, no caribou were seen there on 16 and 22 June. Two caribou (2 bulls) were seen on Moore Island on 8 June 1991; 3 caribou (2 bulls and 1 juvenile male) were seen there on 17 June; and none was seen there on 22 June. Browne and Somerville islands in Barrow Strait were searched by helicopter on 27 June and no caribou were seen on either island. Fog and "whiteout" conditions prevented us from searching the other five secondary satellite islands in Barrow Strait. Subsequently, on 3 July we were able to aerially search Garrett and Lowther islands: 2 caribou (1 cow/calf pair) were seen on Garrett Island; and 8 caribou (3 cows, 3 calves, 1 juvenile female, and 1 bull) were seen on Lowther Island. Fog still prevented us from searching Griffith, Hamilton, and Young islands, however, and those three islands never were searched in 1991. The one western secondary satellite island of Bradford in Graham Moore Bay was searched by helicopter on 22 June and 6 July 1991 and no caribou were seen on either occasion.

There is no feasible way to extrapolate population estimates for caribou on Bathurst Island, the five western major satellite islands, or within the entire BIC from the caribou sightings obtained by nonsystematic aerial searches. The 949 different individual caribou (738 + 211) counted on Bathurst (n = 713) and the five western major satellite islands (n = 236) between 27 June and 5 July 1991 suggests that the 1988 estimate of 1102 (± 146 SE) caribou within the entire BIC (Miller 1989) is still realistic and likely a good approximate estimate for caribou within the BIC in summer 1991. The proportion of caribou that were seen on Bathurst Island in late June-early July 1991 (75%) vs. the five western major satellite islands (25%) was similar to the effort expended in the nonsystematic aerial searches on Bathurst (79%) and the five western major satellite islands (19%). The ca. 3.0:1 caribou seen on Bathurst vs. the five western major satellite islands in late June-early July 1991 is identical to the early July 1990 ratio and similar to the ca. 2.5:1 caribou seen on those respective land areas in July 1989 (Miller 1991, 1992). The ratios suggest that proportionately there were slightly more caribou present on the five western major satellite islands in July 1989 than in late June-early July 1990 or 1991 (a 16% decrease in 1991 and 1990 over the 1989 rate).

## 1.2. Distributions and intra- or inter-island movements/migrations

The 1991 data base for late spring and early summer distributions and movements of caribou within the BIC is fragmentary, particularly for the period 22 May to 22 June. Some apparent patterns can be deduced, however, from the existing data (Tables 2 - 4).

<u>Bathurst Island</u>. We had no helicopter support between 22 May and 6 June 1991. We saw 51 caribou in the area just west of our base camp during that time period (daily range 1-11 caribou; $\bar{X} \pm$ SD, 4.2 $\pm$ 3.3 caribou). Essentially all of those caribou were 3-7 km inland from the seacoast, where snow-free patches of ground were most prevalent at that time. The caribou appeared to be paralleling the coast line in a slow generally northward movement.

Caribou were on the move and already relatively overrepresented on a zonal search effort basis in the NEI and less so in the SEI, NEC, and SEC, when the first helicopter searches were carried out in all 12 search zones between 7-9 June 1991 (Table 2). Caribou in each of the other 8 zones were comparatively underrepresented or were not detected (although search efforts were brief in some of those zones due to unfavourable flying conditions). It appeared that at that time, most caribou were either in the northern part of the island or were moving in that direction. Unlike in early June 1990, high frequencies of snow-free sites throughout all of Bathurst, except the southwest portion of the island, made it possible for caribou, especially parturient cows, to occupy interior areas at intermediate elevations above mean sea level. For unknown reasons, bulls were markedly absent in the early samples and it is not known whether the missing bulls were occupying coastal or interior sites at that time or actually whether they were on the south or the north of the island.

By 16-18 June 1991, with the initiation of calving, the strongest representation was in the NEC and NEI. Parturient and maternal cows were scattered throughout the NEI and to a lesser degree in the NEC and NCE zones. No caribou were seen on the south of the island, with exception of a few on the SEC and SEI. The NWC, NWI, and NCW zones were not searched because of persistent "white out" conditions over them.

By 20-22 June 1991, caribou remained overrepresented only in the NEC and NEI (however, the NCW and NWI were not searched nor were the SEI and PBP). The general impression was that more caribou were in the north and many were still moving northward toward the NCE zone. Caribou were markedly underrepresented elsewhere on the island.

The best measure of caribou distribution on Bathurst Island between 27 June and 3 July 1991 comes from the composite sample of 713 caribou. The distribution of caribou seen by search zone in the composite sample varied significantly among the 12 search zones on a proportional search effort basis ($X^2$ = 663.40, 11df; P<0.005). Caribou were overrepresented in descending order only in the NCE and NCW zones; about as numerous as expected by chance alone in the NEC zone; and increasingly underrepresented in the NEI, NWC, SC, PBP, SEC, NWI, SWI, SEI, and SWC. Therefore, relative to the search effort expended, more (55%) of the 713 caribou in the composite sample were seen on northeastern (NCE and NEC) coastal sites than on the remainder of Bathurst Island in late June-early July 1991 ($X^2 = 294.29$, 1df; $P < 0.005$). Maternal cows and their newborn calves along with many juvenile and yearling animals and some bulls had moved in large numbers into the extreme northern part of the island, especially on the eastern side and on the east side of the northwestern section of the island (east side of Stratrum I & all of Stratum II, Miller et al. 1977 a). Bulls were building up on the north shore of Bracebridge Inlet, on the largest unnamed island in Bracebridge Inlet, and also on the NEC.

Ninety percent (642) of the 713 caribou in the composite sample were on the northern portion of Bathurst Island, north of the middle lowlands of Polar Bear Pass (survey strata I & II of Miller et al. 1977a). Most (72%) of those 642 caribou were on northeastern Bathurst (Stratum II) and 85% of those 462 caribou were on coastal sites. Overall, 88% of the 713 caribou were on coastal sites; but only 9.8% of these were on southern coastal sites.

The 6-7 July 1991 searches on Bathurst Island were carried out mainly in zones where bulls were relatively concentrated. Bulls were still in relatively high numbers along the north shore and on the large unnamed island (which is included in the NWC zone) of Bracebridge Inlet. Bulls also remained high in number on the NEC and more bulls showed up on the SEC. It was not possible to determine where the bulls on the SEC came from as heavy fog along most of the SC and SWC prevented us from searching those areas.

When the first three sampling periods (7-22 June) are compared to the last three periods (27 June-7 July) on an island-wide basis, frequencies of occurrence of caribou were (1) greater on northern Bathurst (north of Polar Bear Pass in Strata I & II of Miller et al. 1977a) than on the southern part of the Island (Stratum III); (2) greater on eastern Bathurst than on the western half of the island; and (3) between 7 and 22 June greater in interior zones than coastal zones, and between 27 June and 7 July greater in coastal zones than in interior zones (Table 3).

**Major satellite islands**. Fog and "whiteout" conditions prevented us from searching the major satellite islands within the BIC throughout June 1991, with the exception of Sherard Osborn Island. The one caribou seen on Sherard Osborn Island was on the southeast coast. All of the caribou seen on Helena Island, the other northern major satellite island, were along the north coast of the island, seemingly, moving east to west. No clear pattern of distribution could be discerned for the caribou on the satellite islands (Table 4), but most of those seen on Alexander, Massey and Vanier were on the southern halves of the islands (on both coastal and interior sites). Most (52%) of the caribou were seen on Massey Island; and as in all past years, bulls were essentially lacking (only one bull was seen on Massey). About 35% of the caribou were on Alexander; ca. 12% on Vanier; and only less than 1% on Cameron and Marc each.

Original plans called for low-level aerial searches over the sea ice for evidence of inter-island movements by Peary caribou in the BIC (cf. Miller et al. 1977b, Miller and Gunn 1978, 1980, Miller et al. 1982). Poor visibility over the sea ice due to fog caused by early rapid loss of snow cover and pooling of meltwater on the sea ice prevented us from carrying out this phase of the studies in a satisfactory manner. Most of our attempts to search sea ice areas were aborted and those few searches that were flown were unproductive, with two minor exceptions. We did see two bull caribou and several trails between Bathurst and Moore islands and one trail from Bathurst headed toward Baker Island. Evidence for inter-island movements, at least among the western satellite islands, comes from the following. (1) The highly skewed sex/age composition of caribou on the western satellite islands. (2) The apparently ongoing changes in numbers of caribou on those islands during at least the first week of July 1991.

## 1.3. Sex/age composition

Nonrandom distribution of 1+ yr-old caribou by sex/age classes within the BIC (among the 12 search zones on Bathurst Island and among Bathurst and each of the five western major satellite islands) markedly influenced and confounded the determination of sex/age composition at the population level. All grouped samples, except the composite sample (27 June-5 July 1991) suffer from incomplete spatial coverage or relatively small sample sizes (Tables 1,5,6; App. 2,3).

The best information obtained from the composite sample of 949 caribou during 1991 suggests that the sex/age composition of the population of 1+ yr-old caribou within the BIC favoured young animals (Table 6). There were 160 juvenile/yearlings:100 breeding cows or 280 juvenile/yearlings:100 bulls. Bulls were well represented at ca. 57 bulls:100 breeding cows and about 3 in every 10 animals were breeding cows.

Females (1+ yr-old) equalled 62.9% of all 1+ yr-old caribou, based on the actual counts between 27 June and 5 July 1991 (Table 1). Those segregation counts (Table 1) suggest, however, that there were only 61 juvenile/yearling males:100 juvenile/yearling females, which appears questionable as the "primary sex ratio" for the species is supposedly 51 males to 49 females at birth (e.g., Miller 1974). The percentage of 1+ yr-old females dropped by about 10% to 56.8%, when I assumed that only 50% (rather than the 62.1% obtained from the counts) of the juvenile/yearlings should have been females. Thus, the representation of females in the population appears to lie somewhere between 131 (adjusted) to 169 1+ yr-old females:100 1+ yr-old males.

Males (1+ yr-old) equalled 37.1% of all 1+ yr-old caribou, based on the actual counts between 27 June and 5 July 1991 (Table 1). Male representation increases by about 16% to 43.2%, however, when the juvenile/yearling animals are adjusted to a 50:50 sex ratio. Thus, the representation of males in the population appears to lie somewhere between 59 to 76 (adjusted) 1+ yr-old males:100 1+ yr-old females.

Calves were most commonly seen on Massey Island and on the NEI and NCE zones of Bathurst Island, based on "observed/expected" ratios obtained from the composite sample of 949 caribou. The frequency of occurrence of those calves on Massey Island was greater than expected by chance alone, when compared to the remainder of the BIC ($X^2$ = 10.15, 1df; P <0.005) or to the calves in the NEI and NCE zones of Bathurst Island ($X^2$ = 7.15, 1df; P <0.01). No calves occurred in the composite sample on the SWC, NWI, and PBP zones of Bathurst Island or on Marc and Cameron islands.

Bathurst Island. Aerial searches yielded 1020 sightings of caribou between 7-30 June and 416 sightings between 2-7 July 1991 (Table 1, App. 2). Spatial overlaps, involving possible uneven distribution of sex/age classes by major land areas, and temporal spans (involving possible redistributions throughout the overall sampling period) probably sometimes caused over- or underrepresentation of some sex/age classes and duplication of effort (possible repeated counts of the same individuals) in June-July 1991. Therefore, the grouped composite sample of 713 caribou believed to be of different individuals on 27-30 June and 2-3 July taken from all 12 search zones on Bathurst Island is both the largest and most representative on an island-wide basis (Table 1). The second and third largest grouped samples obtained on 27-30 June (n = 584) and 2-3 July (n = 244) are less satisfactory because both samples were somewhat more spatially restricted (Table 4) and the 2-3 July sample is relatively small. The 27-30 June sample resulted in underrepresentation of males (ca. 38%) and the 2-3 July sample overrepresentation of males (ca. 16%) when compared to the 27-30 June plus 2-3 July composite sample structure. Females equalled 62.5% of the 558 1+ yr-old caribou sampled on 27-30 June and 2-3 July 1991 (Table 1), based on the actual count. It appears that the postcalving structure of the caribou population segment on Bathurst Island in late June-early July 1991 approximated 14.0% bulls, 24.0% breeding cows, 21.7% calves, and 40.3% juvenile/yearlings of both sexes (ca. 7.6% juvenile males, 11.4% juvenile females, 7.7% yearling males, and 13.6% yearling females). When the juvenile/yearling sample (n = 287) is adjusted to an assumed 50:50 sex ratio, the percentage of 1+ yr-old females drops by 10.0% to 56.3% (juvenile/yearling females were significantly overrepresented among all juvenile/yearlings (Table 1: $X^2$ = 16.53, 1df; P <0.005).

Five western major satellite islands. The postcalving sex/age structure of the caribou population segment on the five western major satellite islands in early July 1991 was 14.0% bulls, 26.3% cows, 23.7% calves, and 36.0% juvenile/yearlings of both sexes (ca. 10.6% juvenile males, 16.1% juvenile females, 3.0% yearling males, and 6.3% yearling females). Females equalled 63.9% of the 180 1+ yr-old caribou sampled on 4-5 July 1991 based on the actual count (Table 1). When the juvenile/yearling sample (n = 85) is adjusted to an assumed 50:50 sex ratio, the percentage of 1+ yr-old females drops by 9.6% to 57.8% (juvenile/yearling females were significantly overrepresented among all juvenile/yearlings (Table 1: $X^2$ = 5.31, 1df; P <0.05).

In June 1991 persistent fog cover prevented us from carrying out successful aerial searches of the five western major satellite islands.

Subsequently, after completing the 4-5 July searches of all five islands, time allowed us only to search Alexander, Marc, and Massey islands a second time (all aerial searches were terminated on 7 July 1991). Although ca. 27% fewer caribou were seen on the three islands (233 vs. 171) during the second search period, the sex/age compositions of the two samples were nonsignificantly similar when compared: bulls (13 vs. 11%), cows (27 vs. 27%), calves (24 vs. 25%), and all juvenile/yearling animals (36 vs. 37%). However, when all juvenile/yearling animals were segregated and then compared by sex/age class, there are significant differences ($X^2 = 13.76$, 3df; $P < 0.005$) among their respective contributions to the two samples (juv. males, ca. 29 vs. 27%; juv. females, ca. 45 vs. 23%; yearl. males, ca. 8 vs. 28%; and yearl. females, ca. 18 vs. 22%). Differences in the representations of yearling males and juvenile females contributed 97% of the Chi-square value, with the contribution from yearling males being nearly twice as great as that for the juvenile females. Juveniles of both sexes were overrepresented in the 4 July sample, while yearlings of both sexes but especially males were underrepresented. It is not possible to conclude with confidence how or why these differences occurred because of the overall differences in the two sample sizes. The probable error or errors appear to be restricted to juvenile/yearling animals, and the probable error(s) are mainly of consequence when attempting to evaluate calf:1+ yr-old female ratios (e.g., calf:breeding cows ratios - 90:100, 4 July, and 89:100, 7 July; and calf:1+ yr-old females - 49:100, 4 July, and 55:100, 7 July).

**Accuracy of sex/age classifications**. The evaluation of the airborne observer's ability to consistently visually recognize and separate juveniles from yearlings and to make accurate sex determinations for both juveniles and yearlings remains ongoing. The 1991 segregations, like those in June-July 1989 and 1990 (Miller 1991, 1992), resulted in an unexplainable overabundance of juveniles over yearlings (1.1 juveniles:1 yearling); female juveniles over male juveniles (1.6 females:1 male); and female yearlings over male yearlings (1.8 females:1 male), based on the 27 June-5 July 1991 composite sample. It is probable that much of this overrepresentation of females, at least among the juveniles, can be explained by the mistaken classification of nonpregnant cows as juvenile females during June-July of the year. It now seems reasonable to assume that the "drab appearance" of a "breeding cow" at that time of the year is more a function of the burden of carrying a fetus to full-term or near-term and thus applies to all pregnant females regardless of age. Therefore, while most "breeding cows" will be 3+ yr old, a certain percentage, most likely varying annually, will be juveniles (2 yr old) or even yearlings (1 yr-old). This condition would explain the total lack of any juvenile or yearling females with calves at heel in June-July 1990 as well as much of the overabundance of juvenile/yearling females in the 6-10 July 1990 sample of caribou segregated by sex and age. Proportional representation of sex/age classes in the 6-10 July sample is within previously reported levels for calves, bulls, and all 1+ yr-old females, although somewhat low for breeding cows (e.g., Miller 1974, 1982). A more complete evaluation of the results still awaits a better understanding of the probable bias associated with the consistent recognition of all the individuals in all of the designated sex/age classes.

The strengths of the sex/age classifications, with a high degree of empirical confidence, are currently restricted to the consistent identification of (1) all "bulls"; (2) all newborn "calves"; (3) all or essentially all "breeding cows"; (4) at least most of juvenile/yearlings combined; and (5) the separation of juvenile/yearling females from "breeding cows" (and "bulls"). We currently do not know (1) if the annual number of parturient and maternal juvenile and yearling females that are classified as "breeding cows" actually equals, exceeds, or falls below the number of nonpregnant 3+ yr-old cows that are mistakenly classified as "juvenile females"; (2) if we can separate all nonpregnant 3+ yr-old cows from "juvenile males", especially before the end of June in each year; (3) if we can separate all juveniles from all yearlings, especially after mid June of each year; (4) if we can make correct determinations of the sex for all juveniles and all yearlings, especially before the end of June in each year; and (5) if we could consistently sex newborn "calves", while the observer is airborne.

## 1.4. Social formations

Caribou were seen on 457 sites throughout the six search periods (Tables 7,8). Groups of two or more individuals constituted 86% of those observations. The remaining 14% of the observations were of solitary animals: 20 bulls; 10 cows; and 34 juvenile/yearlings. All groups (n = 393) averaged 4.6 $\pm$ 3.23 (SD) and ranged from 2 to 26 members each: mixed sex/age groups (n = 242), mean 5.1 $\pm$ 3.76 (SD), range 2-26; and male-only groups (n = 151), mean 3.7 $\pm$ 1.81 (SD), range 2-10. Two-thirds (66.7%) of all sightings were of caribou in mixed sex/age social groups; 29.9% were in male-only groups; and only 3.4% occurred as solitary individuals. All sex/age classes were represented by solitary individuals, except newborn calves.

Overall, mixed sex/age groups averaged significantly larger than male-only groups (t-test; P <0.05). When compared as grouped data on a six-sample-period basis (Table 7), however, this significant difference pertained to only the 27-30 June and 6-7 July 1991 periods (t-test; P <0.05). The mean group size for mixed sex/age groups with calves present during 27-30 June and 6-7 July 1991 also averaged significantly greater than the mean for mixed sex/age groups without calves present during those periods (Table 7: t-test; P <0.05). The presence of newborn calves in those groups accounted for the significant difference during both periods; when calves were excluded from group sizes, there were no significant differences between group sizes for groups that had calves excluded vs. those that had no calves (Table 7: t-test; P >0.05).

The average group size for male-only groups did not vary significantly among any of the six search periods (Table 7). The largest male-only group seen was only ca. 38% as large as the largest mixed sex/age group with calves present (10 vs. 26, respectively).

The following statistics are obtained for formations of social groupings of caribou within the BIC, when the composite sample of 949 different individual caribou sampled between 27 June and 5 July 1991 is used. Those caribou were seen on 209 sites. Groups of two or more individuals constituted 88% of those observations. The remaining 12% of the observations were of solitary animals: 10 bulls, 1 cow, and 15 juvenile/yearlings. All groups (n = 183) averaged 5.0 ± 3.30 (SD) and ranged from 2 to 19 members each: mixed sex/age groups (n = 122), mean 5.8 ± 3.65 (SD), range 2-19: and male-only groups (n = 61), mean 3.6 ± 1.72 (SD), range 2-10. All mixed sex/age groups averaged larger than all male-only groups (t-test, $P < 0.05$). The significant difference between the mean size of all mixed sex/age groups with calves present vs. all those mixed sex/age groups with no calves present was caused solely by the presence of calves. Calves were present in ca. 72% (n = 88) of all mixed sex/age groups seen, or 48% of all social groupings. Nearly 98% (n = 228) of the breeding cows were seen in groups with calves present, but only ca. 49% (n = 114) of all juvenile/yearling females were in those groups. Only 5% of all 1+ yr-old males seen (bulls = 6, juv./yrl. males = 7) occurred in those mixed sex/age groups with calves present. The possibility of seeing a caribou group with no females present was 1 in 3 on average.

Group formations followed the same general patterns exhibited in 1985 (Miller 1987a), 1988 (Miller 1989), and 1989 (Miller 1991).

On an island basis, only the sample sizes for Bathurst Island were large enough to be meaningful. As in the overall sample, all mixed sex/age groups averaged significantly larger than male-only groups for all groups seen on Bathurst Island (Table 8: t-test; $P < 0.05$). However, as in the overall sample, significant differences occurred only during the 27-30 June and 6-7 July 1991 sampling periods (Table 7: t-test; $P < 0.05$).

## 1.5. Calving period, calf production, and early survival of calves

The data suggest that calving apparently peaked 10 days to 2 weeks earlier in June 1991 than in June-July 1990 (Miller 1992). The overall period of calving extended, however, from at least the first week of June until the last days of June, and possibly into the first few days of July 1991 (Tables 9, 10). Both initial calf production and immediate survival of newborn calves appeared high in June as did early survival of calves in the first week of July 1991. By 7 July 1991, it appeared that either 90% of the calf production remained alive or 10% of the breeding cows had not produced viable neonates in 1991, based on the calf:breeding cow ratios (Table 9).

These data indicate that the 1991 calving season was a relatively successful one compared to 1990 (Miller 1992). However, it also appears that only 81% of the theoretical average rate of pregnancy was realized within the BIC in 1991, assuming that 82% of all 2+ yr-old female caribou should have been pregnant in any one year (cf. Bergerud 1974, 1980). Therefore, if overall early mortality of calves was 10%, only ca. 73% of the theoretical maximum calf production and early survival of calves was realized within the BIC in 1991, if the above assumption applies to Peary caribou within the BIC. Apparent initial calf production (observed number of calves/0.90) and observed early survival of calves in 1991 declines somewhat to 72 and 65% of the expected maximums, respectively, when it is assumed that 70% of all 1+ yr-old females should have been pregnant (cf. Dauphine 1976). As most of the calving in 1991 took place during the third week of June the time lapse between then and 27 June to 7 July was great enough for all initial and most, if not essentially all, early calf mortality to have taken place (e.g., Zhigunov 1961, Miller and Broughton 1964, Baskin 1983, Mauer et al. 1983, Whitten et al. 1984, Miller et al. 1988). The 1961, 1985, 1988, and 1989 calving seasons were also relatively successful ones (Tener 1963, Miller, 1987a, 1989, 1991). The poorest calving season documented within the BIC was in 1974, when almost no calves were produced or survived due to environmental stresses (Gauthier 1975, Parker et al. 1975, Fischer and Duncan 1976, Miller et al. 1977a).

Problems with overrepresentation or underrepresentation of 1+ yr-old males and small sample sizes of breeding cows and newborn calves obtained in all but the 27-30 June 1991 sampling period seriously detract from accepting the observed and even the "adjusted" percentages of calves among all caribou seen as accurate determinations of the timing of calving, initial calf production, and immediate and early survival of calves (Table 10). At times, observed percentages of calves among all caribou seen grossly overestimate immediate and early mortality of newborn calves, and possibly underestimate initial production of calves (Table 10). Even "adjusted" percent calves seems to underestimate early survival of calves in July 1991 (Table 10). Although the observed calf:1+ yr-old female ratios might be accurate, there is more liklihood of errors in determining all 1+ yr-old females than in identifying breeding cows only. Therefore, I currently assume that calf:breeding cow ratios permit the most accurate evaluations of the timing of calving, initial calf production, and immediate and early survival of calves in June-July 1991 (Table 9).

As in June 1990, the shedding of hard antlers (previous year's growth) by breeding cows was not well synchronized with calving (Table 11, App. 4). About 82% of the breeding cows had cast both (ca. 73%) or one (ca. 9%) of their hard antlers by 7-9 June 1991, when about only ca. 18 out of every 100 of those cows had calves at heel. Subsequently, essentially all (ca. 97%) of the breeding cows were without hard antlers before 22 June, during the later part of the peak of calving, and no cows were seen after 3 July that still retained hard antlers.

**Bathurst Island**. The progression of the calving season on Bathurst Island in June 1991 appeared essentially on schedule but somewhat early (Tables 9, 10). Not a single newborn calf was among the 51 caribou seen by ground observers in the vicinity of the CWS base camp between 23

May and 6 June 1991. By 7-9 June, when the helicopter was first in use, only 10 (7.8%) of the 129 caribou segregated were newborn calves. Proportions of newborn calves among all caribou seen then rose to 14% between 16-22 June and reached a high of 24% by 27-30 June 1991, and declined thereafter (Table 10).

The apparent sharp decline in percentage of calves among all caribou seen by sample period suggested by the actual counts from 27-30 June to 6-7 July 1991 is misleading (Table 10). The spurious values for percent calves were caused by 1+ yr-old males being significantly overrepresented during the 2-3 and 6-7 July sample periods ($X^2 = 202.94$, 5df; $P < 0.005$: also during the 20-22 June period). Proportional representation of calves is markedly increased in the 2-3 July sample and especially so in the 6-7 July 1991 sample, when those samples are adjusted by assuming that all 1+ yr-old females in each sample should have equalled 62.9% of all 1+ yr-old animals (Table 10). Overrepresentation of males in the 20-22 June sample also caused an apparently inexplicable interim decrease in percent calves between 16-18 June and 27-30 June 1991 (Table 10). However, when the 20-22 June sample is adjusted to compensate for too many males present, the percent calves increased by over 52% to a more believable subsequent maximum value of ca. 24% (Table 10), which supports the peak of calving occurring during the 3rd week of June in 1991 (although it could have begun during the end of the 2nd week).

The best evaluations of calf production appear to come from the calf:breeding cow ratios (Table 9). Less than one-fifth of the breeding cows seen had calves at heel by 9 June 1991. The proportions of breeding cows with calves in their company then rose quickly to slightly more than three-fifths by 18 June and nearly four-fifths by 22 June 1991. By 30 June 1991, 90% of all breeding cows had calves at heel. The 2-3 July 1991 value of ca. 97% breeding cows with calves at heel (Table 9) is likely a spurious value caused by an unrepresentative high rate of early survival of calves (36) among the breeding cows (37) sampled on those dates. Both the composite sample of 713 caribou from Bathurst Island and the 949 caribou representative of the entire BIC (Tables 1, 2, 9) suggest that 90% was most likely closer to the true maximum overall rate of breeding cows with calves than the 97% obtained on 2-3 July 1991.

Early mortality of newborn calves on Bathurst Island appears to have been 10% or less. However, only 83% of the theoretical average rate of pregnancy was realized in 1991, when it is assumed that 82% of all 2+ yr-old female caribou should have been pregnant in any one year (cf. Bergerud 1974, 1980). Therefore, only ca. 75% of the theoretical potential maximum calf production and early survival of calves on Bathurst Island was realized in 1991, if the above assumption applies to Peary caribou within the BIC. Apparent initial calf production and early survival of calves declines somewhat to 70 and 64% of the expected maximums, respectively, when it is assumed that 70% of all 1+ yr-old females should have been pregnant (cf. Dauphine 1976).

It thus appears that although both the rate of initial calving and that of subsequent early survival of calves were high among breeding cows, those breeding cows represented only ca. 49% of all 1+ yr-old females sampled. Therefore, allowing for ca. 1-2% mortality of parturient cows, it appears that the maximum potential growth of the Bathurst Island segment of the BIC population in 1991 would have been only ca. 0.24 rather than 0.30, the theoretical maximum annual rate of population growth for the species (Bergerud 1971, 1974, 1980). If the maximum of 24% growth is accepted, observed percent calves suggests that the maximum level was reached some time during 27-30 June 1991 (Table 10). The "adjusted" percent calves suggests, however, that the maximum could have been reached as early as 20-22 June 1991 (Table 10).

<u>Five western satellite islands</u>. On a collective basis, initial calving and early survival of newborn calves was high among all breeding cows (Tables 9, 10). But, as on Bathurst Island, those breeding cows represented only about one-half (ca. 54%) of all 1+ yr-old females sampled on the five western major satellite islands. Thus, the maximum potential rate of increase in 1991 at only 0.26 was also less than the expected theoretical maximum high for the species of 0.30. These data suggest that on a collective basis, at least 90% of the newborn calves were still alive at the end of the first week of July 1991 (Tables 9. 10). However, only 76% of the theoretical average rate of pregnancy was realized in 1991, when it is assumed that on average 82% of all 2+ yr-old female caribou should be pregnant in any one year (cf. Bergerud 1974, 1980). Therefore, only 68% of the theoretical potential maximum calf production and early survival of calves was realized in 1991, if the above assumption applies to Peary caribou within the BIC. Apparent initial calf production and early survival of calves remains similar at 78 and 70% of the expected maximums, respectively, when it is assumed that 70% of all 1+ yr-old females should have been pregnant (cf. Dauphine 1976).

It was not possible to track the timing of the calving season on the five satellite islands in June-July 1991. There is, however, no obvious reason for believing that the timing of the calving period varied markedly from that for Bathurst Island in 1991.

Also, only Alexander, Massey, and Marc islands were sampled twice, and then, only 3 days apart and not until the first week of July 1991 (Table 1). It appears, on the basis of those three islands, that little if any change in representation of calves occurred between 4 and 7 July 1991.

Although calving success and early survival of calves on all five satellite islands closely paralleled the composite rate for Bathurst Island on a collective basis (Tables 1, 9, 10), possible initial calf production and early survival of calves varied noticeably among the five satellite islands. Unfortunately, the lack of repeated sampling and the small sample sizes for Alexander, Vanier, and Marc islands detracts from subsequent analyses and evaluations of the success of the 1991 calving period for caribou on each of the five western major satellite islands.

On 4 July 1991, females and newborn calves were seen only on Vanier, Alexander, and Massey islands. Percentages of calves present among all caribou by actual count ranged from 10.7% on Ile Vanier, to 14.6% on Alexander Island, to 33.3% on Massey Island. However, those values became 27.4, 19.6, and 24.6%, respectively, when the sample sizes for those three islands were adjusted by assuming that the number of 1+ yr-old females present should equal 62.9% of each sample, when the sample is representative of the inter-island population of caribou within the BIC. The adjusted values on 4 July 1991 suggested that while the contribution of calves on Massey Island was the highest within the BIC, it was likely considerably lower than the actual count suggests (33.3 vs. 24.6%). Also, the adjusted value of 19.6% for Alexander Island suggests that while the percent of calves was relatively low on Alexander, it was probably much better than the actual count suggests. This condition of misleadingly low actual counts also appears to pertain to caribou on Ile Vanier. The small sample size of only 1 calf might have confounded the adjustment effort; thus only a tenuous acceptance of the actual value (27.4%) can be made.

When Alexander, Massey, and Marc islands were again searched on 7 July 1991, the percent calves among all caribou by actual count on each of those islands were 8.1, 34.6, and 20.0%, respectively. Adjusted values became 25.9, 26.1, and 17.3%, respectively; suggesting the extremely high value for Massey Island and low value for Alexander Island should, in reality, be similar, if the small sample sizes for cows and calves on Alexander Island has not caused misleading results. The sample size for Ile Marc, particularly only the 1 calf, is too small to consider further in isolation.

The representation of newborn calves among all caribou seen was significantly greater ($X^2$ = 11.38, 2df; P <0.005) by island for calves on Massey Island than those proportions for Bathurst or Alexander islands. Overrepresentation of calves on Massey Island contributed 70.5% to the Chi-square value. However, 1+ yr-old females were grossly overrepresented among 1+ yr-old caribou in both samples for Massey Island: 4 July, 96.3% (79/82); and 7 July, 94.1% (64/68). Therefore, the percentages of calves seen among all caribou are reduced by 24-26% to 24.6% and 26.1%, respectively, when the 1+ yr-old females are adjusted to represent 62.9% of the 1+ yr-old animals in each sample. Thus, the proportion of calves among all caribou remains the highest for Massey and Alexander islands within the BIC (but again questionably so for Alexander Island because of the small sample sizes for calves (5) and breeding cows (7).

The condition of increasing calf representation, both by calf:breeding cow (and 1+ yr-old female) ratios and percent calves among all caribou on Massey Island, suggests either no mortality of newborn calves took place after 4 July 1991 and there were some additional births between 4-7 July 1991, or whatever mortality occurred after 4 July was masked by additional births between 4-7 July. The 7 July 1991 sample for Massey Island suggests that only ca. 5% of the breeding cows had lost their calves.

## 2. Ground Activities

### 2.1. Snow depth measurements

Snow depth measurements (n = 5751, including zero values) were obtained from 639 sample sites at 71 sampling stations along the 7.5-km and 1-km snow/ice courses during May-June 1991. Sampling effort on both the 7.5-km and 1-km snow/ice courses was governed mainly by the rapidity of changes in the snow pack during the 1991 season. The snow cover became very wet by the end of the first week of June 1991 and free-standing water was visible on the edges of ponds. Over a third (n = 26) of the snow/ice stations were snow-free by 11 June 1991 and none of them had any ground fast ice formations present on any of the 234 sample sites. Travel by snowmobile was limited and all of the stations on the 1-km course and most of the stations on the 7.5-km course had to be reached on foot. Streams in the primary study area began showing areas of open water in the second week of June 1991. By 13-14 June, stream freshets prevented snowmobile or foot travel beyond the 3.0-km Station on the 7.5-km course. Therefore, sampling of stations 3.0- through 7.5-km had to be carried out with helicopter support (all remaining stations on both courses were sampled on foot after 11 June 1991).

7.5-km Snow/ice Course. Snow depths (n = 2430) were measured, or recorded as zero values, on 9 different days at all 30 stations (270 sample sites) from 24 May to 17 June 1991 (Table 12). Time intervals between samples averaged 3.0 d ($\pm$1.41 d, SD) and ranged from 2 to 6 d. Snow cover on the 7.5-km course was highly variable, both within the sets of 9 sample sites at each of the stations and among all sample sites at all stations. Where snow cover persisted on individual sample sites, it averaged ca. 20-26 cm and ranged from 1 to 95 cm in depth during the 24 May-13 June period (Table 12). Thereafter, means based on all sites with snow cover still present on each sample date continually increased over time because the late remaining snow-covered sites were those originally with the deepest snow cover (Table 12).

When the 7.5-km snow/ice course was first sampled on 24 May 1991 all but 8 of the 270 sample sites at the 30 stations were snow-covered (Table 12). On that date, 81% of the sites had snow cover that was less than or equal to 30 cm (3% was snow-free), 95% of the sites had snow cover that was less than or equal to 60 cm, and the overall range was 0-73 cm. Snow-free sample sites then increased to ca. 22% by 4 June to ca. 58% by 10 June to 77% by ca. 13 June. After 13 June 1991, the temporal aspect of naturally occurring snow-free sample sites could not be accurately tracked at each station because of the need for altering the sampling procedures (i.e., most stations were terminated from 10 to 13 June while some or all of the sample sites at each of those stations were still snow-covered).

More than three-fourths (n = 23, 76.7%) of the stations on the 7.5-km snow/ice course became entirely snow-free and were terminated by 13 June 1991 (App. 5). The remaining six stations were terminated by 17

June: 4 were still partially snow-covered (1-7 snow-free sample sites each); and 2 still each had all 9 sample sites snow-covered.

<u>1-km Snow/ice Course</u>. Snow depths (n = 3321) were measured, or recorded as zero values, on 19 different days at all 41 stations (369 sample sites) between 26 May to 17 June 1991 (Table 13). Time intervals between samples averaged 2.8 d ($\pm$ 1.04 d, SD) and ranged from 1 to 4 d. As on the 7.5-km course, snow cover on the 1-km course was highly variable both within sample site sets and among all stations. Where snow cover persisted on individual sample sites, it averaged 16-24 cm and ranged from 1 to 94 cm during the 26 May-14 June period (Table 13).

The 1-km snow/ice course was established in 1989 to permit more intensive sampling of the then prevailing snow cover and any subsequent formation of ground fast ice. The 1-km course was located on the coastal slope about midway between the seacoast and the first rise of high ground toward the interior of the island. When the 1-km course was first sampled on 26 May, all of the 369 sample sites at the 41 stations were snow-covered (Table 13). On 26 May 1991, 78% of the sites had snow cover that was less than or equal to 30 cm, 97% of the sites had snow cover that was less than or equal to 60 cm, and the overall range was 1-84 cm. Snow-free sample sites then increased slowly to ca. 4% by 5 June. Percentages of snow-free sample sites then increased more rapidly to ca. 36% by 11 June and 67% by 14 June. The temporal aspect of naturally occurring snow-free sample sites could not be accurately tracked at each station after 14 June because of the need for altering the sample procedures (i.e., all stations were terminated by 17 June while some or all of the sample sites at each of those stations were still snow-covered).

Three-fifths (n = 25, 61%) of the stations on the 1-km course became entirely snow-free and were terminated by 14 June 1991 (App. 6). On 14 June, 8 additional stations were terminated: 4 were still partially snow covered (4-7 snow-free sample sites each) and 4 still had all 9 sample sites snow-covered. Three of the remaining eight stations were closed out on 16 June: 1 was partially snow-covered (with 6 snow-free sample sites); and 2 were totally snow-covered. The last five stations were still entirely snow-covered when terminated on 17 June 1991.

## 2.2. Patterns of snow obliteration

Obliteration of the snow cover along the 1-km snow/ice course was determined by exact measurements along each of the 40 25-m segments between the centres of each pair of stations on 30 different days from 26 May to 7 July 1991 (Tables 14 and 15, App. 7 and 8). The 1-km course was 99.7% snow covered on 26 May 1991 (Table 14). Snow cover then remained greater than 85% until 8 June. The snow cover on the 1-km course then began to deteriorate more rapidly during the second week of June with the onset of continual positive temperatures. The 1-km course was nearly three-fifths (ca. 57%) snow-free by 14 June. The obliteration of the snow cover on the 1-km course continued throughout June to 7 July 1991 but was greater than 90% complete by 23 June (Table 14).

Continuous patches of snow cover were at their greatest expanses during the last week of May 1991 (Table 15). Then, both mean and maximum lengths decreased rapidly during the first and second weeks of June, with mean lengths falling to less than 10 m (median = <3 m) and maximum lengths less than 100 m by 14 June 1991 (Table 15).

Considerable variation in the patterns of snow cover ablation occurred among the 40 25-m segments (Table 15). No one segment was completely snow-free until 11 June 1991, when two became so. Subsequently, only seven (18%) of the 25-m segments were completely snow-free by 14 June. The number of totally snow-free 25-m segments then increased rapidly to 30 (75%) by 21 June, 38 (95%) by 30 June, and all 40 by 7 July 1991.

Initiation of widespread snow melt was earlier and the rate of deterioration of the snow cover was faster by as much as several days to 2 weeks on many areas in June 1991 compared to June 1990 (Miller 1992). However, small, late-lying snow patches persisted a full week later throughout the first week of July 1991 compared to only 1 July in 1990.

## 2.3. Ground fast ice measurements

The formation of ground fast ice on the primary study area in June 1991 was insignificant compared to the extent of ground fast ice accumulation in June 1990 (Miller 1992).

<u>7.5-km Snow/ice Course</u>. Ground fast ice occurred only at 23% of the 30 stations and 23% of the 270 sample sites in June 1991 (Table 16, App. 5). No ground fast ice was found at any of the 23 stations (207 sample sites) that became totally snow-free on or before 13 June 1991. Ground fast ice was detected after that date, however, at all of the remaining 7 stations and 97% (n = 61) of the 63 sample sites. Ground fast ice averaged 4.4 cm (± 1.6 cm SD) to 9.8 cm (± 4.6 cm SD) and ranged from 2 to 14 cm in thickness (Table 16).

<u>1-km Snow/ice Course</u>. The formation of ground fast ice occurred at 51.2% of the 41 stations and 41.5% of the 369 sample sites in June 1991 (Table 17, App. 6). No ground fast ice was found at 80% of the 25 stations (225 sample sites) that became totally snow-free on or before 14 June 1991. Ground fast ice was detected from that date onward, however, at all of the remaining 21 stations and 81% of the remaining 189 sample sites. Ground fast ice averaged 4.1 cm (± 2.1 cm SD) to 11 cm (± 1.8 cm SD) and ranged from 1 to 15 cm in thickness (Table 17).

## 2.4. On-site weather data

Mean daily temperatures remained continually below 0°C only until 1 June 1991; then, they began vascillating between positive and negative values until 11 June (App. 9). From 12 June 1991 onward mean daily temperatures remained positive, but relatively low compared to the same time period in June 1990. As June 1991 progressed, the season seemed to stagnate, with minimum daily temperatures remaining at or below 0°C until 27 June (App. 9). Most importantly, maximum daily temperatures, even though positive, remained low throughout June (App. 9: range -3 to +6.9°C; $\bar{X} \pm SD$, 2.8 ± 1.6°C). The first 2 weeks of July 1991 remained relatively cool compared to the same time period in July 1990, with maximum daily temperatures exceeding 10°C on only 3 dates (App. 9: 7-9 July).

Little precipitation fell throughout the field period: only 4.7 cm of snow and 1.0 mm of rain could be measured. All of the measureable snowfall came in the last week of May and the one measureable rainfall occurred on 9 July 1991. Trace amounts of precipitation occurred as snow on 9 days and as rain on 3 days. It is unlikely that precipitation hindered caribou foraging after 4 June 1991.

Empirically, it appeared in late May-early June 1991 that snow ablation was proceeding relatively rapidly compared to the same time period in 1990. The snow cover was thinner and small (<1000 $m^2$) and moderate-sized (>1000 and < 10 000 $m^2$) patches of snow-free ground were more prevalent in the vicinity of the CWS "Walker River" field base camp during the last week of May 1991 than at the same time in May 1990. Only light snow or trace amounts of snow fell between 23-31 May 1991, but a wind storm out of the east-southeast came up on 31 May and blew until 4 June. The wind storm produced heavy blowing snow on 31 May and 1 June. Then, a wet snowfall occurred during the early hours of 2 June and apparently partially stabilized the snow pack, as only light blowing snow occurred afterwards, even though the winds remained above 30 km · $h^{-1}$. A heavy rain fell briefly for ca. 15 min just before 1200 on 2 June, and although the winds remained constantly high, no blowing snow was associated with them thereafter. A second brief, wet snowfall occurred on the morning of the 3rd and the winds continued to be strong until the evening of the 3rd. Although the snow-free patches were glazed over with wind-formed ice during the first days of the storm and remained so until 2-3 June, the heavy brief rain of the 2nd and the very wet but brief snowfall of the 3rd in association with positive overnight temperatures (1-2°C, 2-3 July) caused most of the glazing to disappear by late on the 3rd. By late 4 June, the snow-free patches had essentially returned to their former number and extent. The snow pack had become noticeably wet during 3-4 June 1991, much earlier than in June 1990. Water was moving vertically and horizontally through the snow cover and free-standing water was beginning to accumulate at the edges of ponds. Snow-free sites remained plentiful after 4 June 1991, some 10 days to 2 weeks earlier than in June 1990.

Our first visual aerial inspection of the primary study area in the vicinity of the Moses Robinson and Walker rivers on northeastern coastal Bathurst Island on 7 June 1991 indicated that the overall proportion of snow-free sites occurred as belts paralleling the coast line from the seacoast inland. Some 20-30% of the land area from the seacoast inland to ca. 2 km was made up of small to moderate-sized patches of snow-free ground. Then, the extent of the overall snow-free ground decreased to ca. 10-20% in a belt from ca. 2-4 km inland, where only small-sized patches of snow-free ground occurred. The total snow-free area then increased markedly to 40-60% between ca. 4-6 km inland with some few large

(>10 000 $m^2$) snow-free sites occurring there. Then, with increasing elevation above mean sea level, the overall snow-free area decreased to 10% or less, immediately west of the primary study area.

By 7 June 1991, when the helicopter was first available, flights over northern Bathurst indicated that large tracks of land on the north end of the island were ca. 50% snow-free, while snow cover on northeastern Bathurst was more complete but still probably 20-30% snow-free total. Northwestern Bathurst had numerous, small, snow-free patches of ground, but appeared to lack any large snow-free areas. Snow cover on the southern part of the island was much more complete, with small, snow-free patches making up 10% or less of the total area and mostly in the southeast. The southwest corner of the island remained essentially totally snow-covered.

By the second week of June 1991 much of Bathurst Island had large sections that were 40-60% snow-free. Exceptions being the highest ground on the interiors, but even those areas usually had many small and some moderate-sized snow-free patches of ground along ridges or on knolls. The southwest corner of the island was the only area where snow cover remained essentially complete at greater than ca. 95%. It appeared that more than enough snow-free ground was present over most of the island to allow parturient cows to distribute themselves widely at low densities, especially throughout much of the northern interior of Bathurst Island. Although snow-free sites were numerous and many were of considerable extent, some areas on all sections of the island remained snow-covered into the first week of July 1991, particularly in the southern part (Stratum III of Miller et al. 1977a).

## 2.5. Off-site weather data

Monthly temperature during winter 1990-91 (Sep.-May) tended to be lower during September-November 1990 and February-March 1991 at Mould Bay than at Resolute Bay (Table 18). Monthly temperatures at both Mould Bay and Resolute Bay in the winter of 1990-91 were lower than their respective 30-year (1951-80) normals (means) in October 1990 through January 1991. March 1991 temperatures ran lower at Mould Bay but were higher at Resolute Bay than their respective 30-year means; while, September 1990, February, April, and May 1991 temperatures were slightly higher than their respective 30-year averages at both weather stations.

It was a snowy winter (Sep-May) at Mould Bay in 1990-91 (Table 19). Total monthly precipitation at Mould Bay during September through May exceeded the 30-year monthly normals in 6 out of 9 months (Sep-Dec, Mar, and May). Total precipitation in February 1991 was below the 95% C.I. for the 30-year normal in February at Mould Bay and total monthly precipitation in January and in April 1991 were within the 30-year normals for those months at Mould Bay. In winter 1990-91, total monthly precipitation at Resolute Bay during September through May exceeded the 30-year normals in only 3 months (Sep, Dec, and Mar) and fell below 30-year averages in 5 months (Nov, Jan, Feb, Apr, and May). Total precipitation in October 1990 was within the 95% C.I. of the 30-year normal for that month at Resolute Bay.

Total annual precipitation at Mould Bay from 1 June 1990 through May 1991 exceeded the 30-year (1951-80) normal (annual mean value) by 5.6 standard errors of the 30-year mean, 122.2 mm (1990-91) vs. 93.1 mm ± 5.17 mm ($\bar{X}$ ± SE, 1951-80). Total annual precipitation at Resolute Bay fell short, however, of the 30-year normal by one standard error, 126.2 mm (1990-91) vs. 131.4 mm ± 5.22 mm ($\bar{X}$ ± SE, 1951-80). September 1990 and June 1991 were especially wet at Mould Bay, 35.4 mm (Sep 1990) vs. 13.8 mm ± 1.40 mm ($\bar{X}$ ± SE, 1951-80) and 24.5 mm (Jun 1991) vs. 6.3 mm ± 1.17 mm ($\bar{X}$ ± SE, 1951-80). To a lesser extent, so were those months at Resolute Bay, 26.9 mm (Sep 1990) vs. 18.0 mm ± 2.01 mm ($\bar{X}$ ± SE, 1951-80) and 33.6 (Jun 1991) vs. 12.1 mm ± 1.70 mm ($\bar{X}$ ± SE, 1951-80).

Maximum daily temperatures remained continually below 0°C from 4 and 8 September 1990 to 1 June 1991 at Mould Bay (271 days) and Resolute Bay (267 days), respectively. Blowing snow was recorded on 90 days between 1 September and 31 May 1991 at Mould Bay and on 85 days at Resolute Bay. Between 1 September 1990 and 31 May 1991, peak wind speeds equalled or exceeded 30 km · $h^{-1}$ (range 30-78 km · $h^{-1}$) on 113 days ($\bar{X}$ ± SD, 12.6 ± 3.2 days per month) at Mould Bay and 142 days ($\bar{X}$ ± SD, 15.8 ± 5.6 days per month) at Resolute Bay (Table 20). The strongest winds occurred in December 1990 and March 1991 at both weather stations (Table 20).

Freezing rain occurred in September 1990 and June 1991 while the ground was snow-covered on 11 occasions at Mould Bay and on 7 occasions at Resolute Bay (Table 21). Maximum temperatures remained below 0°C on all occasions in September 1990 and June 1991 when freezing rain occurred, except on 2 June at Resolute Bay and 19 June at Mould Bay (Table 21).

A detailed evaluation of relatively long-term "off-site" weather records from the AES weather stations at Mould Bay, Prince Patrick Island, and Resolute Bay, Cornwallis Island, will subsequently be carried out, when the necessary computerized weather records can be obtained from AES, Downsview, Ontario. As a necessary first step, we will compare the "on-site" weather records to those AES records for the same time periods to evaluate the potential usefulness of the "off-site" weather records on both a temporal and spatial basis (e.g., "completeness indices", Wheaton and Chakravarti 1988). This will require examining both the degree of completeness of the available time series of data and the spatial adequacy of the network of reporting stations in the area under consideration. It is obvious beforehand that the use of only Mould Bay and Resolute Bay weather records do not meet the World Meteorological Organization's recommendations of having reporting stations no more than 50-60 km apart for temperature measurements and not greater than 30 km apart for precipitation measurements (Gandin 1970). The Mould Bay AES weather station is ca. 480 km and the Resolute Bay AES weather station is ca. 160 km from the CWS Walker River base camp on northeastern Bathurst Island.

## 2.6. Fecal pellet samples

Only eight pellet group samples were obtained on an opportunistic basis between 23 May and 3 June 1991. All of the samples were collected by snowmobile-mounted trackers following trails of caribou and locating the pellet groups in the snow. However, snow-free sites hindered snowmobile travel in some directions by the end of the last week of May 1991 and essentially no snowmobile travel was feasible in the vicinity of the field base camp by the end of the first week of June.

All of the fecal samples were found within ca. 10 km of the base camp, although snowmobile searches were extended at least twice that distance out from the base camp in various directions. Defecation appeared to be infrequent during late May and the first week of June when forage availability was relatively restricted. It was the second week of June 1991 before caribou feces appeared as amorphous masses. Such fecal samples were not collected because it was considered that they signalled the advanced transition from the "spring pinch-period" diet to the initial summer diet, at least in terms of internal adjustment in the rumen. Our detection of amorphous fecal droppings was a week earlier in June 1991 than in June 1990 (3rd week).

The samples were all salted down and air dried in brown paper bags at the base camp. They were subsequently shipped to Edmonton and stored frozen, awaiting availability of funds for processing by the "Composition Analysis Laboratory" at Colorado State University, Fort Collins.

**ACKNOWLEDGEMENTS**

The studies were supported by the Canadian Wildlife Service (CWS), Environment Canada, and Polar Continental Shelf Project (PCSP), Energy, Mines and Resources Canada. I am most grateful to B. Hrycyk, A/Director, of PCSP for her continued support of my caribou studies. I am also grateful to PCSP personnel at Resolute Bay, C. Barmig, G. Benoit, W. Benoit, J. Godden, B. Hough, J. McEachern, and T. Norman for their invaluable assistance. I thank B. Ambrose, R. Glenfield, and A. Kozlowski, for their assistance in the field; and pilot E. Neil, Canadian Helicopters Ltd., for his flying skill and assistance as navigator-spotter on the aerial searches. I also thank S.J. Barry, CWS, for statistical assistance.

## LITERATURE CITED

**BASKIN, L.M.** 1983. The causes of calf reindeer mortality. Acta Zool. Fenn. 175:133-134.

**BERGERUD, A.T.** 1961. Sex determinations of caribou calves. J. Wildl. Manage. 25:205.

_____. 1964. A field method to determine annual parturition rates for Newfoundland caribou. J. Wildl. Manage. 28:477-480.

_____. 1971. The population dynamics of Newfoundland caribou. Wildl. Monogr. 25:1-55.

_____. 1974. Decline of caribou in North America following settlement. J. Wildl. Manage. 38:757-770.

_____. 1980. A review of the population dynamics of caribou and wild reindeer in North America. In: E. Reimers, E. Gaare, and S. Skjenneberg (eds.). Proc. 2nd Int. Reindeer/Caribou Symp. Røros, Norway, 1979. Direktoratet for vilt og ferskvannsfisk, Trondheim. 556-681 pp.

**BISSETT, D.** 1968. Resolute: an area economic survey (vol. II of Lancaster Sound Survey). Industrial Div., Dep. Indian Aff. and North. Dev., Ottawa. 175 pp.

**BLAKE, W. Jr.** 1964. Preliminary account of the glacial history of Bathurst Is., Arctic Archipelago. Geol. Surv. Can. Pap. 64-30. Queen's Printer, Ottawa. 8 pp.

**DAUPHINE, T.C.** 1976. Biology of the Kaminuriak Population of barren-ground caribou. Part 4: Growth, reproduction and energy reserves. Can. Wildl. Serv. Rep. Ser. No. 38. 69 pp.

**DUNBAR, M.; and GREENAWAY, K.R.** 1956. Arctic Canada from the air. Can. Defense Res. Board. Queen's Printer, Ottawa. 541 pp.

**EDLUND, S.A.** 1983. Bioclimatic zonation in a High Arctic region: central Queen Elizabeth Islands. In: Current Research, Part A, Geol. Surv. Can. Pap. 83-1A:381-390.

**FERGUSON, M.A.D.** 1987. Status of Peary caribou and muskox populations on Bathurst Island, N.W.T., August 1981. Arctic 40:131-137.

**FISCHER, C.A.; and DUNCAN, E.A.** 1976. Ecological studies of caribou and muskoxen in the Arctic Archipelago and northern Keewatin. Renewable Resour. Consulting Serv. Ltd., Edmonton, Alta. 194 pp.

**FORTIER, Y.O.; BLACKADAR, R.G.; GREINER, H.R.; MCLAREN, D.J.; MCMILLAN, N.F.; NORRIS, A.W.; ROOTS, E.F.; SOUTHER, J.G.; THORSTEINSSON, R.; and TOZER, E.T.** 1963. Geology of the north-central part of the Arctic Archipelago, Northwest Territories (Operation Franklin). Geol. Surv. Can., Ottawa, Mem. 320. 671 pp.

**FREEMAN, M.M.R.** 1975. Assessing movement in an Arctic caribou population. J. Environ. Manage. 3:251-257.

**GANDIN, L.S.** 1970. The planning of meteorological station networks. Rep. No. 111. Secretariat World Meteorol. Organiz., Geneva.

**GAUTHIER, M.C.** 1975. An investigation of the food preferences of muskoxen, Peary caribou and arctic hare on Bathurst Island, N.W.T. 1974. Can. Wildl. Serv. unpubl. rep. CWS-78-75, Edmonton, Alta. 69 pp.

**GUNN, A.; MILLER, F.L.; and THOMAS, D.C.** 1979. Peary caribou, a status report. Can. Wildl. Serv. unpubl. rep. prepared for Committee On the Status of Endangered Wildlife In Canada (COSEWIC), Edmonton, Alta. 32 pp.

**_____; _____; and _____.** 1981. The current status and future of Peary caribou (Rangifer tarandus pearyi) on the Arctic Islands of Canada. Biol. Conserv. 19(1980-81):283-296.

**KERR, J.W.** 1974. Geology of Bathurst Island Group and Byam Martin Island, Arctic Canada (Operation Bathurst Island). Geol. Surv. Can. Mem. 378. 152 pp.

**MAUER, F.J.; GARNER, G.W.; MARTIN, L.D.; and WEILER, G.J.** 1983. Evaluation of techniques for assessing neonatal caribou calf mortality in the Porcupine herd. In: G.W. Garner, and P.E. Reynolds, (eds.). 1982 update report baseline study of the fish, wildlife and their habitats. U.S. Fish and Wild. Serv. Anchorage, Alas. 201-226 pp.

**MAXWELL, B.** 1981. Climatic regions of the Canadian Arctic Islands. Arctic 34:225-240.

**METEOROLOGICAL BRANCH DEPARTMENT OF TRANSPORT, CANADA.** 1970. Climate of the Canadian Arctic. Can. Hydrographic Serv., Mar. Sci. Br., Dep. Energy, Mines and Resour., Ottawa. 71 pp.

**MILLER, F.L.** 1974. Biology of the Kaminuriak Population of barren-ground caribou. Part 2: Dentition as an indicator of sex and age; composition and socialization of the population. Can. Wildl. Serv. Rep. Ser. No. 31. 88 pp.

_____. **1982.** Caribou Rangifer tarandus. In: J.A. Chapman and G.A. Feldhamer (eds.). Wild mammals of North America: biology, management, and economics. John Hopkins Univ. Press, Baltimore. 923-959 pp.

_____. **1987a.** Peary caribou and muskoxen on Bathurst, Alexander, Marc, Massey, Vanier, Cameron, Helena, Lougheed, and Edmund Walker islands, Northwest Territories, July 1985. Tech. Rep. Ser. No. 20. Can. Wildl. Serv., West. & North. Reg., Alta. 45 pp.

_____. **1987b.** Peary caribou and muskoxen on Prince Patrick Island, Eglinton Island, and Emerald Isle, Northwest Territories, July 1986. Tech. Rep. Ser. No. 29. Can. Wildl. Serv., West. & North. Reg., Alta. 65 pp.

_____. **1988.** Peary caribou and muskoxen on Melville and Byam Martin islands, Northwest Territories, July 1987. Tech. Rep. Ser. No. 37. Can. Wildl. Serv., West. & North. Reg., Alta. 58 pp.

_____. **1989.** Reevaluation of the status of Peary caribou and muskox populations within the Bathurst Island complex, Northwest Territories, July 1988. Tech. Rep. Ser. No. 78. Can. Wildl. Serv., West. & North. Reg., Alta. 86 pp.

_____. **1990.** Peary caribou status report. Environment Canada, Can. Wildl. Serv. West. & North. Reg. Alta. 64 pp.

_____. **1991.** Peary caribou calving and postcalving periods, Bathurst Island complex, Northwest Territories, 1989. Tech. Rep. Ser. No. 118. Can. Wildl. Serv. West. & North. Reg. Alta. 72 pp.

_____. **1992.** Peary caribou calving and postcalving periods, Bathurst Island complex, Northwest Territories, Canada, 1990. Tech. Rep. Ser. No. 151. Can. Wildl. Serv. West. & North. Reg. Edmonton, Alberta. 87 pp.

_____**; and BROUGHTON, E. 1974.** Calf mortality on the calving grounds of the Kaminuriak caribou. Can. Wildl. Serv. Rep. Ser. No. 26. 26 pp.

_____; _____**; and GUNN, A. 1988.** Mortality of migratory barren-ground caribou on the calving grounds of the Beverly herd, Northwest Territories, 1981-83. Can. Wildl. Serv. Occas. Pap. No. 66. 26 pp.

_____**; EDMONDS, E.J.; and GUNN, A. 1982.** Foraging behaviour of Peary caribou in response to springtime snow and ice conditions. Can. Wildl. Serv. Occas. Pap. No. 48. 41 pp.

_____; and **GUNN, A. 1978.** Inter-island movements of Peary caribou south of Viscount Melville Sound, Northwest Territories. Can. Field-Natur. 92:327-333.

_____; and ________. **1980.** Inter-island movements of Peary caribou (Rangifer tarandus pearyi) south of Viscount Melville Sound and Barrow Strait, Northwest Territories, Canada. In: Reimers, E.; Gaare, E.; and Skjenneberg, S. (eds.). Proceedings Second International Reindeer/Caribou Symposium, Røros, Norway, 1979. Direktoratet for vilt og ferskvannsfisk, Trondheim. 99-114 pp.

_____; **RUSSELL, R.H.; and GUNN, A. 1977a.** Distributions, movements and numbers of Peary caribou and muskoxen on western Queen Elizabeth Islands, Northwest Territories, 1972-74. Can. Wildl. Serv. Rep. Ser. No. 40. 55 pp.

_____; _____; and _____. **1977b.** Interisland movements of Peary caribou (Rangifer tarandus pearyi) on western Queen Elizabeth Islands, Arctic Canada. Can. J. Zool. 55:1029-1037.

**PARKER, G.R.; THOMAS, D.C.; MADORE, P.L.; and GRAY, D.R. 1975.** Crashes of muskox and Peary caribou populations in 1973-74 in the Parry Islands, Arctic Canada. Can. Wildl. Serv. Prog. Notes No. 56. 10 pp.

**POTTER, J.G. 1965.** Snow cover. Dep. Transport, Meteorol. Br., Ottawa. Climatol. Stud. No. 3. 69 pp.

**SAVILE, D.B.O. 1961.** The botany of the northwestern Queen Elizabeth Islands. Can. J. Bot. 39:909-942.

**TENER, J.S. 1961.** Queen Elizabeth Islands game survey. Can. Wildl. Serv. Rep. CWSC 972. 94 pp.

_____. **1963.** Queen Elizabeth Islands game survey, 1961. Can. Wildl.Serv. Occas. Pap. No. 4. 50 pp.

**THOMPSON, J. 1971.** A comparison of meteorological observations from May 1970 through April 1971, National Museum Bathurst Island Station 75°43'N 98°25'W, Resolute Airport 74°43'N 94°59'W. Atmos. Environ. Serv. unpub. rep. 15 pp.

**THORSTEINSSON, R. 1958.** Cornwallis and Little Cornwallis islands, District of Franklin, Northwest Territories. Geol. Surv. Can. Mem. 294. 134 pp.

**WEIN, R.W.; and RENCZ, A.N. 1976.** Plant cover and standing crop sampling procedures for the Canadian High Arctic. Arctic and Alpine Res. 8:139-150.

**WHEATON, E.E.; and CHAKRAVARTI, A.K.** 1988. Evaluating the climatic data base of a large area with few reporting stations: a case study of northern Saskatchewan. Musk-ox 36:15-19.

**WHITTEN, K.R.; GARNER, G.W.; and MAUER, F.J.** 1984. Calving distribution, initial productivity and neonatal mortality of the Porcupine caribou herd, 1983. In: G.W. Garner, and P.E. Reynolds (eds.). 1983 update report baseline study of the fish, wildlife and their habitats. U.S. Fish and Wildl. Serv. Anchorage, Alas. 201-226 pp.

**ZHIGUNOV. P.S.** (ed.). 1961. Reindeer husbandry. (Translated from Russian) Publ. for U.S. Dep. Inter. and Natl. Sci. Found., Washington, D.C. by Israel Program Sci. Trans. Jerusalem, 1968. 2nd rev. edition. 348 pp.

Table 1. Grouped sex/age segregation counts of Peary caribou, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991

| Date (month/day) | Bulls | Cows | Calves | Juv.[a] males | Juv. females | Yrl.[a] males | Yrl. females | N | Search effort (min) | Caribou sighted (· 100 min$^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sex/age composition | | | | | | | | | |
| Bathurst Island | | | | | | | | | | |
| 06/07-06/09 | 0 | 57 | 10 | 12 | 24 | 7 | 19 | 129 | 748 | 17.2 |
| 06/16-06/18 | 25 | 30 | 19 | 8 | 12 | 11 | 22 | 127 | 504 | 24.8 |
| 06/20-06/22 | 45 | 31 | 24 | 37 | 10 | 26 | 7 | 180 | 273 | 65.9 |
| 06/27-06/30 | 63 | 155 | 140 | 39 | 71 | 33 | 83 | 584 | 547 | 106.8 |
| 07/02-07/03 | 54 | 37 | 36 | 24 | 44 | 27 | 22 | 244 | 514 | 47.5 |
| 07/06-07/07 | 72 | 11 | 10 | 32 | 12 | 27 | 8 | 172 | 344 | 50.0 |
| Vanier, Cameron, Alexander, Massey, and Marc islands | | | | | | | | | | |
| 07/04-07/05 | 33 | 62 | 56 | 25 | 38 | 7 | 15 | 236 | 514 | 45.9 |
| Alexander, Massey, and Marc islands | | | | | | | | | | |
| 07/04 | 30 | 62 | 56 | 25 | 38 | 7 | 15 | 233 | 211 | 110.4 |
| 07/07 | 18 | 47 | 42 | 17 | 15 | 18 | 14 | 171 | 208 | 82.2 |
| Bathurst Island only | | | | | | | | | | |
| 06/27-07/03[b] | 100 | 171 | 155 | 54 | 81 | 55 | 97 | 713 | 964 | 74.0 |

Continued

Table 1. Continued

| Date (month/day) | Sex/age composition: Bulls | Cows | Calves | Juv.[a] males | Juv. females | Yrl.[a] males | Yrl. females | N | Search effort (min) | Caribou sighted (·100 $min^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|---|
| Bathurst Island plus five western satellite islands | | | | | | | | | | |
| 06/27-07/05[c] | 133 | 233 | 211 | 79 | 119 | 62 | 112 | 949 | 1478 | 64.2 |
| Sherard Osborn Island | | | | | | | | | | |
| 06/28 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 13 | 7.7 |
| Helena Island | | | | | | | | | | |
| 07/06 | 5 | 6 | 6 | 3 | 0 | 2 | 0 | 22 | 50 | 44.0 |

[a] Juv. equals juvenile animals and Yrl. equals yearling animals.

[b] The "06/27-07/03" composite sample for Bathurst Island only equals grouped samples from 27-30 June, NEC, NEI, NCW, NCE: and 2-3 July 1991, SEC, SEI, SC, SWC, SWI, NWC, NWI, PBP.

[c] The "06/27-07/05" composite sample for the entire Bathurst Island complex equals as in footnote "a" plus 4-5 July 1991 for the five western major satellite islands: Alexander, Marc, Massey, Vanier, and Cameron.

Table 2. Frequency of occurrence of Peary caribou in 12 search zones during six periods of sampling, Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991, data obtained by nonsystematic helicopter searches

| Zone[a] by sampling period (month/day) | Number of different caribou sighted | Time spent searching (min) | Frequency of occurrence caribou ($\cdot$ 100 $min^{-1}$) |
|---|---|---|---|
| 06/07-06/09 | | | |
| NEC | 23 | 91 | 25.3 |
| NEI | 74 | 170 | 43.5 |
| SEC | 11 | 561 | 19.6 |
| SEI | 3 | 9 | 33.3 |
| SC | 2 | 19 | 10.5 |
| SWC | 0 | 28 | 0.0 |
| SWI | 0 | 17 | 0.0 |
| NWC | 0 | 50 | 0.0 |
| NWI | 8 | 86 | 9.3 |
| NCW | 3 | 81 | 3.7 |
| NCE | 5 | 104 | 4.8 |
| PBP | 0 | 37 | 0.0 |
| 06/16-06/18 | | | |
| NEC | 42 | 85 | 49.4 |
| NEI | 42 | 85 | 49.4 |
| SEC | 30 | 138 | 21.7 |
| SEI | 2 | 29 | 6.9 |
| SC | 0 | 20 | 0.0 |
| SWC | 0 | 14 | 0.0 |
| SWI | 0 | 8 | 0.0 |
| NCE | 11 | 69 | 15.9 |
| PBP | 0 | 22 | 0.0 |

Continued

Table 2. Continued

| Zone[a] by sampling period (month/day) | Number of different caribou sighted | Time spent searching (min) | Frequency of occurrence caribou (· 100 $min^{-1}$) |
|---|---|---|---|
| 06/20-06/22 | | | |
| NEC | 64 | 47 | 136.2 |
| NEI | 66 | 49 | 134.7 |
| SEC | 19 | 40 | 47.5 |
| SC | 3 | 19 | 15.8 |
| SWC | 2 | 20 | 10.0 |
| SWI | 0 | 32 | 0.0 |
| NWC | 11 | 39 | 28.2 |
| NCW | 15 | 27 | 55.6 |
| 06/27-06/30 | | | |
| NEC | 78 | 77 | 101.3 |
| NEI | 72 | 67 | 107.5 |
| SEC | 10 | 41 | 24.7 |
| SEI | 2 | 4 | 50.0 |
| NCW | 112 | 130 | 86.2 |
| NCE | 310 | 228 | 136.0 |
| 07/02-07/03 | | | |
| NEC | 21 | 13 | 161.5 |
| SEC | 43 | 58 | 74.1 |
| SEI | 4 | 92 | 4.3 |
| SC | 18 | 50 | 36.0 |
| SWC | 0 | 36 | 0.0 |
| SWI | 6 | 78 | 7.7 |
| NWC | 51 | 73 | 69.9 |
| NWI | 6 | 36 | 16.7 |
| NCW | 82 | 39 | 210.2 |
| PBP | 13 | 39 | 33.3 |

Continued

Table 2. Continued

| Zone[a] by sampling period (month/day) | Number of different caribou sighted | Time spent searching (min) | Frequency of occurrence caribou (· 100 min$^{-1}$) |
|---|---|---|---|
| 07/06-07/07 | | | |
| NEC | 32 | 18 | 177.8 |
| SEC | 30 | 47 | 63.8 |
| SC | 4 | 21 | 19.0 |
| SWC | 13 | 104 | 12.5 |
| SWI | 0 | 7 | 0.0 |
| NWC | 88 | 138 | 63.8 |
| PBP | 5 | 9 | 55.6 |

[a] Search zones equal (1) northeast coast (NEC), (2) northeast interior (NEI), (3) southeast coast (SEC), (4) southeast interior (SEI), (5) south coast (SC), (6) southwest coast (SWC), (7) southwest interior (SWI), (8) northwest coast (NWC), (9) northwest interior (NWI), (10) north coast, western section (NCW), (11) north coast, eastern section (NCE), and (12) Polar Bear Pass (PBP).

Table 3. Frequency of occurrence of Peary caribou by major land divisions during six sampling periods, Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991, data obtained by nonsystematic helicopter searches

| Major divisions by sampling period (month/day) | Number of different caribou sighted | Time spent searching (min) | Frequency of occurrence caribou (· 100 min$^{-1}$) |
|---|---|---|---|
| 06/07-06/09 | | | |
| Coastal vs. | 44 | 466 | 9.4 |
| interior | 85 | 282 | 30.1 |
| North vs. | 113 | 619 | 18.2 |
| south | 16 | 129 | 12.4 |
| East vs. | 118 | 468 | 25.2 |
| west | 11 | 280 | 3.9 |
| 06/16-06/18 | | | |
| Coastal vs. | 83 | 348 | 23.8 |
| interior | 44 | 156 | 28.2 |
| North vs. | 95 | 295 | 32.2 |
| south | 32 | 209 | 15.3 |
| East vs. | 127 | 471 | 27.0 |
| west | 0 | 33 | 0.0 |
| 06/20-06/22 | | | |
| Coastal vs. | 114 | 192 | 59.4 |
| interior | 66 | 81 | 81.5 |
| North vs. | 156 | 162 | 96.3 |
| south | 24 | 111 | 21.6 |
| East vs. | 152 | 155 | 98.1 |
| west | 28 | 118 | 23.7 |
| 06/27-06/30 | | | |
| Coastal vs. | 510 | 476 | 107.1 |
| interior | 74 | 71 | 104.2 |

Continued

Table 3. Continued

| Major divisions by sampling period (month/day) | Number of different caribou sighted | Time spent searching (min) | Frequency of occurrence caribou (· 100 $min^{-1}$) |
|---|---|---|---|
| North vs. | 572 | 502 | 114.0 |
| south | 12 | 45 | 26.7 |
| East vs. | 472 | 417 | 113.2 |
| west | 112 | 130 | 86.2 |
| 07/02-07/03 | | | |
| Coastal vs. | 228 | 308 | 74.0 |
| interior | 16 | 206 | 7.8 |
| North vs. | 172 | 200 | 86.0 |
| south | 72 | 314 | 22.6 |
| East vs. | 90 | 207 | 43.5 |
| west | 154 | 307 | 50.2 |
| 07/06-07/07 | | | |
| Coastal vs. | 172 | 337 | 51.0 |
| interior | 0 | 7 | 0.0 |
| North vs. | 125 | 165 | 75.8 |
| south | 47 | 179 | 26.2 |
| East vs. | 71 | 80 | 88.8 |
| west | 101 | 264 | 38.2 |

Table 4. Frequency of occurrence of Peary caribou on the five western major satellite islands of Vanier, Cameron, Alexander, Massey, and Marc during three sampling periods, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, July 1991, data obtained by nonsystematic helicopter searches

| Island by sampling period (month/day) | Number of different caribou sighted | Time spent searching (min) | Frequency of occurrence caribou ($\cdot$ 100 $min^{-1}$) |
|---|---|---|---|
| <u>07/04</u> | | | |
| Massey | 123 | 91 | 135.2 |
| Alexander | 82 | 106 | 77.4 |
| Vanier | 28 | 121 | 23.1 |
| Marc | 1 | 14 | 7.1 |
| <u>07/05</u> | | | |
| Cameron | 2 | 182 | 1.1 |
| <u>07/07</u> | | | |
| Massey | 104 | 92 | 113.0 |
| Alexander | 62 | 100 | 62.0 |
| Marc | 5 | 16 | 31.2 |

Table 5. Variation in sex/age counts, based on grouped samples[a] of individual Peary caribou (1+ yr-old), Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, 7 June-7 July 1991, data obtained by nonsystematic helicopter searches

| Sex/age classes | Sample periods (N) | statistics (%) Mean | ± SD | 95% CI | Range |
|---|---|---|---|---|---|
| Bathurst Island | | | | | |
| Bulls | 6 | 23 | 15 | 12-34 | 0-44 |
| Cows | 6 | 26 | 14 | 16-36 | 7-48 |
| Juvenile/yearlings | 6 | 51 | 3 | 47-55 | 49-56 |
| Three western major satellite islands[b] | | | | | |
| Bulls | 2 | 13 | 2 | 0-31 | 12-14 |
| Cows | 2 | 37 | 1 | 24-50 | 36-38 |
| Juvenile/yearlings | 2 | 50 | - | - | 50-50 |

[a] Sample sizes of number of individuals involved by each grouped sample are given in Table 1.

[b] Only three of the five western satellite islands (Alexander, Marc, and Massey) were searched twice in 1991.

Table 6. Approximation of sex/age composition of "precalving" and "postcalving" populations of Peary caribou within the Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, based on a composite sample of segregation counts made between 27-30 June, 2-3 July, and 4-5 July 1991, data obtained by nonsystematic helicopter searches

| | | % sex/age composition | | | |
|---|---|---|---|---|---|
| Search area | N | Bulls | Cows | Calves | Juvenile/ Yearlings |
| Precalving | | | | | |
| Bathurst Island[a] | 558 | 17.9 | 30.7 | - | 51.4 |
| Five western major satellite islands | 180 | 18.3 | 34.5 | - | 47.2 |
| Bathurst island complex | 738 | 18.0 | 31.6 | - | 50.4 |
| Postcalving | | | | | |
| Bathurst Island[a] | 713 | 14.0 | 24.0 | 21.7 | 40.3 |
| Five western major satellite islands | 236 | 14.0 | 26.3 | 23.7 | 36.0 |
| Bathurst island complex | 949 | 14.0 | 24.6 | 22.2 | 39.2 |

[a] Based on composite sample 27 June-5 July 1991 in Table 1 (see also footnote b, Table 1).

Table 7. Group statistics by search period for Peary caribou, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991, data obtained by nonsystematic helicopter searches

| Search period (month/day) | Group type | Group statistics | | | | |
|---|---|---|---|---|---|---|
| | | N | Mean | ± SD | Range | 95% CI |
| 06/07-06/09 | Male-only groups | 4 | 3.3 | 1.26 | 2- 5 | 1.2-5.2 |
| | All mixed sex/age groups | 36 | 2.9 | 1.35 | 2- 8 | 2.5-3.4 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 10 | 2.1 | 0.32 | 2- 3 | 1.9- 2.3 |
| | calves excluded | 10 | 1.1 | 0.32 | 1- 2 | 0.9- 1.3 |
| | Mixed sex/age groups without calves | 26 | 3.3 | 1.46 | 2- 8 | 2.7- 3.9 |
| | Solitary individuals | 10 | | | | |
| 06/16-06/18 | Male-only groups | 10 | 3.2 | 0.92 | 2- 5 | 2.5- 3.9 |
| | All mixed sex/age groups | 27 | 3.2 | 1.97 | 2-11 | 2.4- 4.0 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 16 | 2.8 | 1.28 | 2- 6 | 2.1- 3.5 |
| | calves excluded | 16 | 1.6 | 0.96 | 1- 4 | 1.1- 2.1 |
| | Mixed sex/age groups without calves | 11 | 3.8 | 2.64 | 2-11 | 2.0- 5.6 |
| | Solitary individuals | 8 | | | | |

Continued

Table 7. Continued

| Search period (month/day) | Group type | Group statistics | | | | |
|---|---|---|---|---|---|---|
| | | N | Mean | ± SD | Range | 95% CI |
| 06/20-06/22 | Male-only groups | 25 | 4.0 | 2.14 | 2- 9 | 3.1- 4.9 |
| | All mixed sex/age groups | 17 | 4.5 | 2.24 | 2-10 | 3.3- 5.6 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 11 | 5.2 | 2.40 | 2-10 | 3.6- 6.8 |
| | calves excluded | 11 | 3.0 | 1.61 | 1- 6 | 1.9- 4.1 |
| | Mixed sex/age groups without calves | 6 | 3.2 | 1.17 | 2- 5 | 1.9- 4.4 |
| | Solitary individuals | 4 | | | | |
| 06/27-06/30 | Male-only groups | 32 | 3.4 | 1.70 | 2-10 | 2.8- 4.0 |
| | All mixed sex/age groups | 84 | 5.5 | 3.37 | 2-19 | 4.7- 6.2 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 63 | 6.0 | 3.60 | 2-19 | 5.1- 6.9 |
| | calves excluded | 63 | 3.8 | 2.47 | 1-12 | 3.2- 4.4 |
| | Mixed sex/age groups without calves | 21 | 3.8 | 1.73 | 2- 8 | 3.0- 4.6 |
| | Solitary individuals | 17 | | | | |

Continued

Table 7. Continued

| Search period (month/day) | Group type | N | Mean | ± SD | Range | 95% CI |
|---|---|---|---|---|---|---|
| | | Group statistics | | | | |
| 07/02-07/03 | Male-only groups | 26 | 3.7 | 2.06 | 2- 9 | 2.8- 4.5 |
| | All mixed sex/age groups | 23 | 6.3 | 5.59 | 2-26 | 3.7- 8.7 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 15 | 7.1 | 6.61 | 2-26 | 3.4-10.7 |
| | calves excluded | 15 | 4.7 | 5.30 | 1-21 | 1.7- 7.6 |
| | Mixed sex/age groups without calves | 8 | 4.8 | 2.66 | 2-10 | 2.5- 7.0 |
| | Solitary individuals | 5 | | | | |
| 07/04-07/05 | Male-only groups | 10 | 4.2 | 1.48 | 2- 6 | 3.1- 5.3 |
| | All mixed sex/age groups | 26 | 7.2 | 4.63 | 2-19 | 5.3- 9.1 |
| | Mixed sex age groups with calves | | | | | |
| | calves included | 18 | 8.4 | 4.92 | 2-19 | 5.9-10.8 |
| | calves excluded | 18 | 5.3 | 3.44 | 1-13 | 3.6- 7.0 |
| | Mixed sex/age groups without calves | 8 | 4.5 | 2.39 | 2- 8 | 2.5- 6.5 |
| | Solitary individuals | 7 | | | | |

Continued

Table 7. Continued

| Search period (month/day) | Group type | Group Statistics | | | | |
|---|---|---|---|---|---|---|
| | | N | Mean | ± SD | Range | 95% CI |
| 07/06-07/07 | Male-only groups | 44 | 3.8 | 1.84 | 2- 8 | 3.2- 4.3 |
| | All mixed sex/age groups | 29 | 6.4 | 4.34 | 2-22 | 4.7- 8.0 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 22 | 7.4 | 4.49 | 2-22 | 5.4- 9.4 |
| | calves excluded | 22 | 4.7 | 3.04 | 1-14 | 3.4- 6.1 |
| | Mixed sex/age groups without calves | 7 | 3.3 | 1.60 | 2- 6 | 1.8- 4.8 |
| | Solitary individuals | 13 | | | | |

Table 8. Group statistics for Peary caribou seen during all search periods, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, 7 June to 7 July 1991, data obtained by nonsystematic helicopter searches

| | | Group statistics | | | | |
|---|---|---|---|---|---|---|
| Island | Group type | N | Mean | ± SD | Range | 95% CI |
| Bathurst | Male-only groups | 128 | 3.6 | 1.81 | 2-10 | 3.3- 4.0 |
| | All mixed sex/age groups | 196 | 4.7 | 3.37 | 2-26 | 4.2- 5.2 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 119 | 5.4 | 3.92 | 2-26 | 4.6- 6.1 |
| | calves excluded | 119 | 3.3 | 2.86 | 1-21 | 2.8- 3.9 |
| | Mixed sex/age groups without calves | 77 | 3.7 | 1.87 | 2-11 | 3.2- 4.1 |
| | Solitary individuals | 50 | | | | |
| Alexander | Male-only groups | 15 | 4.4 | 1.92 | 2- 8 | 3.3- 5.5 |
| | All mixed sex/age groups | 9 | 8.0 | 4.33 | 2-14 | 4.7-11.3 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 4 | 11.7 | 2.06 | 10-14 | 8.5-15.0 |
| | calves excluded | 4 | 7.5 | 1.73 | 6- 9 | 4.7-10.3 |
| | Mixed sex/age groups without calves | 5 | 5.0 | 3.00 | 2- 8 | 1.3- 8.7 |
| | Solitary individuals | 6 | | | | |

Continued

Table 8. Continued

| Island | Group type | Group statistics N | Mean | ± SD | Range | 95% CI |
|---|---|---|---|---|---|---|
| Marc | Male-only groups | 0 | | | | |
| | All mixed sex/age groups | 1 | 5.0 | - | 5- 5 | - |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 1 | 5.0 | - | 5- 5 | - |
| | calves excluded | 1 | 4.0 | - | 4- 4 | - |
| | Mixed sex/age groups without calves | 0 | | | | |
| | Solitary individuals | 1 | | | | |
| Massey | Male-only groups | 1 | 3.0 | - | 3- 3 | - |
| | All mixed sex/age groups | 32 | 6.9 | 5.01 | 2-22 | 5.2- 8.6 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 27 | 7.6 | 5.12 | 2-22 | 5.6- 9.7 |
| | calves excluded | 27 | 4.8 | 3.51 | 1-14 | 3.4- 6.2 |
| | Mixed sex/age groups without calves | 5 | 3.0 | 1.00 | 2- 4 | 1.8- 4.2 |
| | Solitary individuals | 3 | | | | |

Continued

Table 8. Continued

| | | Group statistics | | | | |
|---|---|---|---|---|---|---|
| Island | Group type | N | Mean | ± SD | Range | 95% CI |
| Vanier | Male-only groups | 4 | 4.3 | 1.71 | 2- 6 | 1.5- 7.0 |
| | All mixed sex/age groups | 1 | 10.0 | - | 10-10 | - |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 1 | 10.0 | - | 10-10 | - |
| | calves excluded | 1 | 7.0 | - | 7- 7 | - |
| | Mixed sex/age groups without calves | 0 | | | | |
| | Solitary individuals | 1 | | | | |
| Cameron | Male-only groups | 1 | 2.0 | - | 2- 2 | - |
| | All mixed sex/age groups | 0 | | | | |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 0 | | | | |
| | calves excluded | 0 | | | | |
| | Mixed sex/age groups without calves | 0 | | | | |
| | Solitary individuals | 0 | | | | |

Continued

Table 8. Continued

| Island | Group type | N | Mean | ± SD | Range | 95% CI |
|---|---|---|---|---|---|---|
| | | Group statistics | | | | |
| Helena | Male-only | 2 | 2.0 | - | 2- 2 | - |
| | All mixed sex/age groups | 3 | 5.3 | 4.16 | 2-10 | -5.0-15.7 |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 3 | 5.3 | 4.16 | 2-10 | -5.0-15.7 |
| | calves excluded | 3 | 3.3 | 3.21 | 1- 7 | -4.6-11.3 |
| | Mixed sex/age groups without calves | 0 | | | | |
| | Solitary individuals | 2 | | | | |
| Sherard Osborn | Male-only groups | 0 | | | | |
| | All mixed sex/age groups | 0 | | | | |
| | Mixed sex/age groups with calves | | | | | |
| | calves included | 0 | | | | |
| | calves excluded | 0 | | | | |
| | Mixed sex/age groups without calves | 0 | | | | |
| | Solitary inidividuals | 1 | | | | |

Table 9. Percent "breeding cows", percent "1+ yr-old females", and associated chronology of "calf:female ratios" for Peary caribou, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991, data obtained by nonsystematic helicopter searches

| Date (month/day) | N[a] | Females as % of N: Breeding cows | Females as % of N: 1+ yr-old females | Calves:100 breeding cows | Calves:100 1+ yr-old females |
|---|---|---|---|---|---|
| Bathurst Island | | | | | |
| 06/07-06/09 | 119 | 47.9 | 84.0 | 17.5 | 10.0 |
| 06/16-06/18 | 108 | 27.8 | 59.2 | 63.3 | 29.7 |
| 06/20-06/22 | 156 | 19.9 | 30.8 | 77.4 | 50.0 |
| 06/27-06/30 | 444 | 34.9 | 69.6 | 90.3 | 45.3 |
| 07/02-07/03 | 208 | 17.8 | 49.5 | 97.3 | 35.0 |
| 07/06-07/07 | 162 | 6.8 | 19.1 | 90.9 | 32.2 |
| Vanier, Cameron, Alexander, Massey, and Marc islands | | | | | |
| 07/04-07/05 | 180 | 34.4 | 63.9 | 90.3 | 48.7 |
| Alexander, Massey, and Marc islands[b] | | | | | |
| 07/07 | 129 | 36.4 | 58.9 | 89.4 | 55.3 |
| Bathurst Island composite sample, plus five western major satellite islands | | | | | |
| composite[c] | 738 | 31.6 | 62.9 | 90.6 | 45.5 |

[a] Equals number of 1+ yr-old animals only.

[b] Only Alexander, Massey, and Marc islands among the five major western satellite islands were aerially searched a second time in 1991.

[c] Composite of three sample periods: 27-30 June, NEC, NEI, NCW, NCE; 2-3 July, SEC, SEI, SC, SWC, SWI, NWC, NWI, PBP; and 4-5 July, Vanier, Cameron, Alexander, Massey, and Marc.

Table 10. Chronology of observed and "adjusted" proportions of newborn calves among all Peary caribou, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991, data obtained by nonsystematic helicopter searches

| Date (month/day) | N | % calves | Adjusted[a] N | Adjusted % calves |
|---|---|---|---|---|
| Bathurst Island | | | | |
| 06/07-06/09 | 129 | 7.8 | 169 | 5.9 |
| 06/16-06/18 | 127 | 15.0 | 121 | 15.7 |
| 06/20-06/22 | 180 | 13.3 | 100 | 24.0 |
| 06/27-06/30 | 584 | 24.0 | 631 | 22.2 |
| 07/02-07/03 | 244 | 14.8 | 200 | 18.0 |
| 07/06-07/07 | 172 | 5.8 | 59 | 16.9 |
| Vanier, Cameron, Alexander, Massey, and Marc islands | | | | |
| 07/04-07/05 | 236 | 23.7 | 239 | 23.4 |
| Alexander, Massey, and Marc islands[b] | | | | |
| 07/07 | 171 | 24.6 | 163 | 25.8 |
| Bathurst Island composite sample, plus five western major satellite islands | | | | |
| 06/27-06/30, 07/02-07/03, 07/04-07/05 | 949 | 22.2 | 949 | 22.2 |

[a] Adjusted by assuming that the 62.9% 1+ yr-old females obtained in the composte sample (Bathurst, plus the five western major satellite islands: 464/738 = 0.629) for caribou counted on 27-30 June, 2-3 July, and 4-5 July 1991 was the true proportion of 1+ yr-old females in the BIC.

[b] Vanier and Cameron islands were not aerially searched a second time in 1991.

Table 11. Chronology of hard antler casting by Peary caribou breeding cows, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991, data obtained by nonsystematic helicopter searches

| Sampling period (month/day) | N | % that had cast both hard antlers | % that had cast one hard antler only | % with both hard antlers retained |
|---|---|---|---|---|
| 06/07-06/09 | 57 | 82.4 | 8.8 | 8.8 |
| 06/16-06/18 | 30 | 86.6 | 6.7 | 6.7 |
| 06/20-06/22 | 31 | 96.8 | 0.0 | 3.2 |
| 06/27-06/30 | 155 | 99.4 | 0.0 | 0.6 |
| 07/02-07/03 | 37 | 100.0 | 0.0 | 0.0 |
| 07/04-07/05 | 62 | 100.0 | 0.0 | 0.0 |
| 07/06-07/07 | 64 | 100.0 | 0.0 | 0.0 |

Table 12. Statistics for snow depth measurements made on 7.5-km snow/ice course, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, May-June 1991

| Date | | Snow depth (cm) | | | | |
|---|---|---|---|---|---|---|
| (month/day) | N | Mean | ± SD | Minimum | Maximum | 95% CI |
| 05/24 | 30[a] | 20.7 | 16.1 | 2.0[b] | 66.1[b] | 14.7-26.7 |
| | 262[c] | 21.3 | 16.1 | 2.0 | 73.0 | 19.3-23.2 |
| 05/28 | 29 | 21.6 | 15.6 | 1.0 | 65.8 | 15.6-27.5 |
| | 252 | 22.3 | 15.4 | 1.0 | 71.0 | 20.4-24.2 |
| 06/03 | 27 | 20.9 | 20.5 | 4.6 | 90.6 | 12.8-29.0 |
| | 233 | 21.6 | 20.6 | 1.0 | 95.0 | 19.0-24.3 |
| 06/05 | 27 | 19.7 | 20.6 | 1.0 | 89.9 | 11.5-27.8 |
| | 212 | 21.9 | 21.0 | 1.0 | 93.0 | 19.0-24.7 |
| 06/07 | 25 | 20.2 | 20.9 | 2.8 | 89.3 | 11.6-28.8 |
| | 196 | 22.4 | 21.4 | 1.0 | 93.0 | 19.4-25.4 |
| 06/10 | 14 | 22.2 | 23.8 | 4.0 | 86.6 | 8.4-36.0 |
| | 113 | 24.0 | 24.0 | 3.0 | 75.0 | 19.5-28.4 |
| 06/13 | 7 | 25.9 | 25.8 | 5.6 | 70.7 | 2.0-49.8 |
| | 61 | 26.6 | 24.4 | 3.0 | 75.0 | 20.3-32.8 |
| 06/15 | 6 | 19.3 | 25.5 | 2.0 | 60.0 | -7.4-46.1 |
| | 40 | 25.1 | 25.0 | 1.0 | 65.0 | 17.1-33.1 |

Continued

Table 12. Continued

| Date (month/day) | N | Snow depth (cm) Mean | ± SD | Minimum | Maximum | 95% CI |
|---|---|---|---|---|---|---|
| 06/17 | 2 | 42.7 | 13.3 | 33.3 | 52.1 | -76.6-162.0 |
| | 18 | 42.7 | 10.0 | 30.0 | 56.0 | 37.8-47.7 |

[a] N equals the number of different stations sampled that were not entirely snow-free and the statistics are based on the mean of the summation of the mean of all snow-covered sites in each set of 9 sites at each station.

[b] These minimal and maximal values were derived from mean of 9 sample points at the stations where the lowest and the highest station means were calculated on that date.

[c] N equals the total number of different sites sampled that were not entirely snow-free and the statistics are based on the summation of all snow-covered sites.

Table 13. Statistics for snow depth measurements made on 1-km snow/ice course, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, May-June 1991

| Date | | Snow depth (cm) | | | | |
|---|---|---|---|---|---|---|
| (month/day) | N | Mean | ± SD | Minimum | Maximum | 95% CI |
| 05/02 | 41[a] | 23.9 | 13.6 | 1.2[b] | 75.9[b] | 19.6-28.1 |
| | 369[c] | 23.9 | 13.7 | 1.0 | 84.0 | 22.4-25.3 |
| 05/30 | 41 | 23.5 | 13.1 | 1.5 | 74.3 | 19.4-27.6 |
| | 364 | 23.8 | 13.2 | 1.0 | 80.0 | 22.5-25.2 |
| 06/03 | 40 | 23.8 | 17.8 | 4.8 | 87.9 | 18.1-29.6 |
| | 360 | 23.8 | 17.9 | 2.0 | 94.0 | 22.0-25.7 |
| 06/05 | 40 | 22.2 | 17.6 | 3.3 | 85.2 | 16.6-27.9 |
| | 355 | 22.5 | 17.7 | 1.0 | 91.0 | 20.6-24.3 |
| 06/08 | 38 | 20.0 | 17.5 | 2.0 | 83.2 | 14.2-25.7 |
| | 322 | 20.9 | 17.6 | 1.0 | 89.0 | 19.0-22.8 |
| 06/11 | 31 | 17.6 | 17.3 | 1.5 | 78.1 | 11.3-24.0 |
| | 235 | 20.2 | 17.6 | 1.0 | 85.0 | 18.0-22.5 |
| 06/14 | 16 | 16.2 | 17.3 | 1.3 | 64.1 | 17.3-18.7 |
| | 122 | 18.8 | 17.3 | 1.0 | 72.0 | 15.7-21.9 |
| 06/16 | 8 | 19.4 | 16.9 | 1.0 | 53.3 | 5.3-33.5 |
| | 66 | 21.2 | 16.0 | 1.0 | 64.0 | 17.1-25.0 |

Continued

Table 13. Continued

| Date (month/day) | N | Snow depth (cm) Mean | ± SD | Minimum | Maximum | 95% CI |
|---|---|---|---|---|---|---|
| 06/17 | 5 | 22.5 | 15.3 | 4.3 | 46.9 | 3.4-41.5 |
| | 43 | 23.3 | 13.9 | 1.0 | 53.0 | 19.0-27.6 |

[a] N equals the number of different stations sampled that were not entirely snow-free and the statistics are based on the mean of the summation of the mean of all snow-covered sites in each set of 9 sites at each station.

[b] These minimal and maximal values were derived from the 9 sample sites at the stations where the lowest and the highest station means were calculated on that date.

[c] N equals the total number of sites sampled that were not entirely snow-free and the statistics for each date are based on the summation of all snow-covered sites.

Table 14. Obliteration of snow cover along the 1-km snow/ice course, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, May-July 1991

| Date | % bare ground | Change in amount of bare ground from previous sample date (m) | Extent of remaining snow cover (m) |
|---|---|---|---|
| 26 May | 0.3 | - | 996.9 |
| 30 | 0.3 | - 0.3 | 997.2 |
| 03 June | 3.0 | + 27.4 | 969.8 |
| 05 | 4.8 | + 18.0 | 951.8 |
| 08 | 14.7 | + 99.1 | 852.7 |
| 11 | 34.2 | +195.2 | 657.5 |
| 12 | 42.0 | + 77.7 | 579.8 |
| 13 | 52.0 | + 99.7 | 480.1 |
| 14 | 57.4 | + 54.6 | 425.5 |
| 16 | 70.9 | +134.4 | 291.1 |
| 17 | 77.5 | + 66.5 | 224.6 |
| 18 | 80.7 | + 32.3 | 192.3 |
| 19 | 83.5 | + 27.4 | 164.9 |
| 20 | 85.8 | + 22.9 | 142.0 |
| 21 | 87.9 | + 21.0 | 121.0 |
| 22 | 89.2 | + 13.4 | 107.6 |
| 23 | 91.0 | + 18.0 | 89.6 |
| 24 June | 92.4 | + 14.0 | 75.6 |
| 25 | 93.8 | + 14.3 | 61.3 |
| 26 | 94.8 | + 9.2 | 52.1 |
| 27 | 95.2 | + 4.6 | 47.5 |
| 28[a] | 95.6 | + 3.5 | 44.0 |
| 29 | 95.9 | + 3.5 | 40.0 |
| 30 | 96.5 | + 5.5 | 35.0 |

Continued

Table 14. Continued

| Date | % bare ground | Change in amount of bare ground from previous sample date (m) | Extent of remaining snow cover (m) |
|---|---|---|---|
| 01 July | 96.9 | + 4.2 | 30.8 |
| 02 | 96.9 | + 0.3 | 30.5 |
| 03 | 97.1 | + 2.2 | 28.3 |
| 04 | 97.6 | + 4.8 | 23.5 |
| 05 | 99.1 | + 15.0 | 8.5 |
| 06 | 99.5 | + 3.9 | 4.6 |
| 07 | 100.0 | + 4.6 | 0.0 |

[a] Changes on segments 15-16, 29-30, 30-31 were estimated on 28 June by averaging differences between 27 and 29 June for those three stations.

Table 15. Snow-covered ground statistics for snow obliteration along the 1-km snow/ice course, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, May-July 1991

| Date | Number of snow patches | Length of snow-covered patches (m) | | | | |
|---|---|---|---|---|---|---|
| | | Mean | ± SD | Minimum | Maximum | Median |
| 26 May | 6 | 166.2 | 178.9 | 0.6 | 414.4 | 111.7 |
| 30 | 7 | 142.5 | 180.6 | 0.6 | 411.9 | 65.5 |
| 3 June | 21 | 46.2 | 92.7 | 0.3 | 401.5 | 3.0 |
| 5 | 22 | 43.3 | 87.7 | 0.3 | 388.1 | 9.0 |
| 8 | 50 | 17.0 | 36.8 | 0.3 | 164.0 | 1.7 |
| 11 | 76 | 8.6 | 19.1 | 0.3 | 118.6 | 1.2 |
| 12 | 70 | 8.3 | 17.4 | 0.3 | 100.9 | 1.2 |
| 13 | 54 | 8.9 | 16.8 | 0.3 | 100.3 | 2.7 |
| 14 | 48 | 8.9 | 17.4 | 0.3 | 99.4 | 2.3 |
| 16 | 32 | 9.1 | 17.1 | 0.3 | 89.6 | 2.3 |
| 17 | 18 | 12.5 | 20.7 | 0.3 | 85.7 | 5.5 |
| 18 | 16 | 12.0 | 18.8 | 0.6 | 75.0 | 5.6 |
| 19 | 12 | 13.7 | 20.4 | 0.9 | 72.6 | 4.9 |
| 20 | 9 | 15.8 | 22.7 | 0.3 | 71.0 | 10.4 |
| 21 | 8 | 15.1 | 18.5 | 0.3 | 55.8 | 7.8 |

Continued

Table 15. Continued

| Date | Number of snow patches | Length of snow-covered patches (m) | | | | |
|---|---|---|---|---|---|---|
| | | Mean | ± SD | Minimum | Maximum | Median |
| 22 June | 8 | 13.4 | 18.4 | 0.6 | 55.2 | 5.9 |
| 23 | 6 | 14.9 | 19.8 | 1.8 | 53.3 | 5.8 |
| 24 | 6 | 12.6 | 18.0 | 0.6 | 46.9 | 4.3 |
| 25 | 5 | 12.2 | 18.8 | 0.9 | 44.5 | 1.2 |
| 26 | 3 | 17.4 | 22.6 | 1.8 | 43.3 | 7.0 |
| 27 | 3 | 15.8 | 8.6 | 6.1 | 22.2 | 19.2 |
| 29 | 3 | 13.5 | 10.4 | 1.5 | 20.7 | 18.3 |
| 30 | 2 | 17.5 | 4.1 | 14.6 | 20.4 | 17.5 |
| 1 July | 2 | 15.4 | 5.0 | 11.9 | 18.9 | 15.4 |
| 2 | 2 | 15.2 | 4.7 | 11.9 | 18.6 | 15.2 |
| 3 | 3 | 9.4 | 7.7 | 4.3 | 18.3 | 5.8 |
| 4 | 3 | 7.8 | 7.8 | 2.4 | 16.8 | 4.3 |
| 5 | 3 | 2.8 | 2.2 | 0.3 | 4.3 | 4.0 |
| 6 | 3 | 1.5 | 0.6 | 0.9 | 2.1 | 1.5 |
| 7 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Table 16. Statistics for ice thickness measurements made on 7.5-km snow/ice course, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, June 1991

| Date (month/day) | N | Ice thickness (cm) Mean | ± SD | Minimum | Maximum | 95% CI |
|---|---|---|---|---|---|---|
| 06/13 | 1[a] | 4.4 | - | - | - | - |
| | 7[b] | 4.4 | 1.6 | 3.0[c] | 7.0[c] | 2.9- 5.9 |
| 06/15 | 4 | 6.2 | 1.8 | 3.8 | 7.9 | 3.4- 9.0 |
| | 36 | 6.2 | 2.7 | 2.0 | 11.0 | 5.3- 7.1 |
| 06/17 | 2 | 9.8 | 4.3 | 6.8 | 12.9 | -23.0-48.6 |
| | 18 | 9.8 | 4.6 | 2.0 | 14.0 | 7.5-12.1 |

[a] N equals the number of different stations sampled that had ground fast ice present and the statistics are based on the mean of the summation of the mean of all sites covered with ground fast ice in each set of 9 sites at each station.

[b] N equals the total number of different sites sampled that had ground fast ice present and the statistics for each date are based on the summation of all sites with ground fast ice present.

[c] These minimal and maximal values were derived from the mean of 9 or less sample sites at the stations where the lowest and the highest station means were calculated on that date.

Table 17. Statistics for ice thickness measurements made on 1-km snow/ice course, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, June 1991

| Date | | Ice thickness (cm) | | | | |
|---|---|---|---|---|---|---|
| (month/day) | N | Mean | ± SD | Minimum | Maximum | 95% CI |
| 06/14 | 13[a] | 4.1 | 2.1 | 1.8[b] | 7.6[b] | 2.9- 5.4 |
| | 81[c] | 4.8 | 2.6 | 1.0 | 11.0 | 4.2- 5.4 |
| 06/16 | 3 | 7.6 | 0.3 | 7.3 | 7.6 | 6.9- 8.3 |
| | 27 | 7.6 | 2.0 | 4.0 | 10.0 | 6.8- 8.4 |
| 06/17 | 5 | 11.0 | 0.8 | 10.2 | 12.3 | 10.0-12.1 |
| | 45 | 11.0 | 1.8 | 5.0 | 15.0 | 10.5-11.6 |

[a] N equals the number of different stations sampled that had ground fast ice present and the statistics are based on the mean of the summation of the mean of all sites covered with ground fast ice in each set of 9 sites at each station.

[b] These mimimal and maximal values were derived from the mean of 9 of less sample sites at the stations where the lowest and the highest station means were calculated on that date.

[c] N equals the total number of different sites sampled that had ground fast ice present and the statistics for each date are based on the summation of all sites with ground fast ice present.

Table 18. Monthly statistics for air temperature (°C) at Atmospheric Environment Service weather stations, Resolute Bay, Cornwallis Island, and Mould Bay, Prince Patrick Island, Northwest Territories, June 1990-June 1991

| | | Daily temperatures °C | | | | |
|---|---|---|---|---|---|---|
| AES[a] weather station | Month 1990-1991 | Monthly mean max. | Monthly mean min. | Monthly mean aver. | Monthly extreme high | Monthly extreme low |
| RB[a] | Jun | 2.5 | - 2.0 | 0.5 | 10.1 | - 7.5 |
| MB[a] | | 4.7 | - 0.3 | 2.2 | 13.7 | - 6.0 |
| RB | Jul | 6.4 | 1.5 | 4.0 | 11.1 | - 1.1 |
| MB | | 7.1 | 1.7 | 4.4 | 16.3 | - 0.5 |
| RB | Aug | 4.1 | - 0.3 | 0.1 | 8.6 | - 2.6 |
| MB | | 4.0 | - 0.8 | 1.6 | 11.0 | - 3.9 |
| RB | Sep | - 2.7 | - 7.1 | - 4.9 | 4.3 | -15.3 |
| MB | | - 3.1 | - 7.8 | - 5.5 | 3.2 | -18.5 |
| RB | Oct | -14.4 | -21.0 | -17.7 | - 4.4 | -30.3 |
| MB | | -14.7 | -22.1 | -18.4 | - 5.1 | -32.9 |
| RB | Nov | -21.8 | -28.6 | -25.2 | -12.4 | -35.6 |
| MB | | -26.5 | -33.0 | -29.8 | -14.4 | -40.4 |
| RB | Dec | -29.8 | -35.3 | -32.6 | -13.6 | -38.8 |
| MB | | -28.7 | -36.5 | -32.6 | -14.2 | -44.8 |
| RB | Jan | -31.7 | -38.7 | -35.2 | -25.6 | -46.8 |
| MB | | -31.2 | -38.1 | -34.7 | -16.2 | -46.1 |
| RB | Feb | -27.6 | -35.6 | -31.6 | -16.5 | -43.2 |
| MB | | -29.8 | -34.4 | -32.1 | -22.8 | -45.9 |
| RB | Mar | -25.4 | -32.1 | -28.9 | -16.0 | -40.6 |
| MB | | -29.4 | -36.8 | -33.0 | -20.8 | -41.7 |
| RB | Apr | -18.7 | -26.2 | -22.5 | - 8.6 | -37.3 |
| MB | | -18.3 | -26.1 | -22.2 | - 7.8 | -38.5 |

Continued

Table 18. Continued

| AES[a] weather station | Month 1990-1991 | Daily temperatures °C: Monthly mean max. | Monthly mean min. | Monthly mean aver. | Monthly extreme high | Monthly extreme low |
|---|---|---|---|---|---|---|
| RB | May | - 6.8 | -12.6 | - 9.7 | - 0.6 | -19.1 |
| MB | | - 5.0 | -12.3 | - 8.9 | - 1.3 | -19.8 |
| RB | Jun | 2.2 | - 1.3 | 0.9 | 6.1 | - 5.1 |
| MB | | 0.9 | - 2.8 | - 0.9 | 2.8 | - 7.8 |

[a] AES equals Atmospheric Environment Service; RB equals Resolute Bay; and MB equals Mould Bay.

Table 19. Monthly statistics for precipitation at Atmospheric Environment Service weather stations, Resolute Bay, Cornwallis Island, and Mould Bay, Prince Patrick Island, Northwest Territories, June 1990-June 1991

| AES[a] weather station | Month 1990-1991 | Rainfall (mm) | Snowfall (cm) | Total precipitation[b] (mm) | Depth of snow on ground[c] (cm) | Days with 1.0 cm precipitation or more |
|---|---|---|---|---|---|---|
| RB[a] | Jun | Trace | 18.7 | 18.5 | Trace | 3 |
| MB[a] | | 1.2 | 2.6 | 3.8 | 0 | 1 |
| RB | Jul | 22.5 | 1.0 | 23.5 | 0 | 6 |
| MB | | 8.6 | 14.0 | 22.6 | 0 | 6 |
| RB | Aug | 8.4 | 5.8 | 14.2 | Trace | 5 |
| MB | | 4.0 | 6.8 | 10.8 | 0 | 2 |
| RB | Sep | 1.2 | 27.0 | 26.9 | 17 | 6 |
| MB | | 10.0 | 25.4 | 35.4 | 11 | 9 |
| RB | Oct | 0 | 18.8 | 13.7 | 27 | 5 |
| MB | | 0 | 13.8 | 13.8 | 22 | 5 |
| RB | Nov | 0 | 1.4 | 1.4 | 27 | 0 |
| MB | | 0 | 7.4 | 7.4 | 27 | 2 |
| RB | Dec | 0 | 10.6 | 10.4 | 34 | 5 |
| MB | | 0 | 6.5 | 5.1 | 24 | 1 |

Continued

Table 19. Continued

| AES[a] weather station | Month 1990-1991 | Rainfall (mm) | Snowfall (cm) | Total precipitation[b] (mm) | Depth of snow on ground[c] (cm) | Days with 1.0 cm precipitation or more |
|---|---|---|---|---|---|---|
| RB | Jan | 0 | 2.0 | 1.8 | 21 | 0 |
| MB | | 0 | 3.0 | 2.4 | 21 | 0 |
| RB | Feb | 0 | 1.4 | 1.4 | 17 | 1 |
| MB | | 0 | 1.2 | 0.6 | 19 | 0 |
| RB | Mar | 0 | 5.6 | 5.6 | 12 | 3 |
| MB | | 0 | 4.5 | 3.6 | 18 | 1 |
| RB | Apr | 0 | 3.0 | 3.0 | 15 | 2 |
| MB | | 0 | 4.0 | 4.0 | 21 | 2 |
| RB | May | 0.2 | 7.9 | 5.8 | 13 | 3 |
| MB | | Trace | 13.3 | 12.7 | 31 | 6 |
| RB | June | 10.4 | 23.4 | 33.6 | Trace | 1 |
| MB | | 6.6 | 17.9 | 24.5 | 3 | 9 |

[a] AES equals Atmospheric Environment Service; RB equals Resolute Bay; and MB equals Mould Bay.

[b] Total precipitation (mm) can be a value equal of slightly less than "total rainfall" plus "total snowfall".

[c] On last day of each month.

Table 20. Peak wind recorded at Atmospheric Environment Service weather stations, Resolute Bay, Cornwallis Island, and Mould Bay, Prince Patrick Island, south-central Queen Elizabeth Islands, Northwest Territories, 1 September 1990 to 31 May 1991.

| Month 1990-91 | N[a] | Peak wind speeds (km · $h^{-1}$) | | | | |
|---|---|---|---|---|---|---|
| | | Mean | ± SD | ± 95% CL | Maximum | Minimum |
| Resolute Bay | | | | | | |
| Sep | 13 | 49.3 | 11.7 | 7.0 | 67 | 33 |
| Oct | 8 | 40.7 | 7.7 | 6.4 | 54 | 33 |
| Nov | 12 | 51.5 | 14.7 | 9.4 | 81 | 33 |
| Dec | 25 | 50.2 | 18.5 | 7.6 | 120 | 31 |
| Jan | 15 | 46.5 | 9.1 | 5.0 | 57 | 33 |
| Feb | 22 | 55.2 | 15.0 | 6.6 | 87 | 35 |
| Mar | 19 | 61.7 | 25.2 | 12.1 | 117 | 33 |
| Apr | 10 | 43.2 | 8.5 | 6.0 | 57 | 33 |
| May | 18 | 50.7 | 16.8 | 8.4 | 104 | 33 |
| Mould Bay | | | | | | |
| Sep | 19 | 46.8 | 9.4 | 4.6 | 65 | 35 |
| Oct | 10 | 44.4 | 11.7 | 8.3 | 65 | 32 |
| Nov | 9 | 38.2 | 6.8 | 5.2 | 54 | 32 |
| Dec | 14 | 51.3 | 14.5 | 8.4 | 78 | 32 |
| Jan | 13 | 48.5 | 10.4 | 6.3 | 68 | 35 |
| Feb | 13 | 46.7 | 10.4 | 6.3 | 67 | 32 |
| Mar | 15 | 43.0 | 11.1 | 6.1 | 74 | 32 |
| Apr | 10 | 40.6 | 8.4 | 6.0 | 56 | 30 |
| May | 10 | 36.3 | 5.5 | 3.9 | 48 | 30 |

[a] N equals number of days per month on which peak wind speeds equalled or exceeded 30 km · $h^{-1}$.

Table 21. Days with freezing rain in September 1990 and June 1991 at Atmospheric Environment Service weather stations, Resolute Bay, Cornwallis Island, and Mould Bay, Prince Patrick Island, Northwest Territories.

| Day/ Month 1990-91 | Freezing rain (mm) | Associated snowfall (cm) | Daily temperatures °C | | | Snow-depth on ground (cm) |
|---|---|---|---|---|---|---|
| | | | Maximum | Minimum | Mean | |
| Resolute Bay | | | | | | |
| 25 Sep | 1.2 | 3.8 | -2.6 | - 3.7 | - 2.9 | 15 |
| 26 | trace | trace | -2.4 | - 4.1 | - 3.3 | 15 |
| 28 | trace | 0.8 | -2.4 | - 7.6 | - 5.0 | 16 |
| 30 | trace | trace | -5.3 | -15.3 | -10.3 | 17 |
| 01 June | trace | 1.0 | -2.1 | - 5.1 | - 3.6 | 15 |
| 02 | 1.4 | 0.2 | +2.5 | - 2.3 | + 0.1 | 15 |
| 20 | trace | 6.4 | +0.8 | - 2.1 | - 0.2 | 1 |
| Mould Bay | | | | | | |
| 23 Sep | trace | trace | -3.7 | - 9.9 | - 6.8 | 8 |
| 25 | trace | 0.4 | -1.6 | - 5.1 | - 3.4 | 10 |
| 27 | trace | 1.6 | -1.9 | - 4.8 | - 3.4 | 10 |

Continued

Table 21. Continued

| Day/ Month 1990-91 | Freezing rain (mm) | Associated snowfall (cm) | Daily temperatures °C | | | Snow-depth on ground (cm) |
|---|---|---|---|---|---|---|
| | | | Maximum | Minimum | Mean | |
| 01 June | trace | 1.1 | -1.5 | -5.5 | -3.5 | 32 |
| 02 | trace | trace | +2.3 | -5.5 | -1.6 | 33 |
| 03 | 0.6 | 0.6 | +1.6 | -2.0 | -0.2 | 32 |
| 04 | trace | trace | -0.5 | -4.6 | -2.6 | 31 |
| 11 | 0.2 | 0.0 | +0.4 | -2.4 | -1.0 | 16 |
| 15 | trace | 7.5 | +0.3 | -2.4 | -1.3 | 17 |
| 18 | trace | trace | +0.7 | -2.3 | -0.8 | 17 |
| 19 | trace | trace | +1.3 | -0.7 | +0.3 | 15 |

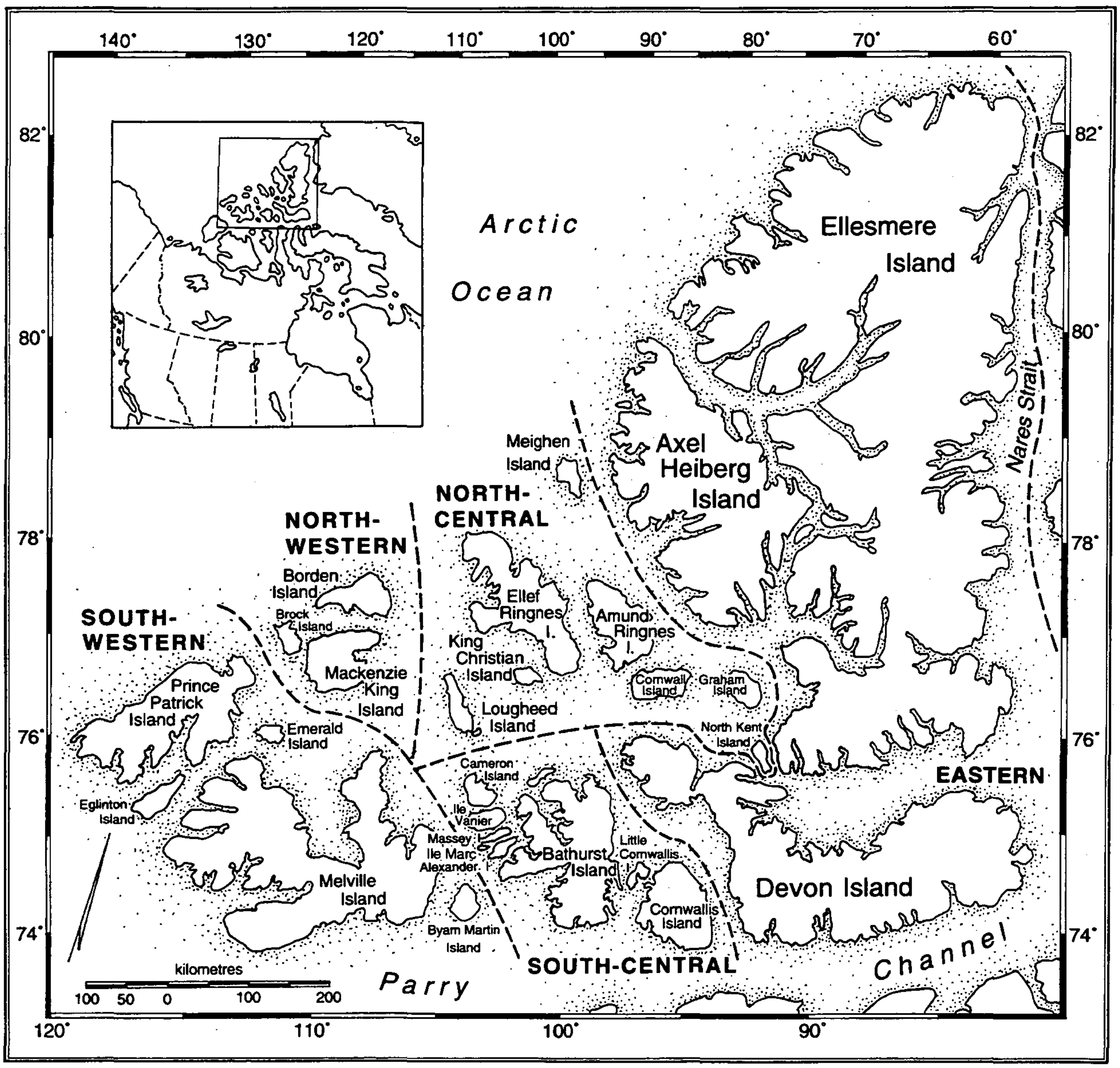


Fig. 1. Queen Elizabeth Islands of the Canadian Arctic Archipelago

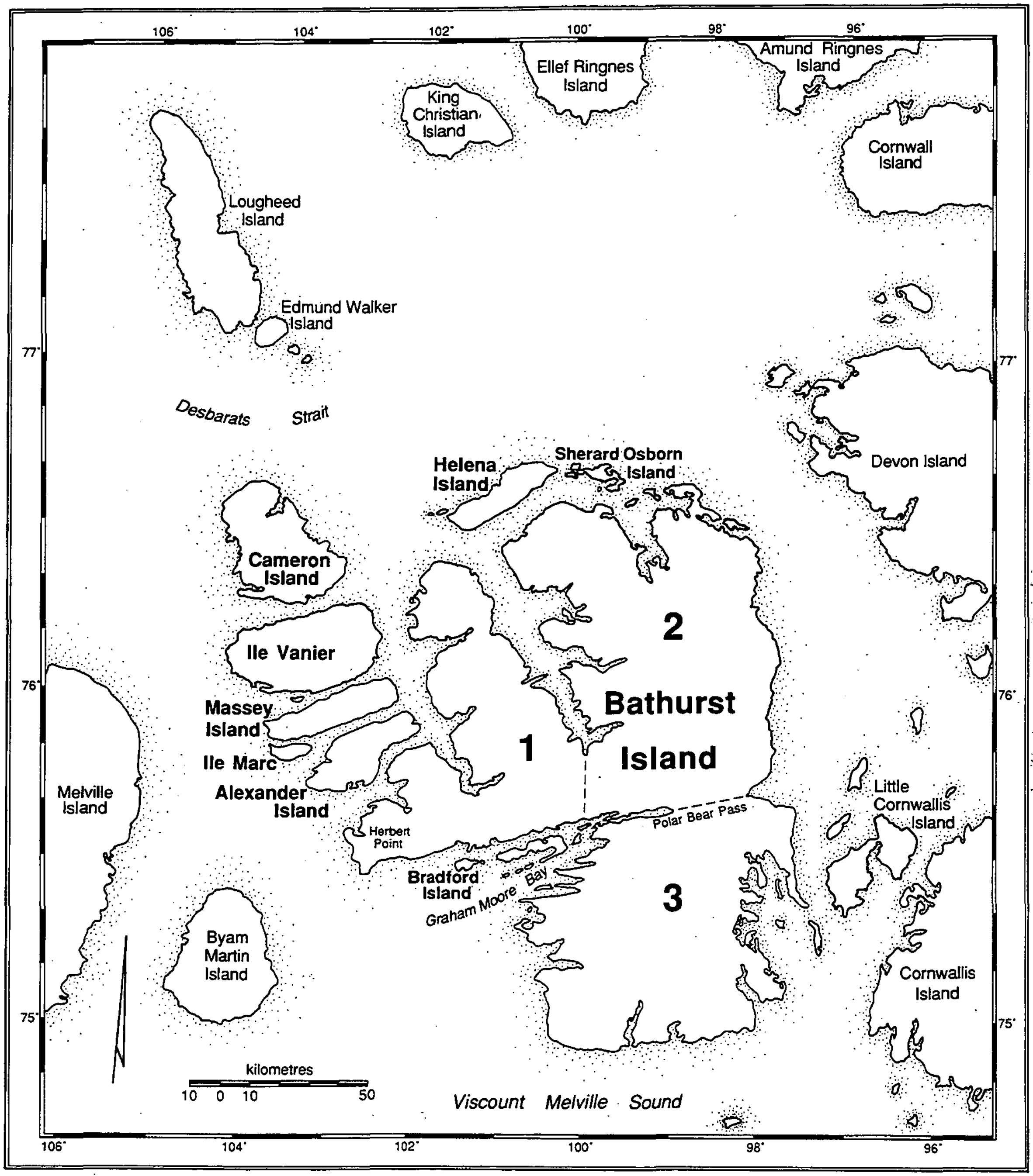


Fig. 2. Locations of nine of the 26 islands within the Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories: the principal island, Bathurst; the five western major satellite islands, Alexander, Marc, Massey, Vanier, and Cameron; the two northern major satellite islands, Helena and Sherard Osborn; and the one western secondary satellite island, Bradford

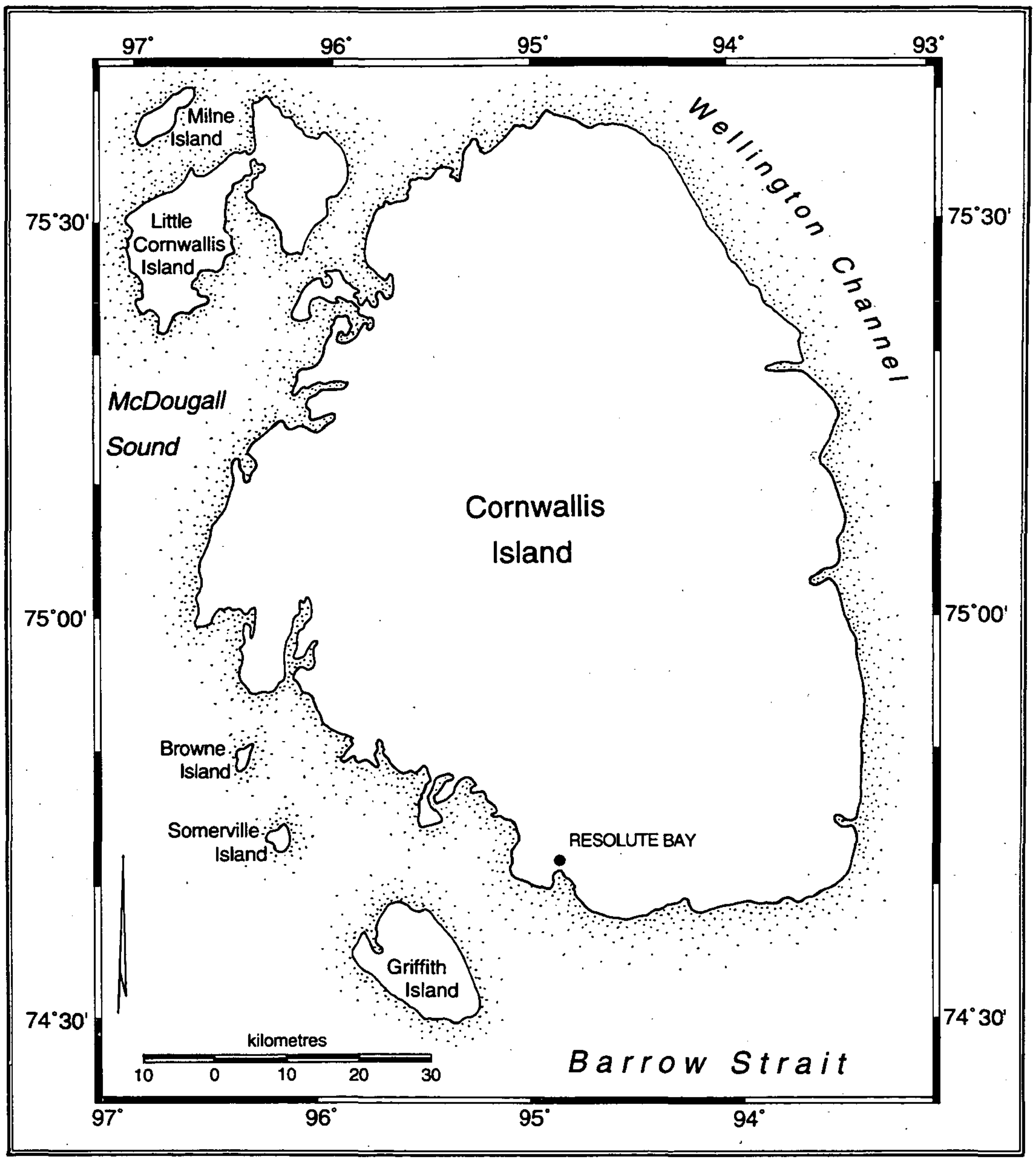


Fig. 3. Locations of two of the 26 islands within the Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories: the two eastern major satellite islands, Cornwallis and Little Cornwallis

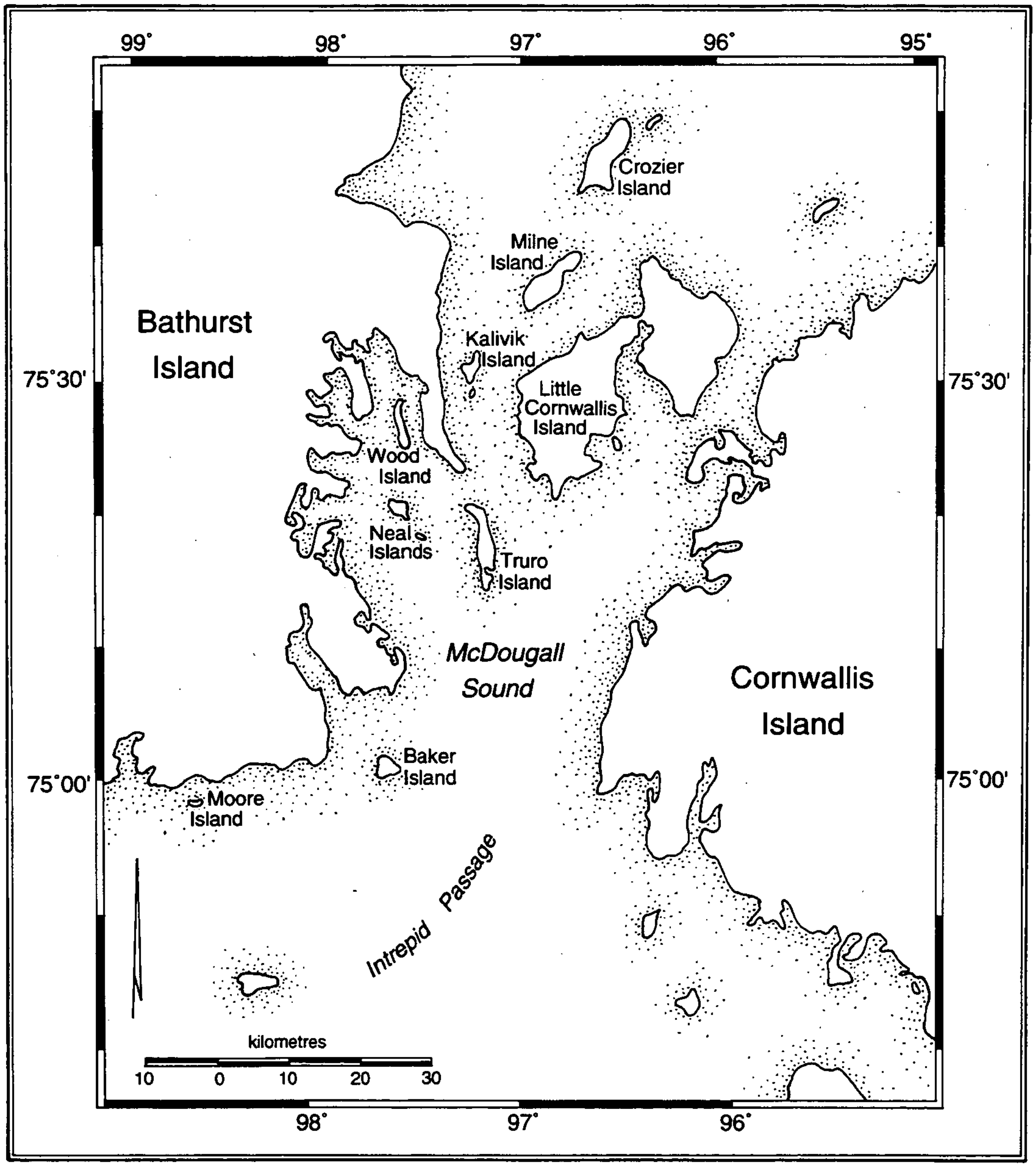


Fig. 4. Locations of eight of the 26 islands within the Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories: the six secondary satellite islands in McDougall Sound, Crozier, Kalivik, Milne, Neal, Truro, and Wood; and the two secondary satellite islands in Intrepid Passage, Baker and Moore

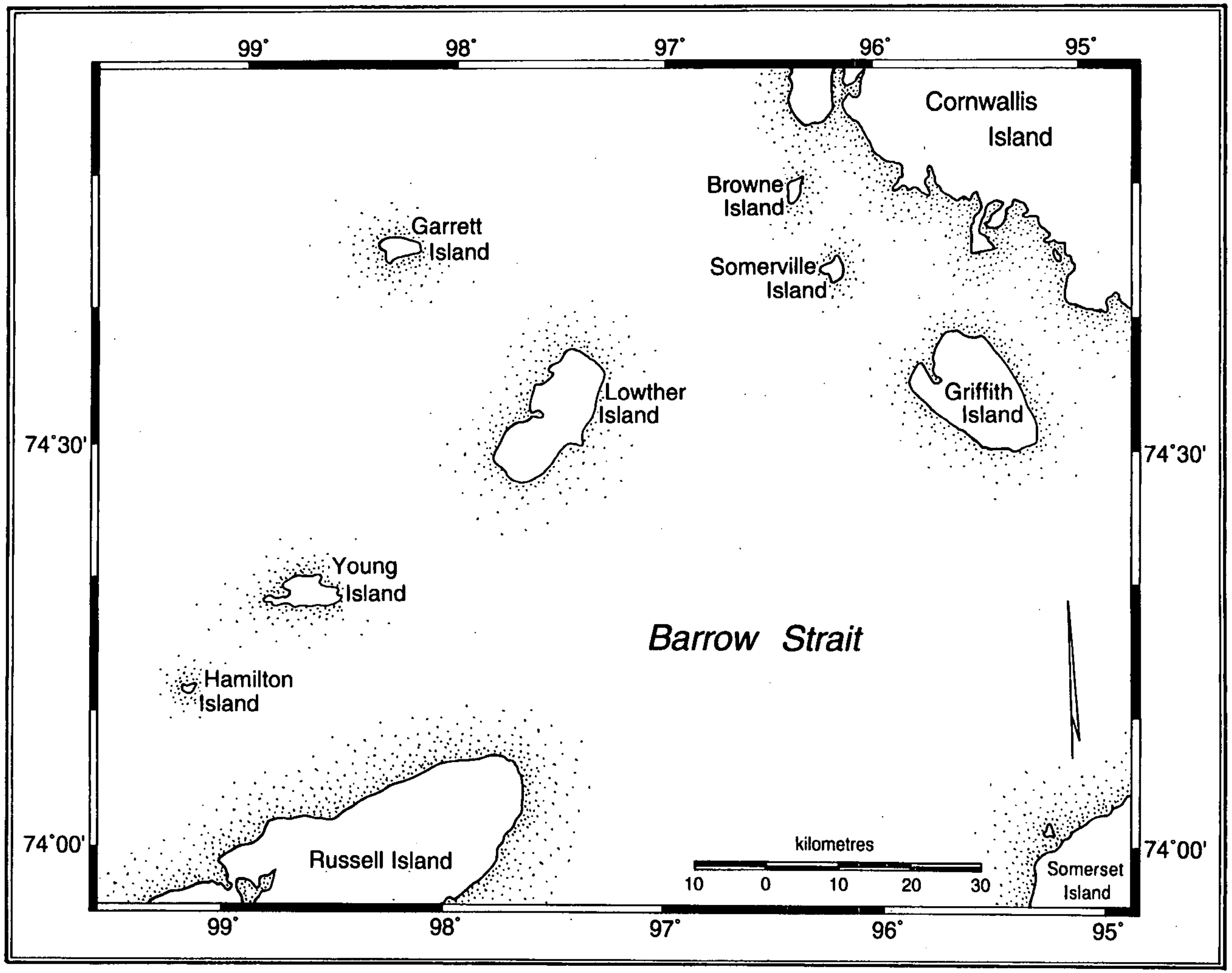


Fig. 5. Locations of seven of the 26 islands within the Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories: the seven secondary satellite islands in Barrow Strait, Browne, Garrett, Griffith, Hamilton, Lowther, Somerville, and Young

Appendix 1. Time spent carrying out nonsystematic aerial sex/age segregation counts of Peary caribou, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991

| Search zone | Minutes by date (month/day) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 06/07 | 06/08 | 06/09 | 06/16 | 06/17 | 16/18 | 06/20 | 06/22 | 06/27 | 06/28 | 06/30 |
| NEC | 43 | 16 | 32 | 35 | 10 | 40 | 5 | 42 | 7 | 65 | 5 |
| NEI | 8 | 23 | 139 | 99 | 20 | 0 | 10 | 39 | 0 | 30 | 37 |
| SEC | 0 | 56 | 0 | 51 | 36 | 51 | 0 | 40 | 18 | 23 | 0 |
| SEI | 0 | 9 | 0 | 17 | 12 | 0 | 0 | 0 | 4 | 0 | 0 |
| SC | 0 | 19 | 0 | 0 | 20 | 0 | 0 | 19 | 0 | 0 | 0 |
| SWC | 0 | 28 | 0 | 0 | 14 | 0 | 0 | 20 | 0 | 0 | 0 |
| SWI | 0 | 17 | 0 | 0 | 8 | 0 | 0 | 32 | 0 | 0 | 0 |
| NWC | 0 | 41 | 9 | 0 | 0 | 0 | 0 | 39 | 0 | 0 | 0 |
| NWI | 0 | 10 | 76 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| NCW | 23 | 58 | 0 | 0 | 0 | 0 | 0 | 27 | 0 | 0 | 130 |
| NCE | 97 | 7 | 0 | 69 | 0 | 0 | 0 | 0 | 0 | 130 | 98 |
| PBP | 21 | 16 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 |
| Alexander | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Marc | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Massey | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vanier | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cameron | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Helena | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sherard Osborn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 0 |

Continued

Appendix 1. Continued

| Search zone | Minutes by date (month/day) 07/02 | 07/03 | 07/04 | 07/05 | 07/06 | 07/07 | Total time by search zone (min) |
|---|---|---|---|---|---|---|---|
| Helena | 0 | 0 | | | | | |
| NEC | 13 | 0 | 0 | 0 | 18 | 0 | 331 |
| NEI | 0 | 0 | 0 | 0 | 0 | 0 | 405 |
| SEC | 58 | 0 | 0 | 0 | 47 | 0 | 380 |
| SEI | 0 | 92 | 0 | 0 | 0 | 0 | 134 |
| SC | 26 | 24 | 0 | 0 | 21 | 0 | 129 |
| SWC | 36 | 0 | 0 | 0 | 104 | 0 | 202 |
| SWI | 78 | 0 | 0 | 0 | 7 | 0 | 142 |
| NWC | 73 | 0 | 0 | 0 | 49 | 89 | 300 |
| NWI | 36 | 0 | 0 | 0 | 0 | 0 | 122 |
| NCW | 39 | 0 | 0 | 0 | 0 | 0 | 277 |
| NCE | 0 | 0 | 0 | 0 | 0 | 0 | 401 |
| PBP | 39 | 0 | 0 | 0 | 0 | 9 | 107 |
| Alexander | 0 | 0 | 106 | 0 | 0 | 100 | 206 |
| Marc | 0 | 0 | 14 | 0 | 0 | 16 | 30 |
| Massey | 0 | 0 | 91 | 0 | 0 | 92 | 183 |
| Vanier | 0 | 0 | 121 | 0 | 0 | 0 | 121 |
| Cameron | 0 | 0 | 0 | 182 | 0 | 0 | 182 |
| Helena | 0 | 0 | 0 | 0 | 50 | 0 | 50 |
| Sherard Osborn | 0 | 0 | 0 | 0 | 0 | 0 | 13 |

[a] For the purpose of nonsystematic aerial searches Bathurst Island was divided into 12 "search zones": NEC = northeast coast; NEI = northeast interior; SEC = southeast coast; SEI = southeast interior; SC = south coast; SWC = southwest coast; SWI = southwest interior; NWC = northwest coast; NWI = northwest interior; NCW = north coast, western section; NCE = north coast, eastern section; and PBP = Polar Bear Pass.

Appendix 2. Sex/age structure of samples of Peary caribou by sample day, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991, data obtained by nonsystematic helicopter searches

| Search date (month/day) | N | Sex/age composition | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Bulls | Cows | Calves | Juv.[a] males | Juv. females | Yrl.[a] males | Yrl. females |
| 06/07 | 13 | 0 | 4 | 2 | 2 | 3 | 0 | 2 |
| 06/08 | 29 | 0 | 6 | 0 | 8 | 7 | 5 | 3 |
| 06/09 | 87 | 0 | 47 | 8 | 2 | 14 | 2 | 14 |
| 06/16 | 87 | 10 | 29 | 18 | 1 | 12 | 3 | 14 |
| 06/17 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 06/18 | 38 | 15 | 0 | 0 | 7 | 0 | 8 | 8 |
| 06/20 | 12 | 0 | 4 | 3 | 0 | 4 | 0 | 1 |
| 06/22 | 168 | 45 | 27 | 21 | 37 | 6 | 26 | 6 |
| 06/27 | 24 | 11 | 1 | 1 | 6 | 0 | 5 | 0 |
| 06/28 | 264 | 25 | 68 | 58 | 23 | 28 | 16 | 46 |
| 06/30 | 296 | 27 | 86 | 81 | 10 | 43 | 12 | 37 |
| 07/02 | 225 | 52 | 32 | 32 | 23 | 44 | 26 | 16 |
| 07/03 | 19 | 2 | 5 | 4 | 1 | 0 | 1 | 6 |
| 07/04 | 234 | 31 | 62 | 56 | 25 | 38 | 7 | 15 |
| 07/05 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 07/06 | 123 | 47 | 11 | 10 | 23 | 8 | 19 | 5 |
| 07/07 | 242 | 58 | 53 | 48 | 29 | 19 | 28 | 17 |

[a] Juv. equals juvenile animals and Yrl. equals yearling animals.

Appendix 3. Sex/age structure of samples of Peary caribou by island and search zone, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991, data obtained by nonsystematic helicopter searches

| | | | Sex/age composition | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Island | Zone | N | Bulls | Cows | Calves | Juv.[a] males | Juv. females | Yrl.[a] males | Yrl. females |
| Bathurst | NEC | 260 | 69 | 30 | 16 | 56 | 30 | 36 | 23 |
| | NEI | 254 | 1 | 116 | 67 | 10 | 20 | 9 | 31 |
| | SEC | 143 | 47 | 11 | 8 | 24 | 16 | 23 | 14 |
| | SEI | 11 | 0 | 4 | 4 | 0 | 1 | 0 | 2 |
| | SC | 27 | 7 | 4 | 2 | 3 | 0 | 4 | 7 |
| | SWC | 15 | 8 | 0 | 0 | 3 | 0 | 4 | 0 |
| | SWI | 6 | 0 | 3 | 3 | 0 | 0 | 0 | 0 |
| | NWC | 150 | 65 | 14 | 14 | 26 | 6 | 22 | 3 |
| | NWI | 14 | 1 | 3 | 0 | 1 | 7 | 1 | 1 |
| | NCW | 212 | 35 | 38 | 38 | 12 | 57 | 15 | 17 |
| | NCE | 326 | 18 | 98 | 87 | 14 | 36 | 13 | 60 |
| | PBP | 18 | 8 | 0 | 0 | 3 | 0 | 4 | 3 |

Continued

Appendix 3. Continued

| Island | Zone | N | Bulls | Cows | Calves | Juv.[a] males | Juv. females | Yrl.[a] males | Yrl. females |
|---|---|---|---|---|---|---|---|---|---|
| | | | Sex/age composition | | | | | | |
| Alexander | - | 144 | 33 | 19 | 17 | 35 | 15 | 19 | 6 |
| Marc | - | 6 | 2 | 2 | 1 | 0 | 0 | 0 | 1 |
| Massey | - | 227 | 1 | 85 | 77 | 1 | 36 | 5 | 22 |
| Vanier | - | 28 | 13 | 3 | 3 | 6 | 2 | 1 | 0 |
| Cameron | - | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Helena | - | 22 | 5 | 6 | 6 | 3 | 0 | 2 | 0 |
| Sherard Osborn | - | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

[a] Juv. equals juvenile animals and Yrl. equals yearling animals.

Appendix 4. Chronological listing of hard antler casting by Peary caribou breeding cows, Bathurst Island complex, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991, data obtained by nonsystematic helicopter searches

| Date (mo./d)[a] | N | Number that cast both hard antlers | Number that cast one hard antler only: Left | Number that cast one hard antler only: Right | Number with both hard antlers retained |
|---|---|---|---|---|---|
| 06/07 | 4 | 2 | 1 | 0 | 1 |
| 06/08 | 6 | 2 | 1 | 0 | 3 |
| 06/09 | 47 | 43 | 1 | 2 | 1 |
| 06/16 | 29 | 25 | 1 | 1 | 2 |
| 06/17 | 1 | 1 | 0 | 0 | 0 |
| 06/18 | 0 | 0 | 0 | 0 | 0 |
| 06/20 | 4 | 4 | 0 | 0 | 0 |
| 06/22 | 27 | 26 | 0 | 0 | 1 |
| 06/27 | 1 | 1 | 0 | 0 | 0 |
| 06/28 | 68 | 67 | 0 | 0 | 1 |
| 06/30 | 86 | 86 | 0 | 0 | 0 |
| 07/02 | 32 | 32 | 0 | 0 | 0 |
| 07/03 | 5 | 5 | 0 | 0 | 0 |
| 07/04 | 62 | 62 | 0 | 0 | 0 |
| 07/05 | 0 | 0 | 0 | 0 | 0 |
| 07/06 | 11 | 11 | 0 | 0 | 0 |
| 07/07 | 53 | 53 | 0 | 0 | 0 |

[a] (mo./d) equals (month/day).

Appendix 5. Termination dates for 30 snow/ice stations (270 sample sites) and the number of sample sites at each of those stations with or without ground fast ice present when the station became inactive on the 7.5-km snow/ice course, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, May-June 1991

| Station number | Date station became inactive (month/day) | Number of sample sites | |
|---|---|---|---|
| | | No. with ice | No. without ice |
| 0.0 | 06/10 | 0 | 9 |
| 0.5 | 06/10 | 0 | 9 |
| 1.0 | 06/10 | 0 | 9 |
| 1.0-N | 06/10 | 0 | 9 |
| 1.0-S | 06/13 | 0 | 9 |
| 1.5 | 06/15 | 9 | 0 |
| 2.0 | 06/17 | 9 | 0 |
| 2.0-N | 06/13 | 7 | 2 |
| 2.0-S | 06/15 | 9 | 0 |
| 2.5 | 06/15 | 9 | 0 |
| 3.0 | 06/10 | 0 | 9 |
| 3.0-N | 06/13 | 0 | 9 |
| 3.0-S | 06/13 | 0 | 9 |
| 3.5 | 06/13 | 0 | 9 |
| 4.0 | 06/03 | 0 | 9 |
| 4.0-N | 06/10 | 0 | 9 |
| 4.0-S | 06/10 | 0 | 9 |
| 4.5 | 05/28 | 0 | 9 |
| 5.0 | 06/10 | 0 | 9 |
| 5.0-N | 06/10 | 0 | 9 |
| 5.0-S | 06/07 | 0 | 9 |
| 5.5 | 06/07 | 0 | 9 |

Continued

Appendix 5. Continued

| Station number | Date station became inactive (month/day) | Number of sample sites | |
|---|---|---|---|
| | | No. with ice | No. without ice |
| 6.0 | 06/03 | 0 | 9 |
| 6.0-N | 06/13 | 0 | 9 |
| 6.0-S | 06/10 | 0 | 9 |
| 6.5 | 06/13 | 0 | 9 |
| 7.0 | 06/13 | 0 | 9 |
| 7.0-N | 06/17 | 9 | 0 |
| 7.0-S | 06/10 | 0 | 9 |
| 7.5 | 06/15 | 9 | 0 |

Appendix 6. Termination dates for 41 snow/ice stations (369 sample sites) and the number of sample sites at each of those stations with or without ground fast ice present when the station became inactive on the 1-km snow/ice course, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, June 1991

| Station | Date station became | Number of sample sites | |
|---|---|---|---|
| number | inactive (month/day) | No. with ice | No. without ice |
| 1 | 06/08 | 0 | 9 |
| 2 | 06/14 | 9 | 0 |
| 3 | 06/11 | 0 | 9 |
| 4 | 06/14 | 6 | 3 |
| 5 | 06/14 | 4 | 5 |
| 6 | 06/14 | 0 | 9 |
| 7 | 06/14 | 0 | 9 |
| 8 | 06/14 | 7 | 2 |
| 9 | 06/17 | 9 | 0 |
| 10 | 06/14 | 1 | 8 |
| 11 | 06/11 | 0 | 9 |
| 12 | 06/14 | 9 | 0 |
| 13 | 06/14 | 6 | 3 |
| 14 | 06/17 | 9 | 0 |
| 15 | 06/17 | 9 | 0 |
| 16 | 06/14 | 0 | 9 |
| 17 | 06/14 | 9 | 0 |
| 18 | 06/16 | 9 | 0 |
| 19 | 06/14 | 3 | 6 |
| 20 | 06/14 | 9 | 0 |
| 21 | 06/16 | 9 | 0 |
| 22 | 06/14 | 0 | 9 |
| 23 | 06/03 | 0 | 9 |
| 24 | 06/14 | 0 | 9 |
| 25 | 06/14 | 0 | 9 |

Continued

Appendix 6. Continued

| Station number | Date station became inactive (month/day) | Number of sample sites | |
|---|---|---|---|
| | | No. with ice | No. without ice |
| 26 | 06/14 | 0 | 9 |
| 27 | 06/11 | 0 | 9 |
| 28 | 06/14 | 6 | 3 |
| 29 | 06/16 | 9 | 0 |
| 30 | 06/17 | 9 | 0 |
| 31 | 06/17 | 9 | 0 |
| 32 | 06/14 | 0 | 9 |
| 33 | 06/14 | 0 | 9 |
| 34 | 06/11 | 0 | 9 |
| 35 | 06/14 | 9 | 0 |
| 36 | 06/11 | 0 | 9 |
| 37 | 06/08 | 0 | 9 |
| 38 | 06/11 | 0 | 9 |
| 39 | 06/14 | 4 | 5 |
| 40 | 06/14 | 0 | 9 |
| 41 | 06/11 | 0 | 9 |

Appendix 7. Chronology of when profile of 25-m segments between the centres of each pair of stations on the 1-km snow/ice course became 100% snow-free, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, June-July 1991

| Station pair | Date[a] | Station pair | Date | Station pair | Date | Station pair | Date |
|---|---|---|---|---|---|---|---|
| 1- 2 | 6/17 | 2- 3 | 6/17 | 3- 4 | 6/16 | 4- 5 | 6/16 |
| 5- 6 | 6/25 | 6- 7 | 6/11 | 7- 8 | 6/16 | 8- 9 | 6/22 |
| 9-10 | 6/23 | 10-11 | 6/16 | 11-12 | 6/17 | 12-13 | 6/20 |
| 13-14 | 6/26 | 14-15 | 6/26 | 15-16 | 6/30 | 16-17 | 6/18 |
| 17-18 | 6/19 | 18-19 | 6/18 | 19-20 | 6/17 | 20-21 | 6/21 |
| 21-22 | 6/19 | 22-23 | 6/16 | 23-24 | 6/13 | 24-25 | 6/20 |
| 25-26 | 6/14 | 26-27 | 6/14 | 27-28 | 6/16 | 28-29 | 6/26 |
| 29-30 | 7/05 | 30-31 | 7/ 7 | 31-32 | 6/25 | 32-33 | 6/17 |
| 33-34 | 6/13 | 34-35 | 6/18 | 35-36 | 6/18 | 36-37 | 6/13 |
| 37-38 | 6/11 | 38-39 | 6/16 | 39-40 | 6/16 | 40-41 | 6/16 |

[a] Month/day.

Appendix 8. Bare ground (snow-free) statistics for the 1-km snow/ice course, northeastern Bathurst Island, south-central Queen Elizabeth Islands, Northwest Territories, May-July 1991

| Date | Number of bare-ground patches | Length of bare-ground patches (m) | | | | |
|---|---|---|---|---|---|---|
| | | Mean | ± SD | Minimum | Maximum | Median |
| 26 May | 5 | 0.6 | 0.3 | 0.3 | 0.9 | 0.6 |
| 30 | 6 | 0.5 | 0.2 | 0.3 | 0.6 | 0.5 |
| 03 June | 20 | 1.5 | 2.3 | 0.3 | 7.9 | 0.5 |
| 05 | 21 | 2.3 | 4.6 | 0.3 | 18.3 | 0.6 |
| 08 | 49 | 3.0 | 4.2 | 0.3 | 21.3 | 0.9 |
| 11 | 77 | 4.4 | 7.9 | 0.3 | 34.1 | 0.9 |
| 12 | 71 | 5.9 | 9.4 | 0.3 | 35.0 | 1.2 |
| 13 | 55 | 9.4 | 14.3 | 0.3 | 67.4 | 2.4 |
| 14 | 49 | 11.7 | 19.1 | 0.3 | 88.4 | 2.4 |
| 16 | 33 | 21.5 | 33.6 | 0.3 | 142.6 | 1.5 |
| 17 | 19 | 40.8 | 43.7 | 0.6 | 145.1 | 20.1 |
| 18 | 17 | 47.5 | 59.8 | 0.3 | 229.8 | 21.3 |
| 19 | 13 | 64.2 | 68.0 | 0.3 | 230.7 | 75.6 |
| 20 | 10 | 85.8 | 82.5 | 1.2 | 231.0 | 94.3 |
| 21 | 9 | 97.6 | 113.2 | 0.3 | 321.2 | 94.2 |
| 22 | 9 | 99.1 | 112.9 | 1.2 | 322.5 | 97.2 |
| 23 | 7 | 130.0 | 129.3 | 5.2 | 327.7 | 102.7 |
| 24 | 7 | 132.0 | 128.2 | 9.4 | 330.1 | 103.9 |
| 25 | 6 | 156.4 | 161.8 | 1.5 | 331.3 | 136.2 |
| 26 | 4 | 236.9 | 164.0 | 0.3 | 350.8 | 298.2 |
| 27 | 4 | 238.0 | 165.0 | 0.3 | 351.1 | 300.4 |
| 29 | 4 | 239.8 | 165.6 | 1.5 | 352.3 | 302.7 |
| 30 | 3 | 321.6 | 358.6 | 1.8 | 709.3 | 253.6 |

Continued

Appendix 8. Continued

| Date | Number of bare-ground patches | Length of bare-ground patches (m) | | | | |
|---|---|---|---|---|---|---|
| | | Mean | ± SD | Minimum | Maximum | Median |
| 01 July | 3 | 323.0 | 359.6 | 2.1 | 711.7 | 255.1 |
| 02 | 3 | 323.1 | 359.5 | 2.4 | 711.7 | 255.1 |
| 03 | 4 | 242.8 | 344.5 | 1.8 | 711.7 | 128.9 |
| 04 | 4 | 244.1 | 334.2 | 4.0 | 712.9 | 129.7 |
| 05 | 4 | 247.8 | 343.3 | 1.2 | 729.4 | 130.3 |
| 06 | 4 | 248.8 | 343.9 | 0.9 | 730.9 | 131.7 |
| 07 | 1 | - | - | 1000.0 | 1000.0 | - |

Appendix 9. Summary of maximum, minimum, and mean temperatures recorded at the Canadian Wildlife Service "Walker River base camp", northeastern Bathurst Island (76° 00'N, 97° 40'W), south-central Queen Elizabeth Islands, Northwest Territories, 23 May to 12 July 1991

| Date | Temperature[a] °C | | |
|---|---|---|---|
| (month/day) | Maximum | Minimum | Mean |
| 5/23 | - 5.0 | - 8.5 | - 6.8 |
| 5/24 | + 1.0 | - 6.4 | - 2.7 |
| 5/25 | + 2.2 | -11.0 | - 4.4 |
| 5/26 | - 4.5 | - 9.7 | - 7.1 |
| 5/27 | - 5.0 | - 9.0 | - 7.0 |
| 5/28 | - 5.5 | -11.5 | - 8.5 |
| 5/29 | - 3.1 | -12.5 | - 7.8 |
| 5/30 | - 2.5 | -10.5 | - 6.5 |
| 5/31 | - 1.0 | - 8.0 | - 4.5 |
| 6/01 | - 3.0 | - 5.5 | - 4.2 |
| 6/02 | + 1.5 | + 1.0 | + 1.2 |
| 6/03 | + 2.2 | - 0.4 | + 0.9 |
| 6/04 | + 1.0 | - 3.5 | - 1.2 |
| 6/05 | + 3.0 | - 1.5 | + 0.8 |
| 6/06 | + 0.5 | - 2.2 | - 0.8 |
| 6/07 | + 3.7 | - 1.5 | + 1.1 |
| 6/08 | + 5.5 | - 0.5 | + 2.5 |
| 6/09 | + 6.9 | - 0.6 | + 3.2 |
| 6/10 | + 3.0 | - 2.4 | + 0.3 |
| 6/11 | + 2.5 | - 2.5 | 0.0 |
| 6/12 | + 1.7 | - 1.0 | + 0.4 |
| 6/13 | + 2.5 | - 0.6 | + 1.0 |
| 6/14 | + 2.6 | - 0.5 | + 1.0 |
| 6/15 | + 2.7 | - 0.5 | + 1.1 |
| 6/16 | + 3.7 | - 0.2 | + 1.8 |

Continued

Appendix 9. Continued

| Date (month/day) | Temperature[a] °C | | |
|---|---|---|---|
| | Maximum | Minimum | Mean |
| 6/17 | + 2.5 | - 0.5 | + 1.0 |
| 6/18 | + 2.6 | - 0.6 | + 1.0 |
| 6/19 | + 4.0 | 0.0 | + 2.0 |
| 6/20 | + 2.8 | - 0.2 | + 1.3 |
| 6/21 | + 3.2 | - 0.3 | + 1.5 |
| 6/22 | + 2.6 | - 0.7 | + 1.0 |
| 6/23 | + 2.6 | - 0.5 | + 1.0 |
| 6/24 | + 1.7 | - 0.2 | + 0.8 |
| 6/25 | + 3.9 | - 0.5 | + 1.7 |
| 6/26 | + 3.0 | - 0.3 | + 1.4 |
| 6/27 | + 3.4 | + 0.3 | + 1.8 |
| 6/28 | + 2.7 | - 0.5 | + 1.1 |
| 6/29 | + 3.5 | 0.0 | + 1.8 |
| 6/30 | + 4.1 | + 0.4 | + 2.2 |
| 7/01 | + 4.0 | + 0.1 | + 2.0 |
| 7/02 | + 4.5 | + 0.1 | + 2.3 |
| 7/03 | + 3.7 | - 0.5 | + 1.6 |
| 7/04 | + 4.0 | - 0.4 | + 1.8 |
| 7/05 | + 8.7 | + 2.0 | + 5.4 |
| 7/06 | + 9.2 | + 1.3 | + 5.2 |
| 7/07 | +10.5 | + 4.5 | + 7.5 |
| 7/08 | +10.0 | + 3.1 | + 6.6 |
| 7/09 | +10.0 | + 4.1 | + 7.0 |
| 7/10 | + 8.5 | + 4.0 | + 6.2 |
| 7/11 | + 9.2 | + 4.7 | + 7.0 |
| 7/12 | + 8.9 | + 1.6 | + 5.2 |

[a] Temperatures were recorded at ca. 0700 and 1900 each day; therefore, temperatures for each date actually range from 1900 the previous day to 1900 that day.