

Defining the Pen Islands Caribou Herd of southern Hudson Bay

Kenneth F. Abraham¹ & John E. Thompson²

Ontario Ministry of Natural Resources,

¹300 Water Street, Peterborough, Ontario K9J 8M5, Canada (ABRAHAK@gov.on.ca).

²P.O. Box 190, Moosonee, Ontario P0L 1Y0, Canada.

Abstract: In this paper, we describe the Pen Islands Herd of caribou, the largest aggregation of caribou in Ontario (it also occupies a portion of northeastern Manitoba). Photographic counts showed the herd had a minimum population of 2300 in 1979, 4660 in 1986, 7424 in 1987 and 10 798 in 1994. Throughout the 1980s, the Pen Islands caribou exhibited population behaviour similar to migratory barren-ground caribou herds, although morphology suggests they are woodland caribou or possibly a mixture of subspecies. The herd had well-defined traditional tundra calving grounds, formed nursery groups and large mobile post-calving aggregations, and migrated over 400 km between tundra summer habitats and boreal forest winter habitats. Its migration took it into three Canadian jurisdictions (Ontario, Manitoba, Northwest Territories) and it was important to residents of both Manitoba and Ontario. It is clear that the herd should be managed as a migratory herd and the critical importance of both the coastal and variable large winter ranges should be noted in ensuring the herd's habitat needs are secure.

Key words: woodland caribou, Ontario, Manitoba, migration, population size, annual range.

Rangifer, Special Issue No. 10, 33–40

Introduction

Woodland Caribou (*Rangifer tarandus caribou*) are found throughout northern Ontario north of about 50°30' north latitude (Darby *et al.*, 1989). The Hudson Bay Lowlands contains the majority of the province's caribou, including aggregations that occur along the Hudson Bay coast (Fig. 1). In the late 1970s and early 1980s, evidence accumulated about increasing numbers of caribou summering near the Ontario-Manitoba border (Thompson & Abraham, 1994). It was thought that this summer aggregation might be the source of the increasing number of observations of caribou in winter in the boreal forest of extreme northeastern Manitoba and northwestern Ontario. In addition to the many questions of biological interest raised, the discovery of so many caribou had several implications for harvest by the Cree people of the area, tourism and jurisdictional management. These implications provided the impetus for the Ontario Ministry of Natural Resources (OMNR) to undertake a 3 year study to document the characteristics of the herd.

The objectives of this paper are: 1) to review the history of caribou occupation of the Hudson Bay

Lowlands between Ft. Severn, Ontario and York Factory, Manitoba; 2) to define the size of this herd during the 1980s and early 1990s, and 3) to delineate the annual range and seasonal use areas.

Study area

East Pen Island lies offshore from Ontario and is thus part of the Northwest Territories. West Pen Island, formerly an island but now a peninsula of the Ontario coast, lies to the southwest of East Pen Island, within 5 km of the Manitoba border (Fig. 1). Because these islands are near the longitudinal centre of the calving and summer range where the first evidence of a large summer aggregation was obtained, we named this group of caribou the Pen Islands Herd.

The study area comprised an area of approximately 80 000 km² in extreme northwestern Ontario and northeastern Manitoba (Fig. 1). It is bounded on the east by the Severn River, on the north by Hudson Bay, on the west by the Nelson River, and on the south (at approximately latitude 55° N) by God's Lake, Edmund Lake, Kistigan Lake

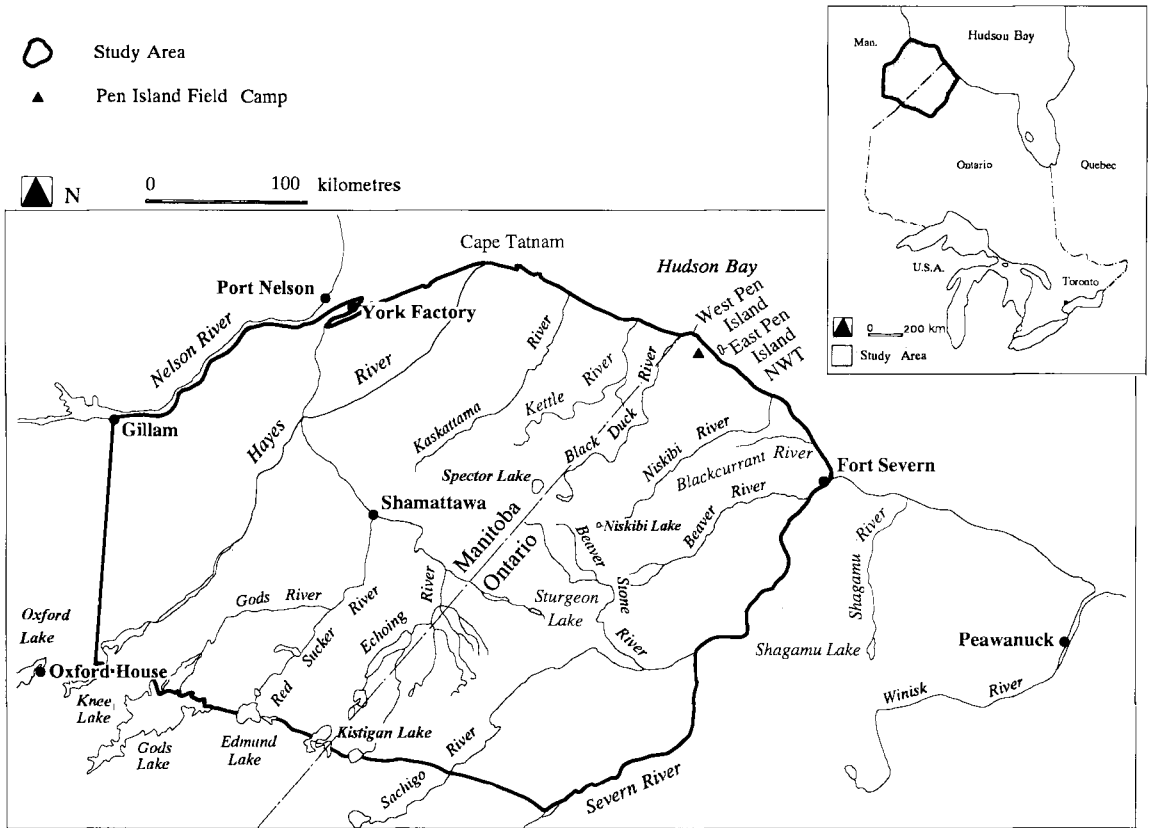


Fig. 1. Pen Islands caribou study area in Ontario and Manitoba and southern Hudson Bay coast showing places of caribou groups and movements described in text.

and the upper reaches of the Echoing River watershed. The majority of the study area is in the Hudson Bay Lowland physiographic region (Hutchison, 1982) and the remainder is on the Canadian Shield (Rowe, 1972). Within this broad study area, spring, summer and fall studies were concentrated between the Niskibi River, Ontario and Cape Tatnam, Manitoba and within 20 km of Hudson Bay (the Forest-Tundra zone of Rowe, 1972). Winter radio-tracking and aerial surveys defined the inland extent of the study area.

Methods

Historical information on caribou numbers, distribution and harvest was assembled from published and unpublished reports, OMNR and Manitoba Department of Natural Resources (MDNR) files, researchers' notes and Lowland residents.

Visual and photographic aerial surveys were flown in the coastal portion of the study area to locate important areas and to estimate population size in summer. We conducted a total of 26 reconnaissance and photographic aerial surveys on a subjective schedule between 25 May 1987 and 13 June 1989. Aggregations were photographed to obtain total population surveys on 11 July 1986, 25-26 May, 22-23 June and 14 July 1987 and 20 July 1988.

Caribou were captured and collared or tagged in two separate time periods. The first session was during the rut from 28 September to 5 October 1987 when 21 females and 2 males were captured and fitted with radio-collars. The second session was from 7 to 14 June 1988 just after calving when 4 females (all collared) and 23 males (13 collared, 10 ear-tagged) were captured. We conducted a total of 25 telemetry surveys between 28 October 1987

and 27 March 1990, approximately bi-weekly during winter to locate collared caribou. The annual ranges of the 23 caribou tagged during the rut in September-October 1987 and the 27 caribou tagged during early aggregation period in June 1988 were overlapping and indicated that both sets of captured animals did come from the same population. Therefore, these two groups are combined for analysis and discussion of the Pen Islands Herd characteristics. Annual range was estimated by creating an outer convex polygon of locations of radio-marked caribou each year.

A detailed description of methods is provided in an OMNR internal report by Thompson & Abraham (1994).

Historical perspective on caribou in the Pen Islands area

Relatively little quantitative information is available on the historic numbers, distribution or behaviour of caribou in the Hudson Bay Lowland, particularly along the Hudson Bay coast. The earliest written records are from the period of Hudson's Bay company settlement in the 1700s. Andrew Graham (in Williams, 1969:14-16) describes "reindeer" as being "several kinds" and "very numerous" in the 1770s along the Hudson Bay coast. He mentions their great importance in the diet of Indians and in the local economy. He also provides a vivid description of their "southward" migratory movement in May along the coast past the "York Fort" (now York Factory) and "Severn" (now Fort Severn) settlements and their return "northward" migratory movement in September. Finally, he notes them as "rarely seen within eighty or one hundred miles of the coast" between November and April. Other early accounts of caribou in this area by S. Hearne, N. J  r  mie, and J.B. Tyrrell were summarized in Banfield (1961:85); these noted migration between forested interior areas and coastal tundra. Banfield (1961) also raised a question of taxonomic status of "the herds that formerly inhabited the southern Hudson Bay coast from Cape Henrietta Maria, Ontario to Cape Churchill, Manitoba". The question he posed (and left unanswered) was whether they were "migratory woodland caribou" or the "southernmost tundra caribou". Despite rapid reduction of the herds through heavy killing in the eighteenth century, apparently a few migratory bands still existed as late as 1912. The caribou that Banfield himself examined in northeastern Manitoba in 1949

"appeared to be woodland caribou" but interestingly, he noted that the area was "overrun by migrating tundra reindeer" at the time. Despite the observation, he offered qualified conclusions that "reduction of local populations has apparently curtailed the migratory habit" and that the area was a "possible ... area of intergradation between the subspecies." de Vos & Peterson (1951) stated that woodland caribou occurred widely in scattered herds but also noted that they were "absent from a fringe along the Hudson Bay in the northwestern part" of Ontario.

In the 1950s and 1960s, a series of surveys of the Hudson Bay Lowland was made during summer, fall and winter. Winter surveys (Simkin, 1962; 1964; 1966; 1967) and interviews with Cree living in the area revealed that the coastal zone was virtually unoccupied in winter, just as Graham had noted so much earlier, except that there was a small group north of Sutton Lake toward Cape Henrietta Maria (de Vos & Peterson, 1951; D. Simkin, pers. comm.). Simkin found caribou in winter (January to March) 50-100 miles inland from Hudson Bay and showed winter densities in these interior Lowland forests to be similar to densities in the bulk of Ontario's boreal forest. Occasional winter surveys conducted between 1959 and 1982 by Ontario and Manitoba provincial employees documented caribou distribution and densities in parts of our study area. Although winter concentration areas were mapped, neither month to month movements nor annual variation in areas occupied were known and no population estimates were made that could be related to the entire study area we defined. Thompson (1986) presented results of a survey conducted from 1981-1983 and summarized all previous winter caribou surveys from the Ontario Hudson Bay Lowland. The 1981-83 surveys re-confirmed the absence of caribou from the coastal zone in winter, and documented significant wintering concentration areas at the habitat boundary of the Hudson Bay Lowlands Forest and the Northern Boreal Forest (terminology of Rowe, 1972) particularly around Sturgeon Lake, Ontario and the upper reaches of the Echoing River near the Manitoba border.

Simkin's (1959) interviews with Cree residents provided accounts of caribou movement inland in November (i.e., away from open tundra areas to forested areas) and coastward in February and March, a pattern that appears to have held true for the entire Hudson Bay coast. During our community visits from 1987-90, Fort Severn hunters related their accumulated knowledge of caribou in their

areas of activity. They reported that caribou were thinly scattered over this portion of the Lowland about 50 years ago. In more recent years, they noted the migratory nature of these animals, particularly an east to west movement to the coast in April when the snow is crusted (J. Stoney, pers. comm.) and an increase in summer numbers on the coast. Fort Severn hunters distinguished three types of caribou within and near their hunting grounds: small caribou north of the Nelson River called "little white ones", the Pen Islands animals, and larger "woodlands" caribou. Their caribou harvesting habits incorporated a shift from mainly inland hunting to coastal harvesting in the early 1970s.

Independent discussions we had at this time with Shamattawa, Manitoba, Cree hunters revealed similar information. They also distinguished three types. Shamattawa hunters began to see and hunt the migrating caribou in about 1980 (possibly the Pen Islands Herd) in addition to the more usual resident "woodlands" caribou and the Cape Churchill caribou with thinner hides and "pelage like a rabbit". Corresponding reports from Manitoba Department of Renewable Resources (S. Kearney, pers. comm.) suggested increases in winter use of the boreal forest in extreme northeastern Manitoba near the Ontario border, including the Shamattawa area and the Echoing River watershed, during the early 1980s. Movement patterns reported by Shamattawa Cree hunters were westward movements in the fall towards Oxford House (Fig. 1) and return movements in winter and towards the coast in spring.

Information from both Fort Severn and Shamattawa revealed an awareness that beginning in the early 1970s, caribou seemed to concentrate in summer near the Pen Islands. Interestingly, neither community was aware of the location of calving. Taken as a whole, the information from Fort Severn and Shamattawa pointed either to an increasing herd in the Pen Islands area or, alternately, a range shift (from the interior or further north along the coast?) and increased use of coastal areas in spring and summer and interior areas in winter in extreme northwestern Ontario and northeastern Manitoba. We cannot distinguish between these alternatives.

Generally missing from both the technical and Native accounts is a comprehensive understanding of numbers, distribution and behaviour of caribou in the Lowland during the snow-free seasons. In summer surveys, Simkin (1959; 1961; 1965) recorded small bands along the Hudson Bay coast from

Cape Henrietta Maria to the Manitoba border. The largest summer group he recorded was 41, with averages from 6 to 9 depending on month and year; these data are mostly from the Hudson Bay coast east of the Winisk River. From the Winisk River west to the Shagamu River, he found no evidence of large groups, nor tracks of more than 2 together. West of Severn, near the Niskibi River he found "heavy track concentrations" but few caribou. Simkin (1965) found no specific coastal calving grounds.

During 20 coastal polar bear (*Ursus maritimus*) surveys conducted between 1963 and 1990, no large caribou aggregations were recorded (G. Kolenosky and others, unpubl. reports). However, most of these surveys were conducted between late August and early September and covered only the area within 5 km of the high tide line. Our study indicates that the large aggregations disperse by late July and that smaller bands of caribou probably move into the treed ridges and fen areas some distance from the coastline. This probably resulted in polar bear surveyors seeing few caribou, even in years when the population was growing.

In the 1970s, observations and photographic documentation of caribou in summer along the Hudson Bay coast were obtained by biologists conducting waterfowl surveys. The existence of a large herd west of Fort Severn was first suggested by the observations of H. G. Lumsden (pers. comm.) in 1973. During July waterfowl surveys, he observed tracks in tidal mudflats along the coast strongly suggestive of large numbers of caribou. R.K. Ross (pers. comm.) recorded many small groups (1-40) near the Pen Islands between May and October 1977, but he also found mixed sex groups of 150 and 300 in July 1977. The first photographs confirming large caribou aggregations (totalling 2300 animals) in the Pen Islands area were taken on 6 July 1979 by Lumsden near the mouth of the Black Duck River at the Ontario-Manitoba border.

As a result of heightened awareness, OMNR employees were encouraged to regularly report and if possible, photograph caribou they observed along the coast. In 1983, we began systematic attempts to collect numerical population data on caribou summering in this area, with variable success. However, by 1985, we knew unequivocally that summer post-calving aggregations containing a few thousand caribou occupied the coastal tundra west of Fort Severn, but we did not have a reliable estimate of numbers. Finally, a count of 4,666 caribou

of both sexes and all ages was obtained from photographs of three large aggregates found between Black Currant River and the Pen Islands on 11 July 1986. We did not search west of the Kettle River, Manitoba on this date so it is possible that other similar groups were not located. On 27 March 1987, approximately 400-500 animals were observed in a 4-6 km area approximately 10 km from the Pen Islands (D. McKnight, pers. comm.). At this time, we knew little else about this population of animals, including their connections, if any, to Manitoba and Ontario winter concentrations (Thompson, 1986).

This was the information that led us to the working hypothesis that a group of migratory caribou occupied coastal tundra areas centered at the Pen Islands in spring and summer and moved to inland forested areas in winter. The "herd" appeared to straddle the Ontario-Manitoba border and seemed to be both large and increasing in size.

The intensive study from 1987-1990 allowed us to define the general population behaviour of the Pen Islands Caribou Herd. Although subsequent population growth and other events may have changed this picture, we offer the following information as the first definitive description of the Herd.

Subspecies identity

The subspecies identity of the Pen Islands caribou is not certain. Pen Islands animals are larger than barren-ground caribou and resemble woodland caribou in external body and skull measurements and antler position, but antler characteristics are more similar to barren-ground caribou (Thompson & Abraham, 1994). Genetic studies may help resolve the question posed by Banfield (1961) about whether the herd has a mixed subspecies origin.

Population size 1987-1989

Aerial photographic surveys of summer aggregations containing both sexes and all ages were conducted in 1987 and 1988 to determine population size. We located the aggregations by flying parallel low altitude transects over the entire coastal calving and summer range and few single caribou were observed. On 14 July 1987, we found and photographed 7 distinct groups on intertidal flats and beach ridges near the coast, totalling 7424 caribou. Surveys before and after this date in 1987 indicated

that this was the peak of aggregation and this survey gave us the largest count obtained during the three year study. Other counts at peak aggregation yielded as few as 3190 (20 July 1988). Thus, we recognize that the photographic technique we used is only able to provide a minimum population estimate and that scattered individuals, small bands and in some years, even large aggregates could have been missed. However, the aggregating behaviour was consistent among years and provided an annual opportunity in mid July to record the majority of caribou in the Herd.

Population size since 1990

The techniques we established were used to conduct photographic counts after the intensive study. Delean (1993) photographed 5113 caribou in aggregates, primarily between Kaskattama River and Cape Tatnam, Manitoba. Scholten (1994) photographed 10 798 caribou in 12 aggregates across virtually the entire described summer range from Cape Tatnam, Manitoba to Niskibi River, Ontario. We interpret the difference between years (a two fold increase) as a problem with the visual location of aggregates in 1993, similar to our earlier experience, rather than real population change. Simultaneous ground observations made by us in 1993 indicated over 500 caribou along the coast between the Severn River and the Winisk River. We have not previously associated this portion of the coast with the Pen Islands herd summer range, chiefly because of the lack of observations of caribou near Ft. Severn between 1987 and 1990 and because of the physical barrier to eastward travel that the large Severn River and the community of Ft. Severn might pose. However, it is possible that as the herd has grown such factors as their own habitat impacts, increased human disturbance and coincidental increases in other herbivores (e.g. snow geese) may have induced the herd to move farther eastward than during our initial study. An alternative explanation is that the caribou bands near the Shagamu River and Shagamu Lake have increased in parallel with the Pen Islands Herd. Regular observations have been made of small summer bands near the river mouth and winter concentrations near the lake.

In summary, the known number of caribou summering in the Pen Islands area has risen steadily from at least 2300 in 1979 to at least 10 800 in 1994.

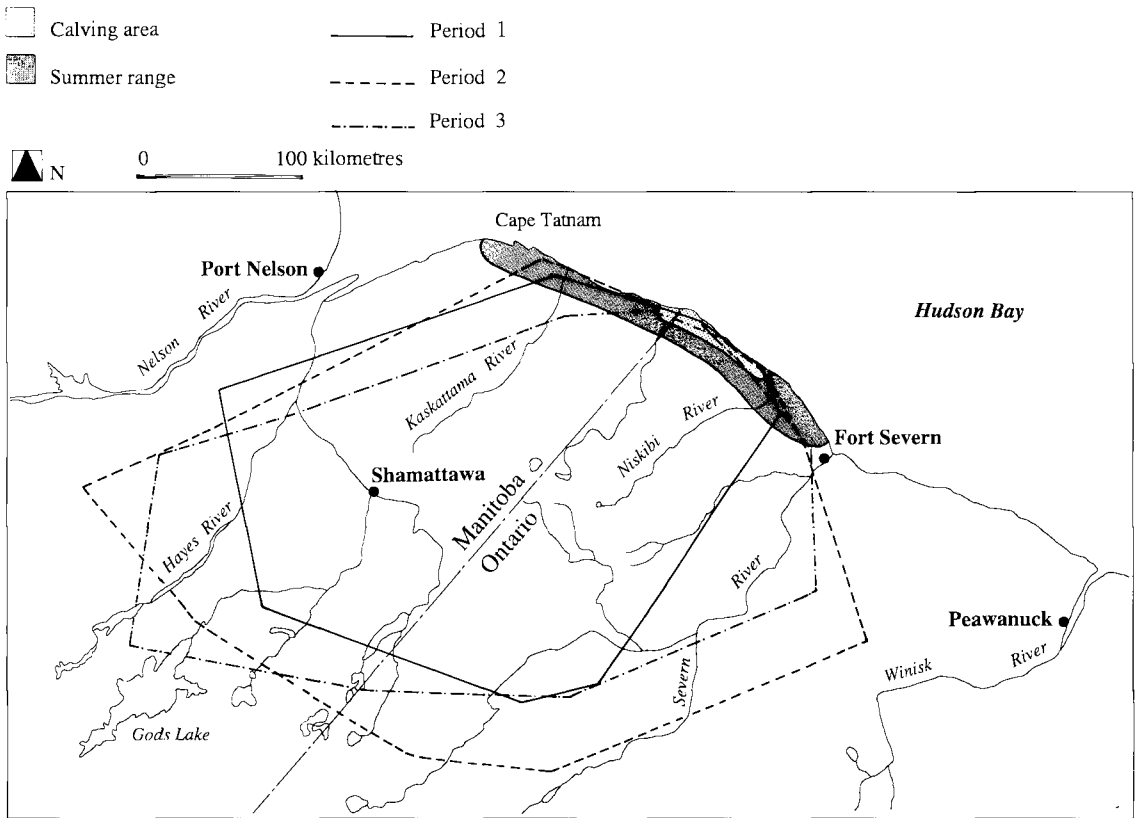


Fig. 2. Annual range of Pen Islands caribou herd showing calving area and summer areas and outer convex polygon of all fall-winter radio telemetry locations in each year (Period 1 = Sept. 1987- June 1988; Period 2 = Sept. 1988 - July 1989; Period 3 = Sept. 1989 - March 1990).

Annual range

Spring

The Pen Islands Herd calving area extended from the Niskibi River, Ontario ($56^{\circ}56' \text{ N}$, $89^{\circ}22' \text{ W}$) westward to the Kettle River, Manitoba ($56^{\circ}30' \text{ N}$, $88^{\circ}09' \text{ W}$), was approximately 90 km in length and caribou were observed using these same grounds during all 3 years of study (Fig. 2). This was also where R. K. Ross (pers. comm.) noted calving caribou in 1977. There was nearly complete segregation of the sexes during the peak calving period from the 17-21 May. Most bulls were presumed to be in forest and forest-tundra areas south of the calving grounds. Thus, the Pen Islands herd exhibited a pattern of dispersion during calving and traditional use that is characteristic of migratory barren-ground herds.

Summer

Summer aggregations occupied the Forest-Tundra zone from the Black Currant River, Ontario to Cape

Tatnam, Manitoba and were usually found within 5 km of the coast. Cow-dominated "nursery" groups formed immediately after calving (surveys from 24-28 May) and contained up to 764 animals. Bull-dominated groups at this time usually contained 10 or fewer individuals although groups of up to 50 were found. Beginning in early June, all age and sex classes came together to form larger, loosely-knit aggregations and by mid-June, these mixed groups predominated (81%) and a few contained over 500 animals and the largest was 1465. The peak aggregation period occurred in mid July each year when virtually the entire Pen Islands population was found in a few large groups, some containing 2000 animals. By late July and throughout August, these large mixed groups could not be found, despite extensive searches. Apparently they fractured into small bands or solitary social units, including cow-calf pairs. Caribou were rarely encountered in the immediate coastal area. Limited observations of caribou in the fens and bogs up to 40 km inland

from 1993 to 1996 suggest they retreated to the spruce-lichen ridges and wetlands of the interior.

Autumn

Telemetry surveys in early to mid-September showed that 79% of caribou were within 30 km of the coast. Small groups were more widely distributed over the available Forest-Tundra and edge of the Hudson Bay Lowlands Forest than during the calving and aggregation periods. The rutting period of the Pen Islands Herd was from mid-September to mid-October. Back-dating from calving, the peak rutting period in all years was estimated to be the last week of September and the first week of October. This back-dated estimate was supported by observations of behaviour and condition during tagging operations.

Winter

After spending approximately 6 months in the open tundra and forest-tundra transition near the coast, the Pen Islands caribou moved southward and inland in late October. No narrowly defined fall migration routes were detected during the study, instead, the movement occurred across a broad front. The infrequency of our radio locations (2-4 weeks apart) precluded defining whether movements occurred along river drainages.

The pattern in each of the three years was for the herd to move gradually inland during November and December, reaching the most distant points from the coast by mid-January and February, then returning slowly to the coast in March and arriving in April. They used substantially different areas in each year: in the 1987-88 they straddled the Ontario-Manitoba border throughout the fall and winter as they moved inland and back toward the coast. In 1988-89, they concentrated in Manitoba in early fall, shifted eastward into Ontario in November, moved back into Manitoba in December through late winter, then east into Ontario for spring. In 1989-90, they moved inland in Manitoba during early fall but then moved eastward into Ontario in December where they remained for the rest of the winter. The Pen Islands Herd showed no consistent preference for either the Northern Coniferous or Hudson Bay Lowlands forest types. Instead, they showed a complex movement and habitat use pattern among months and years. Our data indicate that bulls and cows shared the same winter range over the three years.

The maximum area occupied in each year (includ-

ing all locations for collared caribou plus summer observations) is shown in Fig. 2. Similarity of annual ranges is evident, however, variation in extent of inland movement is present among years, possibly associated with differences in snow fall or other environmental factors such as timing of freeze up on lakes and rivers, or altered habitat due to the previous summer's forest fires.

Conclusion

Migratory caribou herds that occupy tundra habitats in summer and move into forested habitats in winter have been documented from northwestern Alaska continuously to Manitoba (Baker, 1980:207; Calef, 1981: 16-17). The migratory George River Herd (Couturier *et al.*, 1990) occupies the Ungava peninsula in Quebec. A notable gap in southern Hudson Bay has been filled by our documentation of the range and behaviour of the Pen Islands Herd.

The herd's usual range has been documented by this study. Although it is small in population and range relative to most of the migratory herds, it is similar to them in behaviour, population characteristics and habitat use and appears to be in a rapid growth phase (Thompson & Abraham, 1994). Exceptional movements that probably involved the Pen Islands Herd (e.g., large numbers of caribou were located west and south of Gillam, Manitoba in winter 1991-92, C. Elliott, pers. comm.) have subsequently been noted. Further assessments will be required to monitor annual variation in size of the summer and winter range and location of additional use areas. Management policy must address the herd's need to respond positively to a variety of environmental factors and to vary its use of extensive portions of the land base. Management plans must also account for increased human awareness, use and activity in the herd's known range.

Acknowledgments

We are grateful for the help given us throughout the study by many OMNR staff, Cree of the Hudson Bay lowland villages and volunteers. We specially thank D. McKnight, M. Regis, D. Ladouceur, M. Pauli, J. Bell, A.T. Bergerud and H. Butler. Unpublished historical information was kindly provided by C. Elliott, S. Kearney and V. Crichton (Manitoba DNR), H.G. Lumsden, G. Kolenosky and J. Prevett (OMNR), R.K. Ross (Canadian Wildlife Service), J. Stoney and S. Thomas (Fort Severn, Ontario) and many OMNR staff

employed by the Moosonee District during the 1980s who contributed occasional observations. We thank two anonymous reviewers for their comments.

References

- Baker, R. 1980. *The mystery of migration*. John Wiley and Sons Canada Ltd., Toronto. 256 pp.
- Banfield, A. W. F. 1961. A revision of the reindeer and caribou, genus *Rangifer*. – *National Museums of Canada Bulletin*. No. 177. *Bio. Ser.* No. 66: 1–137.
- Couturier, S., Brunelle, J. D., Vandal, D. & St-Martin, G. 1990. Changes in the population dynamics of the George River Caribou Herd, 1976–87. – *Arctic* 43 (1): 9–20.
- Calef, G. 1981. *Caribou and the barren-lands*. Canadian Arctic Resources Committee, Ottawa and Firefly Books Limited, Toronto. 176 pp.
- Darby, W. R., Timmermann, H. R., Snider, J. B., Abraham, K. F., Stefanski, R. A. & Johnson, C. A. 1989. *Woodland caribou in Ontario: background to a policy*. Ontario Ministry of Natural Resources. 38 pp.
- Delean, L. D. 1993. *Aerial survey of the Pen Islands caribou herd for 1993*. Unpubl. Report. Ontario Ministry of Natural Resources, Moosonee. 6 pp.
- deVos, A., & Peterson, R. L. 1951. A review of the status of woodland caribou (*Rangifer caribou*) in Ontario. – *J. Mammalogy* 32 (3): 329–337.
- Hutchison, W. A. 1982. The physiography of the lowland. – *Ontario Fish and Wildlife Review* 20 (1): 4–5.
- Rowe, J. S. 1972. *Forest regions of Canada*. Dept. of Fisheries and the Environment, Can. Forest Ser. Publ. 1300. Ottawa, Can. 172 pp.
- Scholten, S. J. 1994. *Aerial survey of the Pen Islands caribou herd for 1994*. Unpubl. Report. Ontario Min. of Nat. Res., Moosonee. 6 pp.
- Simkin, D. W. 1959. *Caribou inventory in northwest corner of Patricias, 1959*. Unpubl. Report. Ontario Dept. Lands and Forests. 6 pp.
- Simkin, D. W. 1961. *Aerial survey for caribou in Hudson Bay Lowland 1961*. Unpubl. Report. Ontario Dept. Lands and Forests. 9 pp.
- Simkin, D. W. 1962. *Aerial survey for caribou for Winisk-Cape Henrietta Maria area 1962*. Unpubl. Report. Ontario Dept. Lands and Forests. 10 pp.
- Simkin, D. W. 1964. *An aerial survey for caribou in the Shagamu, Shamattawa, Sutton Lakes area 1964*. Unpubl. Report. Ontario Dept. Lands and Forests. 9 pp.
- Simkin, D. W. 1965. *A preliminary report of the woodland caribou study in Ontario*. Dept. Lands and Forests. Research Branch Section Report (Wildlife) No. 59. Toronto. 76 pp.
- Simkin, D. W. 1966. *Aerial survey for caribou in area northwest of Big Trout Lake, February 1966*. Unpubl. Report. Ontario Dept. Lands and Forests. 9 pp.
- Simkin, D. W. 1967. *Aerial survey for caribou between Severn and Winisk Rivers, March 1967*. Unpubl. Report. Ontario Dept. Lands and Forests. 5 pp.
- Thompson, J. E. 1986. *Population and harvest surveys for the Ontario Hudson Bay Lowland caribou*. Unpubl. Report. Ontario Min. of Nat. Res., Moosonee. 36 pp.
- Thompson, J. E. & Abraham, K. F. 1994. *Range, seasonal distribution and population dynamics of the Pen Islands caribou herd of southern Hudson Bay*. Unpubl. Report. Ontario Min. Nat. Res., Moosonee, Ontario. 94 pp.
- Williams, G. (ed.) 1969. *Andrew Graham's observations on Hudson's Bay*. Hudson's Bay Record Society, London. 423 pp.