



MONITORING CONDITION, FEEDING HABITS AND
DEMOGRAPHIC PARAMETERS OF ISLAND BOUND
BARREN-GROUND CARIBOU (*RANGIFER TARANDUS GROENLANDICUS*)
SOUTHAMPTON ISLAND, NUNAVUT

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FINAL REPORT TO THE NUNAVUT WILDLIFE MANAGEMENT BOARD

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Title: Monitoring Condition, Feeding Habits and Demographic Parameters Of
Island Bound Barren-Ground Caribou (*Rangifer tarandus groenlandicus*)
Southampton Island, Nunavut..

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Project Summary

Condition Studies

Results from the 2003-condition sampling raised concern over a sharp decline in pregnancy rates from between 90% and 95% over the 1997, 1998, 1999 and 2000 harvesting seasons to 60% in February 2003 and 25% in February 2005. The reasons for these findings are unclear but could be related to a general reduction of mature bulls to a point where all the breeding cows are not getting bred, to genetic health stemming from the relatively small genetic pool that was used to reintroduce coats Island caribou onto Southampton Island in 1965, to reproductive diseases such as *Brucellosis*, parasitic infections, weather. The majority of cows examined in 2003 were in good to very good condition raising doubts that poor condition of these animals could be the cause. Animals sampled in February 2005 were in the poorest condition recorded since the 1999 sampling season. The 2003 and 2005 findings served to increase concern regarding the ability of the Southampton Island caribou herds' ability to sustain

and recover from large-scale commercial harvests in the future. These findings also clearly showed that more information was necessary if wildlife managers would be able to ensure the protection of the subsistence harvest on the Island.

Composition Studies

In April 2004 fixed wing and rotary wing unavailability due to conflicts with a delayed (weather and delayed caribou migration) capture program on the Qamanirjuaq range led to the postponement of reconnaissance aerial surveys and the corresponding composition and recruitment surveys (associated with the aerial surveys) until April 2005 pending approval of the NWMB to carry over their 2004/05 contribution into the 2005/2006 fiscal year. In spring 2005 the composition of Southampton Island caribou was completed using carried over funds. The survey involved an aerial component to map out aggregations of caribou across the Island, and a ground component which involved four two man ground crews to navigate to the mapped caribou aggregations and classify them as adult female, calf, yearling, young bull and mature bull. Results indicated lower than expected numbers of mature males which could still be negatively affecting pregnancy rates though the results could not account for the entire reduction observed. Physiological work is still being carried out to determine additional causes of the low pregnancy rates (less than 25% of breeding females) observed in 2005. The avoidance of harvesting mature bulls during the commercial harvest will continue to be recommended until the numbers of mature male's increases

Stable Isotope Studies

The stable Isotope work initiated in 2004 is nearing completion with two publications being submitted on or about July/August 2006. Initial results are indicating an ability to determine variations in condition and dietary trends. The findings of this study will be incorporated into a cost effective long-term solution to the monitoring of the populations state of health.

Population Studies

In June 2005 the Aiviit HTO and the Department of Environment (DoE) wildlife research staff estimated the population of the Southampton Island Caribou Herd. The results of the survey showed an increase in total caribou numbers from the last survey flown in June 2003. Estimates increased from a range of 15,070 to 19,316 (mean = 17,193) in June 2003 to a range of 17,517 to 23,647 (mean = 20,582) in June 2005. Though the increase suggests that harvesting over the time period between the surveys has been below maximum sustained yield,

caution must still be factored into any future harvesting scenarios due to evidence of below normal pregnancy rates and associated low spring calf recruitment.

Project Start/Finish:

The composition and recruitment surveys were to start April 2004 but were postponed until April 2005 due to unpredictable research conflicts that led to time constraints. The remainder of the proposed research commenced on or about February 15th, 2005 and involved condition sampling and analysis. The stable isotope work was fast tracked by using archived tissue samples from the 2003 harvest season and publications are expected in the coming months. The 2005 population estimate was initiated and completed June 2005

Study Area:

At 43,000 Km² Southampton Island is the largest Island in Hudson Bay (Figure 1). The entire western and much of the Southeastern portions of the Island are dominated by low, flat often-exposed limestone plains sparsely to densely vegetated by *Dryas integrifolia* (Mountain avens) barrens and *Carex* spp. (Sedge) meadows. The remainder of the Island is shaped by an undulating Precambrian shield dominated by a lichen (*Allectoria* spp., *Cetraria* spp.) and heath tundra (Heard and Ouellet, 1994). The snow season persists from mid-September to mid-June and accumulates up to 133cm of snow (Parker, 1975).

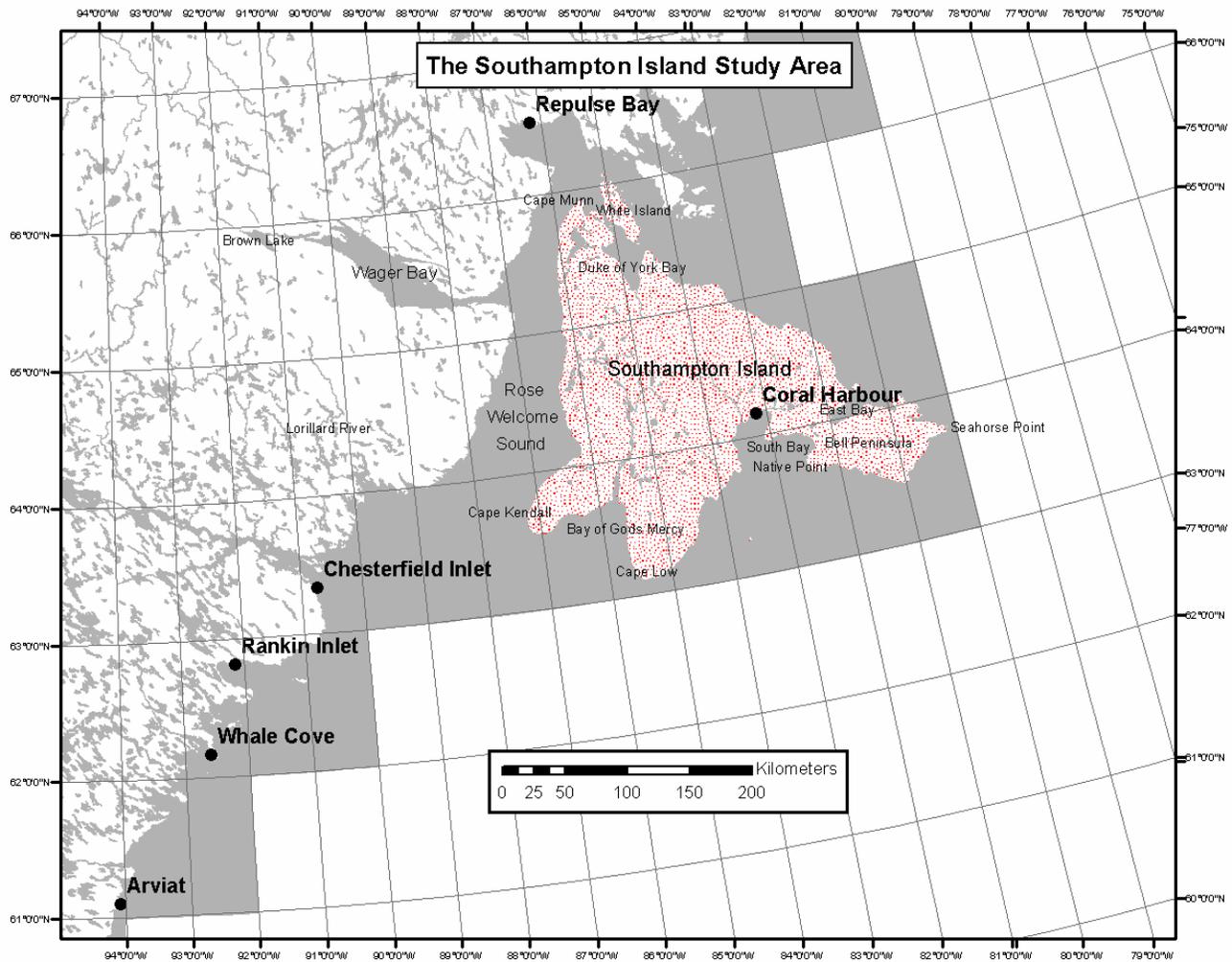


Figure 1 The Southampton Island study area including White Island.

Background:

Wolves (*Canis lupus*) and barren-ground caribou (*Rangifer tarandus groenlandicus*) were a common component of Southampton Island ecology until the early 1900's. The decline of these animals became obvious by 1935 and was followed by the local extinction of wolves by 1937 (Parker, 1975). The extirpation of caribou from Southampton was complete by 1952, a result in part of over hunting. The absence of this resource was keenly felt by residents of Coral Harbor prompting both the local HTO and government to initiate the re-introduction of caribou onto the Island. In 1967, 14 years following their extirpation, 48 caribou from Coats Island were introduced onto Southampton Island. Caribou numbers have since increased rapidly which is in part due to exceptional range conditions resulting from the 14-year absence of caribou from

the Island. The lack of predation and low initial harvest rates also played a role in the overwhelming success of the introduction which was first realized following a population survey in 1978, estimating 1,200 +/- 340 caribou (Heard and Ouellet, 1994). Since the 1978 survey the Southampton caribou population continued to grow rapidly to 5,400 +/- 1,130 in 1987, 9,000 +/- 3,200 in 1990, 13,700 +/- 1,600 in 1991, 18,275 +/- 1,390 in 1995 (Heard and Ouellet, 1994), 30,381 +/- 3,982 in 1997 and finally 17,981 +/- 2,127 in June 2003 (Campbell and Mulders in press.). These survey results, suggest a population growth rate of approximately 27 %/year up until 1997 followed by a 40% decline between June 1997 and June 2003. During this six-year period 8,529 adult males and 10,221 adult females were harvested commercially and an estimated 7,000 males and 7,000 females were harvested domestically for an estimated total of 15,529 males and 17,221 females.

The Southampton Island Caribou Herd is extensively utilized both commercially and domestically. The latest estimates for annual domestic use are +/- 1,500 animals. Commercial harvests have seen a general increase from 564 in 1992, to 759 in 1993, 1,554 in 1994, 2,356 in 1995, 1,839 animals in 1996, 3,365 in 1997, 2,956 in 1998, 1,094 in 1999, 2,166 in 2000, 3,696 in 2001, 3,834 in 2002 to 5005 animals in 2003. Following the June 2003 survey a meeting between the Aiviit HTO and DSD (Department of Sustainable Development) staff was held November 5, 2003. During this meeting the Aiviit HTO discussed with DSD recommendations that the commercial caribou quota be reduced to 2000. Following much discussion and additional information (calving success and observed densities provided by HTO members), both parties agreed to recommend a commercial quota reduction from the 6000 tags currently in place to 3300 tags (300 of which will remain dedicated to Coral Harbour's sport hunting industry). As the community of Coral Harbour has been commercially harvesting in excess of 3300 animals each of the 2001 and 2002 harvesting seasons. Over the 2004 harvesting season in excess of 4,000 animals were harvested at a sixty percent male ratio. The Department of Environment (DoE) over this same period recommended a harvest of 3,500 animals at a minimum 80 percent females with no mature females.

Objectives:

The objectives of the proposed research are to: 1) monitor the condition of Southampton caribou and how any change in condition relates to range condition, availability and/or extent; 2) monitor recruitment and the sex and age structure of the population; 3) study feeding habits using stable Isotope analysis of tissue and rumen samples as well as plant samples from across the Island, 4) determine if the Southampton Island caribou herd is increasing, stable or decreasing in light of the commercial and subsistence harvest of the 2003/04 and 2004/05 harvesting seasons. The proposed studies are meant to answer the following questions:

- 1)** Determine the population of the Southampton caribou herd
Biological Rationale: Determination of population size is critical in protecting the subsistence harvest on the Island in the wake of large scale commercial harvesting and in the assessment of current management techniques in the search for sustainable harvests of the Southampton caribou herd and the ultimate protection of the Islands caribou and their range. The results of such an estimate will be used to determine status and trend, which will be used to direct management decisions.
- 2)** Determine the condition of Southampton Island caribou. *Biological rationale:* The monitoring of sex and age specific condition will be achieved through the analysis of the Riney kidney fat index, the recording and sampling of any apparent disease and/or diseased tissue, the recording and sampling of parasitic infections, the measurement of back fat, bone marrow condition, pregnancy rates, fetal sex and age through the analysis of cementum-annuli. As condition work was monitored up until February 2000 a continuation of this long-term data set will greatly enhance our understanding of Southampton Island harvest management issues as well as our ability to predict future trends.
- 3)** Determine the important forage species for caribou on Southampton Island. *Biological Rational* The identification of important winter forage species is a crucial component of any range study. In conjunction with the present commercial harvest rumen samples will be collected and analyzed to determine vegetative content and isotopic signatures. Isotopic Signatures will also be developed for caribou tissue samples collected during the harvest.
- 4)** Utilize the stable isotope analysis of rumen and tissue samples to determine whether important forage species can be identified through tissue samples alone and through time using the isotopic signatures developed through the analysis of cementum annuli and determine if these signatures can be temporally associated with mapped plant communities using digital Landsat data.
Biological Rational: The study addresses monitoring objectives through the development of standardized methods for determining and monitoring changes in the dietary status and health of caribou herds and comparing the feasibility of numerous monitoring techniques (e.g., stable isotope and rumen analysis) for widespread, standardized use in the north as a means of assessing caribou herd status and health.
- 3)** Herd classification and recruitment monitoring. *Biological Rational:* Determining the sex ratio of the Southampton Island caribou population is a necessary first step to understanding the Herds reproductive potential. Once the age and sex structure of the herd has been estimated spring recruitment figures will provide a good indication of the herd's rate of growth. Recruitment can then

be monitored locally between population estimates as a window into TAH (total allowable harvest) and how that may impact the BNL (basic needs level) of the community.

Methods:

Composition Studies

We classified Southampton Island caribou in early May 2004 using a Dehavelland Turbo Beaver high wing aircraft and 4 ground crews made up of eight local hunters chosen by the Coral Harbour HTO. The aerial reconnaissance survey was flown with two HTO observers in advance of the ground classification work to determine relative densities. Following the reconnaissance survey the Island was divided into four density strata within which one ground crew was sent to classify all caribou encountered into cow, calf, yearling, young bull and mature bull classes. Ground observations were coordinated in a manner that minimized the potential error of double counting. Animals were classified while moving away from observers using a Bushnell space maker zoom spotting scope attaches to a tripod. One member of the two man crew was assigned the task of identifying the age and sex classes observed through the spotting scope while the second recorded the results in a field note book. GPS coordinates were collected for all groups of caribou classified (With the exception of one crew whose GPS malfunctioned) and included in the notebook beside the group observations.

Condition Studies

Southampton Island caribou condition was recorded using a ratio of kidney to kidney fat index, the recording and sampling of any apparent disease and/or diseased tissue, the recording and sampling of parasitic infections, the measurement of back fat, bone marrow condition, pregnancy rates, fetal sex, and age through the analysis of cementum-annuli. During some years the collection of blood and reproductive tracts was also made for the purposes of determining reproductive stress and/or disease. All sampling was carried out in conjunction with the commercial harvest which runs from mid-February to early April. Preferred forage species will be identified using rumen analysis and stable Isotope analysis of tissue and rumen samples. Isotopic signatures for Southampton Island plant species have already been recorded and will be used comparatively with the tissue and rumen signatures.

Population Studies

Both the June 2003 and 2005 surveys were flown using a high wing single engine turbine aircraft. Strip widths were established using streamers attached to the wing struts (Figure 2). Strip width (w) was calculated using the formula of Norton-Griffiths (1978):

$$w = W * h/H$$

where:

W = the required strip width;
h = the height of the observer's eye from the tarmac; and
H = the required flying height

Strip width calculations were confirmed by flying perpendicularly over runway distance markers periodically throughout the survey. The strip width area for both the reconnaissance and abundance surveys was 400 meters per side.

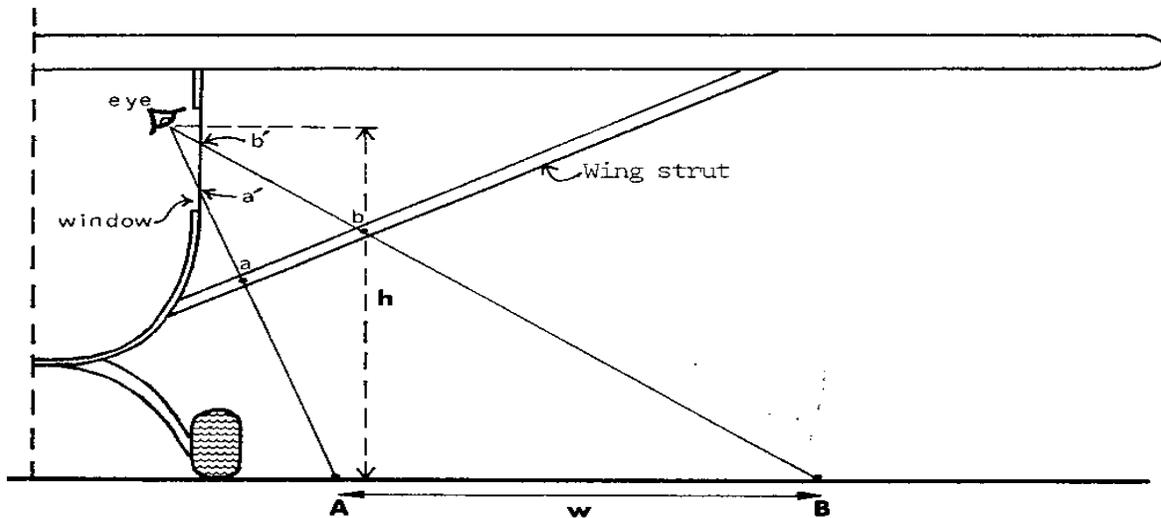


Figure 2. Schematic diagram of aircraft configuration for strip width sampling (Norton-Griffiths, 1978). W is marked out on the tarmac, and the two lines of sight $a' - a - A$ and $b' - b - B$ established. The dowels are attached to the struts at a and b . a' and b' are the window marks.

Standardized reconnaissance transects with a total observation strip of 800 meters were flown from across the Island during the 1997, 2003 and 2005 surveys. A stratified random transect method was used during the abundance phase of the survey. Altitudes of 400 ft were maintained using a radar altimeter for both the reconnaissance and abundance phases. Rough density and distribution estimates from the reconnaissance survey were used to stratify the study area into low-, medium-, and high-density strata, and survey effort was allocated accordingly (Heard 1987). The first transect within each of the three strata was randomly placed along a line of latitude with each sequential line being evenly spaced. In the case where transect density was the same as the 1997 survey, transects followed identical routes to those developed randomly in

1997. Stratified surveys were not conducted in areas where caribou were not observed during the reconnaissance survey.

The survey crew included the pilot (front left seat), the data recorder/navigator (front right seat), the left rear seat observer and the right rear seat observer. The pilots responsibilities were to monitor air speed and altitude while following a route pre-programmed on a Garmin GPS III plus Geographic positioning system (GPS) unit. The data recorder/navigator was responsible for monitoring a second identically programmed GPS unit for the purposes of double-checking the position and to record the waypoints and numbers of adult and calf caribou groups on data sheets. The responsibilities of the left and right rear observers were to monitor their 400 m strips and call out numbers of caribou separated by adults and calves both on and off transect. The 2003 air crew remained the same throughout the survey while during the 2005 survey the rear left observer was changed following the reconnaissance phase.

Results:

Composition Studies

An aerial survey designed to map caribou aggregations was flown in advance of the ground classification for the purposes of directing classification efforts (Figure 3). Aggregations of caribou in April were almost exclusively within the central portion of the island where the land becomes hillier and as a result reveals areas of exposed ground and vegetation. Results from the 2005 condition sampling raised concern over a sharp decline in pregnancy rates from between 90% and 95% over the 1997, 1998, 1999, and 2000 harvesting seasons to 60% in 2003 and further to 25% in 2005. The reasons for these findings are still unclear but are at least partly related to a general reduction of mature bulls (Figure 4). As all aggregations of Southampton Island caribou were estimated as to their age/sex class these results reflect the composition of the entire Southampton Island caribou population of which only 12 % represented breeding bulls. Though results indicated lower than expected numbers of mature breeding males, it is unlikely that this factor alone is responsible for the extremely low pregnancy rates observed in 2005. Physiological work is still being carried out to determine additional causes of the low pregnancy rates observed. Genetic health issues stemming from the relatively small genetic pool that was used to reintroduce coats Island caribou onto Southampton Island, to reproductive diseases such as *Brucellosis*, parasites and weather conditions are also being examined. The avoidance of harvesting mature bulls during the commercial harvest will continue to be recommended until the numbers of mature male's increases.

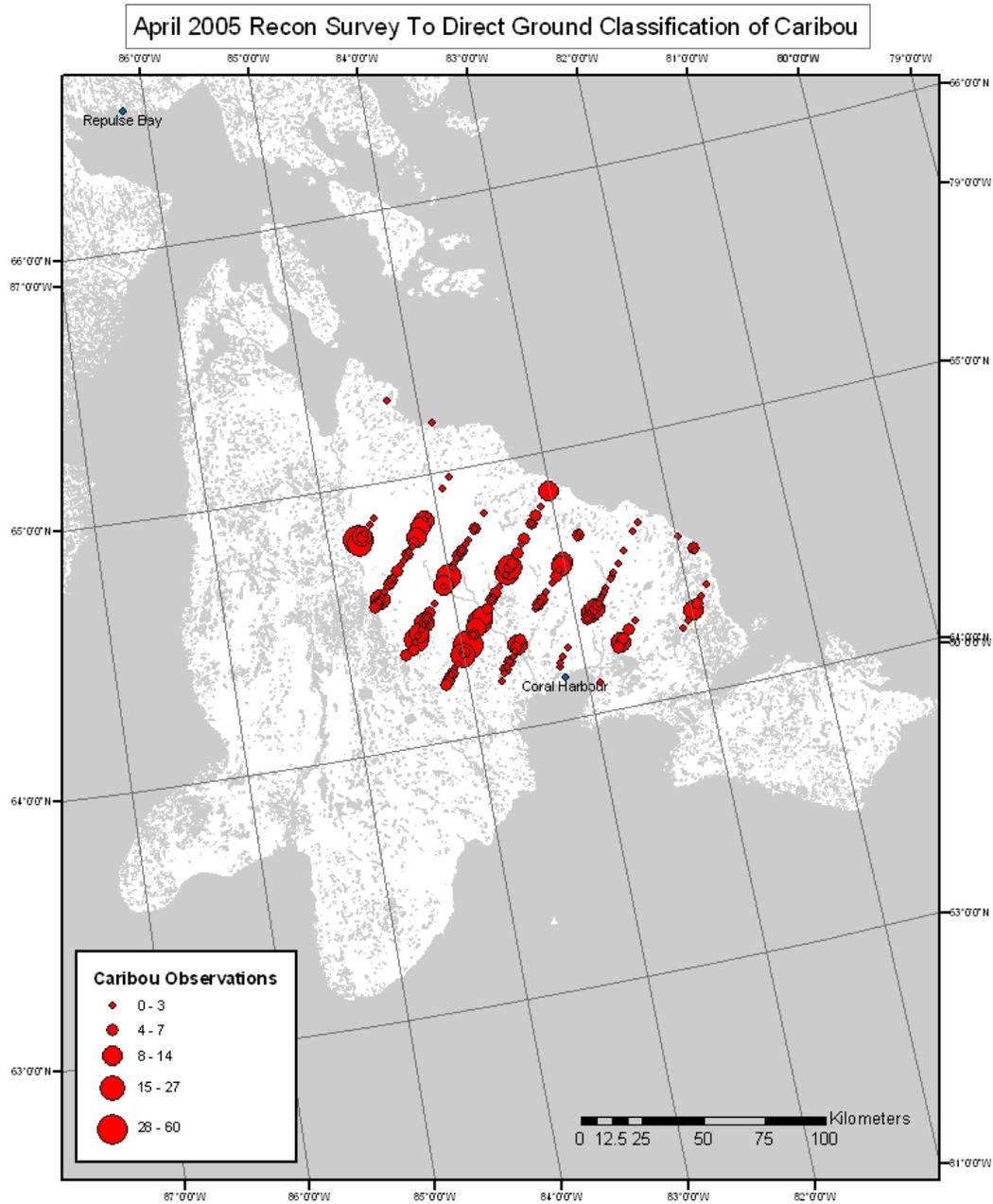


Figure 3 The locations of Southampton Island barren-ground caribou aggregations mapped during an April Reconnaissance survey. Caribou group observations were used to direct ground classification studies.

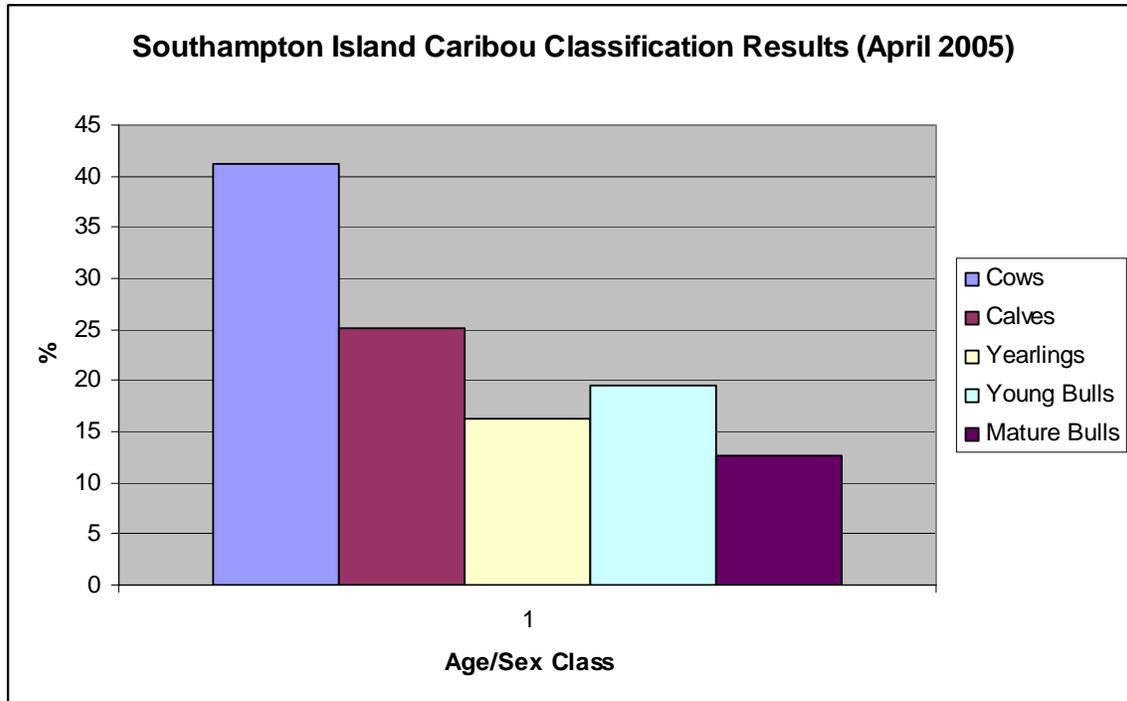


Figure 4 The results of the 2005 spring composition ground survey.

Condition Studies

Two condition indices monitored for Southampton Island caribou from 1995 through 2000 and 2004 through 2005 included measurements of back fat and the calculation of a Kidney fat index which represents a simple ratio based on kidney weight to kidney fat weight (Kidney wt/kidney fat weight). Three adult breeding categories were isolated for comparison including non-pregnant females, pregnant females and males. The condition measurements were made in February and March in all years as a part of the Southampton Island commercial caribou harvest. From 1995 to 1998 caribou condition displayed a gradual decline (Figure 5). Condition began to recover in 1999 followed by a full recovery to 1995 levels in 2000. From this point condition has shown a steady decline through 2004 and 2005 though not below previously recorded levels for any of the three categories.

Rumen Samples were also collected during the 1998, 1999, 2004 and 2005 Commercial harvests (Figure 6). During the sampling years of 1998 and 2005 when condition values were at their lowest, mosses seemed to dominate the diets of Southampton Island caribou. Further analysis is ongoing though initial results suggest adverse weather rather than poor range was largely responsible for the patterns observed. A series of icing events over both the 1998 and 2005 snow seasons likely made wetter habitats containing largely graminoides, an important forage to Southampton Island caribou in early and mid-winter, inaccessible.

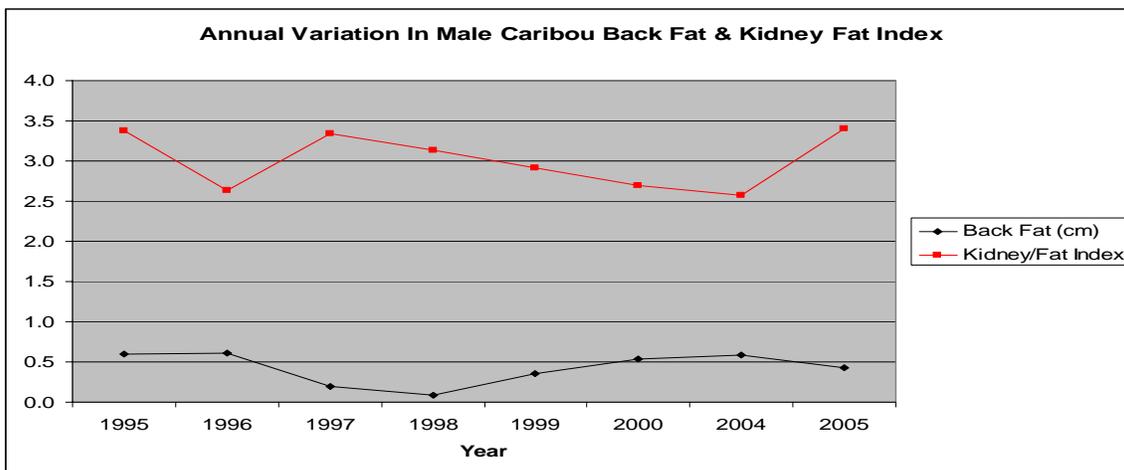
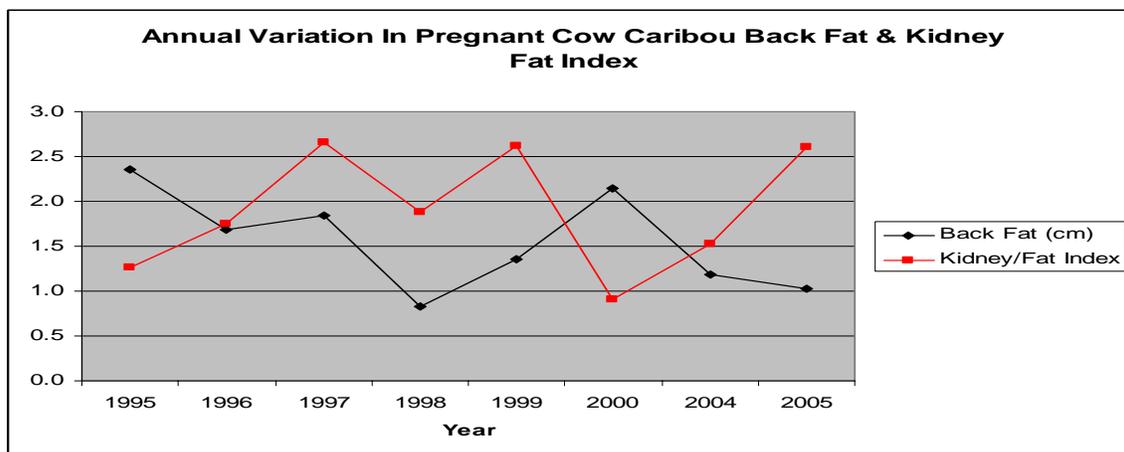
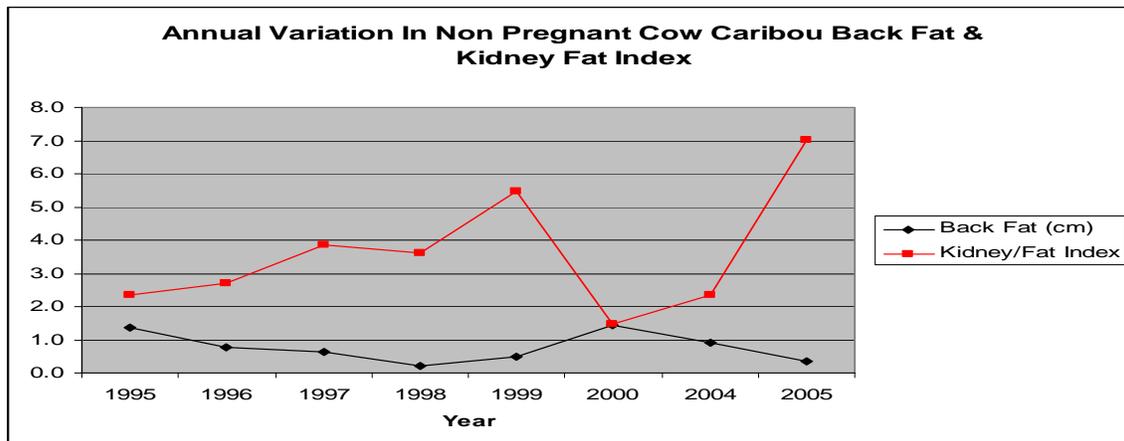


Figure 5 Between year variation in two condition indices, back fat and an index of Kidney fat for three breeding classes of Southampton Island barren-ground caribou. Kidney fat values are inversely related to caribou condition (i.e. the lower the value the better the condition) while back fat measurements are directly proportional to condition.

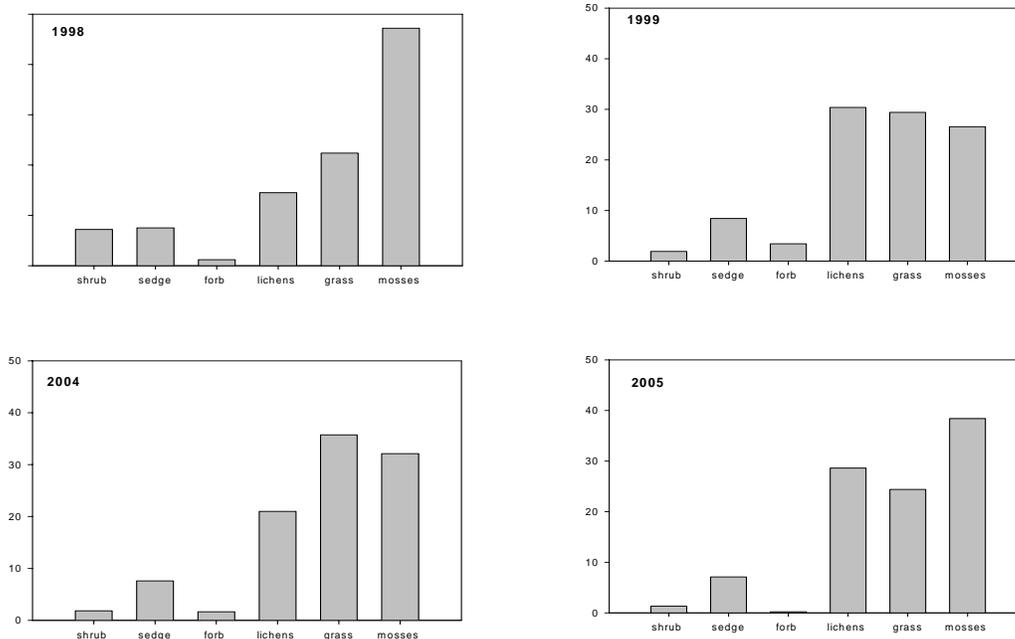


Figure 6 Mean (\pm standard deviation) percentage of plant type in rumen, grouped into 6 major plant categories from detailed rumen analysis of 50 caribou (54 in 2004) separated by year (McLeman et al in prep, 2006).

Population Studies

Caribou numbers have increased rapidly since their re-introduction off Coats Island in 1968. The earliest estimates of this growing population were made in 1978, when 1,200 \pm 340 caribou were estimated (Heard and Ouellet, 1994). Since the 1978 survey the Southampton caribou population continued to grow rapidly to 5,400 \pm 1,130 in 1987, 9,000 \pm 3,200 in 1990, 13,700 \pm 1,600 in 1991, 18,275 \pm 1,390 in 1995 (Heard and Ouellet, 1994), 30,381 \pm 3,982 in 1997, 17,981 \pm 2,127 in June 2003 (Campbell in prep.) and finally 20,582 \pm 3,065 in June 2005 (Campbell in prep) (Figure 7). These survey results, suggest a population growth rate of approximately 27 %/year up until 1997 followed by a 40% decline between June 1997 and June 2003. The apparent increase in 2005 did not test significant though at the very least suggests that harvesting rates between the 2003 and 2005 surveys was close to or slightly below the maximum sustained yield of the population. During this two year period between harvests an estimated 9,500 caribou (approx. 5,500 females and 4,000 males) were harvested for both commercial and subsistence use. Over the seven year period of study 9,729 adult males and 13,021 adult females were harvested commercially and an estimated 8,000 males and 8,000 females were harvested domestically for an estimated total of 17,729 males and 21,021 females. Caribou

distributions remained similar though the 2005 results indicated a range shift from Bell Peninsula to more central areas (Figure 8).

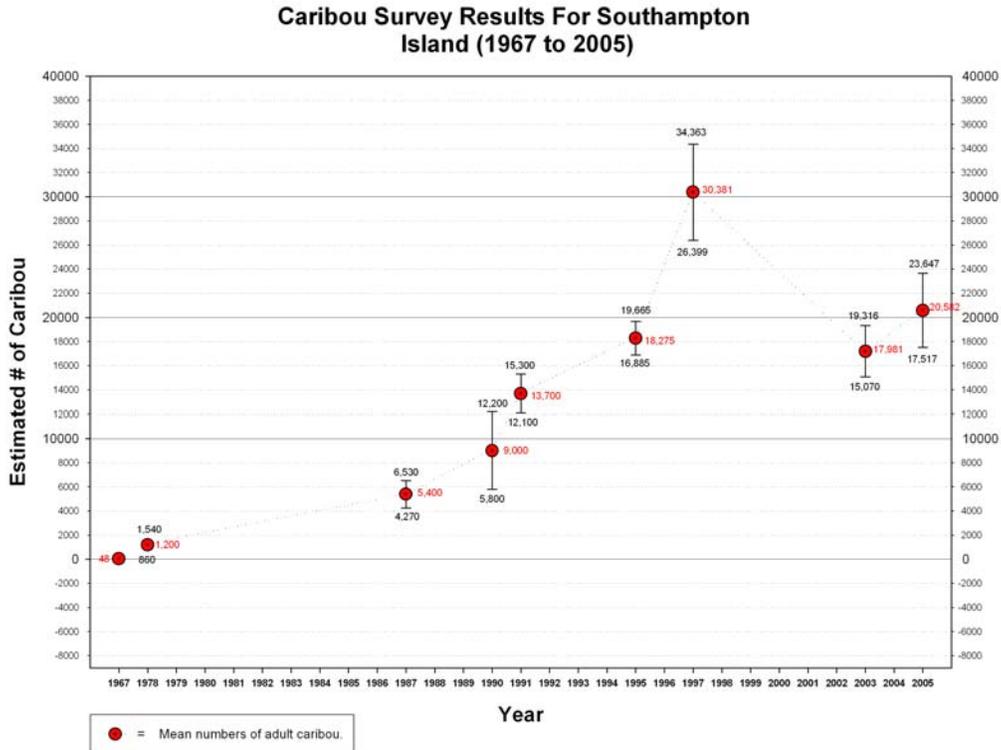


Figure 7 A history of survey results of the Southampton Island caribou population. The first value has been arbitrarily set at zero.

Reporting to Communities/Resource Users:

The findings of the 2003 through 2005-field seasons were discussed with the Coral Harbour HTO as were the implications and risks involved with a continuation of a large-scale commercial harvest into the 2005/06 harvesting season. Following the 2005/06 analysis, a meeting was held in Coral Harbour by phone to explain the results of all research findings. A copy of this status report has also been provided to the Coral Harbour HTO.

This work remains a component of a larger management plan being drafted by the Coral Harbour HTO and the Department of Environment. The goals of the management plan are to provide a long term management framework that will focus on maintaining caribou numbers at or above levels necessary to 1) sustain current and future domestic harvesting needs (primary objective), and, 2) sustain commercial sport hunting needs (secondary objective) and 3) sustain commercial meat sales needs.

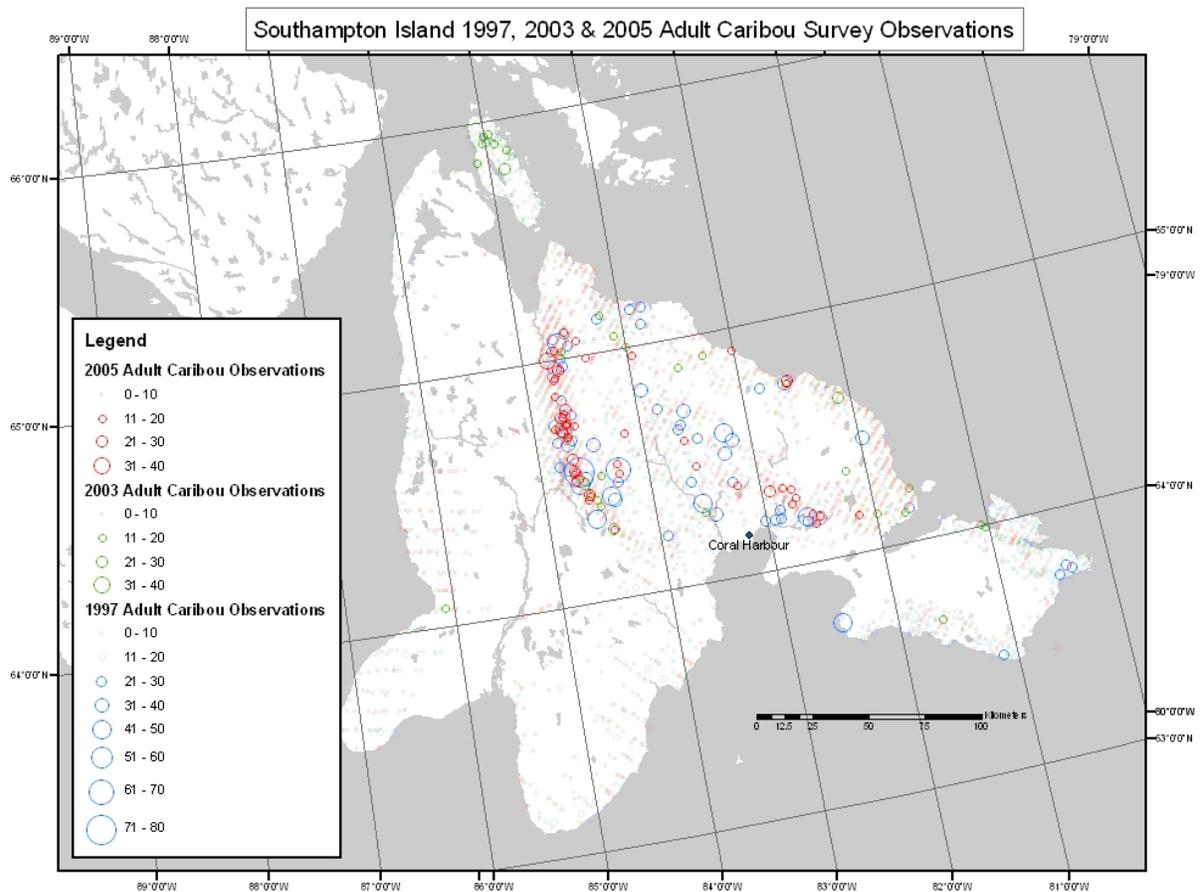


Figure 8 Survey observations from the June 1997, 2003 and 2005 Southampton Island barren-ground caribou aerial population estimates.

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Partners:

The proposed studies are a cooperative effort between the Department of Environment, the Coral Harbour Hunters and Trappers Organization and the Nunavut Wildlife Management Board. Present and future roles each of the organizations will play in the financial and logistic structure of the Southampton Island Management plan will continue to be discussed.

Contributions:

Population estimate and condition of island bound barren-ground caribou (<i>Rangifer tarandus groenlandicus</i>), Southampton Island NU.		
AGENCY	CONTRIBUTION	
	2004/2005 (Funds)	Confirmed/Requested
DoE	\$64,400.00	Approved
NWMB	\$25,000.00	Approved
TOTALS	\$89,400.00	