Dear [Name],

Re: Your request for access to information under Part II of the Access to Information and Protection of Privacy Act (Act) [Our file #ENV/012/2016]

On March 16, 2016 the Department of Environment and Conservation received your request for access to the following records/information:

"With respect to the "Fall 2014" George River Caribou Hunting Ban review committed to by the NLG, the following information is requested: 1) A list of any and all meetings that have taken place in connection with the Review. Information to include, but shall not be limited to, the date/location of each meeting, along with a "synopsis" and/or minutes of each meeting. 2) A copy of any and all technical reports/studies/assessments/information or decision notes, associated with the Labrador Caribou Initiative. 3) A timeframe of when the Hunting Ban review will be completed, and when the results and/or final report will be made available to the public and/or Industry Stakeholders."

On April 11, 2016 the Department advised you that the 20 business day time limit for responding to your request had been extended, in accordance with section 23 of the Act, for an additional 7 business days and that we expected to respond to your request by April 26, 2016.

I am pleased to inform you that a decision has been made by the Deputy Minister of the Department of Environment and Conservation to grant access in part to the requested information. Portions of the attached documents have been severed in accordance with the following exceptions to disclosure as specified in the Act:

27(1)(i): In this section, "cabinet record" means that portion of a record which contains information about the contents of a record within a class of information referred to in paragraphs (a) to (h);

27(2)(a): The head of a public body shall refuse to disclose to an applicant a cabinet record;
27(2)(b): The head of a public body shall refuse to disclose to an applicant information in a record other than a cabinet record that would reveal the substance of deliberations of Cabinet;

29(1)(a): The head of a public body may refuse to disclose to an applicant information that would reveal advice, proposals, recommendations, analyses or policy options developed by or for a public body or minister;

34(1)(a)(v): The head of a public body may refuse to disclose information to an applicant if the disclosure could reasonably be expected to harm the conduct by the government of the province of relations between that government and the following or their agencies: the Nunatsiavut Government;

40(1): The head of a public body shall refuse to disclose personal information to an applicant where the disclosure would be an unreasonable invasion of a third party’s personal privacy.

As required by subsection 8(2) of the Act, we have severed information that is exempted from disclosure and have provided you with as much information as possible. In accordance with your request, the appropriate copies of records have been enclosed. In addition, please note that on March 23, 2016 the Government of Newfoundland and Labrador announced that a review of the hunting ban was complete and that hunting of the George River Caribou Herd throughout Labrador will remain closed until March 31, 2017. For additional information, please refer to the news release at: www.releases.gov.nl.ca/releases/2016/env/0323n02.aspx

Section 42 of the Act provides that you may ask the Information and Privacy Commissioner to review the processing of your access request or you may appeal to the Supreme Court Trial Division. A request to the Commissioner must be made in writing within 15 business days of the date of this letter or within a longer period that may be allowed by the Commissioner.

The address and contact information of the Information and Privacy Commissioner is as follows:

Office of the Information and Privacy Commissioner
2 Canada Drive
P. O. Box 13004, Stn. A
St. John’s, NL
A1B 3V8
Telephone: (709) 729-6309
Toll-Free: 1-877-729-6309
Facsimile: (709) 729-6500

In the event that you choose to appeal to the Trial Division, you must do so within 15 business days after you receive the decision of the public body, pursuant to section 52 of the Act.

Please be advised that this response will be published following a 72 hour period after it is sent electronically to you or five business days in the case where records are mailed to you.
It is the goal to have the response posted to the Office of Public Engagement's website within one business day following the applicable period of time. Please note that requests for personal information will not be posted online.

If you have any further questions, I can be reached by telephone at (709) 729-7183 or by e-mail at courtneyblundon@gov.nl.ca

Sincerely,

COURTNEY BLUNDON
Departmental ATIPP Coordinator
Information Note
Department of Environment and Conservation

Title: George River Caribou Herd

Issue: Update on management of the George River Caribou Herd (GRCH)

Background and Current Status:

- The GRCH has long been used by Aboriginals, residents, non-residents and businesses in Labrador and Quebec as a source of country food, recreational activity, and economic benefit. Caribou on the Ungava Peninsula have important social, dietary and cultural ties to many different Aboriginal groups. Management of the GRCH is the responsibility of the Governments of Newfoundland and Labrador (NL) and Quebec (QC).

- The GRCH population has declined from an estimated 775,000 in 1993, to 385,000 in 2001, to 74,000 in 2010, and to 27,000 in 2012. Ongoing population monitoring suggests the herd is now less than 20,000 animals and is continuing to decline in number.

- This projection is supported by other biological indicators of herd health; including low calf recruitment, low adult survival measured from collared caribou, and reduced size of the calving area. Biologists believe the current decline was not caused by hunting; however, as the population becomes smaller, hunting adds to natural mortality, leading to a faster decline and impeding recovery efforts. Continued harvest, even in the short term, significantly increases the risk for extirpation of this herd.

Additional conservation measures for the 2011/2012 hunting season included a reduction in the season length for resident harvest, limiting license sales to government offices only, and herd health monitoring program where successful hunters were required to collect/submit biological samples from their animals.

In January 2013, an announcement was made ending legal harvesting of GRCH by all users for a period of five years (until March 31, 2017) with a review after two years.

- Despite the closure, limited harvesting by Aboriginal groups continued in 2013. An estimated 500 caribou were harvested, including approximately 300 by the Labrador Innu, who have recently indicated their intention to take a similar number in 2014, in open defiance of the ban, as noted below.

- In December 2012 the Nunatsiavut Government (NG) announced that it was recommending that the Labrador Inuit immediately suspend harvesting of GRCH for a period of two years. It also requested that all other Aboriginal groups suspend harvesting for two years. Recent communication from NG indicates that they are receiving requests from beneficiaries to commence immediate harvest of the GRCH, and what is perceived as a lack of enforcement of the hunting moratorium by the Province.
In December, 2012 the NunatuKavut Community Council (NCC) announced that it was placing a 1-year moratorium on hunting the GRCH. In January, 2014 the NCC announced a further 1-year moratorium. In December, 2013 the Innu Nation announced that it would harvest 300 male only caribou from the GRCH; 150 animals for the community of Sheshatshui and 150 animals for the community of Natuashish.

QC closed its sport hunt of the GRCH in 2012/13. Currently, Aboriginal harvest of GRCH by the Naskapi, Cree and Inuit continues under the terms and conditions of the Hunting, Fishing and Trapping Coordinating Committee as per the 1975 James Bay Agreement; effectively, there is no restriction on Aboriginal harvest in QC.

In September, 2013 Aboriginal groups of the Ungava Peninsula initiated an Aboriginal Round Table (UPCART) to discuss Aboriginal management of the GRCH. The group has not sought the participation of government officials. Furthermore, it has indicated its intent to develop its own management plan for GRCH. The Round Table has two Co-chairs: Sarah Leo (NG President), and Adamie Deslile Alaku (QC Inuit), as well as an executive committee composed of representatives from each Aboriginal group, namely Réal McKenzie (QC Innu), George Guanish (Naskapi Nation of Kawawachikamach), Todd Russell (NCC), Prose Poker (Innu Nation) and Isaac Masty (QC Cree).

NL and QC are preparing to engage Aboriginal groups in the development of caribou Management Plan. NL and QC are collaborating to draft the plan for presentation to Aboriginal groups for input and consideration. This approach envisions a final management plan co-authored by both governments and representatives from UPCART.

In 2011/12, Government approved the Labrador Caribou Initiative (LCI); a $1.9 million investment over 3-years designed to enhance data collection of the GRCH and help better understand the factors affecting the caribou population. Funding for this initiative will conclude March 31, 2014.

Action Being Taken:

The proposed next three year phase would conclude intensive monitoring and would (i) include an assessment of the effects of the hunting ban after two and five years; (ii) help document a sufficient degree of certainty whether or not the herd has stabilized; (iii) enhance understanding the influences of predation and other potential limiting factors in supporting management options and decisions; (iv) demonstrate a strong commitment to caribou and long term Aboriginal food security; and (v) help facilitate the development and implementation of the Management Plan including establishment of long term target population thresholds and possible mechanisms for eventual resumption of harvest (resources to support aboriginal consultation in this have not yet been identified).

The Department plans to complete a population census in the summer 2014 in collaboration with QC. The outcome of this census, combined with the Fall 2014 classification, will form the basis of an update to Cabinet in late 2014. The Department advises that up to date scientific information and research about the GRCH is necessary in order to proceed with prosecutions and obtain convictions against hunters who choose to ignore the hunting...
prohibition. In the absence of this quantity and quality of information, management decisions are subject to greater error and criticism.

- On January 22, 2014, the Minister of ENVC spoke with the NG’s Minister of Lands and Natural Resources, who expressed concern with the GRCH 5-year hunting ban and noted a perception that Aboriginal groups are being treated differently when it comes to enforcement. The NG Minister requested that the Province immediately remove the ban for Aboriginal people, but noted he would continue to recommend that his people suspend hunting should no new information emerge indicating an improvement with the herd’s numbers. Alternatively, the NG Minister noted that if the ban on the Aboriginal harvest was to remain in place, aggressive enforcement was essential.

- On January 22, 2014, the Department of Justice announced that charges were laid by officers of the Fish and Wildlife Enforcement Division (FWED) of the Department of Justice related to allegations of illegal hunting of caribou that took place in Labrador in March 2013. Following a lengthy investigation into allegations that members of the Innu community were violating the GRCH hunting ban in the Shipiskan Lake region, officers charged 12 individuals (10 aboriginal residents of Labrador and 2 pilots from Ontario) with violations under the Wild Life Act. One corporation (pilot’s employer) has also been charged. The Department of Justice remains active in conducting land based patrols in Labrador to assess compliance with the hunting ban. Helicopter surveillance is scheduled to resume on January 29, 2014, weather permitting. Current intelligence indicates that Innu and Inuit hunters are engaged or plan to engage in caribou hunting this season.

- Currently, ten FWED Officers are located in Labrador. An operational plan has been developed that will enable quick mobilization of additional officers from the island if additional resources are required. Within the justice system, FWED continues to work in cooperation with the RCMP, the RNC, and Criminal Intelligence Service NL on matters related to any illegal hunting activities.

Prepared by: J. Blake/D. MacKenzie/R. Firth, ADM, ENVC
In Consultation with: Departments of Justice/Aboriginal Affairs
Approved by: J. Chippett, DM, ENVC [pending]
January 29, 2014
Title: George River caribou (GRC)
Issue: George River caribou 2014 census results

Background and Current Status:
- Biologists with the Department of Environment and Conservation and the Québec Ministère des Forêts, de la Faune et des Parcs, along with a representative from the Ungava Peninsula Caribou Aboriginal Round Table (UPCART), completed a census of the GRC in July 2014.
- Photo-census results estimate the herd is currently comprised of 14,400 ± 763 caribou.
- Comparable photo-census surveys were conducted for the GRC in 1993, 2001, 2010, and 2012. These survey results, along with other indices of animal health and recruitment/mortality estimates, document a continued and severe population decline. This unprecedented decline now represents the loss of 98% of what was once the largest caribou herd in the world, over a 21 year period. See Figure 1.
- Although population projections are best informed after fall classification surveys, data collected to date indicate that the decline will continue into 2016 at a reduced rate.
- Previous findings (2012) prompted conservation measures aimed at supporting the recovery of the herd, including a 5 year hunting ban in Labrador with a review after two years. This new estimate suggests that additional management measures may be necessary, including the need for enhanced compliance with existing harvest restrictions, habitat protection, and improved collaboration and unity amongst all user groups.

Actions Being Taken:
- Consideration of a joint news release by the Province of Newfoundland and Labrador and the Province of Quebec.
- Both QC and NL are awaiting a reply from UPCART on whether the Round Table supports the initiative of collaborative dialogue on the creation of the GRC management plan.
- Continuation of research, monitoring and management actions under the $975,000 Phase 2 Labrador Caribou Initiative 2014-2017.

Prepared / Approved by: S. McCarthy / J. Pisapio / J. Blake / R. Firth, ADM
Approved by:
August 4, 2014
Title: George River caribou herd (GRCH)

Issue: An update of the management of the GRCH

Background and Current Status:

- The George River caribou herd (GRCH) is a migratory herd that ranges on both sides of the border between northern and central Labrador and northern Quebec.

- The GRCH declined from a population estimate of 775,000 in 1993 to 385,000 animals in 2001 to a current estimate of 10,300. This is a greater than 99% decline since 1993.

- The GRCH has traditionally been a food source for Aboriginal communities in Labrador and in northern Quebec. Prior to the current hunting moratorium the GRCH also supported a resident and non-resident sport hunt and commercial harvest. During the 1990’s, the GRCH sustained harvests of upwards of 45,000 animals annually.

- The principal Labrador stakeholders are Nunatsiavut Government beneficiaries, Labrador Innu Nation, NunatuKavut Community Council, non-Aboriginal Labrador hunters, outfitters, and the general public.

- Census results in 2010 indicated an estimated population of 74,000 (the previous estimate in 2001 was 385,000), prompting changes in harvest management and consultations with Labrador and Quebec Aboriginal groups.

- ENVC introduced a series of management restrictions applied to the non-aboriginal hunt and introduced mandatory herd health monitoring program to collect samples for biological analysis. In November 2010 a press release was issued to communicate details of these conservation measures.

- In 2011 the province implemented a three year, $1.9 million Labrador Caribou Initiative (LCI) to enhance research and monitoring of the GRCH to help better understand factors contributing to the decline and to support management decisions.

- The LCI indicates that decline in numbers was not caused by hunting. Rather, the GRCH has natural cycles tied to over grazing when numbers are high (as seen in the 1980s and 1990s). When the population reached low numbers, however, hunting began to have compounding effects which accelerated the rate of decline.

- Consultations with Labrador and Quebec Aboriginal groups were conducted again in 2012 and focused on the status of the herd and the need to consider reductions in aboriginal harvest.
• Census results in 2012 indicated a decline to 24,300 and prompted a closure on all hunting of
GRCH for conservation purposes. In January 2013, an announcement was
made closing harvest to all users, including Aboriginal peoples, for a period of five years
with reviews to be conducted after two and five years. \textit{s.27}(1)(i), \textit{s.27}(2)(a)

• Other jurisdictions, including Nunavut and NWT have enacted similar hunting bans.

• Non-compliance with the hunting closure has occurred. The Labrador Innu Nation publically
oppose the ban and its members have continued to hunt GRCH. The Quebec Innu also
oppose the ban.

• The Ungava Peninsula Caribou Aboriginal Round Table (UPCART) was established in 2013
as the main body representing Aboriginal groups on caribou issues. Membership includes
representation of both Labrador and Quebec-based Aboriginal governments and
organizations.

• The province (ENVC) and Quebec have made repeated efforts to UPCART to work
collaboratively on the writing of a management plan for GRCH. To date, UPCART has
indicated its intention to proceed on a GRCH management plan on its own.

• In 2014, a further $975,000 was approved for an additional three years of the LCI (Phase II).

• In June 2015, ENVC conducted Aboriginal consultations as part of the two year review of
the hunting ban. This included the dissemination of an information update on the most recent
status of the GRCH, and a request for feedback on consideration of continuing the hunting
ban. At the request of the Nunatsiavut Government, ENVC and JPS officials visited several
Nunatsiavut communities. Additional efforts were made to offer community visits to
Labrador Innu, but this offer was not accepted.

• The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is preparing a
status report that includes the GRCH. A COSEWIC assessment is anticipated in November
2016.

\textbf{Analysis:}

• Continued hunting has undermined the ability for ENVC to undertake an evaluation to
determine the effect of management action (hunting closure) as part of the two year review.
The total number of caribou harvested during the ban period is not known but any harvesting
under the current circumstances, including any continued hunting into the fall and winter of
2015 and 2016, is contributing to further decline.

• The potential for a long recovery period may need to be communicated to stakeholders to
proactively manage expectations.
• If the decline is not stabilized, extirpation of the GRCH (functional disappearance of the herd) is possible.

• The UPCART decision to proceed with its own management plan is problematic. In order to be operational, any management plan will require the substantive participation of the provinces as the responsible authorities for wildlife.

• The GRCH numbers have been critically low for several years, but the results of the population classifications completed in November 2015 together with survival estimations place the current estimated herd size at 10,300. Having reached a point of decline greater than 99% from peak numbers will likely draw interprovincial and international attention and potentially evoke discussion on the possibility of the herd nearing extirpation.

**Action being taken:**

- [s.27(1)(i), s.27(2)(a)]

• Department of Justice and Public Safety (JPS) have to date laid a number of charges against Labrador Innu for hunting GRCH. These charges are proceeding through the courts. On 2 November 2015 Wilderness North Air, an aircraft charter company employed by the Labrador Innu to facilitate caribou hunting pleaded guilty to a charge under the *Wildlife Act*. The Court imposed a fine and a prohibition order.

• ENVC continues LCI research and monitoring efforts in partnership with Quebec and University affiliations including investigations on other population factors such as predation, disease and caribou health.

• Wildlife Division is providing comment on the first draft of the COSEWIC status report.

• ENVC continues to attempt to engage with UPCART. The most recent correspondence, reiterating need for collaboration, was a letter sent November 3, 2015.
LABRADOR CARIBOU INITIATIVE YEAR 1 (2011-2012) PROGRESS REPORT

Newfoundland and Labrador
Department of Environment and Conservation
Wildlife Division
# TABLE OF CONTENTS

LIST OF TABLES ................................................................................................. iii
LIST OF FIGURES ............................................................................................... iii
EXECUTIVE SUMMARY ................................................................................... v

1.0 PURPOSE ...................................................................................................... 1

2.0 BACKGROUND ............................................................................................ 1

3.0 SUMMARY OF ACTIONS AND RATIONALE FOR ACTIVITIES IN 2011-2012 .... 2

4.0 YEAR 1 ACTIVITIES .................................................................................. 3
  4.1 Biological monitoring activities – Year 1 ..................................................... 3
  4.2 Harvest Monitoring - Year 1 ........................................................................... 5
  4.3 Stakeholder Engagement .......................................................................... 5
  4.4 Community Engagement .......................................................................... 6
  4.5 Harvest management actions .................................................................... 7
  4.6 Population projections ............................................................................. 7

5.0 BUDGET SUMMARY .................................................................................. 8

6.0 LITERATURE CITED ................................................................................ 9

APPENDIX A .................................................................................................. 16

APPENDIX B .................................................................................................. 19

APPENDIX C ................................................................................................??

APPENDIX D ................................................................................................??

APPENDIX E ................................................................................................??

APPENDIX F ................................................................................................??

APPENDIX G ................................................................................................??

APPENDIX H ................................................................................................??
LIST OF TABLES

Table 1. Estimated number of George River caribou harvested by user group, 2010-11 and 2011-12 ................................................................. 10

LIST OF FIGURES

Figure 1. Relative Abundance of George River Caribou, Quebec/Labrador, 1870-2011 .......... 11

Figure 2. Average calves/100 females during fall classification surveys for the GRCH, 1973-2011 ............................................................................................................. 12

Figure 3. Collar deployments and flight lines for George River caribou from January-March 2012 ............................................................................................................. 13

Figure 4. George River Caribou Population Estimates 2000-2012 (Simple model based on herd demographics and survival estimates). Herd survival estimated as .83 from 2000-2009 and .62 from 2010-2012 ............................................................... 14

Figure 5. George River Caribou Population Estimates 2010-2015 (RISKMAN Population Modeling Software) with and without a hunt of 2,500 caribou per year ............................................. 15

LIST OF APPENDICES

Appendix A: 2011-2012 GRCH Work Plans and Updates ............................................................................................................. 16
Appendix B: Spring Calf Condition Survey Report ................................................................................. 19
Appendix C: Fall Classification Report ................................................................................................. 20
Appendix D: Harvest Survey Report 2010-2011 ................................................................................. 20
Appendix E: Harvest Survey Report 2011-2012 ................................................................................. 20
Appendix F: Caribou Poster .................................................................................................................. 20
Appendix G: Wolf Poster ...................................................................................................................... 20
Appendix H: Caribou Placemat ............................................................................................................. 20
EXECUTIVE SUMMARY

Photo-census results from 2010 placed the population of the George River Caribou herd at 74,000; an 81 per cent decline from the previous census estimate of 385,000 in 2001. The census result is supported by other biological indicators of herd health. Low calf recruitment, low adult survival measured from collared caribou, and observations from user groups all corroborate a significant and continued decline in the GRCH. It was the population estimate in 2010 in combination with other biological indicators of herd health that led to the announcement of the Labrador Caribou Initiative in April 2011. The 3-year/1.9 million dollar Labrador Caribou Initiative includes: increased biological monitoring and research efforts, increased harvest monitoring, adaptive management from monitoring activities; enhanced licencing, education and stewardship programs; the formation of stakeholder working groups, advisory boards, and technical committees; and the development and implementation of a management plan for both the short- and long-term conservation of the GRCH.

This document reports on activities that took place during Year 1 of the Labrador Caribou Initiative. For biological monitoring, a total of 80 GPS/Iridium collars were purchased during the fiscal year with 50 of these collars deployed during the winter of 2011-2012. An additional 15 collars were purchased for deployment on predators of George River caribou. Two of these collars were deployed on wolves with the remainder targeted for bears and wolves in Year 2 of the project. A spring calf condition survey and yearling collaring effort were conducted in June 2011. A fall classification survey was conducted in late October 2011. For harvest monitoring, a herd health and harvest monitoring program was initiated in the 2012 hunting season with a 38% sample package return rate from the estimated number of caribou that were harvested by licence. Harvest restrictions from 2010-2011 were continued and expanded to include a shortened season and licence sales through government offices only. There were extensive communications and meetings among stakeholder groups both individually and as part of a multi-stakeholder working group throughout the year. Presentations/discussions on the status, biology, and management of the George River caribou herd were given in communities throughout Labrador. Posters, placemats, and information packets were developed and distributed to Labrador communities. The GRCH will continue to decline at an alarming rate under existing population demographics and trends based on the simple models developed to date. The information from this initiative will be critical to informing future management decisions, directing research projects, developing future population models, and the ultimate long-term conservation of this important caribou herd.
LABRADOR CARIBOU INITIATIVE YEAR 1 (2011-2012) PROGRESS REPORT

1.0 PURPOSE

- The focus of this document is to summarize George River caribou herd (GRCH) activities during the first year of the 3-year Labrador Caribou Initiative. As part of the 2011/12 budget process, the Labrador Caribou Initiative was approved for $1.9 million over 3 years with 1 million of this funding provided in Year 1 of the project. The objectives of this initiative are to enhance monitoring and conservation efforts for the herd to include: increased biological monitoring and research efforts, increased harvest monitoring, enhanced licensing, education and stewardship programs, the formation of stakeholder working groups, advisory and technical committees, and the development and implementation of a management plan for both the short- and long-term conservation of the GRCH.

2.0 BACKGROUND

- The George River caribou herd reached an estimated low of 15,000 in the 1950’s, and peaked at nearly 800,000 in the late 1980s (Figure 1). A 1993 census estimated the population at approximately 775,000 caribou. In 2001, the population was estimated to have fallen to 385,000 animals.
- In July 2010, a census was conducted jointly by the Government of Quebec and the province of Newfoundland and Labrador and the final census result placed the GRCH population at 74,000 animals; an 81 per cent decline from the previous census estimate in 2001.
- The census result is supported by other biological indicators of herd health. Low calf recruitment, low adult survival measured from collared caribou, and observations from user groups all corroborate a significant decline in the GRCH.
- Biologists believe the population decline was not precipitated by hunting. However, at the current population level, hunting may now add to natural mortality, possibly exacerbating the current population decline and affecting future recovery efforts.
- The herding nature of caribou, their range expansion into more accessible areas, and the efficiency of modern harvesting methods have put the George River caribou in a very vulnerable situation. Population projections based on current estimates indicated that the liberal harvest strategy employed since the 1980s to maximize benefits and hunting opportunities for aboriginals, residents, outfitters and commercial operators was not sustainable.
- Consultations were held with stakeholder groups in the fall of 2010, and on Nov. 9, 2010, the Department of Environment and Conservation announced the 2010/11 GRC Harvest Management Plan.
- The commercial caribou hunt, non-resident caribou hunting via the use of outfitters, and the resident caribou licence transfer system for Labrador residents were suspended during the 2010-2011 harvest season. The allowable harvest was reduced to one caribou per licensed hunter from the current limit of two, and the season opened immediately and closed on April 30, 2011 in open zones.
Approval of a 3 year 1.9 million project was obtained within the Budget 2011/12. The objectives included:

- To monitor GRCH demographics, survival, body condition, and range and habitat use through time and investigate biological factors affecting changes in these indicators of herd health and population trends and size.
- To monitor harvest trends by resident and non-resident hunters, outfitters, commercial operators, and aboriginal groups.
- To consult with all interest groups and gather input from stakeholder working groups for both the short- and long-term management of the GRCH.
- To identify and implement harvest management plans and actions for the conservation and continued use of the GRCH.
- To investigate causes of mortality for different caribou age and sex classes.
- To conduct education and stewardship activities for the conservation of the GRCH.

### 3.0 SUMMARY OF ACTIONS AND RATIONALE FOR ACTIVITIES IN 2011-2012

A comprehensive plan for the conservation and management of the GRCH must incorporate scientific research, community involvement and support, management and regulations, and education. Activities in the 2011-2012 fiscal year include:

- **Caribou survival, distribution, movements patterns, and fidelity**
  
  **Action:** 1) Continue monitoring satellite and satellite/GPS collared caribou, 2) deploy & monitor a larger number of active collars in the GRCH and 3) design the work to ensure that collars are representative of all age/sex cohorts in the population.
  
  **Rationale:** Survival estimates are an indicator of herd health and population trends. Knowledge of movement patterns, distribution, and fidelity provide information necessary for developing research objectives, informing management actions, and guiding the efforts of population and classification surveys. A larger number of collars deployed will help to make sure that our conclusions from the data are accurate.

- **Calf weights and calf survival from birth to fall**
  
  **Action:** 1) Record presence of calf with collared females 2) record birth weights of calf caribou on calving grounds in the spring.
  
  **Rationale:** Calf survival and calf weights are key indicators of herd health and population trends and therefore offer insights into how well our management actions are working toward the recovery of the herd.

- **Juvenile survival and adult sex ratios**
  
  **Action:** 1) Conduct annual fall classification surveys for the GRCH
  
  **Rationale:** Ratios of young:adult females, when compared provide a measure of summer survival and both sex and calf ratios are an indicator of population health and trends.

- **Harvest monitoring, caribou body condition, and age structure**
  
  **Action:** 1) Increased monitoring efforts of all caribou harvesting groups; 2) design and implement community efforts to monitor caribou harvest numbers and demographics, body condition, diseases, pregnancy rates, harvest locations, and environmental conditions; 3) in cooperation with aboriginal groups, use a combination of local...
representatives/monitors, interviews, surveys, and direct observations to gather data on the harvest of the herd; 4) annually collect jawbone, lower leg, and kidney samples from harvested caribou in the fall to assess body condition by running a public awareness campaign and creating drop-off locations for samples; 5) teeth will be sectioned and aged to learn about trends in age of the harvested population.

Rationale: Body condition affects caribou survival and is an indicator of population health and trends. Hunters offer a useful and reliable data that can assist managers in learning about herd health and population trends.

- **Stakeholder participation**
  - **Action:** 1) gather input from stakeholders; 2) meet with stakeholders regularly to address concerns, give updates, and gain input on caribou management issues; 2) initiate a cooperation agreement between the Quebec and Newfoundland and Labrador governments to strengthen a working and cooperative relationship.
  - **Rationale:** The GRCH crosses provincial boundaries, is harvested in First Nations traditional territories, and is used as a resource by local hunters and outfitters. Cooperation by all of these stakeholders is critical to the success of a management strategy.

- **Communication and Education**
  - **Action:** Hold a series of public outreach workshops in communities affected by the GRCH before the start of every hunting season to: 1) provide updated information on research and management results, 2) solicit community input, 3) promote understanding and acceptance of management strategies, 4) encourage participation in projects that monitor the health of the herd, 5) improve the use of best harvest practices, 6) build a stronger relationship between communities and wildlife managers, and 7) disseminate reports and other educational materials regularly.
  - **Rationale:** Increased support and cooperation from communities will help provide the best information for management actions. Support and involvement from the local people is critical to success of the management program.

- **Computer modeling**
  - **Action:** Develop a caribou population model that can be used to predict the effects of harvest on the herd.
  - **Rationale:** This model will serve as an important management tool to predict long-term trends at varying harvest levels and to demonstrate the effects of harvest to all user and interest groups.

### 4.0 Year 1 Activities

#### 4.1 Biological Monitoring Activities – Year 1

- Purchase of 80 Lotek GPS/Iridium collars for GR caribou including 50 adult (3D) collars, 20 yearling size collars (2D), and 10 adult (2D) collars.
- Purchase of 15 Lotek 2D collars for predators of GR caribou (5 bear; 10 wolf).
- An additional 2 camera collars given to the project by Lotek to field test new product (2 bear).
- Deployment of 2 wolf collars on GR wintering grounds during February-March 2012. Remaining bear and wolf collars targeted for spring deployment on GR calving grounds.
- Deployment of 50 Lotek GPS/Iridium collars on adult GR caribou from January-March 2012.
• Deployment of 12 yearling collars during spring calving survey (Quebec collars).

• Fall classification survey conducted in late October 2011.
  
  o The percentage of calves in the fall survey is below the 15% suggested by Bergerud and Elliot (1986) as a minimum for population maintenance with little potential for growth.

  o Recruitment in terms of calves per 100 females was also low compared (17 calves/100 females) to historical classifications (Figure 2). Couturier et al. (2009) estimated that fall productivity must be 34 calves/100 females for the George River herd to be stable (under the assumption that adult survival is 0.87 (Crete et al. 1996) and current survival estimates are far below this value).

  o The % large males in the population measured during fall classifications remains low compared to past years.

• Spring calf condition survey and yearling collaring effort:
  
  o Field work for George River Caribou Herd (GRCH) calf birth weights and condition was carried out from 6-11 June 2011. Compared with previous years, caribou were late to arrive on the calving grounds by about 2-3 days. Calving was also later than previous years by 2-3 days. In past years, caribou arrived and stayed at the calving grounds for approximately a week before calving started; however, caribou appeared to calve immediately upon arriving at the calving grounds this year. Late calving is of concern given that late-born calves have been shown to experience higher mortality rates (Whitten et al. 1992). Snow cover was present in large areas throughout the calving grounds this year and may have contributed to the late timing of calving.

  o Caribou groups were sparsely distributed. Group sizes were relatively small. Most groups observed were no more than 30 animals. Only a few groups of 100 or more were observed. Although no survey was conducted to quantify percent calves, anecdotally, calf numbers seemed low. Due to the dispersed nature of the caribou herd, extensive flying over the entire distribution of collared caribou was required. Collared caribou distributions appeared to be representative of caribou distributions across the landscape. Thirty-four calves (23 male, 11 female) were captured. The average weight was 6.26 ± 0.18 (SE).

  o Calf birth weight has been positively correlated with fall recruitment (calves/100 females; Couturier et al. 2009; data from 1978 – 2003). Although a linear regression fits (F = 16.84, P = 0.0005, R^2 = 0.4335; using data from Couturier et al. 2009 and more recent, unpublished data), other factors affect both parameters. In 2011 the average calf birth weight was 6.3 and the fall recruitment was 17%. The slope of the regression line would have predicted a 2010 fall recruitment of 33%. It is possible that this relationship is different when the population numbers are low, as is currently the case. Most of the data used to calculate this correlation was taken when population numbers were high or increasing.

• Mortality investigations throughout the year including one trip in August 2011 to retrieve 18 collars.
4.2 Harvest Monitoring Activities – Year 1

- Harvest Monitoring Activities in 2011-2012 included a focused effort to communicate and disperse sample collection kits.

- Herd Health and Harvest Monitoring program results:
  - 197 sample packages were returned (197 data sheets, 179 jawbones, 178 leg bones, 110 blood samples, 132 fecal samples); a 38% sample package return rate from the estimated number of caribou harvested by licence.
  - 949 licenses sold in 2011-2012 (678 Provincial, 271 Nunatsiavut 12E) compared to 382 provincial in 2010-2011
  - 88.3% of licence holders were contacted compared to 81.4% in 2010-2011
  - 21% of license holders did not hunt compared to 23% in 2010-2011 (Provincial Licences Only)
  - Hunter success was 68% compared to 58% in 2010-2011 (Provincial Licences Only)
  - Harvest estimate for licenced hunt for 2011-2012 is 493 compared 2010-2011 estimate of 173 (Provincial Licences Only)
  - A total rough estimate of 2,300 caribou harvested in 2011-2012 compared to 2,800 in 2010-2011.
  - Samples being sent to labs for analysis.

4.3 Stakeholder Engagement – Year 1

- The Wildlife Division hosted a stakeholder workshop on June 2, 2011 and November 2, 2011 in Happy Valley – Goose Bay to discuss updates, options and future needs for GRC management. The information gained from this workshop will be used to help inform the ongoing management process of GRC
- Representatives from the following organizations were invited to attend:
  - Nunatsiavut Government
  - Torngat Wildlife and Plants Co-Management Board
  - Labrador Innu Nation
  - NunatuKavut
  - Newfoundland and Labrador Outfitters Association
  - Department of Tourism
  - IGA
  - DNR
  - Department of Labrador and Aboriginal Affairs
  - NL Hunter and Trapper’s Organization
- Representatives of all invited stakeholders were present with the exception of the Innu Nation who accepted the invitation but did not attend.
- In September, ENVC biologist met with officials of the Innu Nation to discuss GR herd status and management.
- In June 2011, ENVC biologists gave a presentation on GR management to members of the NL Hunter and Trapper’s Organization.
- On November 22, 2011, ENVC officials met with members of Quebec Innu in HV-GB. ENVC provided a presentation on & discussed issues of GRC herd status with band members.
During the month of November ENVC biologists met on an individual basis with representatives of the Torngat Wildlife and Plants Co-management Board, Torngat Secretariat, Nunatsaviut Government, Innu Nation, Quebec Innu, and the NL Hunter and Trapper’s Organization to present information on and discuss GR herd biology, status, and management.

There continues to be ongoing communications and coordination between the Government of Quebec and the Government of Newfoundland and Labrador at the administrative level concerning management of the GRCH.

Biologists from the Labrador office met with the Caribou Ungava research team in Quebec City on November 18, 2011 to discuss future GRCH research needs and collaborative efforts.

ENVC biologists continue to collaborate with Quebec biologists on monitoring needs and activities and plans are currently underway to discuss opportunities to more formally manage GRCH.

Officials from ENVC and LAA met with officials from the Quebec Government at a meeting in Quebec City on February, 2011, and again in Corner Brook on November, 2011.

ENVC biologists met with all stakeholders groups in April 2012 to present and discuss the latest GRCH biology and management. Groups included: Nunatsaviut Government, Torngat Wildlife and Plants Co-management Board, Innu Nation, Quebec Innu, and Nunatukavut.

4.4 COMMUNITY ENGAGEMENT- YEAR I

- Presentations on the status, biology, and management of the GRCH were given throughout communities in Labrador primarily during the month of November 2011. Communities where presentations were given in November included: Nain, Hopedale, Postville, Makkovik, Rigolet, Happy Valley-Goose Bay, and Northwest River. Presentations were also given in Natuashish in March, Labrador City in February, and to a small group of representatives in Sheshatshiu in November. The same presentation was given to various groups over 20 times throughout the winter.
- A communication plan was developed for informing the public about management actions and to encourage participation in the herd health and harvest monitoring program. Communication mediums included: radio announcements, flyers, news releases, cable announcements, and newspapers.
- A poster on status and biology of the GRCH was developed and distributed to communities.
- A poster on wolf biology in Labrador was developed and distributed to communities.
- A placemat was developed in cooperation with GRCH stakeholders and distributed to local restaurants throughout Labrador.
- An article on the GRCH was written for the Wildlife Division’s newsletter during the summer of 2011.
4.5 Harvest Management Actions—Year 1

- On August 2, 2011 the Minister of ENVC delayed the start of the 2011-2012 GRC season until further assessment and consultations. The GRCH season opened on 20 December, 2012.

- The Quebec Government implemented changes for the 2011-2012 season, including a 50% reduction in outfitter permits, subdivision of Zone 23 into a W/E sections, so that the George River and Leaf River herds could be managed separately; closure of sport hunting in the S section of Zone 23; limitation on sport hunting in Zone 24; a reduced season in the Eastern section of Zone 23; and closure of sport hunting in 2012-2013 in the Eastern section of Zone 23 and in Zone 24, subject to the biological information collected in 2011-2012.

4.6 Population Projections—Year 1

- We used two models to estimate the population of the George River caribou herd since the 2010 census. A simple model based on herd demographics and mortality rates and a more complex model using RISKMAN Population Modeling Software.

- Assumptions for the simple model included:
  o An 11.5 percent calves in the population; average winter survival of calves (0.84).
  o Rate of adult survival of 0.83 from 2000-2009 and 0.68 from 2010-2012 across all cohorts except calves.
  o Adult survival rates include mortality from harvest.

- Assumptions for the model using RISKMAN Population Modeling Software include (Figure 10):
  o Rate of adult survival of 0.68 across all cohorts except calves.
  o Parturition rate of 0.85.
  o A recruitment rate of 0.17
  o Minimum age of reproduction of 2.5 years.
  o Estimates with and without a harvest of 2,500 caribou/year.

- Estimates were similar between model types; approximately 50,000 caribou in fall 2011 and approximately 30,000 caribou in fall 2012.

- Regardless of model or parameter manipulation, the GRCH is in a severe state of decline. Manipulations of parameters such as parturition rates, recruitment rates, or age of 1st reproduction have little effect on the overall results of models and just provide varying degrees of severity to the decline. Adult mortality appears to be the most significant parameter driving the severity of the decline.

- A more robust model incorporating new data sources associated with this initiative is needed for any future population modeling work.
### George River Caribou Initiative Budget - Year 1

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<th>Category</th>
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6.0 REFERENCES


Table 1. Estimated number of George River caribou harvested by user group, 2010-11 and 2011-12.

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*2011/2012 still being updated
**combined 12E & regular licences

*Data sources: Labrador Innu = Provincial conservation officers and Innu guardians; Quebec Innu = Quebec biologists and Provincial conservation officers; Regular Licence = Vendor sales and phone survey; Nunatsiavut/coastal communities = NG conservation officers and wildlife manager; Labrador outfitters = licence sales and phone survey; Quebec sport harvest = Quebec biologists; Quebec Innu harvest = Quebec biologists and Provincial conservation officers.
Figure 1. Relative Abundance of George River Caribou, Quebec/Labrador, 1870-2011.
Figure 2. Average calves/100 females during fall classification surveys for the GRCH, 1973-2010.
Figure 3. Collar deployments and flight lines for George River caribou from January-March 2012.
Figure 4. George River Caribou Population Estimates 2000-2012 (Simple model based on herd demographics and survival estimates). Herd survival estimated as .83 from 2000-2009 and .62 from 2010-2012.
Population Projection for the George River Caribou Herd

Figure 5. George River Caribou Population Estimates 2010-2015 (RISKMAN Population Modeling Software) with and without a hunt of 2,500 caribou per year.
Labrador Work Plan 2011/12

Labrador Caribou Initiative – George River Caribou Herd

1. INTRODUCTION
Project Title: Labrador Caribou Initiative
Activity Leader: Shannon Crowley
Funding Level: $1,000,000.00

Purpose: To monitor, investigate, and manage for the long-term sustainability of the George River caribou herd (GRCH).

2. GOAL AND OBJECTIVE

- Goal: To recover the GRCH from a declining to an increasing population and to ensure the long-term sustainability of this valuable resource for future generations.

- Objectives:
  - To monitor GRCH demographics, survival, body condition, and range and habitat use through time and investigate biological factors affecting changes in these indicators of herd health and population trends and size.
  - To monitor harvest trends by resident and non-resident hunters, outfitters, commercial operators, and aboriginal groups.
  - To consult with all interest groups and initiate the formation of stakeholder working groups, advisory boards, and technical committees for both the short- and long-term management of the GRCH.
  - To identify and implement harvest management plans and actions for the conservation and continued use of the GRCH.
  - To investigate causes of mortality for different caribou age and sex classes.
  - To conduct education and stewardship activities for the conservation of the GRCH.

3. CURRENT CONDITIONS
The GRCH has declined from an estimated 776,000 in 1993 to an estimated 385,000 in 2001. A post calving photo-census in July 2010 shows a continued and accelerated decline with an estimated herd size of 74,000. Although it has been determined that the GRCH has undergone a substantial decline over the last decade, the reason for this decline is not fully understood. One reason for this lack of understanding is the deficiency in information related to the current range utilization and demographic parameters of the population. In addition, it is clear that the success of a management plan for the declining GRCH will depend on the cooperation and participation of all stakeholders.

4. APPROACH AND DELIVERY
A comprehensive plan for the conservation and management of the GRCH needs to incorporate scientific research, community involvement and support, management and regulations, and education. Activities in the 2011-2012 fiscal year include:

- **Caribou survival, distribution, movements patterns, and fidelity**  
  **Action:** 1) Continue monitoring satellite and satellite/GPS collared caribou and increase the number of active collars deployed and monitored in the GRCH and to ensure that collars are representative of all age/sex cohorts in the population.  
  **Rationale:** Survival estimates are an indicator of herd health and population trends. Movement patterns, distribution, and fidelity provide information necessary for developing research objectives, informing management actions, and guiding the efforts of population and classification surveys. Increasing sample size will make any measured parameter more reliable, reduce scientific and statistical scrutiny, and strengthen the credibility of conclusions based on the data.

- **Calf weights and calf survival from birth to fall**  
  **Action:** 1) Record presence of calf with collared females and attach ear tag proximity sensor to calf to record survival. 2) Record birth weights of calf caribou on calving grounds in the spring.  
  **Rationale:** Calf survival and calf weights are key indicators of herd health and population trends.

- **Calf survival and adult sex ratios**  
  **Action:** 1) Conduct annual fall classification surveys for the GRCH and collar calves in fall.  
  **Rationale:** Calf ratios provide a measure of summer survival and both sex and calf ratios are an indicator of population health and trends. Collared calves provide information on fall to spring survival and provide known age animals in study sample.

- **Harvest monitoring, caribou body condition, and age structure**  
  **Action:** 1) Increased monitoring efforts of all caribou harvesting groups. 2) Design and implement community monitoring efforts to monitor caribou harvest numbers and demographics, body condition, diseases, pregnancy rates, harvest locations, and environmental conditions. 3) In cooperation with aboriginal groups, use a combination of local representatives/monitors, interviews, surveys, and direct observations common to social science research to gather and analyze data on the harvest of the GRCH 4) Annually collect jawbone, lower leg, and kidney samples from harvested caribou in the fall to assess body condition by running a public awareness campaign and creating drop-off locations for samples. 5) Collect tissue and organ samples to assess parasites and diseases. 6) Teeth will be sectioned and aged as an indicator of population trends.  
  **Rationale:** Body condition affects caribou survival and is an indicator of population health and trends. Harvest levels can have a direct impact on the herd and reliable data on hunting mortality is critical for making management decisions.

- **Stakeholder participation**  
  **Action:** 1) Create a GRCH working group that would meet regularly to address concerns, give updates, and provide recommendations on caribou management issues 2) Initiate a cooperation agreement between the Quebec and Newfoundland and Labrador governments to create a GRCH Technical and Administrative Committee  
  **Rationale:** The GRCH crosses provincial boundaries, is harvested in First Nations traditional territories, and is used as a resource by local hunters and outfitters. Cooperation by all of these stakeholders is critical to the success of a management strategy.

- **Communication and Education**  
  **Action:** 1) Hold a series of public outreach workshops in communities affected by the GRCH before the start of every hunting season. The purpose of these workshops would be to provide updated information on research and management results, solicit community input, promote understanding and acceptance of management strategies, encourage participation in projects that monitor the health of the herd, improve the use of best harvest practices, and to build a stronger relationship between communities and wildlife managers 2) Reports and other educational materials should be disseminated immediately and regularly.
Rationale: Increased support and cooperation from communities will help provide the best information for management actions. Support and involvement from the local people is critical to success of the management program.

- **Computer modeling**
  
  **Action:** Develop a caribou population model that can be used to predict the effects of harvest on the herd.
  
  **Rationale:** This model will serve as an important management tool to predict long-term trends at varying harvest levels and to demonstrate the effects of harvest to all user and interest groups.

- Schedule of Activities:

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<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
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5. DELIVERABLES
- Telemetry database of filtered and pre-processed spatial data.
- Determination of the causes of mortality and rates for collared caribou.
- Delineation of the current range and habitat use of the GRCH.
- Estimates of calf recruitment, demographics, and cohort specific survival rates.
- Continued development and refinement of population model to predict future population trends and numbers.
- Photographic census of George River caribou herd
- Studies of impacts of predation on George River caribou on calving and wintering grounds
- Continued meetings of Labrador GRCH advisory group
- Consultations with aboriginal communities in Labrador and Quebec
- Stewardship and education materials, presentations, and workshops.
- Continued work on management plan for the George River caribou herd.
APPENDIX B

George River Caribou Herd Calf Birth Weights
2011 Report

Report prepared by: David Elliott

Caribou calf birth weights are a useful tool for management. Body condition early in life can play a role in the future demography, survival rate and health of the population.

Field work for George River Caribou Herd (GRCH) calving survey was carried out from 6-11 June 2011 by David Elliott of the Wildlife Division (WD), Richard Neville (WD), Vincent Brodeur of the Quebec Ministère des Ressources naturelles et de la Faune (MRNF), and (pilot, Universal Helicopters). For this work, the crew was based at the WD cabin at Hebron Fjord. Caribou were located using satellite locations of collared caribou and VHF telemetry. Calves were captured and handled following standard procedures (see calf capture protocol.)

Compared with previous years, caribou were late to arrive on the calving grounds by about 2-3 days. Calving was also later than previous years by 2-3 days. Caribou groups were sparsely distributed. Group sizes were relatively small. Most groups observed were no more than 30 animals. Only a few groups of 100 or more were observed. Although no survey was conducted to quantify percent calves, anecdotally, calf numbers seemed low. Thirty-four calves (23 male, 11 female) were captured. The average weight was 6.26 ± 0.18 (SE).

Calf birth weight has been positively correlated with fall recruitment (calves/100 females; Couturier et al. 2009; data from 1978 – 2003; figure 1 and table 1). Although a linear regression fits (F = 16.84, P = 0.0005, R² = 0.4335; using data from Couturier et al. 2009 and more recent, unpublished data), other factors affect both parameters. In 2010 the average calfbirth weight was 6.02 ± 0.20 and the fall recruitment was 17%. The slope of the regression line would have predicted a 2010 fall recruitment of 33%. It is possible that this relationship is different when the population numbers are low, as is currently the case (2010 population estimate was 74,000 ± 17%). Most of the data used to calculate this correlation was taken when the population numbers were high or increasing.

In addition to the calf captures 13 MRNF satellite collars were deployed on yearling caribou as part of their know-age animal monitoring program, 2 MRNF collars were deployed on recaptured caribou with collars needing maintenance, 1 WD collar was deployed, and 2 mortality collars were recovered.

References:

Figure 1. Birth weight of GRCH calves (± SE) and fall recruitment (calves/100 females). Birth weight was positively correlated with fall recruitment. The 2010 data is shown (arrow).
Table 1. Mean birth mass with standard error and fall recruitment (calves/100 females) for GRCH from 1978 – 2011.

<table>
<thead>
<tr>
<th>Year</th>
<th>Birth mass (kg)</th>
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Appendix C

Insert “Fall 2011 Classification Report” from David Elliott
Resident License Holders’
Hunting Success Survey Report
GRCH 2010-2011

June 10\textsuperscript{th}, 2011
Prepared by Sara McCarthy and Richard Neville
Reviewed by Shannon Crowley
Wildlife Division
Department of Environment and Conservation
Newfoundland and Labrador
At the end of the 2010-2011 hunting season, the wildlife division contacted all resident license vendors and asked for the list of licenses sold that season. There are a total of 11 license vendors in Labrador; the number of license sales they reported is listed below.

![Bar chart showing number of licenses sold per vendor during the 2010-2011 caribou hunting season. Colors co-ordinate with location: blue = Lab West, purple = Churchill Falls, green = HV-GB, and gray = NWR.]

Fig 1- Number of licenses sold per vendor during the 2010-2011 caribou hunting season. Colors co-ordinate with location; blue = Lab West, purple = Churchill Falls, green = HV-GB, and gray = NWR.

On May 10th, after compiling the resulting 382 names and contact information for resident license holders, we began a phone survey. By June 9th, we had successfully contacted 311 hunters (81.4%), and called all other hunters at least 4 times, with messages left on their answering machines. The following is a report on the findings of this survey, with the remaining 18.6% of the license information being extrapolated from the information provided by hunters we were able to contact.

Hunter Success

An estimated 89 resident license holders did not hunt, 120 hunted but were not successful, and 173 harvested a caribou. This translates into a 45% license harvest rate, and a 58% hunter success rate. The minimum number of caribou potentially harvested is 141, while the highest possible harvest count is 212. Hunter success differed between the two open zones. License holders hunting in Orma North had a success rate of 59.9%, while those hunting in Nipishish Lake enjoyed a success rate of 82.7%.

Time and Location

The majority of the caribou harvest occurred towards the end of the season (Fig 2). Many of the survey respondents said they were waiting for more snow so that the caribou would be easier to access, while many others stated that they did not hunt at all because of the difficulty in reaching the animals. The greatest hunting pressure occurred in Orma North, where an estimated 72.5% of harvested caribou were taken.
Jawbone Returns

The Wildlife Division asks hunters to bring in their caribou jawbones so they can be used as a means of gathering data on harvest demographics. Jawbone return rates have been very low in the past. This trend continued during the 2010-2011 hunting season, with a return rate of only 21.6%, despite a new incentive program to encourage returns. It appears as though the incentive program was not effectively advertised, as only 19.2% of surveyed hunters were aware of this initiative. Returns should be much greater next year, as all hunters who were contacted during the survey were informed of the incentive.

Harvest Demographics

We also asked hunters to provide information regarding the traits and health of the animal they harvested. The following figures are based on an extrapolation of replies by hunters who could clearly remember the specifics of their harvest, as some could not remember, or could not answer accurately.
Comments

Hunters were given an opportunity to provide comments at the end of the survey. The following is an amalgamation of the comments put forward.

- I saw 10 caribou.
- I saw 100-150 caribou.
- I saw 125-130 caribou and 1 wolf
- I saw 250 caribou with 4 prickets.
- There were 30-40 caribou in the area.
- There were 600-700 caribou in the area.
- Not many stags, and not as many animals as years before. Lots of wolves.
- I saw 3 wolves.
- I saw 400-500 caribou, and there were only a few prickets, but lots of wolf sign.
- I saw 8 small females.
- I saw a couple 1000 caribou.
- I saw 150 caribou and a wolf.
- I saw a group of 50 caribou.
- There was lots of caribou sign!
• Fattest caribou ever.
• Fur was rubbed off on my friend’s caribou’s belly.
• I didn’t know where the office was to drop off my jawbone.
• There was not enough snow.
• It was too cold out when I went, I saw a group of about 30 but they were hard to get at.
• It’s too far to go for only 1 caribou.
• It’s not worth going that far for one caribou.
• I know there were 6 females shot close to Nain last week and I’m not happy about that. They are pregnant and you shouldn’t shoot them now.
• I don’t like the new rule changes; can’t hunt for your parents and elderly relatives, I would like to be able to hunt for them. Hoping that will change next year.
• I’d rather see a transfer of one license, and the cost of a license should be cut in half like the quota. If the zone near cash is open for aboriginals, it should be open for us too.
• I'd rather see a transfer of one license, and the cost of a license should be cut in half like the quota. If the zone near cash is open for aboriginals, it should be open for us too.
• Innu were in camp in the country up north and had to move camp because there were too many caribou; thousands and thousands and thousands of them. Seems like there are many more of them than the census says. From Metchin River to Grand Lake area closed is too big of an area to be closed. Another thing I don't like - we have to wait until it's a big heard in the zone, but lots of times there’s little groups. I don't understand why you don’t open up all the areas at the same time; lots of times they move through the area before you even get there. Why should we have to wait for the zone to be opened up? There should be set times to open and close them. Hunting for other people who can’t hunt is our traditional way, especially like the elders or single mothers. We've always gotten caribou for them... now the government is saying that we can't do that. We should be able to hunt for them, why should they be penalized because they can't hunt for themselves. Now the elders don't have their traditional diets. That should never be. Its setting people up to break the rules... we feel obligated to hunt for our family. Another thing- I don’t' like how we only have 2 wildlife officers for this area, and all the rest are forestry. We should have more wildlife officers with this situation with the Quebec Innu. Need more help with this problem here in Labrador.
• The hunt should be banned for 5 years and caribou should be an endangered species. The Innu hunt means the population is not being controlled. If caribou had endangered status then all there might be a chance for the population to recover, so all people could enjoy the benefits.
• It’s strange to pay the same license fee and only get one caribou.
• These regulations are only hurting the white man. Whoever made these regulations are not very bright.
GRCH Health Monitoring Program
Results 2011-2012
(Brochure Prep)

October, 2012
Prepared by Sara McCarthy
Wildlife Division
Department of Environment and Conservation
Newfoundland and Labrador
The George River Caribou Health Monitoring Program was initiated for the 2011-12 hunting season in response to the severe decline of the herd and the need to better understand factors that might be contributing to this trend. A sample-collection kit was included with the sale of all resident and Nunatsiavut 12E caribou licences. Hunters were asked to record data and collect jawbone, metatarsus, blood, and fecal samples during their hunt. Successful hunters who turned in their completed sample packages (188) were entered in a draw for prizes. The draw took place on April 30th 2012 and the winners were as follows:

<table>
<thead>
<tr>
<th>Winner</th>
<th>Prize</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robert Nippard</td>
<td>Komatik</td>
</tr>
<tr>
<td>Preston Snow</td>
<td>GPS</td>
</tr>
<tr>
<td>Harvey Blake</td>
<td>Snowshoes</td>
</tr>
<tr>
<td>William Denniston</td>
<td>Beaver Mitts</td>
</tr>
<tr>
<td>Louis Brown</td>
<td>Binoculars</td>
</tr>
</tbody>
</table>

Hunters who did not turn in a sample package were contacted for a survey by the Wildlife Division. Combining sample package information and survey efforts permitted data collection from 89% of the licences sold. The following is a summary of the findings from the Health Monitoring Program to date. DNA and stress hormone analysis have yet to be completed on the hair samples collected from metatarsal bones.

An estimated 13% of licence holders did not hunt, 35% hunted but were not successful, and 52% harvested a caribou. This translates into an overall hunter success rate of 60%. Female caribou accounted for 69% of the reported 2011-12 GRCH harvest.

**Pregnancy**

Hunters who harvested a female caribou were asked to note the pregnancy status of their animal by checking for a fetus in the womb. It was also asked that they collect fecal samples, which scientists at the reproductive biology laboratory at the Toronto Zoo used to conduct pregnancy tests. Interestingly, pregnancy rates differed greatly between those estimated in the field (44% pregnant) versus in the lab using hormone analysis (74% pregnant). This result highlights the difficulty of identifying a fetus in the early stages of pregnancy, especially when it’s freezing cold! Sample collection is a quick and easy way to get precise results. Given that a pregnancy rate of 89% or greater would be considered sustainable, this year’s GRCH pregnancy rate indicates further population decline.

**Age**

Determining the age of caribou in the field is difficult, even for individuals trained in ageing animals based on the degree of tooth wear. Surveyed hunters were asked to specify whether they harvested a calf, yearling, or adult, and results showed that the harvest was 8% yearlings and...
92% adult animals. The age distribution of caribou harvested this season was further broken down using cementum analysis of teeth pulled from lower jawbones submitted by hunters (See Graph). Monitoring the age distribution of a population can tell you if it’s getting older or younger, which has many implications regarding recruitment, productivity, and age-specific survival. Results from this year’s analysis indicate that the GRCH is __.

**Body Condition**

Bone marrow extracted from the metatarsus was analyzed for fat content, an indicator of body condition. The average bone marrow fat score was 86.2% ±11.4 and was not significantly different between males and females. This value is higher than the bone marrow fat percentages found for calving (63.1%) and weaning (84.2%) female George River Caribou from 2007-2009. This suggests that the majority of female caribou were able avoid serious and detrimental body fat loss during the winter months, since bone marrow fat is the last fat reserve to be used up by the animal’s body. More sensitive indicators of body condition, such as kidney or back fat, could have identified smaller changes in body condition; however hunter’s comments of healthy, fat caribou suggest that forage was adequate.
Parasites and Disease

No parasites were noticed by 86% of successful hunters who participated in this program (See Fig), while the remaining 14% noted besnoitia cysts in the eye and warble fly larvae under the skin, among others.

Skin samples from metatarsal bones were analyzed for besnoitia cyst prevalence by scientists at Laval University. It was found that 80% of the caribou tested positive for besnoitia. This is an alarming jump in the 2007-2008 besnoitia prevalence of 15.8% for the GRCH. Effects of besnoitia at a population level are unknown, but a high density of cysts can cause hair loss, create lesions, and lead to cracks in the skin; leading to infection or breathing obstruction. Average density was 1.08 cysts per cm² of metatarsal skin, with a large standard deviation (1.16). Male sterility can also be caused by besnoitia; there was no difference found between male and female results.

The blood filter paper strips included in the hunter sample pack were tested for several known caribou pathogens. Results of these tests and their meanings are shown in the table. Overall, no alarming blood pathogen infection rates were identified.

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Effects</th>
<th>Results</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Toxoplasma gondii</em></td>
<td>abortion, anemia, hemorrhaging, death</td>
<td>Still Waiting</td>
<td>Higher/lower than the 37% prevalence in Western herds</td>
</tr>
<tr>
<td>(protozoan parasite)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Neospora caninum</em></td>
<td>abortion, neonatal mortality</td>
<td>0% Positive</td>
<td>Below infection levels found in Alaska and Yukon</td>
</tr>
<tr>
<td>(protozoan parasite)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bovine herpesvirus-1</td>
<td>abortion, respiratory distress, conjunctivitis</td>
<td>14% Positive</td>
<td>Similar to 2007-9 results (19%) and lower than Western herds (62%)</td>
</tr>
<tr>
<td>(viral agent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Para Influenza-3</td>
<td>Respiratory disease leading to pneumonia</td>
<td>2% Positive</td>
<td>Similar to 2007-9 results (4%)</td>
</tr>
<tr>
<td>(viral agent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bovine Diarrhea</td>
<td>Abortion, diarrhea, weak calves, death</td>
<td>28% Positive</td>
<td>Same as 28% prevalence rate in herds across the arctic</td>
</tr>
<tr>
<td>(viral agent)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Fig X- Examples of incorrectly and correctly filled blood filter paper sample strips. Incorrectly filled strips cannot be used for diagnostic testing. Care must be taken to fill the strip all the way from the tip to the brim.

Comments
Hunters were given an opportunity to provide comments at the end of the survey. The five reoccurring themes raised in the comments were that; very few caribou were seen, there were many hunters and snowmobiles on the land, caribou were being disturbed and injured by hunters, body condition was generally good, and support for increased conservation/harvest restrictions.

The Wildlife Division would like to thank all who participated in the 2011-12 GRCH Health Monitoring Program. Your contributions to improved research and management will be vital to population recovery.

Sticker with the Hunter’s Specifics
Sex-
Age-
Pregnancy Test-
Body Condition Score-
Besnoitia-
Toxoplasma-
Neospora-
BHV-1-
PI-3-
Pestivirus-
APPENDIX F- (INSERT CARIBOU POSTER HERE)
APPENDIX G- (INSERT WOLF POSTER HERE)
APPENDIX H- (INSERT CARIBOU PLACEMAT HERE)
LABRADOR CARIBOU INITIATIVE YEAR 2 (2012-2013) PROGRESS REPORT

Newfoundland and Labrador
Department of Environment and Conservation
Wildlife Division
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>iii</td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>v</td>
</tr>
<tr>
<td>1.0 PURPOSE</td>
<td>1</td>
</tr>
<tr>
<td>2.0 BACKGROUND</td>
<td>1</td>
</tr>
<tr>
<td>3.0 SUMMARY OF ACTIONS AND RATIONALE FOR ACTIVITIES IN 2011-2012</td>
<td>2</td>
</tr>
<tr>
<td>4.0 YEAR 2 ACTIVITIES</td>
<td>4</td>
</tr>
<tr>
<td>4.1 Biological Monitoring Activities</td>
<td>4</td>
</tr>
<tr>
<td>4.2 Population Projections</td>
<td>7</td>
</tr>
<tr>
<td>4.3 Community and Stakeholder Engagement</td>
<td>7</td>
</tr>
<tr>
<td>4.4 Harvest Monitoring</td>
<td>8</td>
</tr>
<tr>
<td>4.5 Harvest Management Actions</td>
<td>8</td>
</tr>
<tr>
<td>5.0 BUDGET SUMMARY</td>
<td>9</td>
</tr>
<tr>
<td>6.0 LITERATURE CITED</td>
<td>10</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>17</td>
</tr>
<tr>
<td>APPENDIX B</td>
<td>27</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>29</td>
</tr>
<tr>
<td>APPENDIX D</td>
<td>30</td>
</tr>
<tr>
<td>APPENDIX E</td>
<td>36</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1. Survival Estimates for 2011/12 and 2012/13 caribou biological years with sample size and 95% confidence intervals.............................................................................. 11

Table 2. Estimated number of George River caribou harvested by user group, 2010-11, 2011-12, and 2012-13........................................................................................................ 11

LIST OF FIGURES

Figure 1. Average calves/100 females during fall classification surveys for the GRCH, 1973-2010, and calves/100 female estimates for 2010, 2011, and 12................................. 12

Figure 2. Percentage of Large Male Caribou seen in the George River Fall Classifications from 2001-2012............................................................ 13

Figure 3. Results of wolf collaring efforts over the first two years of the Labrador Caribou Initiative; monitoring locations recorded between April 1st 2011 and March 31st 2013............................................................................................................ 14

Figure 4. Results of bear collaring efforts over the first two years of the Labrador Caribou Initiative; monitoring locations recorded between April 1st 2011 and March 31st 2013 ............ 15

Figure 5. George River Caribou Population Estimates 2001-2014 (Simple model based on herd demographics and survival estimates)................................................................. 16

LIST OF APPENDICES

Appendix A: 2012-2013 GRCH Work Plans ......................................................... 17

Appendix B: Health Monitoring Program Results Brochure.................................. 27

Appendix C: GRCH Stewardship T-Shirt Design................................................. 29

Appendix D: Information Summary from GRCH Advisory Committee Meeting......... 30

Appendix E: Materials from Ungava Caribou meeting in Montreal ..................... 36
LABRADOR CARIBOU INITIATIVE YEAR 2 (2012-2013) PROGRESS REPORT

1.0 PURPOSE

- The focus of this document is to summarize George River caribou herd (GRCH) activities during the second year of the 3-year Labrador Caribou Initiative. As part of the 2011/12 budget process, the Labrador Caribou Initiative was approved for $1.9 million over 3 years with $522 thousand of this funding provided in Year 2 of the project. The objectives of this initiative are to enhance monitoring and conservation efforts for the herd to include: increased biological monitoring and research efforts, increased harvest monitoring, enhanced licensing, education and stewardship programs, the formation of stakeholder working groups, advisory and technical committees, and the development and implementation of a management plan for both the short- and long-term conservation of the GRCH.

2.0 BACKGROUND

- The George River caribou herd reached an estimated low of 15,000 in the 1950’s, and peaked at nearly 800,000 in the late 1980s (Figure 1). A 1993 census estimated the population at approximately 775,000 caribou. In 2001, the population was estimated to have fallen to 385,000 animals.
- In July 2010, a census was conducted jointly by the Government of Quebec and the province of Newfoundland and Labrador and the final census result placed the GRCH population at 74,000 animals; an 81 per cent decline from the previous census estimate in 2001.
- The census result was supported by other biological indicators of herd health. Low calf recruitment, low adult survival measured from collared caribou, and observations from user groups all corroborate a significant decline in the GRCH.
- Biologists believe the population decline was not precipitated by hunting. However, at the current population level, hunting may now add to natural mortality, possibly exacerbating the current population decline and affecting future recovery efforts.
- The herding nature of caribou, their range expansion into more accessible areas, and the efficiency of modern harvesting methods have put the George River caribou in a very vulnerable situation. Population projections based on current estimates indicated that the liberal harvest strategy employed since the 1980s to maximize benefits and hunting opportunities for aboriginals, residents, outfitters and commercial operators was not sustainable.
- Consultations were held with stakeholder groups in the fall of 2010, and on Nov. 9, 2010, the Department of Environment and Conservation announced the 2010/11 GRC Harvest Management Plan.
- The commercial caribou hunt, non-resident caribou hunting via the use of outfitters, and the resident caribou license transfer system for Labrador residents were suspended during the 2010-2011 harvest season. The allowable harvest was reduced to one caribou per licensed hunter from the current limit of two, and the season opened immediately and closed on April 30, 2011 in open zones.
• Approval of a 3 year 1.9 million project was obtained within the Budget 2011/12. The objectives included:

  o To monitor GRCH demographics, survival, body condition, and range and habitat use through time and investigate biological factors affecting changes in these indicators of herd health and population trends and size.
  o To monitor harvest trends by resident and non-resident hunters, outfitters, commercial operators, and aboriginal groups.
  o To consult with all interest groups and gather input from stakeholder working groups for both the short- and long-term management of the GRCH.
  o To identify and implement harvest management plans and actions for the conservation and continued use of the GRCH.
  o To investigate causes of mortality for different caribou age and sex classes.
  o To conduct education and stewardship activities for the conservation of the GRCH.

3.0 SUMMARY OF ACTIONS AND RATIONALE FOR ACTIVITIES IN 2012-2013

A comprehensive plan for the conservation and management of the GRCH must incorporate scientific research, community involvement and support, management and regulations, and education. Activities in the 2012-2013 fiscal year include:

- **Caribou survival, distribution, movements patterns, and fidelity**
  
  *Action:* 1) Continue monitoring satellite and satellite/GPS collared caribou, 2) purchase, deploy & monitor a larger number of active collars in the GRCH, 3) design the work to ensure that collars are representative of all age/sex cohorts in the population, especially yearlings, and 4) retrieve collars from dead caribou as soon as possible.
  
  *Rationale:* Survival estimates are an indicator of herd health and population trends. Knowledge of movement patterns, distribution, and fidelity provide information necessary for developing research objectives, informing management actions, and guiding the efforts of population and classification surveys. A larger number of collars deployed will help to make sure that our conclusions from the data are accurate. Retrieving collars will provide cost savings in future collar purchases, as well as provide insight to the cause of death.

- **Calf weights and calf survival from birth to fall**
  
  *Action:* 1) Record presence of calf with females, 2) record birth weights of calf caribou on calving grounds in the spring.
  
  *Rationale:* Calf survival and calf weights are key indicators of herd health and population trends and therefore offer insights into how well our management actions are working toward the recovery of the herd.

- **Juvenile survival and adult sex ratios**
  
  *Action:* 1) Conduct annual fall classification surveys for the GRCH
  
  *Rationale:* Ratios of young:adult females, when compared provide a measure of summer survival and both sex and calf ratios are an indicator of population health and trends.

- **Pregnancy rates, stress hormone levels, parasite loads, and body condition**
Action: 1) Collect data and samples from all caribou captured for collaring, 2) send samples to appropriate laboratories for analysis.  
Rationale: While caribou are on hand for collaring, the opportunity to collect hair, fecal, and blood samples is presented, as well as to take physiological measurements. This process can inform managers of the herd’s productivity, food resource availability, and stress/pathogen load.

- **Caribou predator survival, distribution, movement patterns, and fidelity**  
  Action: 1) Continue monitoring collars already deployed on GRCH predators, 2) Collar wolves on the GRCH calving range, 3) Collar wolves on the GRCH winter range, 4) Collar bears on the GRCH calving range.  
  Rationale: The role of predation in the decline of the GRCH is not well understood. By monitoring the survival, home range size, and ecological behaviors of these predators, wildlife managers can gain insight to the density of predators on the landscape and their relative predation pressure on caribou at different times of the year.

- **GRCH Population Estimate**  
  Action: Conduct a post-calving aerial photo-census of the GRCH given adequate aggregations in July.  
  Rationale: Given the severe population decline, and the need for immediate management actions, a population census will validate population modeling projections and provide the necessary information and confidence levels to consider new harvest regulations.

- **Harvest monitoring, caribou body condition, and age structure**  
  Action: 1) Continue monitoring for illegal harvest activities; 2) continue processing and analysis of jawbone, lower leg, fecal, and blood samples from harvested caribou year 1 to assess body condition, age, parasitism, pathogens, and hormone levels.  
  Rationale: Body condition affects caribou survival and is an indicator of population health and trends. When a legal harvest is in place, hunters offer a useful and reliable data that can assist managers in learning about herd health and population trends.

- **Stakeholder participation**  
  Action: 1) gather input from stakeholders; 2) meet with stakeholders regularly to address concerns, give updates, and gain input on caribou management issues; 2) initiate a cooperation agreement between the Quebec and Newfoundland and Labrador governments to strengthen a working and cooperative relationship.  
  Rationale: The GRCH crosses provincial boundaries, is harvested in First Nations traditional territories, and is used as a resource by local hunters and outfitters. Cooperation by all of these stakeholders is critical to the success of a management strategy.

- **Communication and Education**  
  Action: Develop a series of public outreach materials to be distributed within communities affected by the GRCH to; 1) provide updated information on research and management results, 2) solicit community input, 3) promote understanding and acceptance of management strategies, 4) encourage participation in projects that monitor the health of the herd, 5) improve the use of best harvest practices, 6) build a stronger relationship between communities and wildlife managers, and 7) instill a sense of stewardship.  
  Rationale: Increased support and cooperation from the public will help provide the best information for management actions. Support and involvement from the local people is critical to success of the management program.
4.0 Year 2 Activities

4.1 Biological Monitoring Activities—

- Purchase of rebuild services for 5 Lotek GPS/Iridium collars for adult GR caribou (3D), and 4 Lotek GPS/Iridium collars for yearling GR caribou (2D).
- Deployment of 10 bear collars (5 2D Lotek Iridium collars, and 5 Lotek Camera Collars (2 belonging to WD, 2 belonging to Caribou Ungava, and 1 belonging to QC)).
- Deployment of 30 adult collars on GR caribou (21 female and 9 male).
- Deployment of 12 expandable yearling collars on GR caribou (all female) during spring calving survey.
- Spring calf condition survey conducted June 5-8th, 2012
  - Thirty calves (11 male and 19 female) were captured, weighed, and had their cord status and hoof wear recorded. The average weight was 6.40 ± 0.20 (SE) kg, with males significantly heavier than females (average 0.88 kg more; t-test, p < 0.05). The average weight was similar to that the year before (6.26 kg) and is considered a healthy average weight.
  - Calf birth weight has been positively correlated with fall recruitment (calves/100 females; Couturier et al. 2009; data from 1978 – 2003). Although a linear regression fits (F = 16.84, P = 0.0005, R^2 = 0.43; using data from Couturier et al. 2009 and more recent, unpublished data), other factors affect both parameters. In 2011 the average calf birth weight was 6.26 kg and the fall recruitment was 17%. The slope of the regression line would have predicted a 2011 fall recruitment of 33%. In 2012 the average calf birth weight was 6.40 and the fall recruitment was 5.4%. The slope of the regression line would have predicted a 2012 fall recruitment of 40%. It is possible that this relationship is different when the population numbers are low, as is currently the case. Most of the data used to calculate this correlation was taken when population numbers were high or increasing. In fact, using only data from during the population decline (1994-2012), the strength of this relationship is lost (R^2 = 0.06).
- Census (July 12-13th, 2012)
  - A photo census was conducted jointly by biologists from Wildlife NL and Quebec’s Ministry of Natural Resources with funding from Tormagt Wildlife and Plants Co-Management Board, using the same method utilized to survey the GRCH in 1993, 2001, and 2010. This method relies on a large number of marked individuals in the population, and the formation of highly aggregated groups (a common behavior in July to seek relief from insects). Groups are photographed and the marked sample of collared caribou in the photographed groups is used to estimate the total number of caribou in the population.
  - Twenty two highly-aggregated groups were photographed and an additional 5 small groups were counted. A total of 22,725 caribou were photographed in highly aggregated groups, which included 84 of the 90 collared caribou. The corresponding population estimate in July was 27,600 with a 90% confidence interval of 24,900–30,400 animals. These results represent a 63% population decline since 2010, and a 96% population decline since 1993.
o A news release was made on August 16th, 2012, stating the results of the census, the continued decline despite the harvest management measures, and the importance of working together to support long-term management measures for the future of the herd.

- Fall classification survey conducted Oct 23-25th, 2012
  o A total of 1796 caribou were classified
  o The percentage of calves in the population (5.4%) remains below the 15% suggested by Bergerud and Elliot (1986) as a minimum for population maintenance with little potential for growth.
  o Recruitment in terms of calves per 100 females was also low (7.4 calves/100 females) compared to historical classifications (Figure 1), and less than half that measured during the 2010 and 2011 classifications. Couturier et al. (2009) estimated that fall productivity must be 34 calves/100 females for the George River herd to be stable (under the assumption that adult survival is 0.87 (Crete et al. 1996) and current survival estimates are far below this value).
  o The % large males in the population measured during the 2012 fall classification (2.0%), indicates a sustained low since 2009 (Figure 2), while the sex ratio was estimated at 29 males/100 females.

- Five trips between May 23rd and October 27th to investigate a total of 23 collared caribou mortalities and retrieve all but one collar. Evidence of predation was found at 14 of the sites, 2 mortalities were identified as due to natural causes, 1 was identified as a hunter kill, and the collar was the only thing found at the remaining 5 sites.

- Survival rates are estimated from NL and QC collared caribou mortality from June 1st-May 31st annually using MARK. Although still below ideal, survival rates for adult females, adult males, and yearlings all showed a marked increase from 2011/12 to 2012/13 (Table 1).

- Health Monitoring
  Due to the hunting ban put in place for the 2012/13 season, samples and data to inform the health monitoring program was restricted that collected during live caribou captures. There was therefore no new information available regarding bone marrow fat percentages, age distribution via cementum analysis, or besnoitia density via skin samples. As no alarming infection levels were identified in the first year of the Labrador Caribou Initiative, no additional analyses were conducted for blood borne pathogens (Toxoplasma gondii, Neospora caninum, bovine herpesvirus-1, para influenza-3, bovine diarrhea, or west nile virus). It would be informative to run these analyses again within the next few years to monitor any changes in infection levels.

  o The average weight of adult females and males captured in the 2011/12 season was 97.6±1.9kg and 102.1±5.1kg respectively, and 98.0±2.4 and 111.3±10.0 kg respectively in the 2012/13 season. The average weight of GRCH females in April over the 70-90’s was 94.0±1.9 kg (Bergerud et al. 2008).
  o Assessing the level of besnoitia infection during live caribou handling is done by scoring the density of cysts seen in the sclera on a scale from 0-4. Over the first 2 years of the caribou initiative, besnoitia presence was confirmed in 2/3 caribou and the average infection level score was 1. Given this method of detection is less sensitive, these values correspond well with the 80% infection rate for 2011/12 calculated from skin samples. This is considered a very high prevalence for this
parasite, although the individual infection densities appear to be non-severe. There is still concern for population level effects of besnoitia on breathing, reproduction, and stress levels.

- Fecal samples were collected from 17 adult female caribou and sent to the Toronto Zoo for progesterone analysis. 82% of these samples came from pregnant females. This is a lower pregnancy rate than the previous three winters (86-87%). It is also expected that pregnancy rates estimated from captured caribou tend to be overestimates, as targeted females tend to be large, healthy individuals that fall to the back of the group. In 2012, the pregnancy rate of harvested animals was lower (74%) than that of captured animals (85%). Even so, an estimate of 82% is still below the 89% or greater generally required to support a stable or growing population.

- Purchase of cortisol, testosterone, and progesterone hormone concentration analysis services for 153 fecal and 267 hair samples. These results will feed into a collaborative research project examining the relationship between parasite load, stress levels, and reproductive success to gain further understanding on the effects of besnoitia at a population level. Sample analysis is ongoing.

### Predation Pressure

- **Wolves**
  Six wolves were collared during year 2 of the Labrador Caribou Initiative. All were adults except one sub adult female, and the body condition was said to be fair-excellent for all animals (no poor). The average weight was 35.1±2 kg, average total length was 1470±87 mm, and average chest girth was 658±25 mm. One female died 18 days after capture of unknown causes. The remaining 5 wolves had collars that malfunctioned 5, 7, 9, 120, and 190 days after deployment. The collar that lasted 190 days was a Telonics collar, while the other 5 were Lotek Iridium collars. During year 1, 4 wolves were collared (3 females and 1 male), but the male slipped his collar after 1 day. Overall, collaring efforts were fairly unsuccessful. Resulting wolf monitoring during 2 of the Labrador Caribou Initiative has been combined with that from year 1, and is summarized in Fig. 3. As demonstrated in Fig 3, collar deployments have been targeted at both the calving and wintering grounds for comparison or wolf home range size and behaviors between these two areas. Further efforts will be necessary to establish estimates of pack home range size and movement patterns across the vast GRCH range. Samples collected for wolves include hair, feces, and blood, which will permit analysis of DNA, stress levels, hormone production, parasites, and diet (no results to date).

- **Bears**
  Ten bears (6 males and 4 females) were captured during year 2 of the Labrador Caribou Initiative. All were adults except one sub adult male, and the body condition was said to be excellent for all bears except one male said to be ‘fair’ and one female said to be ‘poor’. The average weight for males (108.1±13.0kg) was significantly (P=0.01) higher than that of females (63.0±2.2kg). Average total body length was 1796.7±40.0 mm for males and 1590±22.7 mm for females, and average chest girth was 976.7±55.7 mm for males and 800±9.1 for females. Samples collected for all bears include a premolar, tissue, hair, and blood, which will allow determination of age, and analysis of DNA, stress levels, hormone production, and diet (no results to date). Five of the bears were fitted with Lotek Iridium 2D camera collars. These collars resulted in minimal success, with one collar being successfully recovered with video footage, one collar being recovered
with successfully recovered with one day of video footage, and the remaining three collars malfunctioning within ~1 month and were not recovered. Alternatively, the 5 bears fitted with Lotek Iridium 2D non-camera collars worked well for the duration of the year, and when combined with the minimal locations recorded from the camera collars, illustrate the home-range dynamics of bears close to the GRCH calving grounds. The resulting movement pattern of males vs. females is quite striking, males moving an average 2.5 km/day more than females (Fig. 4). These efforts will continue in Year 3.

4.2 Population Projections-

- In Year 1, population projections from the 2010 census onwards estimated there would be 30,000 animals in the GRCH in fall 2012. In Year 2, the census put the herd at 27,600 animals in July 2012, confirming the continued decline and increasing the degree of severity of that decline.
- Adult survival and calf recruitment rates suggested that the 2012 fall population would be 24,362; stated in the August 2012 press release as below 25,000 animals.
- A simple model based on herd demographics and mortality rates was used to project the population size to fall 2013 and 2014 (using some data collected in Year 3). Assumptions for the simple model included:
  - Calf recruitment to November of 0.054 in 2012 and 0.07 in 2013.
  - Rate of adult survival of 0.80 across all cohorts except calves.
  - An additional 1000 adult mortalities per year due to illegal harvest.
- Estimates for fall 2013 and 2014 were approximately 19,739 and 15,723 GR animals respectively (Fig. 5).
- Regardless of model or parameter manipulation, the GRCH continues to be in a severe state of decline. Manipulations of parameters such as parturition rates, recruitment rates, or age of 1st reproduction have little effect on the overall results of models and just provide varying degrees of severity to the decline. Adult mortality appears to be the most significant parameter driving the severity of the decline.
- Given the hunting ban review scheduled for fall 2014, a public pressure may exist for a July 2014 census, despite the fairly accurate population projection history with intensive indicator/parameter monitoring.

4.3 Community and Stakeholder Engagement—

- Brochure
  In an effort to provide feedback to hunters who participated in the 2011-12 GRCH health monitoring program, share results and information with the public, and encourage participation in harvest returns in the future; a health monitoring results brochure was prepared (Appendix B). The brochure included stats on participation, the winners of the hunter return prizes, hunter success rates, pregnancy estimates, body condition information, the age distribution of harvested animals, an introduction to besnoitia and its prevalence in the population, blood pathogen levels, and a short summary of hunters’ comments. 2000 brochures were printed and they were mailed to all caribou license holders (with animal-specific results if they were a participant). Remaining brochures were circulated to government offices and stakeholders for distribution. Feedback was positive.
**T-shirt initiative**

To spread awareness and increase dialogue surrounding GRCH stewardship, a plan was made to engage all stakeholders in the creation of a t-shirt using a drawing introduced at the 2011 Arctic Ungulate Conference (Appendix C). Although developed by the Wildlife Division, the project was implemented through a contract to Intervale Associates Inc. to ensure maximum participation among stakeholders through a coordinated sponsorship. During Year 2 of the initiative, the agreement was put in place with Intervale, the invitation to participate was drafted, the participants were selected, and the t-shirt was designed. Year 3 will see the mailing of invitations to the stakeholder groups, hopefully the participation of all groups, the purchase of t-shirts and the distribution of those shirts to the public. The Wildlife Division intends to see shirts used as prizes for a stewardship contest within Labrador schools, while we look forward to seeing the shirts distributed by other means through other stakeholder groups.

**Stakeholder Meetings**
- Individual George River Caribou Stakeholder Consultations took place with NunatuKavut, Nunatsiavut, and Innu Nation on April 17th, 18th and 19th respectively. These consultations included Wildlife staff, as well as the Senior Negotiator and Director of Intergovernmental and Aboriginal Affairs.
- The GRCH Advisory Committee met on June 27, 2012 in Goose Bay. Attendees included representation from Wildlife NL, Nunatsiavut, Nunatuavut, Torngat Secretariat, Torngat Wildlife and Plants Co-management Board, NL Outfitters Association, and Labrador and Aboriginal Affairs. A summary of the information exchanged during this meeting can be found in Appendix D.
- The Hunting, Fishing and Trapping Coordinating Committee, along with the Nunatsiavut Government and the Torngat Wildlife Plants & Fisheries Secretariat hosted the “Declining Caribou: Shared Concerns, Shared Solutions” Migratory Caribou Workshop in Montreal September 11-13, 2012. A presentation was made on behalf of Wildlife NL by the Senior Manager of Habitat, Game and Fur. Additional representation present included the Divisional Director and a Wildlife Biologist from the Labrador office. The presentation and workshop proceedings can be found in Appendix E.

### 4.4 Harvest Monitoring Activities –
- During Year 2, 2 adult female caribou that were collared by WD were shot by hunters and the collar was returned, and 3 caribou collared by QC were shot by hunters.
- There was no legal harvest of GRCH animals, so harvest monitoring by Wildlife staff was greatly reduced in Year 2. Illegal harvest estimates were made by recording information gathered via word of mouth from the public, enforcement officers, the media, or through direct observation during field work. Despite the hunting ban, it is estimated that > 2% of the herd was harvested between Dec 3rd 2012 and March 15th 2013 (Table 2).

### 4.5 Harvest Management Actions –
- On August 2, 2011 the Minister of ENVC delayed the start of the 2011-2012 GRC hunting season until further assessment and consultations.
- The GRCH season then opened on 20 December, 2011.
On January 28th, 2013, the Minister of ENVC announced an immediate ban on all caribou hunting in Labrador for conservation purposes for a period of five years, with a review after two years.

The Quebec Government implemented changes for the 2011-2012 season, including a 50% reduction in outfitter permits, subdivision of Zone 23 into a W/E sections, so that the George River and Leaf River herds could be managed separately; closure of sport hunting in the S section of Zone 23; limitation on sport hunting in Zone 24; a reduced season in the Eastern section of Zone 23; and closure of sport hunting in 2012-2013 in the Eastern section of Zone 23 and in Zone 24, subject to the biological information collected in 2011-2012.

The Quebec sport hunt was closed for 2012-13, and the aboriginal groups reiterated their commitment to harvest monitoring.

5.0 BUDGET SUMMARY- YEAR 2

<table>
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<tr>
<th>George River Caribou Initiative Budget - Year 2</th>
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<td>Collar data acquisition</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$522,000</strong></td>
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REFERENCES


Table X- Survival Estimates for 2011/12 and 2012/13 caribou biological years with sample size and 95% confidence intervals.

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<tr>
<th>Survival</th>
<th>June 1&lt;sup&gt;st&lt;/sup&gt;, 2011- May 31&lt;sup&gt;st&lt;/sup&gt;, 2012</th>
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<td>Adult F</td>
<td>Adult M</td>
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<td>0.75</td>
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<td>Sample Size</td>
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</table>

Table X- Estimated number of George River caribou harvested by user group, 2010-11, 2011-12, and 2012-13.

<table>
<thead>
<tr>
<th>Harvest Group</th>
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<th>2011-12</th>
<th>2012-13</th>
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<tbody>
<tr>
<td>Labrador Innu</td>
<td>500</td>
<td>430</td>
<td>254</td>
</tr>
<tr>
<td>QC Aboriginal Groups</td>
<td>300</td>
<td>700</td>
<td>250</td>
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<tr>
<td>Labrador License Holders</td>
<td>250</td>
<td>493*</td>
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<tr>
<td>NG Beneficiaries</td>
<td>1370</td>
<td>360</td>
<td>0</td>
</tr>
<tr>
<td>Labrador Outfitters</td>
<td>80</td>
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<td>0</td>
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<tr>
<td>QC Sport Harvest</td>
<td>360</td>
<td>260</td>
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</table>
| **Total**              | **2860** | **2243** | **594** **

*Includes 12 E license holders
**Reported harvest of ~92 Sedentary Caribou not included
Fig 1- Average calves/100 females during fall classification surveys for the GRCH, 1973-2010, and calves/100 female estimates for 2010, 2011, and 2012.
Fig 2- Percentage of Large Male Caribou seen in the George River Fall Classifications from 2001-2012.
Fig 3- Results of wolf collaring efforts over the first two years of the Labrador Caribou Initiative; monitoring locations recorded between April 1st 2011 and March 31st 2013.
Fig 4- Results of bear collaring efforts over the first two years of the Labrador Caribou Initiative; monitoring locations recorded between April 1st 2011 and March 31st 2013.
Fig 5- George River Caribou Population Estimates 2001-2014 (Simple model based on herd demographics and survival estimates). Herd survival estimated as 0.83 from 2000-2009, 0.62 from 2010-2012, and 0.80 for 2013 and 2014. Diamonds mark census years and circles represent future population projections of 19,739 in fall 2013 and 15,723 in fall 2014.
APPENDIX A

Labrador – Work Plans 2012/13

Project Title:
Labrador Caribou Initiative – George River Caribou Herd

INTRODUCTION
Project Title: Labrador Caribou Initiative
Leader: Shannon Crowley, David Elliot, Sara McCarthy
Funding Level: $522,000
Purpose: To monitor, investigate, and manage for the long-term sustainability of the George River caribou herd (GRCH).

GOALS AND OBJECTIVES
To recover the GRCH from a declining to an increasing population and to ensure the long-term sustainability of this valuable resource for future generations.

The objectives of this work are:
- To monitor GRCH demographics, survival, body condition, and range and habitat use through time and investigate biological factors affecting changes in these indicators of herd health and population trends and size.
- To monitor harvest trends by resident and non-resident hunters, outfitters, commercial operators, and aboriginal groups.
- To consult with all interest groups and initiate the formation of stakeholder working groups, advisory boards, and technical committees for both the short- and long-term management of the GRCH.
- To identify and implement harvest management plans and actions for the conservation and continued use of the GRCH.
- To investigate causes of mortality for different caribou age and sex classes.
- To conduct education and stewardship activities for the conservation of the GRCH.

STATUS
The GRCH has declined from an estimated 776,000 in 1993 to an estimated 385,000 in 2001. A post calving photo-census in July 2010 shows a continued and accelerated decline with an estimated herd size of 74,000. Although it has been determined that the GRCH has undergone a substantial decline over the last decade, the reason for this decline is not fully understood. One reason for this lack of understanding is the deficiency in information related to the current range utilization and demographic parameters of the population. In addition, it is clear that the success of a management plan for the declining GRCH will depend on the cooperation and participation of all stakeholders.

APPROACH AND DELIVERY
A comprehensive plan for the conservation and management of the GRCH needs to incorporate scientific research, community involvement and support, management and regulations, and education. Activities in the 2012-2013 fiscal year include (please see more detailed individual work plans that are not part of GRCH regular monitoring activities following this document):

Caribou survival, distribution, movements patterns, and fidelity
Action: 1) Continue monitoring satellite and satellite/GPS collared caribou and increase the number of active collars deployed and monitored in the GRCH and to ensure that collars are representative of all age/sex cohorts in the population.

Rationale: Survival estimates are an indicator of herd health and population trends. Movement patterns, distribution, and fidelity provide information necessary for developing research objectives, informing management actions, and guiding the efforts of population and classification surveys. Increasing sample size will make any measured parameter more reliable, reduce scientific and statistical scrutiny, and strengthen the credibility of conclusions based on the data.

Calf weights and calf survival from birth to fall
Action: 1) Record presence of calf with collared females and attach ear tag proximity sensor to calf to record survival. 2) Record birth weights of calf caribou on calving grounds in the spring.

Rationale: Calf survival and calf weights are key indicators of herd health and population trends.

Calf survival and adult sex ratios
Action: 1) Conduct annual fall classification surveys for the GRCH and collar calves in fall.

Rationale: Calf ratios provide a measure of summer survival and both sex and calf ratios are an indicator of population health and trends. Collared calves provide information on fall to spring survival and provide known age animals in study sample.

Harvest monitoring, caribou body condition, and age structure
Action: 1) Increased monitoring efforts of all caribou harvesting groups. 2) Design and implement community monitoring efforts to monitor caribou harvest numbers and demographics, body condition, diseases, pregnancy rates, harvest locations, and environmental conditions. 3) In cooperation with aboriginal groups, use a combination of local representatives/monitors, interviews, surveys, and direct observations common to social science research to gather and analyze data on the harvest of the GRCH. 4) Annually collect jawbone, lower leg, and kidney samples from harvested caribou in the fall to assess body condition by running a public awareness campaign and creating drop-off locations for samples. 5) Collect tissue and organ samples to assess parasites and diseases. 6) Teeth will be sectioned and aged as an indicator of population trends.

Rationale: Body condition affects caribou survival and is an indicator of population health and trends. Harvest levels can have a direct impact on the herd and reliable data on hunting mortality is critical for making management decisions.

Predation Studies
Action: Deployment of satellite collars on wolves in GRCH wintering grounds and on both black bears and wolves on calving grounds.

Rationale: A large knowledge gap exists regarding the cause and degree of various mortality factors in the GRCH. Investigations into mortality factors such as predation on both caribou calves and adults is needed to inform population modeling and management, to understand the nature of the GRCH decline, and to gain insight into the ecology of wolves and black bears on the GRCH calving grounds.

Stakeholder participation
Action: 1) Create a GRCH working group that would meet regularly to address concerns, give updates, and provide recommendations on caribou management issues. 2) Initiate a cooperation agreement between the Quebec and Newfoundland and Labrador governments to create a GRCH Technical and Administrative Committee. 3) Consultations with individual stakeholders of the GRCH.

Rationale: The GRCH crosses provincial boundaries, is harvested in First Nations traditional territories, and is used as a resource by local hunters and outfitters. Cooperation by all of these stakeholders is critical to the success of a management strategy.
Photographic census
Action: To derive an updated population estimate for the George River Caribou Herd to assist in future management decisions.
Rationale: Although the most recent census was conducted only two years ago, survival/mortality rates of collared caribou, fall cow:calv ratios, and anecdotal evidence from various groups indicate the population decline is ongoing and possible more severe than previously thought. An updated estimate of the GRCH population will allow both provincial managers to determine the appropriateness of existing management strategies for the GRCH and inform future management decisions, such as the potential establishment of a Total Allowable Harvest (TAH).

Communication and Education
Action: 1) Hold a series of public outreach workshops in communities affected by the GRCH before the start of every hunting season. The purpose of these workshops would be to provide updated information on research and management results, solicit community input, promote understanding and acceptance of management strategies, encourage participation in projects that monitor the health of the herd, improve the use of best harvest practices, and to build a stronger relationship between communities and wildlife managers 2) Reports, posters, brochures, placemats and other educational materials developed and disseminated regularly.
Rationale: Increased support and cooperation from communities will help provide the best information for management actions. Support and involvement from the local people is critical to success of the management program.

Computer modeling
Action: Continue the development of a caribou population model that can be used to predict the effects of harvest on the herd.
Rationale: This model will serve as an important management tool to predict long-term trends at varying harvest levels and to demonstrate the effects of harvest to all user and interest groups.

Budget: (Year 2)

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<th>Item</th>
<th>Cost</th>
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<td>GPS and Satellite based collars</td>
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Schedule of Activities:

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Cow/Calf Collars

Major Collaring Effort X X X X

Photo-census X

Harvest Monitoring X X X X X X X

Development of GRCH working group and stakeholder consultations On-going

Education and Stewardship On-going

DELIVERABLES
• Telemetry database of filtered and pre-processed spatial data.
• Determination of the causes of mortality and rates for collared caribou.
• Delineation of the current range and habitat use of the GRCH.
• Estimates of calf recruitment, demographics, and cohort specific survival rates.
• Continued development and refinement of population model to predict future population trends and numbers.
• Photographic census of George River caribou herd
• Studies of impacts of predation on George River caribou on calving and wintering grounds
• Continued meetings of Labrador GRCH advisory group
• Consultations with aboriginal communities in Labrador and Quebec
• Stewardship and education materials, presentations, and workshops.
• Continued work on management plan for the George River caribou herd.

Labrador – Work Plans 2012/13

Project Title:

George River Caribou Herd (GRCH) Post calving Aerial Photo census

INTRODUCTION

Project Title: George River Caribou Herd (GRCH) Post calving Aerial Photo census Leaders:
Labrador- Shannon Crowley; Quebec- Vincent Brodeur (MRNF)

Funding Level: $60,000: Labrador Caribou Initiative

Purpose: To derive an updated population estimate for the George River Caribou Herd to assist in future management decisions.

GOAL AND OBJECTIVES

Goal: To conduct a post calving aerial (helicopter) photo census of the GRCH between 5 and 25 July 2012 to provide an updated population estimate of the herd for management purposes. These efforts are in collaboration with the province of Quebec, the IEMR, the Nunatsiavut Government, and the Torngat Secretariat Wildlife and Plants Co-management Board and other partners.

Objective: Information obtained through these processes will be used to evaluate the appropriateness of existing management strategies for the GRCH, and inform future management decisions. Additional demographic parameters will be and have been collected to input into the census extrapolation model required to be used in deriving an accurate population estimate.
- Survival rates estimated from collared adult female, adult male, and yearling caribou.
- Newborn calf weights.
• Body condition of harvested caribou.
• Fall cow:calf ratios, % calves and % adult males.
• Total number of collared caribou alive and total number located and photographed during census.

CURRENT CONDITIONS

The three previous censuses on the GRCH were conducted cooperatively between Québec and Labrador in 1993 (775,000 animals), 2001 (385,000 animals), and 2010 (74,000 animals). For all three surveys, field work was conducted from Outfitter Camps in Québec and from the Wildlife Division’s Hebron field camp in Labrador. The 2012 census will again be in collaboration with Québec. Although the most recent census was conducted only two years ago, survival/mortality rates of collared caribou, fall cow:calf ratios, and anecdotal evidence from various groups indicate the population decline is ongoing and possible more severe than previously thought. Harvest numbers of collared caribou during the 2011/2012 Labrador caribou hunting season indicate that mortality due to hunting may be becoming increasingly additive. An updated estimate of the GRCH population will allow both provincial managers to determine the appropriateness of existing management strategies for the GRCH and inform future management decisions, such as the potential establishment of a Total Allowable Harvest (TAH). In the event a TAH is set, a current population estimate will be necessary to establish appropriate harvest levels.

APPROACH and DELIVERY:

The post calving photo census is critically dependent on the number of PTTs randomly deployed in the GRCH. As part of increased monitoring of GRCH, and additional 59 satellite collars were deployed on GRCH this winter (50 WD, 9 MRNF). Additionally, 12 – 15 collars will be deployed on yearling caribou during the June 2012 calving survey. This will increase the number of active (collar is working correctly and animal is alive) collars on GRCH to approximately 90 (anticipating some mortality prior to July 2012) for the 2012 census (71 collars were active for the 2010 census). This large satellite collar sample will facilitate the identification of the photo census survey area and provide annual survival estimates of adult females, males, and yearlings and seasonal range distributions. Logistical plans from the 2010 census will be used to implement the 2012 census. Additional fuel caches were set up during winter 2012 in the area where the census will likely take place. Field work for the post calving aerial photo census will take place between 5 July and 25 July 2012, coordinated by the NL Wildlife Division in cooperation with a Québec field team. Following field work, individuals will be identified to examine the photographs from the census, count caribou in the photographs, and organize and analyze data. Preliminary results should be available by late summer 2012. Final results will be available following the fall 2012 classification survey. Data from the fall classification is necessary for final calculation of a population estimate.
Labrador – Work Plans 2012/13
Project Title:
George River Caribou Health Monitoring Program

INTRODUCTION
Leaders: Shannon Crowley, David Elliot, Sara McCarthy
Funding Level: $30,000- Labrador Caribou Initiative
Purpose: To monitor the health and status of animals harvested from the George River caribou herd (GRCH), in order to further direct research questions and manage for long-term sustainability for the population as a whole.

GOALS AND OBJECTIVES
To monitor the health and body condition of the GRCH, while identifying potential factors in the population decline, such that its nature can be understood and managed appropriately.

The objectives are:
1) To assemble caribou health monitoring hunter sample packs and distribute them for use by all hunter groups.
2) To collect completed sample packs from hunters in order to estimate population pregnancy rates, body condition, age structure, disease rates, parasite rates, as well as environmental contaminant and stress hormone levels.
3) To promote hunter participation and cooperation in wildlife research initiatives through a prize draw for those who turn in completed sample packs.
4) To provide feedback and answers to participating hunters and the general public who have questions regarding program results and their harvested animals.

CURRENT STATUS
The GRCH has declined from an estimated 776,000 in 1993 to an estimated 385,000 in 2001. A post calving photo-census in July 2010 showed a continued and accelerated decline with an estimated herd size of 74,000. Although it has been determined that the GRCH has undergone a substantial decline over the last decade, with density dependent effects and high predation rates playing a role, all the factors in this decline are not fully understood. Estimations of herd health in terms of pregnancy rates, body condition, age structure, disease rates, parasite rates, and environmental contaminant/stress hormone levels were first empirically attempted under this initiative in the 2011-2012 season. Continuing with these estimates will improve our understanding of the decline and how best to manage the population for recovery. Many participating hunters have shown interest and curiosity in the health and age of their harvested animals, but there has not been a good history of getting information back to them, nor to the public as a whole.

APPROACH AND DELIVERY
Sample Pack Assembly, Distribution, Collection, and Prize Draw
Sample packs will include a pencil, an 8X10 envelope, a data sheet on write in the rain paper, a letter to hunters with instructions, 2 garbage bags, a 12 lb freezer bag, a ziplock, 5 hubo blood strips, and a No. 5 coin envelope. Once assembled, they will be distributed to all caribou license vendors, as well as to Nunatsiavut conservation officers and Innu guardians. Completed sample pack drop-off locations will be
set-up within each hunting community and arrangements will be made with contacts to keep received packs frozen. Frozen samples will be shipped to the wildlife division at the end of the season, or picked up directly by wildlife staff. The prize draw will occur a month after the close of the hunting season, and the winners will be announced in a press release, as well as on CBC radio.

Data Collection and Analysis
Information on harvested animal sex ratios and kill locations/dates will be collected directly from data sheets. Fecal samples will be sent to the Endocrine Lab at the Toronto Zoo for analysis of hormone levels, including stress and pregnancy-related hormones. Measurements will be taken from jawbones for information on body condition, before they are boiled, and a tooth is removed. These teeth will be sent to the Matson Lab in Montana for sectioning and ageing. Metatarsal length will be measured for relation to body condition, hair will be plucked from the leg bone to be stored at the wildlife division for DNA cataloguing, skin will be sampled and analyzed for besnoitia cysts by the Kutz lab in Calgary, and the bone marrow will be sampled for fat index analysis in-house. Blood strips will also be sent to the Kutz lab for disease/parasite analysis.

Production of Results Pamphlets
Population pregnancy rates, body condition, age structure, disease rates, parasite rates, and stress hormone levels will be summarized for the 2012-2013 hunting season and presented in a small pamphlet available online and at the wildlife division. Pamphlets will hold an empty space to affix stickers containing animal-specific results, to be mailed to all hunters who participated in the caribou health monitoring program.

Budget:

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Deliverables
1) Estimates of biological parameters important for population modeling.
2) Further understanding of the factors driving the continued population decline.
3) Report/pamphlets summarizing health monitoring program findings for the public and participating hunters.
INTRODUCTION

Leaders: Shannon Crowley, Sara McCarthy, David Elliott; Partnership with Quebec Government and Lavalle University

Funding Level: $78,000

Purpose: Exploratory pilot project to investigate predator kill rates on George River Caribou during the calving/post-calving season via analysis of collar locations.

GOALS AND OBJECTIVES

Determine the feasibility of estimating wolf and black bear predation rates, as well as George River Caribou Herd (GRCH) mortality rates, during the calving/post-calving season for input into management oriented population models.

The objectives are:

5) Maintain a minimum of 50 active satellite collars on GRC.
6) Outfit new born calves with UHF ear tags that communicate with their mother’s proximity collars.
7) Deploy new Lotek Iridium collars on wolves and black bears in the GRCH calving/post-calving range.
8) Real-time monitoring of wolf, black bear, and adult female/calf caribou locations to identify locations of mortalities or potential kills via cluster analysis.
9) Prompt ground-investigation of mortality signals and location clusters to identify predator species and/or prey age-class/sex.
10) Establish estimates of caribou mortality and predator kill rates, and employ these newly estimated parameters to inform future population projections and management strategies.

CURRENT STATUS

A post-calving census of GRCH in July 2010 indicated the current size of the population at 74,131 animals, a marked decrease from the previous estimate of 385,000 in 2001. Poor recruitment and mortality rates estimated from fall classification surveys and collar data indicate a persistent decline in population size. Observations of healthy adult caribou with good body condition and average calf birth weights, as well as frequent wolf and caribou kill sightings, point towards predation as a major factor in this continued decline. Quantifying the magnitude of this pressure and gaining an understanding of the related covariates would improve our ability to effectively direct conservation efforts and create sustainable management initiatives.

UHF calf ear tags have not yet been used in Labrador. GRCH calf mortality rates over the first month of life have not been monitored directly. Fall classification surveys in October have monitored recruitment rates, but unknown pregnancy and parturition rates have limited our ability to infer mortality rates from this data.

The wildlife division has purchased 15 Lotek Iridium 2D predator collars to be deployed on wolves and black bears found within the calving grounds of the GRCH. Little is known about the abundance and basic ecology of wolves and black bears in Northern Labrador, including their range overlap with the GRCH, their movement patterns during the calving/post-calving season,
and most importantly, their predation rates on calves and adult caribou during this vulnerable period.

**APPROACH AND DELIVERY**

Field work for this research will be based out of Hebron cabin beginning in the last week of May and continuing to the end of June. An A-star B2 helicopter equipped with a sliding door will be necessary for captures, while a Long Ranger helicopter can be used for mortality and cluster investigations.

Remaining caribou collars are to be deployed under the pre-existing GRCH 2012 Winter Collaring Work Plan, and in May/June 2012 if necessary. Caribou will be captured using a net-gun deployed from a helicopter. 50 of these adult caribou collars are Lotek Iridium collars, which can be programmed remotely. This will allow us to increase location intensity during the calving/post-calving season, such that mortality events can be promptly identified and investigated, and then to decrease location intensity at the end of the season, to prolong battery life.

New born calves will be UHF ear-tagged, weighed and measured during the annual calving survey beginning during the last week of May. Additional efforts will be necessary for this year’s survey to mark and sample calves of previously collared females, or calf-female pairs, as opposed to random calves. As in the past, the intention will be to capture equal numbers of female and male calves, and those selected for capture must be as young as possible (not running quickly), as they will be captured by hand. The helicopter will land 50 meters from the calves, and handling time will be less than 2 minutes. Female’s collars will then be remotely reprogrammed to detect their calf’s UHF frequency.

Predators will be captured opportunistically, guided by surveying transects of the calving grounds. Wolves will be captured via net gun when conditions permit, otherwise both wolves and bears will be anesthetized with Telazol. Anesthetic will be delivered via pneu-dart injection system from a hand pistol into the rump of the animal. Wildlife staff will collar, ear-tag, sample (blood, hair, and feces), and take measurements of the predator prior to their release. Efforts will be made to collar representative numbers of both sexes, as well as a range of age classes. These collars are also remotely programmable, and will be made to record and transmit locations at a very high frequency during this intensive monitoring period. As they are equipped with remote release capabilities, predator collar retrieval will not require recapture of wolves and black bears.

Wildlife staff on the calving grounds will closely monitor all collar locations/signals for evidence of caribou mortalities and predator location clusters. This will be possible via the use of a remote internet modem, and frequent location fixes and messages, and will run until the end of June. Criteria warranting predator location cluster investigation has yet to be determined, but will be based on existing research across North America. A Long Ranger helicopter will be available for immediate site investigation once a mortality or cluster has been identified. Once on site of a caribou mortality investigation, staff will identify the cause of death through observation of feces, fur, the predator itself, or the nature of the kill. In the case of predator location cluster analysis, staff will examine the area to determine whether the site was used simply for resting, or was actually the location of a calf or adult caribou kill. After the end of June, there is the potential to continue the study from Goose Bay, with weekly trips to the calving grounds to investigate mortality/cluster sites.

Once field work is complete, staff will be able to calculate calf mortality rates over their first month of life, adult mortality rates, and provide a breakdown of mortality causes. Estimation of wolf and black bear kill rates will be possible, and we will also be able to establish criteria upon which to define predator location clusters as calf or adult caribou kill sites. This will greatly
increase our monitoring potential in the future. From these estimates will come better informed and more comprehensive caribou population models and associated management strategies.

**Budget:**

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<tr>
<td>Satellite Internet Access</td>
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<td>Helicopter Time</td>
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<tr>
<td>Fuel</td>
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</tr>
<tr>
<td>Incidentals</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$78,000</strong></td>
</tr>
</tbody>
</table>

**DELIVERABLES**

1) Telemetry database of spatial data on wolf and black bear distribution and movement within the GRCH calving range.

2) Estimation of predation rates on caribou calves and adults.

3) Improved understanding of wolf and black bear ecology in a relatively undisturbed system.

4) Criteria for remote evaluation of predator location clusters for future monitoring of kill rates.
Parasites and Disease

Eighty-six percent of successful hunters did not detect parasites. 14% noted besnoitia cysts in the eye and early fly larvae under the skin, among others.

Researchers at Laval University analyzed skin samples from metatarsal bones for besnoitia cyst prevalence, and 80% of the caribou tested positive. This is an extensive jump in the 2007-2008 besnoitia prevalence estimate of 15.8% for the GRCH and 28% for Leaf River caribou. Effects of besnoitia at a population level are unknown, but a high density of cysts can cause hair loss, create lesions, and lead to cracks in the skin resulting in infection, breathing obstruction, and possible male infertility. Average density was 1.08 cysts per cm² of metatarsal skin, with a large standard deviation (1.16). Further work is being conducted to better understand the effects of besnoitia on the GRCH.

Caribou meat from besnoitia-infected animals is thought to be suitable for human consumption, provided the meat is cooked well. Do not feed infected meat to dogs.

For more information on the GRCH, please contact the Wildlife Division at (709) 806-5107.

Hunters’ Comments

Five recurring themes were:
- very few caribou were seen
- many hunters and snowmobiles were on the land
- caribou were being disturbed and injured by some hunters
- body condition appeared generally good
- evident support for increased conservation and harvest restrictions

Effect of besnoitia at a population level are unknown but a high density of cysts can cause hair loss, create lesions, and lead to cracks in the skin resulting in infection, breathing obstruction, and possible male infertility. Average density was 1.08 cysts per cm² of metatarsal skin, with a large standard deviation (1.16). Further work is being conducted to better understand the effects of besnoitia on the GRCH.

Blood filter paper strips were tested for several known caribou pathogens. Overall, no alarming blood pathogen infection rates were identified.

Pathogen | Effects | Results | Conclusion
--- | --- | --- | ---
Trichostrongylus | Abscess, anemia, lameness, death | 0% positive | Much lower than in Western herds
Besnoitia | Abortion, meningitis, necrotic | 0% positive | Below infection levels found in Alaska and Japan
osteitis | Abscess, osteonecrosis, calciific | 14% positive | Similar to 2003-04 results (4%) and lower than in Western herds (65%)
Protozoa | Respiratory disease leading to pneumonia | 0% positive | Similar to 2003-04 results (4%)
E. coli | Abortion, diarrhea, renal failure, death | 20% positive | Same as 2003 prevalence rate in herds across the Arctic
Wet nasalitis | Convulsions, death | 0% positive | Not currently a concern

Example of incorrectly and correctly third blood filter paper sample strips. Incorrectly filled strips cannot be used for diagnostic testing. Care must be taken to fill the strip of the way from the tip to the base. Photos courtesy: The Sea Duck Joint Venture

The Wildlife Division thanks all GRCH Health Monitoring Program participants, especially the Tanguay Wildlife, Plants and Fisheries Secretariat for their great contributions to sample analysis. Continued participation in research and management will be vital to population recovery.

Newfoundland Labrador Environment and Conservation
The George River Caribou Health Monitoring Program was initiated for the 2011-12 hunting season in an effort to better understand factors that might be contributing to the severe population decline. A sample-collection kit was included with the sale of all resident and Nunatsiavut 12E caribou licences. Hunters were asked to record data and collect jawbone, metatarsus, blood, and fecal samples during their hunt. Successful hunters who turned in their completed sample packages (188) were entered in a draw for prizes. Hunters who did not turn in a sample package were contacted for a telephone survey. With sample package and survey efforts combined, data was collected from 89% of the licences sold. This brochure is a summary of the analysis results to date; there are still some disease, hormone, and DNA analyses yet to be completed.

**Results**

An estimated 19% of licence holders did not hunt, 35% hunted but were not successful, and 32% harvested a caribou. This translates into an overall hunter success rate of 60%. Female caribou accounted for 69% of the reported 2011-12 GRCH harvest.

**Pregnancy**

Hunters who harvested a female caribou were asked to note the pregnancy status of their animal by checking for a fetus in the womb and to collect fecal samples, which scientists at the Toronto Zoo's reproductive biology laboratory used to conduct pregnancy tests. Interestingly, pregnancy rates differed greatly between those estimated in the field (44% pregnant) versus those tested in the lab using hormone analysis (74% pregnant). This result highlights the difficulty of identifying a fetus in the early stages of pregnancy, especially in the freezing cold! Sample collection is a quick and easy way to get precise results. Given that a pregnancy rate for caribou of 80% or greater is generally required to support a stable or growing population, this year's GRCH rate indicates further population decline.

**Bone Marrow Fat Analysis**

Bone marrow extracted from the metatarsus was analyzed for fat content, an indicator of body condition (see graph, right). The average bone marrow fat score was 86.2% ± 11.6, and was not significantly different between males and females. This value is higher than bone marrow fat percentages found for calving (63.1%) and weaning (84.3%) female George River Caribou from 2007-2009.

This suggests most female caribou were able to avoid serious and detrimental body fat loss during the winter, since bone marrow fat is a last fat reserve to be used up by the animal's body.

More sensitive indicators of body condition, such as kidney or back fat, may be looked at in the future to identify more subtle changes in body condition.

**Age**

Determining a caribou's age in the field is difficult, even for individuals trained in aging animals based on the degree of tooth wear.

Surveyed hunters were asked to specify whether they harvested a calf, yearling or adult. Results showed the harvest was 8% yearlings and 92% adult animals. The age distribution of caribou harvested this season was further broken down using cementum analysis of teeth pulled from lower jawbones submitted by hunters (see graph, below).

Monitoring the age distribution of a population can indicate if the population is getting older or younger, which has many implications regarding recruitment, productivity, and age-specific survival. The 2011-12 data shows relatively high harvest of younger animals.
APPENDIX C

GRCH Stewardship T-Shirt Design
APPENDIX D

Information update provided after the GRCH Advisory Committee meeting
The information contained in this update reflects data and discussions presented at the George River Caribou Herd Advisory Committee meeting held in Happy Valley-Goose Bay on June 27, 2012.

Current Population Projection*

The George River Caribou Herd (GRCH), along with other migratory caribou herds across North America, experiences large-scale population fluctuations over extended periods of time.

Since the early 1990s, the GRCH has been in decline. Recently the decline has been occurring at an alarming rate, as confirmed by population censuses completed in 2001 and 2010. Results from monitoring other indicators of herd health, including calf recruitment, percentage of large adult males, and adult mortality, confirm the decline is significant and continuing.

Collared adult caribou annual mortality rates have been estimated to be at or above 30% over the past four years (2012). As of June 2012, mortality rates and calf recruitment estimates projected a population of fewer than 30,000 animals in Fall 2012.

An annual harvest of 2,500 animals can have huge consequences at such population lows, with a herd size difference of around 47% after only five years of harvest.

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* The information contained in this update reflects data and discussions presented at the George River Caribou Herd Advisory Committee meeting held in Happy Valley-Goose Bay on June 27, 2012.
Estimated Harvest

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<th>Harvest Group</th>
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*2011/2012 still being updated  
**combined 12E & regular licences

The Labrador resident/12-E license phone survey has been almost completed and was successful in contacting 88% of licence holders.

There were a total of 678 provincial resident and 271 Nunatsavut 12-E licences sold in 2011-2012. It was found that 21% of license holders did not hunt, and of those who did, success was around 68%. The total harvest estimate was 493 caribou, with the minimum being 433 and the maximum being 544.

2011-2012 showed a different trend in harvest pattern, with more animals harvested in January, while in 2010-11, harvest increased towards the end of the season. This reflects a difference in herd movement, location, accessibility, and weather from year to year. Females constituted 69% of the harvest.
The Caribou Health Monitoring Program has had a very successful first year, with 197 sample packages returned, resulting in 179 jawbones, 178 leg bones, 132 fecal samples, and 110 blood samples. This represents a 38% sample package return rate from the estimated number of caribou harvested. Results from these data sheets and samples will provide information on pregnancy status, stress levels, parasite levels, aging, body size, and body condition indices. Results are expected by the end of November 2012.

Hunters noted parasites in 14% of the animals, including besnoita, stout, and flukes (in decreasing prevalence).
Field Work

Spring 2012 involved many field work efforts, including gathering body condition information from 30 newborn calves. An increasing mean calf body weight trend is one of the few positive indicators of herd recovery potential. Above 6 kg is considered a threshold to reach a minimum necessary recruitment of around 35 calves per 100 females.

Collar Deployment

Sixty-five collars were active as of June 27, 2012. New iridium collars provide many benefits over the older Argos models, such as real-time locations and more efficient mortality investigations.

New collars allow Wildlife staff to quickly identify dead adult caribou and if possible, do an immediate mortality investigation. For example, from the 10 known deaths this spring (2012), two were due to predators, one of unknown natural causes, and one died giving birth. Collars were retrieved from the other six caribou, but the causes of death were undetermined.

Predator Monitoring

The predator monitoring program included the addition of seven wolf and 10 black bear collars on the calving and wintering grounds. The advisory committee noted the black bear population has increased, and offered support for trying to determine the impacts of these predators on caribou at different stages in their cycle, especially on calving grounds. There was also interest among committee members in viewing the bear camera collar footage.

Monitoring predator movement patterns and watching camera footage will lead to a better idea of the impact wolves and bears have on both adults and calves, but it will not help in monitoring predator population sizes.
Discussion

The following issues were brought forward by Advisory Committee meeting participants and discussed:

- Need to identify causes of adult caribou mortality.
- Need to understand why many calves are not surviving their first months.
- Concern that research and monitoring methods contribute to mortalities; Wildlife staff follows protocols re: surveys and how long animals are chased. Whenever possible, work is done from the ground.
- Research and monitoring should occur even when the population is deemed healthy.
- Should explore the potential to open more licences for harvesting other wildlife species in the area to alleviate pressure on GRCH and fill gaps for people who rely on the herd.
- Less experienced hunters could result in more injured animals left on the land. Hunting parties may be able to harvest just as many animals with minimal disturbance over time.
- Management of this herd is a difficult process that requires the full cooperation of all users.
- A proactive approach was deemed essential: stakeholder meetings should continue regardless of the status of the herd.
- This approach would allow grace periods for outfitters to fulfill their contracts.
- We are past the point of a sustainable harvest; if it were possible to establish a biological threshold below which hunting would not occur, it would be helpful to decision makers who could then incorporate social factors. This is difficult to do, given that it is not necessarily the population size that matters, but more so the population trend and demographic indicators that determine how a population should be managed.
- Each population cycle is not the same as the last. It is a complicated system, with many inter-dependent factors.
- Predicting the consequences of extreme management actions, such as promoting a bear-cull, is difficult. We have to be careful with attempts to steer the cycle to our liking.
- Although limiting harvest numbers is useful to population recovery, other methods should be considered.
- Disturbance by snowmobiling and GPS-equipped hunters chased caribou become exhausted and lose weight over time. Perhaps changing hunting methods, assigning specific hunting days, or hunting groups, could benefit the herd.
APPENDIX E

Proceedings of the “Declining Caribou: Shared Concerns, Shared Solutions” Workshop are too long to include here but can be found at:
The presentation given on behalf of NL Wildlife at this workshop can be found at:
LABRADOR CARIBOU INITIATIVE YEAR 3 (2013-2014) PROGRESS REPORT

Newfoundland and Labrador
Department of Environment and Conservation
Wildlife Division
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>iii</td>
</tr>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>iv</td>
</tr>
<tr>
<td>1.0 PURPOSE</td>
<td>5</td>
</tr>
<tr>
<td>2.0 BACKGROUND</td>
<td>5</td>
</tr>
<tr>
<td>3.0 SUMMARY OF ACTIVITIES AND RATIONALE IN 2013-2014</td>
<td>2</td>
</tr>
<tr>
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<td>3</td>
</tr>
<tr>
<td>4.2 Population Projections</td>
<td>8</td>
</tr>
<tr>
<td>4.3 Long Term Management Planning</td>
<td>8</td>
</tr>
<tr>
<td>4.4 Community and Stakeholder Engagement</td>
<td>9</td>
</tr>
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<td>4.4 Harvest Monitoring</td>
<td>9</td>
</tr>
<tr>
<td>4.5 Management Actions</td>
<td>10</td>
</tr>
<tr>
<td>5.0 BUDGET SUMMARY</td>
<td>11</td>
</tr>
<tr>
<td>6.0 LITERATURE CITED</td>
<td>11</td>
</tr>
<tr>
<td>APPENDIX A</td>
<td>18</td>
</tr>
<tr>
<td>APPENDIX B</td>
<td>24</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>25</td>
</tr>
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<td>APPENDIX D</td>
<td>30</td>
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<td>31</td>
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<td>APPENDIX F</td>
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</table>
LIST OF TABLES

Table 1. Survival Estimates for 2011/12, 2012/13, and 2013/14 caribou biological years with sample size (N) and 95% confidence intervals (CI).

Table 2. Average annual harvested GRC age and standard distribution (SD) estimated from cementum ageing of teeth collected from jawbone returns.

Table 3. Estimated number of George River caribou harvested by user group, 2010-11, 2011-12, 2012-13 and 2013-14.

LIST OF FIGURES

Fig 1. Average calves/100 females per decade during fall classification surveys 1973-2010, and annual calves/100 female estimates for 2010 (17), 2011 (17), 2012 (7), and 2013 (9.5).

Fig 2. Percentage of the GRCH composed of Large Males; as estimated during Fall Classification surveys from 2001-2013.

Fig 3. Concentration of a) progesterone in fecal samples- used to determine pregnancy status; b) cortisol in fecal samples- used as an index of stress during the winter; c) corticosterone in fecal samples- used as an index of stress during the winter; d) cortisol in hair samples- used as an index of stress during the fall rut; e) testosterone in hair samples- used as an index of male status during the fall rut; and f) pregnane in hair samples- used as an index of female fertility during the rut. Data is presented annually unless there was no significant difference found between years and by sex unless there was no significant difference found between sexes.

Fig 4. Results of wolf collaring efforts during Year 3 of the Labrador Caribou Initiative; including capture locations and collar location data.

Fig 5. Results of bear collaring efforts during Year 3 of the Labrador Caribou Initiative; including capture locations and collar location data.

Fig 6. George River Caribou Population Estimates 2001-2012, with projection modeling into Fall 2013 and 2014 (Simple model based on herd demographics and survival estimates). Herd survival estimated as 0.83 from 2000-2009, 0.62 from 2010-2012, 0.75 for 2013 and 0.70 for 2014. Diamonds mark census years and circles represent future population projections.

LIST OF APPENDICES

Appendix A: 2013-2014 GRCH Work Plans
Appendix B: Health Monitoring Abstract for the North American Caribou Workshop
Appendix C: Ungava Caribou Symposium Wolf Presentation
Appendix D: Proposed Table of Contents for Management Plan
Appendix E: GRCH Stewardship Contest Poster and Letter
Appendix F: Presentation for Nunatsiavut Community Public Information Sessions
EXECUTIVE SUMMARY

Photo-census results from 2010 placed the population of the George River Caribou herd at 74,000; an 81% decline from the previous census estimate of 385,000 in 2001. Low calf recruitment, low adult survival measured from collared caribou, and observations from user groups all corroborated a significant and continued decline in the GRCH. The 2010 population estimate, in combination with other biological indicators of herd health, that led to the announcement of the 3-year/1.9 million dollar Labrador Caribou Initiative (LCI) in April 2011. Since the launch of the LCI, updated census results, recruitment rates, and adult survival rates all indicate a severe and continued decline. This document reports on activities that took place during Year 3 of the LCI, and follows the format of the two previous annual reports. A comprehensive summary report of the activities, analyses, results and conclusions of the 3-Year LCI will be prepared as a separate document.

For biological monitoring, 25 adult caribou collars (purchased by the Wildlife Division; WD) were deployed winter of 2013-2014. A total of 16 George River caribou predators (wolves and black bears) were captured and collared. A spring calf condition survey was conducted and 17 yearling collars (purchased by Quebec; QC) were deployed in June 2013. A fall classification survey was conducted in late October 2013 and found continued low percentage of calves and large males in the population. Calculated survival estimates were 75% for adult females, 67% for adult males, and 53% for yearlings. Mortality investigations were conducted for 19 sites and resulted in the recovery of 14 collars.

The moratorium on hunting, instituted in January 2013, continued throughout Year 3 of the LCI. Despite the moratorium, Labrador Innu indicated in the fall 2013 that they would harvest 300 male caribou. Although it is expected that 300 caribou were harvested by Labrador Innu community members. Various reports and lines of evidence collected by Wildlife Division and Department of Justice (DOJ) officers confirm that hunting did occur throughout the winter; but the number of animals killed is not known at this time. Wildlife Division and DOJ officers documented that some of the harvested animals, possibly the majority, were females.

Open communication and collaborative team work continued in Year 3 of the LCI between the Wildlife Division, stakeholders of the GRCH, aboriginal communities, and the province of Quebec. In March, WD provided a series of public information sessions to each of the five Nunatisavut communities, with a focus on GRCH biology and the adverse impacts of continued illegal harvest. WD also worked with government of Quebec counterparts to begin preparation of an inter-jurisdictional and long term management plan for GRCH. The Ungava Peninsula Caribou Aboriginal Round Table (UPCART) was invited by the two provinces to begin technical discussions on management planning through a suggested liaison committee.

As part of the stewardship component of the LCI, WD arranged and organized a George River caribou stewardship contest which was run in 17 Labrador schools with caribou t-shirts awarded as prizes.

The current population demographics of the herd combined with continued hunting pressure is such that the GRCH will continue to decline towards very low levels of abundance that may
jeopardize the long term recovery of the herd. The information generated from the LCI will be essential to assessing the effects of the hunting moratorium, documenting the response of the herd to further management decisions, directing research efforts, and the ultimate long-term conservation of this important caribou herd. The Year 3 report is to be followed by a summary document that will focus on analysis and conclusions drawn from information generated in the first three years of the LCI.
1.0 PURPOSE

- The focus of this document is to summarize George River caribou herd (GRCH) research and monitoring activities during the third year of the 3-year Labrador Caribou Initiative (LCI). As part of the 2011/12 budget process, the Labrador Caribou Initiative was approved for $1.9 million over 3 years with $468,000 of this funding originally allocated for Year 3 of the project. This amount was subsequently reduced to $382,000. The objectives of the LCI over the three year program period were to conduct enhanced monitoring and conservation efforts for the herd through increased biological monitoring and research efforts, increased harvest monitoring, enhanced licensing, education and stewardship programs, the formation of stakeholder working groups, advisory and technical committees, and to establish the process for the development and implementation of a management plan for both the short- and long-term conservation of the GRCH.

2.0 BACKGROUND

- The George River caribou herd reached an estimated low of 15,000 in the 1950's, and peaked at nearly 800,000 in the late 1980s. A 1993 census estimated the population at approximately 775,000 caribou. In 2001, the population was estimated to have fallen to 385,000 animals.
- In July 2010, a census was conducted jointly by the Government of Quebec and the province of Newfoundland and Labrador. This census placed the GRCH population at 74,000 animals; an 81% decline from the previous census estimate in 2001. The census result was supported by other biological indicators of herd health. Low calf recruitment, low adult survival measured from collared caribou, and observations from user groups all corroborated a significant decline in the GRCH.
- Approval of a 3 year 1.9 million Labrador Caribou Initiative (LCI) was obtained within the Budget 2011/12. The objectives included:
  - To monitor GRCH demographics, survival, body condition, and range and habitat use through time and investigate biological factors affecting changes in these indicators of herd health and population trends and size.
  - To monitor harvest trends by resident and non-resident hunters, outfitters, commercial operators, and aboriginal groups.
  - To consult with all interest groups and gather input from stakeholder working groups for both the short- and long-term management of the GRCH.
  - To identify and implement harvest management plans and actions for the conservation and continued use of the GRCH.
  - To conduct education and stewardship activities for the conservation of the GRCH.
- During Year 2 of the LCI, another joint GRCH census was conducted. The resulting July 2012 population estimate was 27,600 animals; confirming the continued decline (~96% decline in 20 years).
- Biologists believe the initial and earlier stages of the population decline were not caused by hunting. Density dependent effects are a natural driver of population cycles for migratory caribou herds. However, at the current low population size, any level of
hunting adds to natural mortality, exacerbating the current population decline and limiting future recovery potential.

- Throughout the first two years of the LCI, it was noted that survival and recruitment rates remained low, the herd’s calving and home range sizes decreased and spatial land use patterns changed.
- The role of climate change in GRCH population dynamics is important to acknowledge. Changes in vegetation communities, insect abundance, snow depth, and freeze/thaw cycles can all impact herd health.
- Funding for the LCI was allocated as $996,000 in Year 1, $522,000 in Year 2, and $382,000 in Year 3. A summary of the activities completed, the resulting data, and the associated spending for Year 1 and 2 can be found in their respective Progress Reports. This document focuses on these undertakings for Year 3.

3.0 SUMMARY OF ACTIVITIES AND RATIONALE IN 2013-2014

The conservation and management of the GRCH under the LCI includes scientific research, community involvement and support, regulations on human actions, and education. Activities undertaken in the 2013-2014 fiscal year included:

- **Caribou survival, distribution, movements patterns, and range fidelity**
  
  **Action:** 1) Continue monitoring and mapping of location data from collared caribou, 2) deploy and maintain a large number of active collars in the GRCH, 3) design the monitoring program to ensure that collars are representative of all age/sex cohorts in the population, especially yearlings, and 4) retrieve collars from dead caribou as soon as possible.
  
  **Rationale:** Survival estimates are an indicator of herd health and population trends. Knowledge of movement patterns, distribution, and geographic and habitat fidelity provide information necessary for developing research objectives, informing management actions, and guiding the efforts towards population census and classification surveys. A large number of deployed collars will help to ensure that conclusions drawn from the resulting data are representative of the herd. Retrieving collars will provide cost savings in future collar purchases, as well as provide insight to cause of death.

- **Calf weights and birthing rates**
  
  **Action:** 1) Estimate the proportion of females with calves, 2) record birth weights of calves at birth.
  
  **Rationale:** Female productivity and calf birth weights are indicators of herd health, feeding into population trends, and offer insights into potential for herd recovery.

- **Juvenile survival and adult sex ratios**
  
  **Action:** 1) Conduct annual fall classification surveys for the GRCH
  
  **Rationale:** The number of calves per 100 adult females in October, when compared to in June, provides a measure of summer calf survival, and is used as an indicator for population trend (recruitment rate). Sex ratios are used to measure herd demographics, which are important for reproductive potential and behaviors.

- **Pregnancy rates, stress hormone levels, parasite loads, and body condition**
  
  **Action:** 1) Continue to collect data and samples from all caribou captured for collaring; 2) look for relationships between these factors and survival/recruitment.
  
  **Rationale:** While caribou are on hand for collaring, the opportunity to collect hair, fecal, and blood samples is presented, as well as to take physiological measurements. The resulting data can inform biologists of the herd’s productivity, food resource acquisition, and stress/pathogen load. Analyzing the relationships between these factors and vital rates...
such as survival and recruitment will help us understand the drivers of population fluctuations.

- **Predator survival, distribution, movement patterns, and home range size**
  **Action:** 1) Continue monitoring collars already deployed on black bears and wolves in the range of the GRCH, 2) conduct further collar deployments on wolves on the GRCH calving and winter ranges, 3) conduct further collar deployments on black bears on the GRCH calving range.
  **Rationale:** The role of predation throughout the GRCH decline is not well understood. By monitoring the survival, home range size, and ecological behaviors of wolves and black bears, estimates of density can be gained as the key measure of relative predation influence on caribou at different times of the year.

- **GRCH population estimate**
  **Action:** Run a population model to estimate the population size and trend forward in time from the last census.
  **Rationale:** Given the severe population decline, and the need for continued management actions and public education, current population projection estimates are necessary.

- **Joint long term management**
  **Action:** 1) Advance an inter-jurisdictional strategy for the development of a long term management plan, and 2) engage the aboriginal community in the development and writing of this plan.
  **Rationale:** The GRCH crosses provincial boundaries, is harvested in First Nations traditional territories, and is used as a resource by local hunters and outfitters. Cooperation by all of these stakeholders is critical to the success of a management strategy.

- **Communication and education**
  **Action:** Develop a series of public outreach materials to be distributed within communities associated with the GRCH to; 1) provide updated information on research and management results, 2) solicit community input, 3) promote understanding and acceptance of management strategies, 4) encourage participation in projects that monitor the health of the herd, 5) improve the use of best harvest practices, 6) build a stronger relationship between communities and wildlife managers, and 7) instill a sense of stewardship.
  **Rationale:** Increased support and cooperation from the public will help provide the best information for management actions. Support and involvement from the local people is critical to success of the management program.

### 4.0 Year 3 Activities

#### 4.1 Biological Monitoring Activities –

- No collar purchases, rebuilds, or new batteries were purchased during Year 3 due to sufficient supplies on hand from previous expenditures.
- Deployment of 25 adult collars on GR caribou (18 females, 5 males, and 2 recaptured females; all belonging to WD).
- Deployment of 17 expandable yearling collars on female GR caribou during spring calving survey (2 belonging to WD and 15 belonging to QC).
- Spring calf condition captures were conducted from June 7-8th, 2013
Thirty calves (13 males and 17 females) were captured, weighed, and had their cord status and hoof wear recorded. The average weight was $6.6 \pm 0.2$ (SE) kg, with males not being significantly heavier than females (t-test, $p > 0.05$). The average weight was similar to that of 2011 and 2012 (6.3 and 6.4 kg respectively) and is considered a healthy average weight.

There was no significant difference the weights of calves ranked as having a dry or wet umbilical cord (t-test, $p > 0.05$). No significant relationship was found between the amount of hoof wear and calf weight (linear regression, $F=0.66$, $p > 0.05$).

Calf birth weight has been positively correlated with fall recruitment (calves/100 females; Couturier et al. 2009; data from 1978 – 2003). Although a linear regression fits ($F = 16.84$, $P = 0.0005$, $R^2 = 0.43$; using data from Couturier et al. 2009 and more recent, unpublished data), other factors affect both parameters. In 2011 the average calf birth weight was 6.26 kg and the fall recruitment was 17% (as opposed to 33% as predicted by the regression). In 2012 the average calf birth weight was 6.40 and the fall recruitment was 5.4% (as opposed to 40% as predicted by the regression). It is possible that this relationship is different when the population numbers are low, as is currently the case. Most of the data used to calculate this correlation was taken when population numbers were high or increasing. In fact, using only data from during the population decline (1994-2012), the strength of this relationship is lost ($R^2 = 0.06$).

Extra effort was made in 2013 to confirm whether calves reunited with their mothers post-capture. It was noted that seven of the thirty calves were not promptly reuniting with their mothers (although three of the seven mothers were sniffing the ground in close proximity to their calf). This observation was concerning, and as such, a decision was made to suspend calf captures for the 2014/15 season.

- **Census**

  During Year 2 of the LCI, a July photo census was conducted jointly by biologists from Wildlife NL and Quebec’s Ministry of Natural Resources with funding from Torngat Wildlife and Plants Co-Management Board. A total of 22,725 caribou were photographed and a corresponding July 2012 population estimate of 27,600 animals (90% confidence interval of 24,900-30,400) was released. This result represented a 63% population decline since 2010, and a 96% population decline since 1993.

  The January 2013 implementation of the GRC hunting ban included a commitment by the province to review the effects of the ban after 2 years (by Jan 2015). This review is to include an assessment of both compliance and the numeric and demographic response of the GRCH.

  Also as part of the assessment process, Year 3 of the LCI included the preparation of plans conduct a July 2014 photo census. The census will provide an updated population estimate, which is expected to confirm further decline of the herd as currently indicated by other biological indicators (ex/survival, recruitment, and continued harvesting). This census will use the same methods at those conducted in 1993, 2001, 2010, and 2012, which relies on a large number of collared individuals in the population, and the formation of highly aggregated groups during peak insect abundance.
Funding for this endeavor was secured during Year 3, through the continuation of Newfoundland and Labrador’s Labrador Caribou Initiative (Phase 2). The province of Quebec and the Institute for Environmental Monitoring and Research (IEMR) will be cost sharing with NL, and additional contributions are being sought from the Torngat Wildlife and Plants Co-Management Board.

- Fall classification survey conducted Oct 26-27th, 2013
  - A total of 1406 caribou were classified.
  - The percentage of calves in the population (7.0%) remains below the 15% suggested by Bergerud and Elliot (1986) as a minimum for population maintenance with little potential for growth.
  - Recruitment in terms of calves per 100 females was also low (9.5 calves/100 females) compared to historical classifications, and approximately half that measured during the 2010 and 2011 classifications (Figure 1). Couturier et al. (2009) estimated that fall productivity must be 34 calves/100 females for the George River herd to be stable (under the assumption that adult survival is 0.87 (Crete et al. 1996) and current survival estimates are below this value).
  - Of the 1406 classified caribou, 6.8% were large males. This data indicates a small rebound in the presence of dominant breeders since the extreme lows of 2009-2012 (Figure 2), but is still sub-optimal. The overall sex ratio continues to be highly skewed at 22 males/100 females.

- A total of 19 collared caribou mortality investigations were conducted during Year 3. Five of the mortality sites could not be found (collar no longer functioning or at the bottom of a lake). Fourteen collars were recovered during the remaining investigations. Cause of mortality is difficult, if not impossible, to determine in the field after even little time has passed. There were no remains found with 8 of the 14 collars, signs of predators and scavenge were seen around the carcass remains of 5 of the collars, and one caribou mortality was confirmed to be a hunter kill. Three mortalities that occurred during Year 3 were not yet investigated by the end of March 2014.

- Survival rates are estimated from NL and QC collared caribou from June 1st - May 31st annually using MARK. Adult female, adult male, and yearling survival estimates for 2013/14, along with their confidence intervals, can be found in Table 1. These rates are currently too low to sustain a migratory caribou population, and have been consistently low throughout the LCI.

- GRCH age distribution in 2012 was documented in Year 2 of the LCI as part of the hunter health monitoring program. In Year 3, results were received for the cementum ageing of 145 teeth collected between 1997 and 2011 from hunter jawbone returns. The average age and standard distribution for years with a sample size of 25 teeth or greater are presented in Table 2. An analysis of the trend in age distribution from 1997 to 2012 will be presented in the LCI Phase 1 Summary report.

- Health Monitoring
  Due to the hunting ban in place throughout Year 3 of the LCI, biological caribou samples and data to inform the health monitoring program were restricted to those collected during live caribou captures. There was therefore no new information available regarding bone marrow fat percentages, age distribution via cementum analysis, or besnoitia density via skin samples. As no alarming blood born pathogens (Toxoplasma gondii, Neospora caninum, bovine herpesvirus-1, para influenza-3, bovine diarrhea, or west nile virus)
infection levels were identified in the first year of the Labrador Caribou Initiative, no additional analyses were conducted. It would be informative to run these analyses again within the next few years to monitor any changes in infection levels.

- The average winter weight of adult females and males captured in the 2011/12 season was 97.6±1.9kg and 102.1±5.1kg respectively, 98.0±2.4 and 111.3±10.0 kg respectively in the 2012/13 season, and 90.7±3.2kg and 105.0±4.0kg respectively in the 2013/14 season. The average weight of GRCH females in April over the 70-90’s was 94.0±1.9 kg (Bergerud et al. 2008).
- Assessing the level of besnoitia infection during live caribou handling is done by scoring the density of cysts seen in the sclera on a scale from 0-4. Over the first 2 years of the caribou initiative, besnoitia presence was confirmed in 2/3 caribou and the average infection level score was 1. This infection rate and severity continued into Year 3 for the 15 captured caribou that had their sclera scored for besnoitia. Given sclera scoring is a less sensitive method of besnoitia detection than skin samples, these values correspond well with the 80% infection rate for 2011/12 calculated from skin samples. This is considered a very high prevalence for this parasite, although the individual infection densities appear to be non-severe. There is still concern for population level effects of besnoitia on breathing, reproduction, and stress levels.
- Fecal samples were collected from 11 adult females captured during winter 2014 and sent to the Toronto Zoo for progesterone analysis. Results indicate that 91% of these females were pregnant at the time of sampling (note the very small sample size). This percentage, also estimated from captured females, was 82% in 2013 and 85% in 2012. Pregnancy rate was also estimated from fecal samples collected during the 2012 licensed caribou hunt, and was estimated at 74%. It is suggested that pregnancy rates estimated from captured caribou may be an overestimate, since females targeted for collaring tend to be fully mature, large, heavier individuals that may fall to the back of the group while trying to evade the helicopter. A study design of fecal sample collection from craters or walking paths in the snow and from captured females would help answer questions surrounding these estimates.
- Hormone analyses conducted by Toronto Zoo on fecal and hair samples collected during live caribou captures and from hunters in 2012 have been completed. The results are presented in Figure 3. This data will feed into a collaborative research project examining the relationship between parasite load, stress levels, and reproductive success to gain further understanding on the effects of pathogens and parasites at the population level. This statistical analysis and research is ongoing.
- An abstract was prepared and accepted during Year 3 for poster presentation at the North American Caribou Workshop (Appendix B).

• Predation Pressure
- Wolves

Six wolves were collared during Year 3 of the Labrador Caribou Initiative (2 VHF and 4 Lotek Iridium collars belonging to WD). These wolves included one male pup, three adult males, one sub-adult female, and one adult female. The body condition was said to be fair-excellent for all animals (no poor), although 4 of the wolves had porcupine quills embedded in their face.
Wolf collaring efforts in Year 2 of the LCI were characterized by a small number of locations being transmitted before collars malfunctioned shortly after deployment. Year 3 saw a marked improvement in data collection. The three Lotek Iridium collars deployed on adult male wolves transmitted locations throughout the course of Year 3 with no problems. The one Lotek Iridium collar deployed on the sub adult female transmitted locations well, but she died 41 days after collar deployment (collar successfully recovered). The remaining two wolves were collared with VHF transmitters, and their current status is not known.

Data collected from wolf collaring efforts throughout Year 3 is summarized in Figure 4 for this progress report. As part of a multi-year project, this data will be combined with wolf data collected over the course of the LCI for interpretation in the LCI summary report. A presentation on plans for wolf research under the LCI and data collected to date was presented at the Caribou Ungava Symposium (Appendix C).

As demonstrated in Figure 4, collar deployments have been targeted at both the calving and wintering grounds for comparison or wolf home range size and behaviors between these two areas. Further efforts will be necessary to establish estimates of pack home range size and movement patterns across the vast GRCH range. As part of a multi-year project, this data will be combined with wolf data collected over the course of the LCI for interpretation in the LCI summary report.

Samples collected for wolves include hair, feces, and blood, which will permit analysis of DNA, stress levels, hormone production, parasites, and diet (no analysis conducted to date).

- Bears

Five bears fitted with Lotek Iridium collars in Year 2 were recaptured in Year 3 to have their collars checked (2), refitted/repaired (2), or replaced (1; replaced with a QC ATS collar) if necessary. All these bears were found to have good body condition and had either maintained their weight from last year or gained 2-28 kg. During this collaring period, the three Lotek camera collars that malfunctioned the previous year were searched for but not found.

An additional five new bears (two adult females, two adult males, and one young adult male) were also captured and collared with QC ATS collars in Year 3. The four adults were found to be in good condition, while the young male was fair, with very little fat. One of these male bears was with 2 others, and the group was consuming an adult and a calf caribou carcass.

At the end of Year 3, two of the ten collared bears had died, one Lotek Iridium collar from Year 2 had malfunctioned, and the remaining seven collars were working well on alive bears. Data resulting from bear collaring efforts during Year 3 is summarized in Figure 5 for this progress report. Note that location data from six ATS bear collars has not yet been included; it is being managed by QC and WD is waiting for data transfer. As part of a multi-year project, this data will be combined with bear data collected over the course of the LCI for interpretation in the LCI summary report.
Samples collected for all bears include a premolar, tissue, hair, and blood, which will allow determination of age, and analysis of DNA, stress levels, hormone production, and diet (no analysis conducted to date).

4.2 Population Projections -

- In Year 1, population projections from the 2010 census onwards estimated there would be 30,000 animals in the GRCH in fall 2012.

- In Year 2, the census put the herd at 27,600 animals in July 2012. Adult survival and calf recruitment rates suggested that the 2012 fall population would be 24,362.

  A simple model based on herd demographics and mortality rates was then used to project the population size forward to fall 2013 and 2014 (using some data collected in Year 3). Assumptions for the simple model included:
  - Calf recruitment to November of 0.054 in 2012 and 0.07 in 2013.
  - Annual rates of survival of 0.80 across all cohorts except calves.
  - An additional 1000 adult mortalities per year due to illegal harvest.

  Estimates for fall 2013 and 2014 were approximately 19,739 and 15,723 GR animals respectively.

- In Year 3, this model was updated by including the new monitoring data. Revisions to model assumptions included:
  - Rate of survival of 0.75 and 0.70 for 2012 and 2013 respectively across all cohorts except calves.

  Revised populations estimates were 18,146 for fall 2013 and 12,420 for fall 2014.

- Regardless of model or parameter manipulation, the GRCH continues to be in a severe state of decline. Manipulations of parameters such as parturition rates, recruitment rates, or age of 1st reproduction have little effect on the overall results of models and just provide varying degrees of severity to the decline.

4.3 Long Term Management Planning -

- Wildlife Division worked with government of Quebec counterparts to begin preparation of an inter-jurisdictional and long term management plan for GRCH.

- Representatives from both provinces are working on a status report detailing research conducted, findings, population indices, population trends and current threats.

- A technical table of contents was prepared as a starting point for discussions with the Ungava Peninsula Aboriginal Round Table (Appendix D).

- In April (just after LCI Year 3), the UPCART was invited by the provinces to begin technical discussions on management planning through a suggested liaison committee. This invitation included the table of contents as a suggested starting point for discussions. Acknowledgement of the suggestion was received, but no indication of acceptance of the invitation has been provided to date.
4.4 Community and Stakeholder Engagement –

- **T-Shirt Initiative**

To spread awareness and increase dialogue surrounding GRCH stewardship over the course of the LCI, stakeholders were engaged in the creation of a t-shirt with caribou artwork and stakeholder logos. Year 3 involved inviting stakeholder participations, t-shirt production, and purchase of t-shirts by the Wildlife Division and all other participating stakeholders. With the t-shirts purchased by the Wildlife Division, a stewardship contest was run in 17 Labrador schools. Posters were designed, letters were drafted, and these were assembled along with the T-shirts into packages and sent to the schools (Appendix E). The contest was not yet complete at the end of Phase 1 of the LCI.

- **Public Information Sessions**

In March, WD provided a series of public information sessions to each of the five Nunatsiavut communities. Officials from NL Department of Justice and Nunatsiavut Department of Lands and Natural Resources were also in attendance. Sessions were held from March 10th to March 14th in Nain, Hopedale, Postville, Makkovik, and Rigolet. These sessions focused on the biology of George River caribou and emphasized the adverse impacts on the herd of continued illegal harvest. Despite some limited negative comments by a few individuals who attended the sessions, overall, the Nunatsiavut membership and leadership both expressed their clear support for the hunting moratorium as the appropriate conservation measure to help protect and eventually restore the herd. The presentation given by the Senior Biologist during these information sessions are in Appendix F.

- **Stakeholder Meetings**

A presentation focusing on the biology of George River caribou and the adverse impacts of continued illegal harvest was also provided to the NunatuKavut Community Council in January 2014.

4.5 Harvest Monitoring Activities –

- During Year 3, 1 collared adult male caribou was shot by hunters and the collar was left in the field.
• There was no legal harvest of GRCH animals, so harvest monitoring by Wildlife staff was greatly reduced in Year 3. Illegal harvest estimates are presently being compiled based on assertions by Labrador Innu, reports received by WD, direct observations by WD and DOJ officials, and through ongoing discussions with aboriginal groups.

• Despite the hunting ban, it is estimated that approximately ~ 2% of the herd was harvested between Dec 3\textsuperscript{rd} 2012 and March 30\textsuperscript{th} 2013 (Table 3). In 2013/14, Department of Justice officials confirmed that at minimum 90 animals were poached. It is expected however, that at least 300 were likely harvested by members of Sheshatshiu and Natuashish; as the Innu Nation stated in Fall 2013 that it would continue to defy the ban and harvest 150 caribou per community. WD and DOJ officials also established that a number of confirmed kills were female caribou.

4.6 MANAGEMENT ACTIONS—

• On August 2, 2011 the Minister of ENVC delayed the start of the 2011/12 GRC hunting season until further assessment and consultations.
• The GRCH 2011/12 season then opened on 20 December, 2011.

• The 2012/13 GRCH hunting season was never opened, and then on January 28\textsuperscript{th}, 2013, the Minister of ENVC announced an immediate ban on all caribou hunting (including aboriginal subsistence harvest) in Labrador for conservation purposes for a period of five years, with a review after two years.
• This ban continued for the 2013/14 GRCH historical hunting season (LCI Year 3).
• In Quebec:
  o Changes were implemented for the 2011-2012 season, including a 50\% reduction in outfitter permits, subdivision of Zone 23 into a W/E sections, so that the George River and Leaf River herds could be managed separately; closure of sport hunting in the S section of Zone 23; limitation on sport hunting in Zone 24; a reduced season in the Eastern section of Zone 23; and closure of sport hunting in 2012-2013 in the Eastern section of Zone 23 and in Zone 24, subject to the biological information collected in 2011-2012.
  o The sport hunt was closed for 2012-13 and 2013-14, and the aboriginal groups reiterated their commitment to harvest monitoring.
• WD continues to work with Quebec towards a GRC inter-provincial management plan with direct participation from aboriginal groups being sought through a sub-committee of the UPCART.
5.0 BUDGET SUMMARY - YEAR 3

George River Caribou Initiative Budget - Year 3

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6.0 LITERATURE CITED


Table 1- Survival Estimates for 2011/12, 2012/13, and 2013/14 caribou biological years with sample size (N) and 95% confidence intervals (CI).

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<tr>
<td></td>
<td>Adult F</td>
<td>Adult M</td>
<td>Yearlings</td>
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<td>Survival</td>
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Table 2- Average annual harvested GRC age and standard distribution (SD) estimated from cementum ageing of teeth collected from jawbone returns.

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<th>Year</th>
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Table 3- Estimated number of George River caribou harvested by user group, 2010-11, 2011-12, 2012-13 and 2013-14.

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<th>2012-13</th>
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<td>2860</td>
<td>2243</td>
<td>594**</td>
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*Includes 12 E license holders
**Reported harvest of ~92 Sedentary Caribou not included
Fig 1- Average calves/100 females per decade during fall classification surveys 1973-2010, and annual calves/100 female estimates for 2010 (17), 2011 (17), 2012 (7), and 2013 (9.5).

Fig 2- Percentage of the GRCH composed of Large Males, as estimated during Fall Classification surveys from 2001-2013.
Fig 3- Concentration of a) progesterone in fecal samples- used to determine pregnancy status; b) cortisol in fecal samples- used as an index of stress during the winter; c) corticosterone in fecal samples- used as an index of stress during the winter; d) cortisol in hair samples- used as an index of stress during the fall rut; e) testosterone in hair samples- used as an index of male status during the fall rut; and f) pregnane in hair samples- used as an index of female fertility during the rut. Data is presented annually unless there was no significant difference found between years and by sex unless there was no significant difference found between sexes.
Fig 4- Results of wolf collaring efforts during Year 3 of the Labrador Caribou Initiative; including capture locations and collar location data.
Fig 5- Results of bear collaring efforts during Year 3 of the Labrador Caribou Initiative; including capture locations and collar location data. Note that location data collected from 6 ATS collars are not yet included because it is being managed by QC and has not yet been provided.
Fig 6- George River Caribou Population Estimates 2001-2012, with projection modeling into Fall 2013 and 2014 (Simple model based on herd demographics and survival estimates). Herd survival estimated as 0.83 from 2000-2009, 0.62 from 2010-2012, 0.75 for 2013 and 0.70 for 2014. Diamonds mark census years and circles represent future population projections.
Labrador – Work Plans 2013/14

Project Title:
Labrador Caribou Initiative

INTRODUCTION
Leaders: Katherine Mehl, John Pisapio, Sara McCarthy, Richard Neville
Funding Level: $384,000.00
Purpose: To monitor, investigate, and manage for the long-term sustainability of the George River Caribou Herd (GRCH).

GOALS AND OBJECTIVES
To the best of our ability, provide the conditions that allow the GRCH to recover from its decline and to ensure the long-term sustainability of this valuable resource for future generations.

The objectives are:
1) To consult with all interested groups and initiate the formation of recovery committee to aid in the preparation of a long-term management plan.
2) Monitor GRCH demographics, movements and survival through time.
3) Identify seasonal range use patterns and dates to inform environmental review through the ILUC process.
4) Monitor indicators of herd health and investigate their relationships with stress levels, reproduction, landscape disturbance, and survival.
5) Gain understanding of the density, ecology, and predation rates of bears and wolves throughout the GRCH range.
6) Continue to work with Caribou Ungava in their development of a caribou population model that can be presented to stakeholder groups to clearly evaluate different harvest management options.
7) Prepare a report of the activities and results of the second year of the Labrador Caribou Initiative.
8) To conduct education and stewardship activities for the conservation of the GRCH, namely by improving the Division’s presence in, and communication with, local media.

Meeting these objectives will bring to light the factors behind the low survival and recruitment that are characterizing the decline. They will also allow our partners and the Wildlife Division to work together with the best information possible to steward the population and its habitat into the future.

CURRENT CONDITIONS
The GRCH has declined from an estimated 776,000 in 1993 to an estimated 385,000 in 2001, and 74,000 in 2010. A post calving photo-census in July 2012 showed a continued and accelerated decline with an estimated herd size of 27,600. Although it has been determined that the GRCH has undergone a substantial decline over the last decade, the reason for this decline is not fully understood. One reason for this lack of understanding was the deficiency in information related to the current range utilization and demographic parameters of the population. The provincial government set aside $1.9 million over three years in 2011 under the Labrador Caribou Initiative. This will be the final year of this funding. Concerns were first addressed by the purchase and
continued deployment of Iridium GPS collars, completion of a census, and calving/fall surveys. Since then, the focus has shifted to the level of predation pressure, and the overall health of the herd. In addition, it is clear that the success of a management plan for the declining GRCH will depend on the cooperation and participation of all stakeholders, which continues to be a challenge. In April 2013, the aboriginal GRCH stakeholder groups announced the formation of the Ungava Peninsula Caribou Aboriginal Roundtable; stated as a united and powerful voice that will endeavor to preserve the caribou and the deep relationship that aboriginal people have long held with it.

**APPROACH AND DELIVERY**

**Committee Formation and Management Plan**
A terms of reference has been proposed for formalized interactions with the Aboriginal Round Table. XXX. A draft long term management plan will be prepared by XXX, and reviewed and discussed by XXX. Implementation of the plan will involve XXX.

**Collar Maintenance**
Continue monitoring and mapping collared caribou locations weekly, monitor collar battery life and working order, and check for mortalities. Maintain at least 50 working collars on live animals that are representative of all age/sex cohorts in the population. Mortalities should be picked up as soon as possible, and the bulk of collar replacements and new deployments will occur during winter months, with some during the calving work.

**Calving Survey**
Record the weights and take measurements from 15 male and 15 female new born calves. This work requires extensive preparation planning for piggy-backed other projects (collar maintenance and predation studies), budgeting, and involves collaborative efforts between Wildlife Division, MRNF, and Caribou Ungava (our budgetary responsibility this year).

**Fall Classification**
Conduct annual fall classification survey for the GRCH to estimate recruitment rate and adult sex ratios to estimate summer calf survival and index of population health and trends. This work is in collaboration with MRNF, and will be their budgetary responsibility this year.

**Survival Rate Estimation**
Survival rate will be estimated on a June 1st – May 31st biological year basis. This will be done by recording collared caribou mortality dates throughout the year, and then estimating survival for all caribou, females, males, and yearlings using program MARK. Quebec must be contacted to obtain an update to the list of collared/dead animals for the past year. It is advised to speak with Alex at Caribou Ungava, as he is focusing his PhD on this work and will also have a survival rate estimated.

**Seasonal Range Use**
This project began in the 2012-13 fiscal year, with the help of Mael from Caribou Ungava. The average start and end date for each season was calculated annually by Mael, who provided the dates to us. Location data for GRCH was complied from 1986-present, and was separated into seasons based on these dates. Work will continue to complete the identification of seasonal location data, and projecting that data to annual seasonal shapefiles. This will inform the Wildlife Division as to when GRCH animals frequent a given area; currently and historically, to inform land-use planning under the ILUC process.
Health Monitoring Program
The activities associated with this program are detailed in the GRCH Health Monitoring Work Plan.

Predator Studies
The activities associated with this program are detailed in the GRCH Predators Work Plan.

Population Modeling
Alexandre Rasiulis is in the final stages of development of a caribou population modeling tool that incorporates all historical data and can be used to predict the effects of illegal harvest on the herd. This model will serve as an important messaging tool to predict long-term trends at varying harvest levels and to demonstrate the effects of harvest to all user groups. This tool will be essential to the development of a long-term management plan and effective communications with the aboriginal round table. Work must be done with Alexandre to understand the creation, limitations, and use of this tool once it has been completed and handed to the Wildlife Division.

Labrador Caribou Initiative Year II Report
Prepare a report of the GRCH research and monitoring activities that took place during the second year of the Labrador Caribou Initiative. The emphasis will be on the results of these efforts and their implications.

Our Turn to Help
This is a contract that was drafted in 2012-13. The majority of the work on Wildlife Division’s part has already been completed. Intervale must be monitored to ensure that the project is moving forward, and once the contract is completed, we must ensure payment occurs. This will be included in the 2013-14 budget.

Other Education and Stewardship Initiatives
A series of public outreach workshops will be held in communities affected by the GRCH before the start of the historical hunting season. The purpose of these workshops will be to introduce the long term management plan, the caribou modeling program, share information on research and monitoring results, solicit community input, promote understanding and acceptance of management strategies, and to build a stronger relationship between communities and wildlife managers.

Additionally, there is a great need to improve the Wildlife Division’s presence in the regional media. When issues arise in Labrador concerning the GRCH, we must be able to respond to the questions on the radio, or in the newspapers, rather than having other biologists, who are less familiar with the data, shaping public opinion. This can be accomplished by setting up regulations/protocols with Deborah Thomas, our director of communications. A quarterly article in the newspaper with results and updates on field work would be beneficial.

Budget (Year 3)

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### DELIVERABLES

***Deliverables from the Caribou Health Monitoring Program and the Predation Studies are covered under their separate work plans.

1. A long term management plan with buy-in from all user groups.
2. Telemetry database of filtered and pre-processed caribou spatial data.
3. Annual survival estimates.
4. Dates and spatial occupancy for each caribou season from 1986-present.
6. An interactive tool that incorporates all GRCH historical data and can be used to consult with stakeholders and evaluate the effects of management actions.
7. Labrador Caribou Initiative Year II Report
8. Completion of the Our Turn to Help project.
9. Improved media presence and dissolve myths surrounding GRCH demographics.

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### Labrador – Work Plans 2013/14

**Project Title:**

*George River Caribou Health Monitoring Program*

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### INTRODUCTION

**Leaders:** Sara McCarthy

**Funding Level:** Part of the Labrador Caribou Initiative
Purpose: To monitor the health and status of animals captured from the George River caribou herd (GRCH), in order to gain understanding into the implications of last year’s results. Last year’s broad sampling and analysis informed this year’s more focused research questions. Findings will allow better management for long-term sustainability for the population as a whole.

GOALS AND OBJECTIVES
The main goal of the Labrador Caribou Initiative is to bring to light factors that may be driving the decline of the GRCH. Last year the GRCH Health Monitoring Program identified a few negative factors, including: a below average pregnancy rate, a young average age, a low percentage of large stags and a very high level of besnoitia infection. Understanding what’s influencing these factors will inform appropriate management through population cycles.

The objectives are:
9) To continue to monitor and form a database of pregnancy rates, body conditions, age structures, disease rates, and parasite rates as was done last year, but through animals captured for collaring, and compare results to last year.
10) To measure the concentration of stress hormones in caribou hair and fecal samples in order to compare stress levels at different times of the year (fall and winter/spring respectively).
11) To measure the concentration of sex hormones found in caribou hair.
12) Look for relationships between the quantity of stress and hormones, pregnancy status, animal age, and level of besnoitia infection.
13) Link stress levels at different times of year to locations and disturbance/predation level at that given place and time.
14) Draw conclusions to the relationships between stress and caribou reproduction, parasite load, body condition and survival, and suggest potential methods of mitigation.
15) Continue to communicate these findings in a yearly brochure to be distributed to the public.

Meeting these objectives will ensure that we are considering all aspects of the decline, such that we can understand how best to conserve the remaining animals.

CURRENT CONDITIONS
The GRCH has declined from an estimated 776,000 in 1993 to an estimated 385,000 in 2001. A post calving photo-census in July 2010 showed a continued and accelerated decline with an estimated herd size of 74,000, and the severity of the decline increased with an estimate of 20,000 in July 2012. Although it has been determined that the GRCH has undergone a substantial decline over the last decade, with density dependent effects and high predation rates playing a role, all the factors in this decline are not fully understood.

Estimations of herd health in terms of pregnancy rates, body condition, age structure, disease rates, parasite rates, and environmental contaminant/stress hormone levels were first empirically attempted under this initiative in the 2011-2012 season, with poor participation from hunters. 2012-13 saw a major improvement in participation level and sample return rate; likely due to information being distributed with licences and increased media coverage. Many hunters showed interest and curiosity in the health and age of their harvested animals. Continuing with these estimates will improve our understanding of the decline and how best to manage the population for recovery. With so many health variables measured a large sample size of GRCH animals, a unique opportunity to explore the big picture of how individual health may be affecting the herd’s health has been presented.

APPROACH AND DELIVERY
Data Collection

Hair samples still remain from the GRCH Health Monitoring sample packages that were returned from last year’s program. However, unlike previous years, this year’s biological sample pool will consist of only samples taken from animals captured for collaring efforts. It is expected that approximately 25 animals will be captured. During captures, extra care must be taken to ensure that fecal, blood, and hair samples are collected, as well as body condition scores and weights are recorded. It is expected that next year, a small biopsy will be taken from the metatarsus, but this protocol is still under development by MRNF.

Data Analysis

Laboratory analysis will be performed by Toronto Zoo. Continuation of part one of the GRCH Health Monitoring Program will involve measuring the progesterone concentration in each of 25 fecal samples for pregnancy rates. Another 25 serum samples may potentially be sent to the Canadian Food Inspection Agency for besnoitia antibody testing. There will be no samples available for the other tests. Sample analysis for part 2 and 3 will involve measuring cortisol concentration in 292 hair samples and 178 fecal samples, as well as sex hormone concentration of 292 hair samples.

Reporting Results

A spreadsheet with all the variables will be composed and statistical analysis will be performed to look for relationships between variables. Spatial analysis will involve mapping variables to the place at which they were measured, to look for spatial patterns in relation to habitat and disturbance. Findings will be printed into a brochure and distributed to the public through government offices and GRCH stakeholders.

Budget

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***This total amount is included in the Labrador Caribou Initiative Budget

**DELIVERABLES**

10) Estimates of biological parameters important for population modeling.
11) Further understanding of the factors driving the continued population decline.
12) Report/pamphlets summarizing health monitoring program findings for the public.
APPENDIX B - Health Monitoring Abstract for the North American Caribou Workshop

Factors at play in the George River caribou decline- Understanding gained through hunter based monitoring

Sara C. McCarthy* and Gabriela Mastromonaco

1 Environment and Conservation, Wildlife Division, Goose Bay, NL
2 Toronto Zoo, Reproductive Physiology, Scarborough, ON
* Corresponding Author: saramccarthy@gov.nl.ca

The rapid decline of the George River caribou herd (GRCH) has had unfortunate effects for many people living in Labrador and northern Quebec. In 2011, the Government of Newfoundland and Labrador initiated a health monitoring program to gain a better understanding of factors that might be contributing to the decline. Licensed hunters were provided with packages to gather data and samples from caribou harvested for domestic consumption, in hopes to better understand factors that might be contributing to the decline. One hundred and ninety-one sample packages were returned out of an estimated 487 successful licensed hunters. Samples included metatarsal bones, jawbones, feces, and blood, which were analyzed for a variety of parameters related to general health. Findings included reduced pregnancy rate (74%), high bone marrow fat scores (86.2±11.4%), similar or decreased blood borne pathogen rates compared to other arctic herds, and an average harvest age of 5.5 years. Although the seroprevalence for pestivirus antibodies was consistent with other herds, females testing positive for the antibodies were significantly less likely to be pregnant in GRCH. This virus is known to cause several diseases in Rangifer, with symptoms including poor fertility and abortion, and thus could be playing a role in the decreased pregnancy and associated low calf recruitment in the GRCH. Stress level, as measured by fecal cortisol concentration, was found to be significantly higher in males (28.0±3.7ng/g) than in females (20.9±1.4ng/g). Eighty percent of metatarsal skin samples tested positive for besnoitia; a 64.2% jump from the 2007-2008 estimate. Male sterility has been suspected as an effect of intensive besnoitia infection. Ongoing analyses include the effect of besnoitia on male stress and reproductive hormones. These data show that hunter based programs can be a cost-effective means of gaining otherwise inaccessible information on caribou health and population demographics that concurrently encourages stewardship and improved communication. Maintenance of such programs throughout caribou population fluctuations would improve understanding and lead to more effective management.
APPENDIX C - Ungava Caribou Symposium Wolf Presentation

Preliminary Considerations On Wolf Research Investigations In Relation To Decline Of George River Caribou

John Pisapia and Sara McCarthy
Wildlife Division
Department of Environment and Conservation
Newfoundland and Labrador
November 15, 2013
Caribou Ungava Symposium
Quebec City

Starting Considerations

- Need for more research?
- Lessons Learned
- Regional Context
- Priority questions to investigate
- How to
- Then what?

Do We NEED To Research Wolves In EVERY Situation?

Methods used to estimate wolf population size

Wolf Research by Jurisdiction

Why Research Wolves In The George River Range?

Relative Abundance of George River Caribou, Quebec/Labrador

(Adapted from Begerud et al. 2008, “The Return of Caribou to Ungava”)
Background

- Large scale population cycles occurring over 40 – 70 year time scales are typical of migratory caribou herds.
- Declines are also ongoing in other herds across the North

![Graph showing population cycles over time](image)

Periods of Ungulate Scarcity = focus on wolves

Management Decisions about Wolves

- Allow for predation?
- Kill wolves for the intended purpose of increasing ungulates: Wolf Control?

![Map showing wolf harvest rates](image)

Wolf Harvest Rates: Estimated by Telemetry

- < 4%
- 5 - 7%
- 27%
- 24%

![Images of wolves](image)

Wolf Harvesting

Other Predators

![Images of other predators](image)

GRCH Calving Grounds

![Map showing calving grounds](image)
Hayes and Gunson (1992) estimated the theoretical wolf territories in Labrador at 1000-1500 wolves. The Territory size is inversely related to prey density. Fewer prey species or less of them means coyotes and wolves have to defend a larger territory in order to sustain themselves and successfully rear young. However, it is expected that some George River wolves will be migratory, and there will be resident vs. migratory wolves on the winter range.
Densities estimated with telemetry by:
1) Defining census area containing apparent contiguous packs with radio-collared wolves
2) Summing the number of wolves living in those packs
3) Adding the proportion of lone wolves estimated to be present
4) Dividing this total number of wolves by the area of the census area

Some Lessons of Wolf Control

- Generally ineffective
- Most programs have produced unclear results.
- Lack of experimental design.
- Actions with low probability of achieving stated goals.
- Limited effectiveness only in non remote areas of sedentary ungulates; for short duration; at high $, and for low returns
- Requires near complete elimination of wolves in target areas (intermediate level culling ineffective).
Decline of caribou...Decline of wolves?
Current density in George River Range?
Annual movements to gain access to the herd
Relative predation contribution of wolves and black bears
Relative effects of predation on small prey population dynamics
Moose: Where do they fit in? Or do they?
Management Planning Process

Collared Caribou Mortalities

- Mortality Investigations
  - 26 of 32 mortalities visited during 2012
  - 5 confirmed collared caribou shot by hunters during 2011/12 season
  - Often difficult to determine cause
    * Two from past year confirmed as ‘natural’ i.e. not predation.
APPENDIX E - GRCH Stewardship Contest Letter and Poster

Newfoundland Labrador

Jane Doe
Principal, School XYZ
Town, NL

The Wildlife Division would appreciate your help in assisting with the logistics of a contest to raise awareness surrounding the relationship Labradorians have with our caribou herds. Caribou are a prominent aspect in the culture, traditions, and lifestyle of many Labradorian families. The status of caribou in Labrador is of concern to the public at the community level and this type of initiative serves to garner increased recognition among the youth and support for stewardship considerations within their homes.

If you could post the included poster in an appropriate location in the school and make an announcement on the PA system drawing attention to the contest and the information on the poster that would be great. We are asking students to be creative in expressing why caribou are important to them and their families. Any form of expression, be it a composition, recording, video, drawing, etc. is welcome. Please be sure to remind students on the PA to include their name and the shirt size they are submitting an entry for.

Once the poster is up and the announcement is made, please give students 2 weeks to submit their entries to your office. At the end of the two weeks, separate the entries by the shirt size they are competing for. By yourself or with the help of your staff, choose the winner for each shirt and award the prize. We imagine the winner to be he/she who clearly expresses concern, reflection, and creativity towards the subject matter.

We would like to have entries shipped to us at the end of the contest, to form a collection or poster. Please ensure that all entries sent to the Wildlife Division include the student's permission for this use, and address to:

Wildlife Division
Attn: Sara McCarthy
Environment and Conservation
15 Cherrywood Drive
P.O. Box 3014 stn B
Goose Bay, NL, A0P 1E0

We’d like to thank you for your efforts in helping instill the concept and values of stewardship among our youth. Increasing dialogue regarding the future of Labrador’s caribou herds will bring about fresh perspectives and ideas surrounding these treasured animals! If you do not wish to coordinate this effort within your school, please pass on to another staff member. Feel free to call 896-7932 if you have any questions or concerns.

Looking forward to seeing some creative entries!

Sincerely,

Sara McCarthy
Wildlife Biologist II
Environment and Conservation
Why are LABRADOR’s Caribou important to you and your family?

Young Stewards Contest

How do you connect with caribou? Tell us in a story, drawing, video, poem, song, or any way you want, just be creative!

Enter to win a t-shirt to help promote caribou stewardship in your school

Submit your entry to ________
by ________.
Please include your name, homeroom, and t-shirt size.
APPENDIX F - Presentation for Nunatsiavut Community Public Information Sessions

Status and Management of the George River Caribou Herd
Department of Environment and Conservation
Wildlife Division
Community Information Sessions
March 2014

Key undertakings:
- Collar deployments
- Population census, estimates and projections
- Population demographics
- Sharing of findings
- Health monitoring
- Calving ground surveys
- Fall classifications
- Management Planning

Population Decline

- 1993 pop. estimate ~ 775,000
- 2001 pop. estimate ~ 385,000
- 2010 pop. estimate ~ 74,000
- 2012 pop. estimate ~ 24,000
- 2013 Fall projection ~ 19,739
- 2014 Fall projection ~ 16,793

Population Estimates

GRCH Population Census Years and Population Projections from the Most Recent 2012 Census

Population Changes

Relative Abundance of George River Caribou, Quebec/Labrador

(Adapted from Berglund et al. 2008, "The Return of Caribou to Ungava")

Population Changes

- Large scale population cycles 40 – 70 years
- Cycles (or fluctuations) also documented in other herds across the North
- Greater severity of the highs and lows in George River caribou population
Population Demographics

Newfoundland Labrador

Fall 2013 Classifications

1406 caribou classified

(Large males 7%)

(Calves 7%)  (9.5 calves / 100 females)

Newfoundland

Labrador

Labrador

ID

Yr

Percentage

or Large Male Caribou

In

the George River Caribou Herd
during Fall Classifications from 2001-2012

1406 caribou classified

(Large males 7%)

(Calves 7%)  (9.5 calves / 100 females)

% Large

Adult

Males

Newfoundland

Labrador

Labrador

Survival calculated June 1 – May 31

Most recent is 1 June 2012 – 31 May 2013

2012 Females:
80% up from 75% in 2011

2012 Males:
81% up from 61% in 2011

2012 Yearlings:
58% up from 46% in 2011

(confirmation of increases requires analysis of 2013 findings)

Average Calves per 100 Females by Decade for the George River Caribou Herd during Fall Classifications.

Exceedingly low calf ratios

Average Calves per 100 Females by Decade for the George River Caribou Herd during Fall Classifications.

Exceedingly low calf ratios
GRCH Calving Grounds

1991 to 2010 = shift of 230km eastward

Calving ground size (km²) over time:

- 1974
- 1990
- 2010

5,000 46,000 5,000

Where are the remains of dead caribou?

Health Indicators

- Body mass (Fat ratios good)
- Disease: 80% Besnoitia
- Low pregnancy rate (74%)
- Calf weights stable
How are caribou counted?

What is a photo census?

- 102 collars deployed
- 90 active at census
- Found by VHF telemetry
- 84 photographed for census
- 2 helicopters
- 4 people/helicopter
- 70 hours flying
- July 8 – 17
- NL, QC, TWPCB
Possible Past, Present and Future Factors in the GR Caribou Population Crash

Density Dependent Effects
- Lack of Forage
- Poor Body Condition
- Poor Calf Condition
- Parasites & Disease

Predation
- Wolf/Beaver Pop. Have had Abundant Prey
- Relative contribution to caribou mortality

Hunting
- No longer compensatory - additive mortality
- Change in Group Dynamics/Behaviours

Catastrophic Events
- Outbreak
- Drought
- Forest/Bush Fires
- Protean Harvest

Potential Extirpation

Increasing Cumulative Disturbances
- Landscape Development
- Snowmobiles, ATV’s, Cars, GPS

Changes in Natural Behaviours, Reduced Foraging,
High Stress & Low Reproductive Capacity

Under current conditions for George River caribou – ANY hunting is additive and is driving the population downward at an accelerated rate.

Compensatory Mortality
- the amount of mortality (death) that would occur even without any hunting.

Additive Mortality
- the amount of hunting related mortality (death) that occurs in addition to the level of natural mortality.

Why not a limited males only hunt?

Under current conditions, any hunting mortality is additive

Under current conditions, any harvest is unsustainable

Continued population decline at a faster rate

Delayed recovery of population

Longer time to resumption of future sustainable harvest

Hunting moratorium: January 2013

Necessary for conservation purposes

Assessment after 2 years

Review after 5 years

Purpose is to allow the herd time to stabilize and begin to grow again

The Path Forward:

5 year moratorium on any hunting

Population census (summer 2014)

Assess population and demographic response to hunting ban

Calving grounds studies and fall classifications

Predation Studies (wolves and bears)

Disease investigations

Range condition / Cumulative effects

Management Planning:

Proposed inter-provincial George River Caribou Management Plan

Collaboration with Quebec: shared herd; one management plan

Preparation of table of contents of management plan

Proposed writing of plan together with UPCART and stakeholders

Questions?

Newfoundland and Labrador
Department of Environment and Conservation
Wildlife Division
LIST OF TABLES

Table 1- Estimated George River caribou harvested annually per user group.

LIST OF FIGURES

Fig 1- Average calves/100 females per decade during fall classification surveys 1973-2010, and annual calves/100 female estimates for 2010-2014.

Fig 2- Average males/100 females per decade during fall classification surveys 1973-2010 and annual males/100 female estimates for 2010-2014.

Fig 3- Percentage of the GRCH composed of large males; as estimated during fall classification surveys from 2001-2014.

Figure 4- Historical biological year (June 1st – May 31st) survival estimates for adult GRC (>2 years old). Error bars represent estimated drop in survival rate when harvested collared animals are included in the analysis. These revised estimates were completed by QC biologists using both QC and NL collar data.

Fig 5- Results of wolf collaring efforts during Year 3 of the LCI; including capture locations and collar location data.

Fig 6- Results of bear collaring efforts during Year 3 of the LCI; including capture locations and collar location data. Note that location data collected from 6 ATS collars are not yet included because it is being managed by QC and has not yet been provided.

Fig 7- George River Caribou Population Estimates 2010-2014, with projection modeling into Fall 2015 and 2016 (Simple model based on herd demographics and survival estimates). Future projection uses adult survival at 66% and calf recruitment of 16 calves/100 females, based on five-year average statistics. Diamonds mark census years and associated confidence intervals.

LIST OF APPENDICES


APPENDIX B– Poster Presentation from the North American Caribou Workshop May 2014

APPENDIX C-SOMETHING FROM COMMUNICATION WITH UPCART

APPENDIX D - GRCH Stewardship Contest, Example of Student Entries

APPENDIX E – Presentation to the TWPCB, Fall 2014
EXECUTIVE SUMMARY

Photo-census results from 2010 placed the population of the George River Caribou herd at 74,000; an 81% decline from the previous census estimate of 385,000 in 2001. Low calf recruitment, low adult survival measured from collared caribou, and observations from user groups all corroborated a significant and continued decline in the GRCH. The 2010 population estimate, in combination with other biological indicators of herd health, led to the announcement of the 3-year/1.9 million dollar Labrador Caribou Initiative (LCI) in April 2011. Over the course of the LCI, updated census results, recruitment rates, adult survival rates, and illegal harvest all indicated a severe and continued decline. In response, Newfoundland and Labrador committed another $975,000 over three years to continue the LCI into phase two, beginning in April 2014. This document reports on activities that took place during Year 4 of the LCI, and follows the format of the three previous annual reports. A comprehensive summary of the activities, analyses, results and conclusions of phase one of the LCI was prepared in 2014 and is also available.

For biological monitoring, 24 adult caribou collars were deployed winter of 2014-2015 (18 purchased by the Wildlife Division (WD) and 6 purchased by Quebec (QC)). A total of 14 George River caribou predators (2 wolves and 12 black bears) were captured and collared (wolf collars purchased by WD and bear collars purchased by QC). A spring calving survey was conducted and 12 yearling collars (purchased by QC) were deployed in June. Calves constituted approximately 38% of the population. A collaborative population census was conducted in July and confirmed the herd had continued to decline by 51% in two years to an estimated 14,200 caribou. Calves had dropped to 24% of the population. An additional calving survey was conducted in September, when calves were found to constitute 22% of the population. A fall classification survey was conducted in late October and found calves at 17%. Calculated survival estimates were 79% for adult females, 64% for adult males, and 76% for yearlings. Mortality investigations were conducted for 10 WD collared caribou mortality sites and resulted in the recovery of 10 collars.

The moratorium on hunting, instituted in January 2013, continued throughout Year 4 of the LCI. Despite the moratorium, Labrador Innu Nation indicated in the fall 2013 that they would harvest 300 male caribou. Although intent to continue harvest was expressed by Innu Nation in the fall of 2014, the number of caribou killed is not known. Various reports and lines of evidence collected by Wildlife Division and Department of Justice (DOJ) officers indicate that hunting occurred. This continued illegal harvest precluded the efforts of biologists to conduct an evaluation of the demographic effects of the first two years of the hunting ban.

Collaborative team work and communication continued in Year 4 of the LCI between the Wildlife Division, stakeholders of the GRCH, aboriginal communities, the Ungava Peninsula Aboriginal Round Table (UPCART) and the province of Quebec. In October, WD provided a GRCH update to the Tornagat Wildlife and Plants Co-Management Board to summarize the recent census findings and impacts of continued illegal harvest. WD also worked with government of Quebec counterparts to continue preparation of an inter-jurisdictional and long term management plan for GRCH. The Ungava Peninsula Caribou Aboriginal Round Table
(UPCART) was invited by the two provinces to begin technical discussions on management planning through a suggested liaison committee. Discussions with UPCART on the

The most recent population census, current population demographics and continued hunting pressure is such that the GRCH will continue to decline in the near future. The long term recovery of the herd is in jeopardy. The information generated from the LCI will be essential to assessing the effects of the hunting moratorium, documenting the response of the herd to further management decisions, directing research efforts, and the ultimate long-term conservation and sustainable harvest of this important caribou herd.

1.0 PURPOSE

- The focus of this document is to summarize George River caribou herd (GRCH) research and monitoring activities during the first year of phase two of the Labrador Caribou Initiative (LCI) (hereafter referred to as Year 4). As part of the 2011/12 budget process, the Labrador Caribou Initiative was approved for $1.9 million over 3 years. The objectives of the LCI were to conduct enhanced monitoring and conservation efforts for the herd through increased biological monitoring and research efforts, increased harvest monitoring, enhanced licensing, education and stewardship programs, the formation of stakeholder working groups, advisory and technical committees, and to establish a process for the development and implementation of a management plan for both the short- and long-term conservation of the GRCH. As part of the 2014/15 budget process, the Labrador Caribou Initiative was extended into phase two, with $975,000 in funding over 3 years. The objectives of phase two are to continue the enhanced monitoring and data collection of phase one, work in partnership with Quebec and Ungava Peninsula Aboriginal Round Table (UPCART) to develop an inter-jurisdictional GRC Management Plan, assess the effects of the first two years of the hunting ban, conduct a review of the hunting ban after 5 years, enhance collaborative partnerships, and conduct formal Aboriginal consultations; all to aid in making informed management and regulatory decisions through a period of low caribou abundance. The funds allocated to Year 4 of the LCI were $390,000.

2.0 BACKGROUND

- The George River caribou herd reached an estimated low of 15,000 in the 1950’s, and peaked at nearly 800,000 in the late 1980s. A 1993 census estimated the population at approximately 775,000 caribou. In 2001, the population was estimated to have fallen to 385,000 animals.
- In July 2010, a census was conducted jointly by the Government of Quebec and the province of Newfoundland and Labrador. This census placed the GRCH population at 74,000 animals; an 81% decline from the previous census estimate in 2001. The census result was supported by other biological indicators of herd health. Low calf recruitment, low adult survival measured from collared caribou, and observations from user groups all corroborated a significant decline in the GRCH.
- Approval of a 3 year 1.9 million Labrador Caribou Initiative (LCI) was obtained within the Budget 2011/12. The objectives included:
  o To monitor GRCH demographics, survival, body condition, and range and habitat use through time and investigate biological factors affecting changes in these indicators of herd health and population trends and size.
  o To monitor harvest trends by resident and non-resident hunters, outfitters, commercial operators, and aboriginal groups.
  o To consult with all interest groups and gather input from stakeholder working groups for both the short- and long-term management of the GRCH.
  o To identify and implement harvest management plans and actions for the conservation and continued use of the GRCH.
To conduct education and stewardship activities for the conservation of the GRCH

During Year 2 of the LCI, another joint GRCH census was conducted. The resulting July 2012 population estimate was 27,600 animals; confirming the continued decline (~96% decline in 20 years).

Biologists believe the initial and earlier stages of the population decline were not caused by hunting. Density dependent effects are a natural driver of population cycles for migratory caribou herds. However, at the current low population size, any level of hunting adds to natural mortality, exacerbating the current population decline and limiting future recovery potential.

Throughout the first three years of the LCI, it was noted that survival and recruitment rates remained low, calving weights were healthy, the herd’s calving and home range sizes decreased, spatial land use patterns changed, and wolf abundance was low.

The role of climate change in GRCH population dynamics is important to acknowledge. Changes in vegetation communities, insect abundance, snow depth, and freeze/thaw cycles can all impact herd health.

A summary of the activities completed the resulting data, conclusions, and the associated spending for Year 1, 2, and 3 can be found in their respective Progress Reports, as well as in the Phase 1 Summary Document. This report focuses on these undertakings for Year 4.

3.0 SUMMARY OF ACTIVITIES AND RATIONALE IN 2014-2015

The conservation and management of the GRCH under the LCI includes scientific research, community involvement and support, regulations on human actions, and education. Activities undertaken in the 2013-2014 fiscal year included:

- **Caribou survival, distribution, movements patterns, and range fidelity**
  
  **Action:** 1) Continue monitoring and mapping of location data from collared caribou, 2) deploy and maintain a large number of active collars in the GRCH, 3) design the monitoring program to ensure that collars are representative of all age/sex cohorts in the population, especially yearlings, and 4) retrieve collars from dead caribou as soon as possible.

  **Rationale:** Survival estimates are an indicator of herd health and population trends. Knowledge of movement patterns, distribution, and geographic and habitat fidelity provide information necessary for developing research objectives, informing management actions, and guiding the efforts towards population census and classification surveys. A large number of deployed collars will help to ensure that conclusions drawn from the resulting data are representative of the herd. Retrieving collars will provide cost savings in future collar purchases, as well as provide insight to causes of caribou mortality.

- **Pregnancy and calving rates**
  
  **Action:** 1) Estimate the proportion of females pregnant in the winter; 2) estimate the proportion of females giving birth.

  **Rationale:** Female productivity is an indicator of herd health, feeding into population trends, and offer insights into potential for herd recovery.

- **Calf survival and adult sex ratios**
  
  **Action:** 1) Conduct annual fall classification surveys for the GRCH

  **Rationale:** The number of calves per 100 adult females in October, when compared to in June, provides a measure of summer calf survival, and is used as an indicator for population trend (recruitment rate). Sex ratios are used to measure herd demographics, which are important for reproductive potential and behaviors.

- **Stress hormone levels, parasite loads, and body condition**
Action: 1) Continue to collect data and samples from all caribou captured for collaring; 2) look for relationships between these factors and survival/recruitment.

Rationale: While caribou are on hand for collaring, the opportunity to collect hair, fecal, and blood samples is presented, as well as to take physiological measurements. The resulting data can inform biologists of the herd’s productivity, food resource acquisition, and stress/pathogen load. Analyzing the relationships between these factors and vital rates such as survival and recruitment will help us understand the drivers of population fluctuations.

- **Predator survival, distribution, movement patterns, and home range size**
  
  **Action:** 1) Continue monitoring collars already deployed on black bears and wolves in the range of the GRCH, 2) attempt further collar deployments on wolves and black bears on the GRCH calving and winter ranges

  **Rationale:** The role of predation throughout the GRCH decline is not well understood. By monitoring the survival, home range size, and ecological behaviors of wolves and black bears, estimates of density can be gained as the key measure of relative predation influence on caribou at different times of the year.

- **GRCH population estimate**
  
  **Action:** Conduct a post-calving photo census when caribou are aggregated in July.

  **Rationale:** Given the severe population decline, and the need for continued management actions and public education, and the potential for changing trends, current population estimates are necessary.

- **Joint long term management**

  **Action:** 1) Advance a multi-jurisdictional strategy for the development of a long term management plan, and 2) engage the aboriginal community through the Ungava Peninsula Round Table in the development and writing of this plan.

  **Rationale:** The GRCH crosses provincial boundaries, is harvested in First Nations traditional territories, and is used as a resource by local hunters and outfitters. Cooperation and mutual understanding amongst all stakeholders is critical to the success of a management strategy.

- **Public information sessions**

  **Action:** Develop a series of public presentations to be presented to various communities and audiences along with the department of Labrador and Aboriginal Affairs to; 1) provide updated information on research and management results, 2) solicit community input, 3) promote understanding and acceptance of management strategies, 4) encourage participation in projects that monitor the health of the herd, 5) improve the use of best harvest practices, 6) build a stronger relationship between communities and wildlife managers, and 7) instill a sense of stewardship.

  **Rationale:** Increased support and cooperation from the public will help provide the best information for management actions. Support and involvement from the local people is critical to success of the management program.

- **Hunting ban review**

  **Action:** Conduct an assessment of the effects of the hunting ban after two years.

  **Rationale:** The January 2013 commencement of the 5 year hunting moratorium on GRC included the commitment to conduct an assessment of the effects of the moratorium after the first 2 years. Understanding the demographic effects at the population level can inform further management decisions.
4.0 YEAR 4 ACTIVITIES

4.1 BIOLOGICAL MONITORING ACTIVITIES —

• Twenty-five collars were purchased from Vectronics Aerospace. These collars weigh less and represent a significant cost savings compared to previous models. It is hoped these collars will supply the data for the remainder of LCI phase two.

• Deployment of 18 adult collars on GR caribou (9 females, 2 males, 4 recaptured females, and 2 recaptured males; all belonging to WD), with all possible measurements and samples collected. Deployment of an additional 6 QC adult collars on GR caribou (3 females, 1 male, and 2 recaptured females).

• Using location data from greater than 2 year old collared females during the calving period, the calving grounds were delineated in the same manner as was in the first 3 years of the LCI (Fig X). The total area of the calving grounds was 4124 km$^2$, a decrease from previous estimates of 4895 km$^2$, 4461 km$^2$, and 10112 km$^2$ in 2013, 2012, and 2011 respectively.

• Using all location data collected over the course of Year 4 of the LCI, the total range map of the GRCH was mapped (Fig. X). Similar to the calving grounds, the total range of the herd has been declining since the beginning of the LCI; with fiscal year estimates in ascending order of 164,567 km$^2$, 148,392 km$^2$, 135,460 km$^2$, and 88,256 km$^2$. The amount of land occupied by the GRCH over the course of a year is currently almost half the amount occupied at the beginning of the LCI.

• Spring calving surveys were conducted in June 2014
  - No calves were captured or weighed this year. Calf weights have been healthy throughout the course of the LCI phase 1, and rate of unsuccessful mother-calf reunions led to the reduction in the frequency of such calf condition surveys.
  - It was estimated that at minimum 80% of females were with a calf.
  - Twelve expandable yearling collars were deployed on female GRC (QC collars) with all possible measurements and samples collected.
  - It was noted that the number of caribou seen during the 2014 survey was approximately half of that seen during the 2013 survey, and that caribou were scattered over a much larger area with their distribution extending west into Quebec.

• Photo Census was conducted in July 2014
  - During Year 4 of the LCI, a July photo census was conducted jointly by biologists from Wildlife NL and Quebec’s Ministry of Natural Resources and Wildlife. This census used the same methods at those conducted in 1993, 2001, 2010, and 2012; relying on a large number of collared individuals in the population and the formation of highly aggregated groups during peak insect abundance.
  - A total of 13,083 caribou were photographed and a corresponding July 2014 population estimate of 14,200 animals (90% confidence interval of 13,490-14,910) was released (based on a Peterson population estimate). This result represented a 49% population decline since 2012, and a 98% population decline since 1993. Calves represented 24% of the population.

• Additional calving survey conducted in September 2014
  - The main purpose of this classification was to look specifically at the % calves in the population to compare against that documented in July and the upcoming
October classification, to provide an improved temporal picture of calf survival over this period.

- The Torngat Secretariat funded a substantial portion of this helicopter charter and participated in the field activities.
- A total of 295 caribou were classified; 229 adults and yearlings and 66 calves. The population was therefore 22% calves.

- Fall classification survey conducted October 2014

  - A total of 1493 caribou were classified.
  - The percentage of calves in the population (17%) surpassed the suggested 15% threshold (Bergerud and Elliot; 1986) as a minimum for population maintenance with little potential for growth. This is the first time this target has been met in five years.
  - Recruitment in terms of calves per 100 females also showed a marked improvement (27.4 calves/100 females) compared to the past five years. This value is still below Couturier et al.’s (2009) estimate that fall productivity must be 34 calves/100 females for the George River herd to be stable (under the assumption that adult survival is 0.87 (Crete et al. 1996) and current survival estimates are below this value).
  - Of the 1493 classified caribou, 8.5% were large males. This data indicates another small rebound in the presence of dominant breeders since the extreme lows of 2009-2012 (Figure 2), but is still sub-optimal. The overall sex ratio is nearing that of other migratory caribou herds at 31 males/100 females.

- A total of 12 collared caribou mortality investigations were conducted during Year 4 (10 WD collared caribou). All twelve of the collars were recovered from their respective investigation. Cause of mortality is difficult, if not impossible, to determine in the field after even a little time has passed. There were no remains found with 5 of the 10 collars, signs of predators and scavengers were seen around the carcass remains of 4 of the collars, and one caribou mortality was confirmed to be a predator kill.

- Survival rates are estimated from NL and QC collared caribou from June 1st- May 31st annually using MARK. In 2015, these rates were re-analyzed for adult females and males by QC biologist. The results are graphed in figure X, with negative bars representing the modified survival estimates when harvested collared animals are included in the analysis. The revised estimates for June 2013-May 2014 were 79% and 70% annual survival for females and males respectively. Yearling survival was estimated under a separate analysis as 53%. These rates are currently too low to sustain a migratory caribou population, and have been consistently low throughout the LCI.

- No samples were available in Year 4 of the LCI to conduct cementum ageing and thus no age distribution could be determined. When legal harvest is resumed, it is recommended that jawbone and other sample submission be made mandatory to aid in these monitoring efforts. An analysis of the trend in age distribution from 1997 to 2012 will be presented in the LCI Phase 1 Summary report.

- The increased number of calf classification surveys allowed some observation of calf mortality. Over the first 35 days (June 10th to July 15th), calf percentage of the population declined by approximately 0.40% per day. This rate of mortality decreased over the next 55 days to September 8th, over which it was 0.04% per day. Leading up to the fall classification and rutting period, calf mortality increased slightly to 0.11% per day over the 46 day period until October 24th.
• Health Monitoring

Due to the hunting ban in place throughout Year 4 of the LCI, biological caribou samples and data to inform the health monitoring program were restricted to those collected during live caribou captures. There was therefore no new information available regarding bone marrow fat percentages, age distribution via cementum analysis, blood borne pathogens, or besnoitia density via skin samples. It would be informative to run these analyses again when legal and sustainable harvest resumes to monitor any changes.

- The average winter weight of adult females and males captured in the 2011/12 season was 97.6±1.9kg and 102.1±5.1kg respectively, 98.0±2.4 and 111.3±10.0 kg respectively in the 2012/13 season, and 90.7±3.2kg and 105.0±4.0kg respectively in the 2013/14 season. The average weight of GRCH females in April over the 70-90’s was 94.0±1.9 kg (Bergerud et al. 2008). No caribou were weighed in Y4.

- Assessing the level of besnoitia infection during live caribou handling is done by scoring the density of cysts seen in the sclera on a scale from 0-4. Throughout phase 1 of the LCI, besnoitia presence was consistently confirmed in 2/3 of the captured caribou and the average infection level score was 1. Given that sclera scoring is a less sensitive method of besnoitia detection than skin samples, these values correspond well with the 80% infection rate for 2011/12 calculated from skin samples. This is considered a very high prevalence for this parasite, although the infection severity appears to be non-severe. Of the 21 caribou scored for besnoitia cyst density in Y4, 2 scored a density of 1, while no besnoitia cysts were noted in the rest; a ~80% drop in infection rates. There is still concern for population level effects of besnoitia on breathing, reproduction, and stress levels.

- Fecal samples were collected from 17 adult females captured during winter 2015 and will be sent to the Toronto Zoo for progesterone analysis. 2014 results indicated that 91% of females were pregnant at the time of sampling (note-small sample size; Fig X). This percentage, also estimated from captured females, was 82% in 2013 and 85% in 2012. Pregnancy rate was also estimated from fecal samples collected during the 2012 licensed caribou hunt, and was estimated at 74%. It is expected that 90% of females in a healthy caribou herd will become pregnant every year.

- Hormone analysis results for hair samples collected during the winter of 2014 were received during Year 4. The results of these assays can be seen in Fig X, as added to the previous results from the LCI phase 1 summary report. Stress hormone concentration (ng cortisol/g hair) returned to baseline levels in 2014 after a significant increase in 2013. It appears that stress and sex hormone production varies to a large degree between individual caribou during the fall (when the majority of hair growth occurs). Investigation into the drivers of this variation, may it be body condition, parasite load, reproductive status or other potential factors, is still in progress.

• Predation Pressure

- Wolves

Only two wolves (1 male and 1 female from the same pack) were collared during Year 4 of the LCI despite ongoing efforts to find and collar wolves during caribou field work. These wolves were captured in March 2015, and thus have transmitted a few locations. Wolf abundance appears to be low; no wolves were seen on the
calving grounds in June, or during the September or October classification surveys. Seven previously known to be occupied dens were investigated with no findings, and six additional locations were searched with no findings.

One collared wolf was harvested west of Nain in January. This wolf was collared in August 2012 and the collar had lasted only a week before it malfunctioned. It is possible that the data is stored on board the collar; yet to be determined.

Despite a lack of collar deployments, there were 4 previously collared wolves with functioning GPS collars at the beginning of Year 4. One of the male wolves died in May, only 44 days after capture. The other 2 male and 1 female wolves survived until the end of Year 4. All wolf data collected in Y4 can be seen in figure X. As part of a multi-year project, these data will be combined with wolf data collected over the course of the LCI for further interpretation and analysis across the GRCH home range in the LCI phase 2 summary report.

Samples collected from wolves include hair, feces, and blood, which will permit analysis of DNA, stress levels, hormone production, parasites, and diet (no analysis conducted to date).

**Bears**

Seven bears fitted with collars in phase 1 were recaptured in June 2014 to have their collar fit checked and the collar replaced if necessary. An additional five new bears were also captured and collared with QC ATS collars in Year 4; bringing the total number of active bear collars to 12 (4 females and 8 males). During these field efforts, one large male bear was observed consuming a caribou calf.

At the end of Year 4, all bear collars were still in the dens and had been functioning properly up until den entry. Data resulting from bear collaring efforts during Year 4 is summarized in Figure 5 for this progress report. As part of a multi-year project, this data will be combined with bear data collected over the course of the LCI for interpretation in the LCI summary report. To date, data indicate that females tend to maintain exclusive, yet adjacent territories that are well defined, while male bears exploit several different strategies. Some males are observed to wander large distances over the course of their active season, some males remain exclusively in the valleys, and some males make seasonal migrations to and from the calving grounds to feed opportunistically.

Samples collected for all bears include a premolar, hair, and blood, which will allow determination of age, and analysis of DNA, stress levels, hormone production, and diet (no analysis conducted to date).

### 4.2 POPULATION PROJECTIONS-

- In Year 1, population projections from the 2010 census onwards estimated there would be 30,000 animals in the GRCH in fall 2012.
In Year 2, the census put the herd at 27,600 animals in July 2012. Adult survival and calf recruitment rates suggested that the 2012 fall population would be 24,362. Estimates for fall 2013 and 2014 were approximately 19,739 and 15,723 GR animals respectively.

In Year 3, this model was updated by including the new monitoring data. Revisions to model assumptions included:
- Rate of survival of 0.75 and 0.70 for 2012 and 2013 respectively across all cohorts except calves.

Revised populations estimates were 18,146 for fall 2013 and 12,420 for fall 2014.

In Year 4, the census put the herd at 14,200 animals in July 2014. Projection modeling using five year average adult survival and calf recruitment estimated the herd to be approximately 11,200 in 2015 and 8,800 in 2016 (Fig 6).

4.3 Long Term Management Planning –

- Representatives from both provinces are working on a status report detailing research conducted, findings, population indices, population trends and current threats.
- A technical table of contents and herd status report were prepared as a starting point for discussions with the Ungava Peninsula Aboriginal Round Table.
- In April 2014, the UPCART was invited by the provinces to begin technical discussions on management planning through a suggested liaison committee. This invitation included the table of contents as a suggested starting point for discussions. Acknowledgement of the suggestion was received, but no indication of acceptance of the invitation has been provided to date. Add more to what has happened here.

4.4 Community and Stakeholder Engagement –

- T-Shirt Initiative
  To spread awareness and increase dialogue surrounding GRCH stewardship over the course of the LCI, stakeholders were engaged in the creation of a t-shirt with caribou artwork and stakeholder logos (Year 2). With the t-shirts purchased by the Wildlife Division, a stewardship contest was designed for 17 Labrador schools (Year 3). The contest was completed during Year 4, and the students were awarded t-shirts for most creatively expressing what Caribou mean to themselves and their families. Some of the entries can be found in Appendix X.

- Information Sessions and Meetings
  A herd status update was presented to the Torngat Wildlife and Plants Co-Management Board in October 2014. Public information session presentations were drafted for the GRCH in November 2014 and for all Labrador caribou herds in February 2014, but these presentations were not delivered to the public at the end of the 2014/15 fiscal year.

- North American Caribou Workshop
  NL was represented at the 15th NACW. Training/facilitation was undertaken for engaging with Aboriginal communities in range planning. Information was shared, particularly between biologists from QC and NL, but also from across the north. A poster presentation was made and constructive feedback and suggestions were made by new contacts and partners in the field of caribou health and body condition. The main theme of the
workshop, as expressed by provincial governments, aboriginal governments, management board members, academics, industries and consultants was that in order to have un from local people and aboriginal communities, there is a need for consistent, clear, open communication before things happen, and during their completion. This must occur throughout all the phases of population abundance.

- John’s Fall/Winter 2014
  Conference/meetings Summary to be filled in by John P

- Labrador Research Forum
  Summary to be filled in by John P

4.5 Harvest Monitoring Activities—

- During Year 4, no collared caribou were known to be killed by hunters. There were however, at minimum 10 collars that malfunctioned before their batteries were expected to be getting low, or malfunctioned around the same time period and location. Caribou can be known to malfunction at a relatively high rate, and hence it is likely that many of these collars simply stopped working. There is a chance however, that these collars were destroyed by hunters. An investigation was conducted into several collars malfunctioning north of the Labrador border east of Schefferville, but no evidence of illegal activity was found.
- There was no legal harvest of GRCH animals, so harvest monitoring by Wildlife staff was reduced in Year 4. It was publicly stated that the Innu Nation would continue to practice their cultural right by harvesting (male) caribou. The number of caribou illegally harvested in Year 4 is unknown.
- Despite the hunting ban, it is estimated that approximately ~2% of the herd was harvested between Dec 3rd 2012 and March 30th 2013. In 2013/14, Department of Justice officers confirmed that at minimum 90 animals were poached. It is expected however, that at least 300 were likely harvested by members of Sheshatshiu and Natuashish; as the Innu Nation stated in Fall 2013 that it would continue to defy the ban and harvest 150 male caribou per community. WD and DOJ officials also established that a number of confirmed kills were female caribou.

4.6 Management Actions—

- On August 2, 2011 the Minister of ENVC delayed the start of the 2011/12 GRC hunting season until further assessment and consultations.
- The GRCH 2011/12 season then opened on 20 December, 2011.
The 2012/13 GRCH hunting season was never opened, and then on January 28th, 2013, the Minister of ENVC announced an immediate ban on all caribou hunting (including aboriginal subsistence harvest) in Labrador for conservation purposes for a period of five years, with a review after two years.

This ban continued for the GRCH historical hunting seasons through 2013-2015.

An assessment of the hunting ban after two years was intended to allow for monitoring the demographic and population response of the herd to relief from hunting. This information was to then be used to assess whether or not the ban was having any measure of positive affect on the herd, and the basis upon which the ban might be continued or discontinued.

In Quebec:

- Changes were implemented for the 2011-2012 season, including a 50% reduction in outfitter permits, subdivision of Zone 23 into a W/E sections, so that the George River and Leaf River herds could be managed separately; closure of sport hunting in the S section of Zone 23; limitation on sport hunting in Zone 24; a reduced season in the Eastern section of Zone 23; and closure of sport hunting in 2012-2013 in the Eastern section of Zone 23 and in Zone 24, subject to the biological information collected in 2011-2012.

- The sport hunt was closed for 2012-13, 2013-14, 2014-15 and the aboriginal groups reiterated their commitment to harvest monitoring.

WD continues to work with Quebec towards a GRC inter-provincial management plan with direct participation from aboriginal groups being sought through a sub-committee of the UPCART.

### 5.0 BUDGET SUMMARY - YEAR 4

<table>
<thead>
<tr>
<th>Activities</th>
<th>Expected Cost</th>
<th>Actual Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collar purchase/refurbishment</td>
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<td>?</td>
</tr>
<tr>
<td>Helicopter and fixed wing flight time</td>
<td>70,000</td>
<td>?</td>
</tr>
<tr>
<td>Fuel deployment</td>
<td>15,000</td>
<td>?</td>
</tr>
<tr>
<td>Equipment/supplies</td>
<td>10,000</td>
<td>?</td>
</tr>
<tr>
<td>Travel/meetings</td>
<td>15,000</td>
<td>?</td>
</tr>
<tr>
<td>Fall classification</td>
<td>30,000</td>
<td>?</td>
</tr>
<tr>
<td>Stewardship and education</td>
<td>10,000</td>
<td>?</td>
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<tr>
<td>Management plan</td>
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<td>?</td>
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<td>Health indices</td>
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<td>?</td>
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<td>Collar data fees</td>
<td>50,000</td>
<td>?</td>
</tr>
<tr>
<td>Calving grounds survey</td>
<td>60,000</td>
<td>?</td>
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</table>
6.0 LITERATURE CITED


Table 1- Estimated George River caribou harvested annually per user group.

<table>
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<th></th>
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<th></th>
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<td>QC Aboriginal Groups</td>
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<td>700</td>
<td>250</td>
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<td>?</td>
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<td>Labrador License Holders</td>
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<td>QC Sport Harvest</td>
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<td>0</td>
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<td>Total</td>
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<td>2243</td>
<td>594**</td>
<td>300</td>
<td>?</td>
</tr>
</tbody>
</table>

*Includes 12 E license holders
**Reported harvest of ~92 Sedentary Caribou not included
Fig X. GRCH annual calving ranges as documented over the course of the LCI, highlighting that of Year 4. Calving ranges documented as location of adult females between June 1st and July 15th.
Fig. X. Annual range of the GRCH, represented by MCP of all collar locations from April 1st 2011 to March 31st 2013; highlighting Year 4.
Fig 1- Average calves/100 females per decade during fall classification surveys 1973-2010, and annual calves/100 female estimates for 2010-2014.

Fig X- Average males/100 females per decade during fall classification surveys 1973-2010, and annual males/100 female estimates for 2010-2014.
Figure X- Percentage of the GRCH composed of large males, as estimated during fall classification surveys from 2001-2014.

**Figure X**- Historical biological year (June 1st – May 31st) survival estimates for adult GRC (>2 years old). Error bars represent estimated drop in survival rate when harvested collared animals are include in the analysis. These revised estimates were completed by QC biologists using both QC and NL collar data.
Fig X- Concentration of a) cortisol in hair samples- an index of stress during the fall; b) progesterone in fecal samples- an index of pregnancy status during the winter; c) testosterone in hair samples an index of male status during the fall rut; and d) pregnane in hair samples- an index of female fertility during the rut. Data is presented annually by sex unless there was no significant difference found between years/sexes or the opposite sex was not being considered. If differences were found between hair sample location sites, data was analyzed for samples collected from the shoulder only.
Fig X- Results of wolf collaring efforts during Year 4 of the LCI; including 2015 capture locations and collar location data.
Fig X- Bear collar data collect during Year 4 of the LCI in relation to the GRCH calving grounds.
**Fig X-** George River Caribou Population Estimates 2010-2014, with projection modeling into Fall 2015 and 2016 (Simple model based on herd demographics and survival estimates). Future projection uses adult survival at 66% and calf recruitment of 16 calves/100 females, based on five-year average statistics. Diamonds mark census years and associated confidence intervals.
LABRADOR CARIBOU INITIATIVE
PHASE 1 (2011-2014) SUMMARY

Newfoundland and Labrador
Department of Environment and Conservation
Wildlife Division

Photo: Shannon Crowley - June 2011
# TABLE OF CONTENTS

**LIST OF TABLES**

- iii

**LIST OF FIGURES**

- iii

**EXECUTIVE SUMMARY**

- iv

## 1.0 PURPOSE

## 2.0 BACKGROUND

- 2.1 Circumpolar Status of Rangifer
- 2.2 Aboriginal and Local Peoples Relationships with GRCH
- 2.3 Stakeholders and Partners
- 2.4 GRC Population Trends
- 2.5 Harvest Management
- 2.6 Labrador Caribou Initiative Funding

## 3.0 SUMMARY OF PHASE 1

- 3.1 Biological Monitoring Activities
  - Collar Purchase and Deployment
  - Mortality Collar Investigations
  - Calf Captures
  - Fall Recruitment
  - Sex Ratios
  - Annual Survival
  - Age Distribution
  - Health Monitoring
    - Pregnancy Rates
    - Adult Weights
    - Besnoitia
    - Blood Borne Disease
    - Sex Hormones
    - Stress Hormones
  - Wolf Predation Pressure
  - Bear Predation Pressure
- 3.2 Annual and Seasonal Ranges
- 3.3 Population Size Estimates
  - Census
  - Projection Modeling
- 3.4 Long Term Management Planning
  - Inter-provincial
  - Federal programs
LABRADOR CARIBOU INITIATIVE
PHASE 1 (2011-2014) SUMMARY

1.0 PURPOSE

2.0 BACKGROUND

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2.2 Aboriginal and Local Peoples Relationships with GRCH
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2.4 GRC Population Trends
2.5 Harvest Management

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- The Quebec Government also implemented changes for the 2012-2013 closure of sport hunting in 2012-2013 in the Eastern section of Zone 23 and in Zone 24, subject to the biological information collected in 2011-2012.

- This ban continued for the 2013/14 GRCH historical hunting season (LCI Year 3), as did the sport hunt closure in Quebec. Aboriginal groups in Quebec reiterated their commitment to harvest monitoring.

- WD continues to work with Quebec towards a GRC inter-provincial management plan with direct participation from aboriginal groups being sought through a sub-committee of the UPCART.

2.6 Labrador Caribou Initiative Funding

3.0 SUMMARY OF PHASE 1

3.1 Biological Monitoring Activities
Collar Purchase and Deployment

Work Completed
A total of 60 adult and 20 yearling collars were purchased over the course of Phase 1, and an additional 5 adult and 4 yearling collars were refurbished. These supplies, along with supplies purchased by WD before the LCI and by QC, permitted the capture and collaring of 105 adult and 41 yearling caribou during Phase 1. These collars were distributed throughout the wintering or calving range of the herd, and at a male: female ratio that was representative of the populations’ sex ratio at the time.

Historical Trends
Before the implementation of the LCI, a smaller number of WD owned (often VHF) collars were deployed on the GRCH. Below is a summary of the number of Satellite/GPS collars deployed per fiscal year since 2005. Deployment records pre 2005 were not available for this report.

![Graph](image)

**Figure X** - Number of Satellite/GPS collars deployed on the GRCH by the Wildlife Division between April 2005 and March 2014.

Mortality Collar Investigations

Work Completed
A total of 62 investigations were conducted to try to establish cause of death of dead collared caribou, as well as retrieve the collar for possible redeployment. Of these investigations, 56 mortality sites were found and the associated collars were recovered. Cause of mortality was difficult, if not impossible to determine in the field even if only a little time had passed since death. Of the mortality sites identified, there were signs of predators and scavengers around 52% of the sites, 27% of the sites had no caribou remains or signs of predators, 16% were confirmed to be hunter kills, and 5% were identified as due to natural causes.

Historical Trends
Before the implementation of the LCI, funding for mortality investigations was limited. Below is a summary of the number of mortality investigations conducted per fiscal year since 2009. Almost all of the mortality investigations conducted before the LCI were conclusive, with human harvest being the cause of death.
Fall Recruitment

Work Completed
Classifying a portion of the population into the categories of sex and age class every fall during Phase 1 provided an annual index of the quantity of new individuals being brought into the herd each year. This is expressed as the recruitment (number of calves per 100 females), or the percentage calves in the population. Classification surveys were conducted in each of the three years of Phase 1, and recruitment was 17.0, 7.4, and 9.5 calves/100 females, while percent calves in the population was 10.0, 5.4, and 7.0%.

Historical Trends
Fall recruitment has been extensively documented by the WD, as well as in peer-reviewed journals and in Bergerud's 'The Return of the Caribou to Ungava'. Combining these data shows that calves per 100 females and percent calves in the population have fluctuated through time, with the degree of fluctuation increasing as the population decline progressed (Fig X). In addition to an increasing degree of fluctuation, note an average decrease in recruitment of 0.87 calves/100 females per year.
Couturier et al. (2009) estimated that fall productivity must be 34 calves/100 females for the George River herd to be stable (under the assumption that adult survival is 0.87 (Crete et al. 1996) and current survival estimates are below this value).

Calf Captures

Work Completed

Each June over the course of Phase 1 saw the capture of 30-34 newborn calves (47 males and 47 females in total). These calves were weighed, sexed, and had their cord status and hoof wear recorded. The annual average weights of calves born in Y1, Y2, and Y3 were not significantly different from each other at 6.26 ± 0.1 kg (SE), 6.40 ± 0.2 kg, and 6.6 ± 0.2 kg respectively. There were no significant differences found between the average weight of calves of different sexes, cord status, or hoof wear.

Historical Trends

Calf birth mass data is available almost annually since 1977. Fig X demonstrates how calf mass fluctuated through time as GRCH abundance cycled. The data indicates that calf birth mass declined as the population grew and reached a maximum, maintained a relatively stable average 5.6 kg throughout most of the decline, and began to improve again once the population decreased to 200,000.
Plotting calf birth mass along with recruitment highlights a long-term, significant correlation between the two sets of data (Fig X; linear regression: $F=12.13$, $P<0.00$). This regression has a slope of 10.9, signifying that for every 1 kg increase in annual calf birth mass, we could expect almost 11 more calves/100 females to survive until the fall classification. However, looking closely at Fig X from 2009 onwards, we see that this relationship is lost, and increasing calf birth mass is no longer associated with higher recruitment that fall. It is possible that this relationship is altered when the population numbers are low, as is currently the case ($0.06$).

Extra effort was made in 2013 to confirm whether calves reunited with their mothers post-capture. It was noted that seven of the thirty calves were not promptly reuniting with their mothers (although three of the seven mothers were sniffing the ground in close proximity to their
calf). This observation was concerning, and as such, a decision was made to suspend calf captures for the 2014/15 season.

**Sex Ratios**
**Work Completed**
Classifying a portion of the population into the categories of sex and age class every fall during Phase 1 provided an index of the ratio of males and large dominant males to females in the herd each year. This is expressed as the sex ratio (number of males per 100 females), or the percentage of large males in the population. Classification surveys were conducted in each of the three years of Phase 1, and the sex ratios were 40.8, 29.0, and 22.0 males/100 females, while percent large males in the population was 3.3, 2.0, and 6.8%.

**Historical Trends**
Fall sex ratios have been extensively documented by the WD, as well as in peer-reviewed journals and in Bergerud’s ‘The Return of the Caribou to Ungava’. Combining these data shows that males per 100 females and percent calves in the population have decreased through time from 1973 to present (Fig X), uncorrelated with the population cycle. The average decrease in the number of males/100 females has been 0.94 per year. The percent large males in the population has not been recorded over this entire time span, but records indicate that it was higher (averaging around 12%), before dropping 2007.

![Figure X](image_url)

**Figure X**- Males per 100 females and the percent large males in the GRCH measured during fall classification surveys.

**Annual Survival**
**Work Completed**
Survival rates were estimated annually from June 1st- May 31st in Program MARK using combined data from NL and QC collared caribou. Adult female, adult male, and yearling caribou survival estimates, along with their confidence intervals, can be found in Table X.
Table X- Survival Estimates for 2011/12, 2012/13, and 2013/14 caribou biological years with sample size (N) and 95% confidence intervals (CI).

<table>
<thead>
<tr>
<th></th>
<th>June 1(^{st}), 2011- May 31(^{st}), 2012</th>
<th>June 1(^{st}), 2012- May 31(^{st}), 2013</th>
<th>June 1(^{st}), 2013- May 31(^{st}), 2014</th>
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<tbody>
<tr>
<td></td>
<td>Adult F</td>
<td>Adult M</td>
<td>Yearlings</td>
</tr>
<tr>
<td>Survival</td>
<td>0.75</td>
<td>0.61</td>
<td>0.46</td>
</tr>
<tr>
<td>Lower CI</td>
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<td>0.40</td>
<td>0.22</td>
</tr>
<tr>
<td>Upper CI</td>
<td>0.82</td>
<td>0.78</td>
<td>0.72</td>
</tr>
<tr>
<td>N</td>
<td>49</td>
<td>13</td>
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</tr>
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</table>

Health Monitoring

Body condition and health affect the survival and reproduction of caribou, as well as the survival of their offspring. With the launch of the LCI, a health monitoring program was commenced to evaluate key physiological health indicators known to affect caribou survival and reproduction. These indicators include pregnancy rate, adult weights, parasite load (besnoitia), age structure, prevalence of blood borne diseases, and sex/stress hormone production.

Health monitoring sample packages were distributed to all caribou license holders over the 2011/12 hunting season; resulting in 197 packages with data sheets, jawbones, leg bones, and blood and fecal samples. This effort was a great success, with a 38% sample package return rate. Due to the hunting ban over the course of the 2012/13 and 2013/14 seasons, samples and data to inform the health monitoring program were restricted to those collected during live caribou captures.

Pregnancy Rates

Adult female pregnancy rate is an index of herd productivity or growth potential. Although calf recruitment is the primary indicator used in population modeling, quantifying productivity aids in understanding why recruitment may be high or low in a given year.

Estimation of annual pregnancy rates was conducted using relatively new, low-cost, and non-invasive fecal hormone techniques in partnership with the Toronto Zoo. Pregnancy rate was determined to be below that necessary to sustain a stable or growing migratory caribou herd.

Pregnancy rates for adult female caribou were estimated annually from 2011-2014 by measuring the progesterone concentration in fecal samples excreted or collected from female caribou between January and April of a given winter. Annual pregnancy rate estimates ranged from 82-91% for captured animals, and was much lower (74%), for females harvested through the resident hunt in 2012 (Table X). Potential biases in the females chosen for capture/harvest could play a role in the discrepancy between these estimates. This fecal hormone based method...
of determining pregnancy status was initially validated for the GRCH by testing both blood and fecal samples from the same animals captured in 2011 and 2012. All results were consistent.

Table X- Annual pregnancy rate estimates and sample size for 2011-2014 from fecal samples collected from female GRC live capture or domestic harvest.

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Pregnancy Rate Estimate</td>
<td>Captured Animals</td>
<td>Harvested Animals</td>
<td>Captured Animals</td>
<td>Captured Animals</td>
<td>Captured Animals</td>
</tr>
<tr>
<td></td>
<td>87%</td>
<td>74%</td>
<td>85%</td>
<td>82%</td>
<td>91%</td>
</tr>
<tr>
<td>Sample Size</td>
<td>15</td>
<td>100</td>
<td>32</td>
<td>17</td>
<td>11</td>
</tr>
</tbody>
</table>

Pregnancy rates were not easily estimated before fecal hormone techniques, and were formally documented by necropsy as documented in Couturier et al. (1990). Parturition, measured as the percentage of females observed to have given birth, was easier to measure, and was documented in Bergerud et al. These data are graphed against population size in Fig X. It appears that parturition and pregnancy decreased as the population grew, and that recent estimates of pregnancy rates are generally average.

Figure X- Historical estimates of parturition and pregnancy rates (%) over the rise and fall of the GRCH.

Although questions remain regarding sampling bias, general findings are that pregnancy rates documented during the LCI are not adequate to support a stable or growing population. Fecal samples collected from captured caribou may be overestimating this parameter, since females targeted for collaring tend to be
mature, large, heavier individuals that may fall to the back of the group while trying to evade capture. A study design comparing pregnancy rates of fecal samples collected randomly from the snow in craters or movement corridors with those from captured females would help address questions surrounding potential bias.

Body Condition

Body condition influences the ability of caribou to survive, evade predation, and successfully reproduce. Identifying the proportion of a population in poor body condition can provide insight into low vital rates potentially driven by reduced forage availability. Adult caribou were weighed and their body condition scored as part of data collection during live capture for collaring over the course of the LCI. Metatarsal bone marrow fat score, a robust indicator of body condition, was also analyzed for samples submitted under the hunter health monitoring program. Overall, body condition was found to be good, with low numbers of animals showing poor fat stores.

Over the first three years of the LCI, 31, 23, and 15 caribou respectively, were weighed (results in Fig. X). Males were found to be heavier than females, and average weights were not significantly different in 2011/12 and 2012/13); but female weight did deviate from average in 2013/14 declining to 90.7kg. This value is below the average weight of female GR caribou in April between 1970 and the 1990s as documented by Bergerud et al. (2008).

![Figure X](image)

**Figure X-** Weight (kg) of female and male caribou captured over the three Winter seasons of the LCI. Solid line indicates average weight of GR female caribou in April over the 70-90’s (Bergerud et al. 2008).
The average bone marrow fat score was 86% and was not significantly different between males and females. This value is higher than scores for female GRC between 2007 and 2009.

Both male and female caribou showed an average healthy and adequate weight and fat stores, indicating most caribou were able to meet their caloric demands for survival. The implications of female weight and body condition in terms of successful reproduction are under further investigation.

Parasites (Besnoitia)

Parasites can limit or suppress the body function of caribou and create energy deficiencies leading to poor body condition and associated declines in health and reproductive fitness. Besnoitia is a genus of cyst forming protozoans that use a variety of species as hosts, including caribou. Besnoitia in caribou can affect the epithelial tissues and can leave the animal vulnerable to infection, reduce mobility, obstructed breathing, and/or reduced reproductive potential. Although known to occur in caribou herds in north-western Canada since the 1920’s, Besnoitia has only recently (~2006) been investigated in the GRCH.

Assessing the level of besnoitia infection during live caribou capture is done by scoring the density of cysts seen on the white of the eye. Collecting a skin sample from the lower portion of the hind leg of harvested animals is another, more sensitive means of confirming infection and provides a more accurate estimate of cyst density. Besnoitia prevalence in the GRCH over the course of the LCI was found to be much higher than previously documented. This has been cause for some concern and has resulted in additional efforts to investigate potential health related effects.

Over the first 3 years investigations, besnoitia presence was confirmed in a minimum of 66% of live captured GR caribou through scoring eye cyst density, and the average infection level score was 1 (on a scale of 0 being no cysts and 4 being very dense cysts). This result is corroborated by a more accurate 80% besnoitia infection rate for 2011/12 calculated from skin samples collected by hunters under the hunter health monitoring program.

The 80% infection rate is an extensive jump from previous (2007-2008) besnoitia prevalence estimates of 15.8% for the GRCH. Although many individuals were found to host besnoitia, the population-level infection densities appear to be non-severe. There may however be negative body condition implications for those caribou with cyst densities greater than 3 per cm² of metatarsal skin. The average bone marrow score was found to be significantly lower ($F_{(4,175)} = 2.87, p = 0.02$) for these individuals than those with lower cyst densities (Fig X).
Age Structure

Comparing the proportion of young to old individuals in a wildlife population can be useful to estimate or predict changes in population growth/decline rates. Caribou populations are generally expected to decline if composed of a larger proportion of older individuals, meaning a smaller number of new individuals moving into the reproductive segment of the population each year. The age structure of a population can provide additional inferences, including annual recruitment, productivity, and age-specific survival. The age structure of the GRCH during phase 1 of the LCI was found to be almost evenly distributed among age classes. Average ages of 5.6 and 6 years old compare to average female ages closer to 4 years in the 1970s; when the population was growing most quickly.

GRCH age distribution in winter 2012 was documented during Y2 of Phase 1 via cementum ageing of teeth pulled from jawbones submitted under the hunter health monitoring program. In Y3, results were received for the cementum ageing of 145 teeth collected between 1997 and 2011 from hunter jawbone returns. Results of these analyses can be seen in Table X.

| Table X- Average age and standard deviation (SD) of caribou teeth submitted by hunters through the caribou harvest jawbone return program. Only years with 25 or more samples are included. |
|---|---|---|
| Year | Average Age | SD |
| 1997 | 4.9 | 2.7 |
The Wildlife Division has been conducting an ongoing caribou jawbone return program since the 1990’s. A comparative analysis of the age distribution trend during years with a GRCH sample size of 25 teeth or greater (1997, 1998, 1999, 2011, and 2012) is presented below (Fig X). At the initial stages of the population decline, a larger proportion of the population was comprised of younger individuals, while at the current and later stages of the decline, the population has a larger proportion of older individuals (average age of 4.3 versus 5.8 respectively).

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Age</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>3.6</td>
<td>2.0</td>
</tr>
<tr>
<td>1999</td>
<td>4.5</td>
<td>2.9</td>
</tr>
<tr>
<td>2011</td>
<td>6.0</td>
<td>2.7</td>
</tr>
<tr>
<td>2012</td>
<td>5.6</td>
<td>3.1</td>
</tr>
</tbody>
</table>

**Figure X**: Combined estimated GRCH age distribution from caribou harvested during 1997-1999 and 2011-2012.

The average age of female GRC from 1974-1993 was documented by Bergerud et al. (2008) in the Return of Caribou to Ungava. Plotting this data with the GRCH population estimate over the same time period reveals that as the population grew, the average female age increased (Fig X). This trend appears to have continued as the population began to decline; as shown in the figure above, where the average age at the beginning of the decline (with larger population size) was younger than the average age at the later stages of decline (with smaller population size).
Figure X- Estimated average female GRC age from Bergerud et al. between 1974 and 1993 when the population was increasing.

The current GRCH age structure is less skewed towards young individuals, especially when compared to the age structure of the population at the beginning of the growth phase. The age structure documented during the LCI has likely contributed to a substantial loss of capacity of the herd to rebound from the population decline given lower survival and reproduction rates of older individuals.

Current efforts are being directed toward monitoring any changes in other population demographics concurrent with the moratorium on hunting. It is also anticipated that jaw bone collections and monitoring of age structure will again be utilized as an important management and monitoring tool at such time as sustainable harvest can be resumed in the future.

Blood Borne Disease

Caribou survival and reproduction is subject to a host of pathogens that may negatively affect capacity to breathe, maintain hydration, meet caloric demands, carry a calf to term, etc. Two parasites (Toxoplasma gondii and Neospora caninum) and four viral agents (Pestivirus, Para Influenza-3, Bovine Herpesvirus-1, and West Nile Virus) were chosen from the literature for monitoring during the LCI due to their documented effects on migratory caribou and their proven
methodologies for blood-based detection. Overall, exposure rates for the six known caribou pathogens were similar or below those documented in the past or for other migratory caribou herds. However, female caribou testing positive for Pestivirus antibodies were significantly less likely to be pregnant.

Filter paper strips were soaked in the blood of harvested GRC and then submitted to the Wildlife Division under the hunter health monitoring program, or soaked from sampled caribou during live caribou capture. These strips were sent to the University of Calgary to be tested for antibodies indicating exposure one of the six pathogens. Results of these tests can be seen in Table X, along with a comparison of these results to other years/herds.

Table X - Results of antibody tests for six different blood borne pathogens, known effects of those pathogens, and GRC based conclusions of prevalence rate compared to other herds/years.

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Effects</th>
<th>Testing Positive</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxoplasma gondii</td>
<td>Abortion, anemia, hemorrhaging, death</td>
<td>0%</td>
<td>Much lower than the 27% prevalence in Western herds</td>
</tr>
<tr>
<td>Neospora caninum</td>
<td>Abortion, neonatal mortality</td>
<td>0%</td>
<td>Below infection levels found in Alaska and Yukon</td>
</tr>
<tr>
<td>Pestiviruses</td>
<td>Abortion, diarrhea, weak calves, death</td>
<td>28%</td>
<td>Same as 28% prevalence rate in herds across the arctic</td>
</tr>
<tr>
<td>Para Influenza-3</td>
<td>Respiratory disease leading to pneumonia</td>
<td>2%</td>
<td>Similar to 2007-2009 results (4%)</td>
</tr>
<tr>
<td>Bovine Herpesvirus-1</td>
<td>Abortion, respiratory distress, conjunctivitis</td>
<td>14%</td>
<td>Similar to 2007-09 results (19%) and lower than in the Western herds (62%)</td>
</tr>
<tr>
<td>West Nile Virus</td>
<td>Encephalitis, death</td>
<td>0%</td>
<td>Not currently a concern</td>
</tr>
</tbody>
</table>

Females that tested positive for pestivirus antibodies were 30% less likely to be pregnant (Z-Score = -2.2115 p=0.01), which is not surprising given that this virus has been linked to abortion in Bovids (Radostits et al., 2007). As the great majority of blood samples were collected early in the winter, future investigations may need to focus on pregnancy rate for these pestivirus positive females later in term (April/May). Although bovine diarrhea has also been linked to abortion, no significant decrease in pregnancy rate was noted for BHV-1 positive females.

At the stage of analysis coinciding with the conclusion of LCI Phase I, it appears that some of these pathogens may be effecting individual caribou survival or reproduction. But as documented in other herds, there is presently no strong evidence to implicate any of these pathogens with population level decline. Future investigations are expected to further explore the relationship between pestivirus and pregnancy rates.
Sex Hormones

Effective reproduction requires biological cues in the form of sex hormones. For male caribou, production of testosterone during the rutting season is linked to size and dominance, which ultimately impacts mating success. For female caribou, production of progesterone is important for both cycling into estrus and maintenance of a pregnancy. Evidence suggests that production of sex hormones can be hindered by stress and/or poor body condition, eventually impacting annual recruitment. Analysis of the data collected thus far shows that testosterone and pregnane concentration in hair samples varied between individuals and years. The variation in these hormones show promise as indicators of individual fitness and overall herd productivity.

An index of the concentration of sex hormones circulating in the body was attained from fecal and hair samples collected by participants in the hunter health monitoring program and during live caribou capture. Samples were collected in the winter, and thus hair reflects the level of hormone in the fall breeding season (while the new winter coat was growing), and feces reflect the level of hormone in the winter (within the week prior to collection). These samples were analyzed at the Toronto Zoo Reproductive Endocrinology Laboratory, and the concentration of hormone (testosterone) or hormone metabolite (pregnane) was reported.

Analysis of sex hormone data is still in the preliminary stages. In terms of testosterone, it has been verified that there are significant differences in the hormone concentration of hair collected from different sites on the body, reflecting different hair growth patterns/timing. Male testosterone levels were significantly higher in 2010 and 2013, averaging 56.17ng/g, than in 2011 and 2012, when testosterone concentration averaged 17.47ng/g (Fig Xe). The variance in testosterone concentration was very high, with males ranging from 0.53-168.76 ng/g. Such a large range is promising for the use of hair testosterone concentration as an index of individual male quality and potentially overall herd productivity potential.

For female pregnane, it was also verified that there were significant differences in the hormone concentration of hair collected from different sites on the body. Female pregnane concentrations were significantly higher in 2013, averaging 36.01ng/g, than in 2010-2012, when pregnane concentration averaged 15.26ng/g (Fig Xf). The variance in pregnane concentration was high, although truncated by the upper limit of test detectability, with values ranging from 0.72-41.00 ng/g. Such a large range is promising for the use of hair pregnane concentration as an index of individual female breeding potential or overall herd productivity.

The amount of circulating sex hormones that get sequestered into hair growth during the breeding season has not yet been documented in the literature. Further analysis of existing data, additional research and longer term monitoring will allow conclusions to be drawn as to whether these concentrations can be used an indicator of future population trends.

Stress Hormones
Chronic stress has been identified as a factor in some wildlife population declines; in relation to anthropogenic disturbance or climate change. Sustained high levels of stress hormones (e.g., cortisol or corticosterone) could affect a caribou’s energy budget, suppress growth, reduce reproductive potential, and decrease the animals’ overall health. **Cortisol concentration varied significantly from year to year and 12% of the population was found to have fecal corticosterone concentrations that could be considered as high outliers.** Such fluctuations in hormone levels may therefore hold some promise in highlighting how fitness may change with the changing environment at both the herd and individual level.

An index of the concentration of stress hormones circulating in the body was attained from fecal and hair samples collected by participants in the hunter health monitoring program and during live caribou capture. Samples were collected in the winter, and thus hair reflects the level of hormone in the fall breeding season (while the new winter coat was growing), and feces reflect the level of hormone in the winter (within the week prior to collection). These samples were analyzed at the Toronto Zoo Reproductive Endocrinology Laboratory, and the concentration of hormone (cortisol or corticosterone) was reported.

Males were found to have higher average winter cortisol concentration (27.67ng/g; from fecal samples) than females (22.10ng/g; Fig Xb); yet this trend was reversed some years (perhaps an effect of small male sample size). Winter corticosterone concentration was not significantly different between males and females, averaging 98.77ng/g. However, twelve percent of the population had concentrations above 160ng/g (Fig Xc). Fall cortisol concentrations (from hair samples) were found to differ between the sample sites, but not between sexes. Using only samples collected from the shoulder, cortisol concentration was much higher in 2013 than in other years (Fig Xd).

According to this short term data-set, average stress levels for GRCH caribou appear to be slightly below those documented for captive caribou (Ashley et al. 2011), except in 2013 when hair cortisol concentration was found to be very high. Further analysis is required to identify whether individuals found to have above-average winter corticosterone levels successfully reproduced and/or survived the coming year, as well as explore potential links between average annual stress levels, cumulative human disturbance, and herd survival/recruitment rates.
Fig X- Concentration of a) pregnane in fecal samples- to determine pregnancy status; b) cortisol in fecal samples- an index of stress during the winter; c) corticosterone in fecal samples- an index of stress during the winter; d) cortisol in hair samples- an index of stress during the fall rut; e) testosterone in hair samples an index of male status during the fall rut; and f) pregnane in hair samples- an index of female fertility during the rut. Data is presented annually by sex unless there was no significant difference found between years/sexes or the opposite sex was not being considered. If differences were found between hair sample location sites, data was analyzed for samples collected from the shoulder.

Predation Pressure
Average female home range size – 120 ± 13(SE) km2
Average male home range size – 849 ± 268(SE) km2
Legend
- GRC Calving Grounds
- Bear Capture Location
- Den Sites
Non-Territorial Bears
- BEAR2012002
- Juvenile
Annual Bear Range
- 2012
- 2013
- 2014
- Purchase of 15 Lotek 2D collars for predators of GR caribou (5 bear; 10 wolf).
- An additional 2 camera collars given to the project by Lotek to field test new product (2 bear).
- Deployment of 2 wolf collars on GR wintering grounds during February-March 2012.
- Deployment of 10 bear collars (5 2D Lotek Iridium collars, and 5 Lotek Camera Collars (2 belonging to WD, 2 belonging to Caribou Ungava, and 1 belonging to QC)).
- Six wolves were collared during year 2 of the Labrador Caribou Initiative. All were adults except one sub adult female, and the body condition was said to be fair-excellent for all animals (no poor). The average weight was 35.1±2 kg, average total length was 1470±87 mm, and average chest girth was 658±25 mm. One female died 18 days after capture of unknown causes. The remaining 5 wolves had collars that malfunctioned 5,7,9,120, and 190 days after deployment. The collar that lasted 190 days was a Telonics collar, while the other 5 were Lotek Iridium collars. During year 1, 4 wolves were collared (3 females and 1 male), but the male slipped his collar after 1 day. Overall, collaring efforts were fairly unsuccessful. Resulting wolf monitoring during year 2 has been combined with that from year 1, and is summarized in Fig. 3. As demonstrated in Fig 3, collar deployments have been targeted at both the calving and wintering grounds for comparison or wolf home range size and behaviors between these two areas. Further efforts will be necessary to establish estimates of pack home range size and movement patterns across the vast GRCH range. Samples collected for wolves include hair, feces, and blood, which will permit analysis of DNA, stress levels, hormone production, parasites, and diet (no results to date).
- Ten bears (6 males and 4 females) were captured during year 2 of the Labrador Caribou Initiative. All were adults except one sub adult male, and the body condition was said to be ‘fair’ and one female said to be ‘poor’. The average weight for males (108.1±13.0kg) was significantly (P=0.01) higher than that of females (63.0±2.2kg). Average total body length was 1796.7±40.0 mm for males and 1590±22.7 mm for females, and average chest girth was 976.7±55.7 mm for males and 800±9.1 for females. Samples collected for all bears include a premolar, tissue, hair, and blood, which will allow determination of age, and analysis of DNA, stress levels, hormone production, and diet (no results to date). Five of the bears were fitted with Lotek Iridium 2D camera collars. These collars resulted in minimal success, with one collar being successfully recovered with video footage, one collar being recovered with successfully recovered with one day of video footage, and the remaining three collars malfunctioning within ~1 month and were not recovered. Alternatively, the 5 bears fitted with Lotek Iridium 2D non-camera collars worked well for the duration of the year, and when combined with the minimal locations recorded from the camera collars, illustrate the home-range dynamics of bears close to the GRCH calving grounds. The resulting movement pattern of males vs. females is quite striking, males moving an average 2.5 km/day more than females (Fig. 4). These efforts will continue in Year 3.

Six wolves were collared during Year 3 of the Labrador Caribou Initiative (2 VHF and 4 Lotek Iridium collars belonging to WD). These wolves included one male pup, three adult males, one sub-adult female, and one adult female. The body condition was said to be fair-excellent for all animals (no poor), although 4 of the wolves had porcupine quills embedded in their face.

Wolf collaring efforts in Year 2 of the LCI were characterized by a small number of locations being transmitted before collars malfunctioned shortly after deployment. Year 3 saw a marked improvement in data collection. The three Lotek Iridium collars deployed on adult male wolves transmitted locations throughout the course of Year 3 with no problems. The one Lotek Iridium collar deployed on the sub adult female transmitted locations well, but she died 41 days
after collar deployment (collar successfully recovered). The remaining two wolves were collared with VHF transmitters, and their current status is not known.

Data collected from wolf collaring efforts throughout Year 3 is summarized in Figure 4 for this progress report. As part of a multi-year project, this data will be combined with wolf data collected over the course of the LCI for interpretation in the LCI summary report. A presentation on plans for wolf research under the LCI and data collected to date was presented at the Caribou Ungava Symposium (Appendix C).

As demonstrated in Figure 4, collar deployments have been targeted at both the calving and wintering grounds for comparison or wolf home range size and behaviors between these two areas. Further efforts will be necessary to establish estimates of pack home range size and movement patterns across the vast GRCH range. As part of a multi-year project, this data will be combined with wolf data collected over the course of the LCI for interpretation in the LCI summary report.

Samples collected for wolves include hair, feces, and blood, which will permit analysis of DNA, stress levels, hormone production, parasites, and diet (no analysis conducted to date).

Bears

Five bears fitted with Lotek Iridium collars in Year 2 were recaptured in Year 3 to have their collars checked (2), refitted/repaired (2), or replaced (1; replaced with a QC ATS collar) if necessary. All these bears were found to have good body condition and had either maintained their weight from last year or gained 2-28 kg. During this collaring period, the three Lotek camera collars that malfunctioned the previous year were searched for but not found.

An additional five new bears (two adult females, two adult males, and one young adult male) were also captured and collared with QC ATS collars in Year 3. The four adults were found to be in good condition, while the young male was fair, with very little fat. One of these male bears was with 2 others, and the group was consuming an adult and a calf caribou carcass.

At the end of Year 3, two of the ten collared bears had died, one Lotek Iridium collar from Year 2 had malfunctioned, and the remaining seven collars were working well on alive bears. Data resulting from bear collaring efforts during Year 3 is summarized in Figure 5 for this progress report. Note that location data from six ATS bear collars has not yet been included; it is being managed by QC and WD is waiting for data transfer. As part of a multi-year project, this data will be combined with bear data collected over the course of the LCI for interpretation in the LCI summary report.

Samples collected for all bears include a premolar, tissue, hair, and blood, which will allow determination of age, and analysis of DNA, stress levels, hormone production, and diet (no analysis conducted to date).
As management planning proceeds, it will be essential to have the required information to address the relative influence of wolf (and black bear) predation influence on the herd. Experience shows that in the absence of such research effort, the predation issue can become controversial, divisive, expensive; and can undermine caribou management planning efforts.

3.2 Cumulative and Seasonal Ranges
Cumulative Range area ~179000km²
Based on 142 collared animals and a total of 150390 locations
Fig X. GRCH cumulative and seasonal ranges as documented over the course of Phase 1 of the LCI. Cumulative range represented by MCP of all collar locations from April 1st 2011 to March 31st 2013. Seasonal ranges are schematic outlines of general seasonal locations averaged over the three years.

Area: 2011 = 10112 km², 2012 = 4461 km², 2013 = 4896 km²; common area that was within calving grounds all years - 2989 km²

3.3 Population Size Estimates
Census

Population trends can be monitored using vital rates (recruitment and survival), but a more precise population estimate requires a census. A photo-census relies on a large number of marked individuals in the population, and the formation of highly aggregated groups (a common behavior in July to seek relief from insects). Groups are located via satellite tracking of collars, photographed, and the marked sample of collared caribou in the photographed groups is used to estimate the total number of caribou in the population. **A photo census conducted in July 2012 confirmed a continued decline of the GRCH, with 63% of the population lost since 2010, and 96% lost since 1993.**

The photo census was conducted jointly by biologists from Wildlife NL and Quebec’s Ministry of Natural Resources with funding from Torngat Wildlife and Plants Co-Management Board, using the same method utilized to survey the GRCH in 1993, 2001, and 2010. Twenty two highly-aggregated groups were photographed and an additional 5 small groups were counted. A total of 22,725 caribou were photographed in highly aggregated groups, which included 84 of the 90 collared caribou. The corresponding population estimate in July was 27,600 with a 90% confidence interval of 24,900-30,400 animals. A news release was made on August 16th, 2012, stating the results of the census, the continued decline despite the harvest management measures, and the importance of working together to support long-term management measures for the future of the herd.

The January 2013 implementation of the GRC hunting ban included a commitment by the province to review the effects of the ban after 2 years (by Jan 2015). This review is to include an assessment of both compliance and the numeric and demographic response of the GRCH. Also as part of the assessment process, Year 3 of the LCI included the preparation of plans conduct a July 2014 photo census. Funding for this endeavor was secured during Year 3, through the continuation of Newfoundland and Labrador’s Labrador Caribou Initiative (Phase 2).

Projection Modeling

Between census years, GRCH population trends and size are monitored using projection modeling to inform management decisions. Using the previous population census, the number of caribou projected to be in the population over the next two years is calculated using vital rates (adult survival, calf recruitment, and hunting mortality). **Overall, projection modeling tended to slightly overestimate the herd size; because survival and recruitment rates continued to drop below values used for modelling purposes.** Given this variability of survival and recruitment through the years, projection modelling is still a great tool to understand overall trends and establish a window of potential population sizes moving forward.

In Year 1, population projections from the 2010 census onwards estimated there would be 54,000 GRCH animals in fall 2011 and 30,000 in fall 2012.

In Year 2, the photo census estimated the herd to be 27,600 animals in July 2012. Adult survival and calf recruitment rates projected the 2012 fall population to be
below 25,000. This result confirmed the continued decline, but also that the rate of
decline had increased.

Projections from the 2012 census onwards then estimated the fall 2013 population to
be 19,739 GRC and the fall 2014 to be 15,723 GRC.

In Year 3, this model was updated to include the new vital rates. Revised populations
estimates were 18,146 for fall 2013 and 12,420 for fall 2014 (Fig X).

Regardless how the adult survival, calf recruitment, and hunting mortality rates are
manipulated within their current standard distribution, the combined effect of these
poor rates mean that the GRCH continues to decline. Manipulation of parameters
within their standard distribution merely varies the rate of decline.

![George River Caribou Population Estimates 2001-2012](image)

**Fig X-** George River Caribou Population Estimates 2001-2012, with projection modeling into Fall 2013 and 2014 (Simple model based on herd demographics and survival estimates). Herd survival estimated as 0.83 from 2000-2009, 0.62 from 2010-2012, 0.75 for 2013 and 0.70 for 2014. Diamonds mark census years and circles represent future population projections.

### 2.7 Long Term Management Planning

- Wildlife Division worked with government of Quebec counterparts to begin preparation
  of an inter-jurisdictional and long term management plan for GRCH.
- Representatives from both provinces are working on a status report detailing research
  conducted, findings, population indices, population trends and current threats.
- A technical table of contents was prepared as a starting point for discussions with the
  Ungava Peninsula Aboriginal Round Table (Appendix D).
- In April (just after LCI Year 3), the UPCART was invited by the provinces to begin
  technical discussions on management planning through a suggested liaison committee.
This invitation included the table of contents as a suggested starting point for discussions. Acknowledgement of the suggestion was received, but no indication of acceptance of the invitation has been provided to date.

Inter-provincial Federal programs Management Plan Co-Authorship

2.8 Community and Stakeholder Engagement

Information Sharing
Disseminating the most recent GRCH data and discussing associated conclusions with the public was paramount in phase 1 of the LCI. This ensured that stakeholders were informed of research and monitoring efforts, and presented opportunities for the Wildlife Division to garner input, ideas, and concerns from interested parties. Below is a table detailing the recorded information sessions (Table X).

Table X - Date, event title and attendees at presentations and information sharing sessions hosted by the Wildlife Division. Abbreviations: Nunatsiavut Government (NG), NunatuKavut Community Council (NCC), and Torngat Wildlife and Plants Co-Management Board (TWPCB).

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Title</th>
<th>Attendees</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 2011</td>
<td>Labrador Hunting and Fishing Association AGM</td>
<td>Members of the Association</td>
</tr>
<tr>
<td>June 2011</td>
<td>Stakeholder Workshop</td>
<td>NG, TWPCB, Innu Nation, Torngat Secretariat, NCC, NL Outfitters Association, Labrador Hunting and Fishing Association, Intergovernmental Affairs, Departments of Natural Resources, Tourism, Aboriginal Affairs</td>
</tr>
<tr>
<td>September 2011</td>
<td>Individual Meeting</td>
<td>Innu Nation</td>
</tr>
<tr>
<td>November 2011</td>
<td>Stakeholder Workshop</td>
<td>NG, TWPCB, Innu Nation, Torngat Secretariat, NCC, NL Outfitters Association, Labrador Hunting and Fishing Association, Intergovernmental Affairs, Departments of Natural Resources, Tourism, Aboriginal Affairs</td>
</tr>
<tr>
<td>November 2011</td>
<td>Individual Meetings</td>
<td>TWPCB, Torngat Secretariat, Innu Nation, Quebec Innu, Caribou Ungava</td>
</tr>
<tr>
<td>November 2011</td>
<td>Community Information Sessions</td>
<td>Nain, Hopedale, Postville, Makkovik, Rigolet, HV-GB, Northwest River</td>
</tr>
<tr>
<td>Date</td>
<td>Event Description</td>
<td>Location</td>
</tr>
<tr>
<td>------------</td>
<td>---------------------------------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>February 2012</td>
<td>Community Information Session</td>
<td>Labrador City</td>
</tr>
<tr>
<td>March 2012</td>
<td>Community Information Session</td>
<td>Natuashish</td>
</tr>
<tr>
<td>April 2012</td>
<td>Stakeholder Workshop</td>
<td>NG, TWPCB, Innu Nation, Quebec Innu, NCC</td>
</tr>
<tr>
<td>April 2012</td>
<td>Individual Meetings</td>
<td>NG, NCC, or Innu Nation; all with Intergovernmental and Aboriginal Affairs</td>
</tr>
<tr>
<td>June 2012</td>
<td>Stakeholder Workshop</td>
<td>NG, NCC, Torngat Secretariat, TWPCB, NL Outfitters Association, Labrador and Aboriginal Affairs</td>
</tr>
<tr>
<td>September 2012</td>
<td>Declining Caribou: Shared Concerns, Shared Solutions</td>
<td>Hosted by the Hunting, Fishing and Trapping Coordinating Committee, along with the NG and the Torngat Secretariat; Presentation made by Wildlife NL Senior Manager of Habitat, Game and Fur</td>
</tr>
<tr>
<td>January 2014</td>
<td>Individual Meeting</td>
<td>NunatuKavut Community Council</td>
</tr>
<tr>
<td>March 2014</td>
<td>Community Information Sessions</td>
<td>Nain, Hopedale, Postville, Makkovik, Rigolet</td>
</tr>
<tr>
<td>March 2014</td>
<td>Individual Meeting</td>
<td>TWPCB</td>
</tr>
</tbody>
</table>

**Stewardship and Education**

Over the course of the LCI, multiple projects were coordinated to ensure the public was well informed of the current demographic situation of the GRCH, raise awareness of ongoing research, monitoring, and management actions, and foster stewardship among the people. Some of these projects are mentioned below.

- For the 2011/12 hunting season, a communication plan was developed to inform the public of management actions and to encourage participation in the herd health and harvest monitoring program. Communication mediums included: radio announcements, flyers, news releases, cable announcements, and newspapers.
- Posters on the status and biology of the GRCH and of one of its main predators, the wolf, were developed and distributed to communities.
- An informative placemat was developed in cooperation with GRCH stakeholders, printed in four languages, and distributed to local restaurants throughout Labrador.
- An article on the GRCH was written for the Wildlife Division’s summer 2011 newsletter.
- Brochure
  In an effort to provide feedback to hunters who participated in the 2011-12 GRCH health monitoring program, share results and information with the public, and encourage participation in harvest returns in the future; a health monitoring results brochure was prepared (Appendix X). The brochure included stats on participation, the winners of the hunter return prizes, hunter success rates, pregnancy estimates, body condition information, the age distribution of harvested animals, an introduction to besnoitia and its prevalence in the population, blood pathogen levels, and a short summary of hunters’ comments. 2000 brochures were printed and they were mailed to all caribou license holders (with animal-specific results if they were a participant).
Remaining brochures were circulated to government offices and stakeholders for distribution. Feedback was positive.

- T-shirt initiative
  
  To spread awareness and increase dialogue surrounding GRCH stewardship, a plan was made to engage all stakeholders in the creation of a t-shirt using a drawing introduced at the 2011 Arctic Ungulate Conference (Appendix X). The project was implemented through a contract to Intervale Associates Inc. to ensure maximum participation among stakeholders through a coordinated sponsorship. During Year 2 of the initiative, the agreement was put in place with Intervale, the invitation to participate was drafted, the participants were selected, and the t-shirt was designed. Year 3 saw the mailing of invitations to the stakeholder groups, participation of fourteen groups, the purchase of t-shirts and the distribution of those shirts to the public. With the t-shirts purchased by the Wildlife Division, a stewardship contest was run in 17 Labrador schools. Posters were designed, letters were drafted, and these were assembled along with the T-shirts into packages and sent to the schools (Appendix X). The contest was not yet complete at the end of Phase 1 of the LCI.

3.6 Harvest Monitoring

Harvest Monitoring Activities in 2011-2012 included a focused effort to track license sales, disperse sample collection kits, analyze hunter returns, call all license holders who did not submit a return, and keep record of any harvest reports from non-licensed hunters. These efforts were continued in year 2. Despite the hunting ban in year 3, 1 collared adult male caribou was shot and the collar was left in the field. It is estimated that approximately ~2% of the herd was harvested between Dec 3rd 2012 and March 30th 2013 (Table X). Over 2013/14, Department of Justice officers confirmed that at minimum 90 animals were poached. It is expected however, that at least 300 were likely harvested by members of Sheshatshiu and Natuashish; as the Innu Nation stated in Fall 2013 that it would continue to defy the ban and harvest 150 caribou per community. WD and DOJ officials also established that a number of confirmed kills were female caribou.

Table X- Estimated number of George River caribou harvested by user group, 2010-11, 2011-12, 2012-13 and 2013-14.

<table>
<thead>
<tr>
<th>Harvest Group</th>
<th>2010-11</th>
<th>2011-12</th>
<th>2012-13</th>
<th>2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labrador Innu</td>
<td>500</td>
<td>430</td>
<td>254</td>
<td>300</td>
</tr>
<tr>
<td>QC Aboriginal Groups</td>
<td>300</td>
<td>700</td>
<td>254</td>
<td>?</td>
</tr>
<tr>
<td>Labrador License Holders</td>
<td>250</td>
<td>493*</td>
<td>0</td>
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</tr>
<tr>
<td>NG Beneficiaries</td>
<td>1370</td>
<td>360</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Labrador Outfitters</td>
<td>80</td>
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<tr>
<td>QC Sport Harvest</td>
<td>360</td>
<td>260</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2860</strong></td>
<td><strong>2243</strong></td>
<td><strong>594</strong></td>
<td><strong>300</strong></td>
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</tbody>
</table>

* Includes 12 E license holders
** Reported harvest of ~92 Sedentary Caribou not included
### 4.0 Budget Summary

#### George River Caribou Initiative Budget - Year 1

<table>
<thead>
<tr>
<th>Category</th>
<th>Amount</th>
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</thead>
<tbody>
<tr>
<td>Biological and Harvest Monitoring</td>
<td></td>
</tr>
<tr>
<td>Collar Purchases, refurbishments, and satellite fees</td>
<td>$350,000</td>
</tr>
<tr>
<td>Helicopter Flights (collar deployments, surveys, mortality retrievals)</td>
<td>$425,000</td>
</tr>
<tr>
<td>Stewardship, Education, and Community Outreach (Travel, publications)</td>
<td>$30,000</td>
</tr>
<tr>
<td>Stakeholder Engagement (Meeting venues, travel, etc.)</td>
<td>$40,000</td>
</tr>
<tr>
<td>Miscellaneous supplies and activities</td>
<td>$80,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$925,000</strong></td>
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</tbody>
</table>

#### George River Caribou Initiative Budget - Year 2

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
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<tbody>
<tr>
<td>GPS and Satellite based collars</td>
<td>$40,000</td>
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<tr>
<td>Immobilizing agent</td>
<td>$5,000</td>
</tr>
<tr>
<td>Collar data acquisition</td>
<td>$30,000</td>
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<tr>
<td>Helicopter and fixed wing flight time</td>
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<tr>
<td>Miscellaneous supplies</td>
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<tr>
<td>Travel</td>
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<tr>
<td>GRCH Working Group</td>
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<tr>
<td>Stewardship, Education, and Harvest Monitoring</td>
<td>$30,000</td>
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<tr>
<td>Fuel and delivery</td>
<td>$70,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$522,000</strong></td>
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#### George River Caribou Initiative Budget - Year 3

<table>
<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
<td>GPS and Satellite based collar fees</td>
<td>$50,000</td>
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<tr>
<td>Helicopter and fixed wing flight time</td>
<td>$230,000</td>
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<tr>
<td>Supplies and services</td>
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<td>Travel</td>
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<td>Public Information Sessions</td>
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<td>Stewardship and Education</td>
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<td>Fuel and delivery</td>
<td>$40,000</td>
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<tr>
<td>Health Monitoring Lab Expenditures</td>
<td>$10,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$382,000</strong></td>
</tr>
</tbody>
</table>

### 5.0 Literature Cited