Aerial survey of the Migratory George River Caribou Herd in July 2020

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SUMMARY

Aerial surveys of post calving migratory caribou are fundamental scientific references in the demographic assessment of populations, management actions and long-term conservation planning. Since 2010, population surveys of the George River Herd (GRCH) have been conducted at two-year intervals to complement annual biological monitoring of recruitment, population structure and habitat use through the telemetric monitoring of caribou equipped with satellite collars.

The combination of detailed biological monitoring and frequent aerial surveys is justified because of the more than 99% decline of the GRH since 1993. In 2018, the GRCH reached its lowest recorded population level, at 5,500 caribou (+/- 7%; α = 0.10). A post-calving survey was subsequently conducted in July 2020, continuing the partnership between the governments of Newfoundland and Labrador and Quebec to jointly monitor the GRCH. The 2020 survey estimated the size of the GRH at 8,100 caribou (+/- 6%; α = 0.10). This indicates that the herd increased by 47% since 2018.

This population growth is mainly due to a very high proportion of calves (35%) born just 5 weeks prior to the survey. The percentage of this cohort that will reach adulthood is thus potentially low. Additional contribution to the overall growth of the population is attributed to a recent improvement in adult survival, which translate to an increase of approximately 24% in the number of adults in the population since 2018.

While these demographic improvements are encouraging, the status of the GRCH remains precarious due to its continuing low abundance and variability in adult and calf survival. A sequence of survey results showing sustained positive growth will thus be needed to confirm whether the herd has entered a recovery phase.

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1. INTRODUCTION

Two populations of migratory caribou inhabit the subarctic and arctic regions of northern Quebec and Labrador, each with affiliations based on geographic fidelity to discrete calving grounds[1]. The Leaf River Caribou Herd (LRCH) occurs in the western and northern Ungava region of Quebec. The range of the George River Caribou Herd (GRCH) extends across portions of northeastern Quebec and central and northern Labrador. Historically, the ranges of these two populations have overlapped, but extensive demographic declines have been accompanied by reduction in migratory movements and annual range retraction. Since 2008, the two populations have maintained geographic separation of annual ranges and no interchange of individuals has been documented. Between June 2019 and June 2020, the ranges of the GRCH and LRCH were separated by at least 175 kilometers (Figure 1). Consequently, aerial surveys are conducted independently and the population trend of these two herds is assessed based on the closed population concept, i.e. without emigration or immigration.

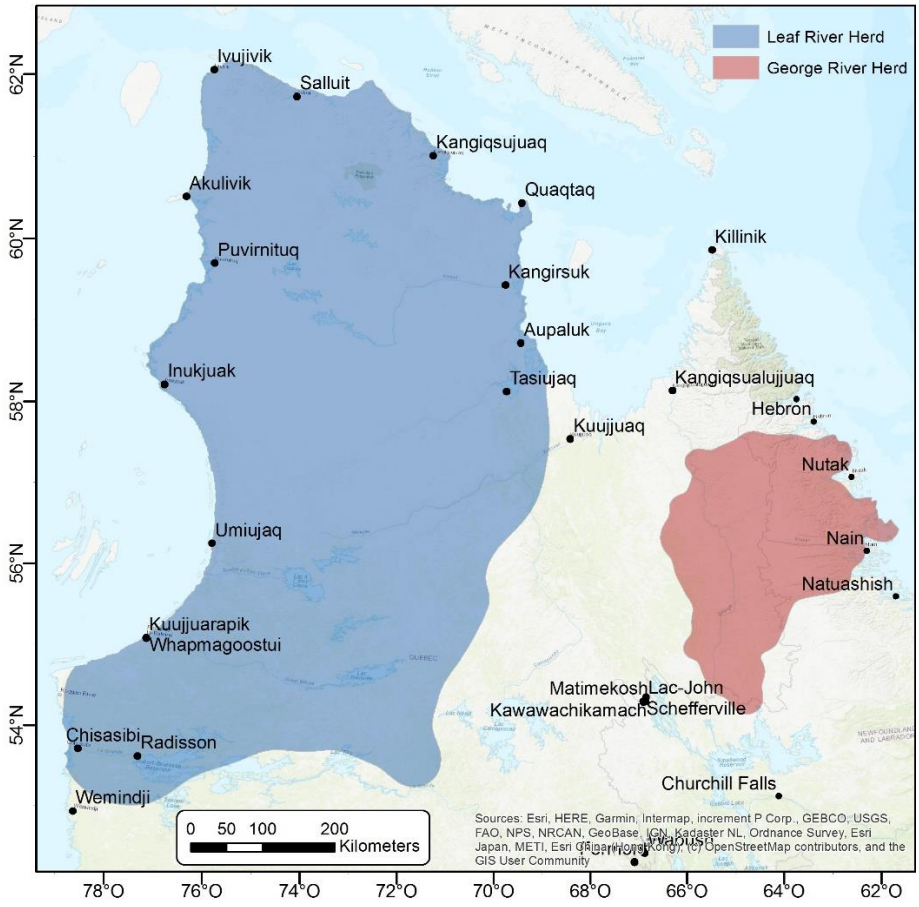

Figure 1: Distribution area of the Leaf River Caribou Herd (427,000 km^2) and the George River Caribou Herd (72,000 km^2) mapped according to the density of telemetric locations (Kernel 99%) of caribou equipped with transmitter collars between June 1, 2019 and May 31, 2020 (LRCH n = 160; GRCH n = 87).

1 TAILLON, Joëlle, Vincent BRODEUR & Stéphane RIVARD. 2016. Biological status of migratory caribou, Leaf River herd, ministère des Forêts, de la Faune et des Parcs, Québec, 67 p.

Since the 1970s, 13 aerial surveys of the GRCH have been conducted at varying intervals and using two methodologies based on the gregariousness of migratory caribou. From 1973 to 1988, surveys were based on counting females grouped together during spring in low densities on the calving grounds. Since 1993[2], the consolidation of monitoring by satellite telemetry collars has made it possible to carry out post-calving aggregation surveys during which females, calves and males aggregate together in high-density groups. This allows for population size estimates based on counting a large proportion of the population. This sequence of surveys documented the rapid growth of the herd during the 1970s and 1980s, and the population peak in the 1990s. Population size has since declined by over 99% (Figure 2), and the average annual decline between the 1993 and 2018 surveys has ranged from 9% to 39%.

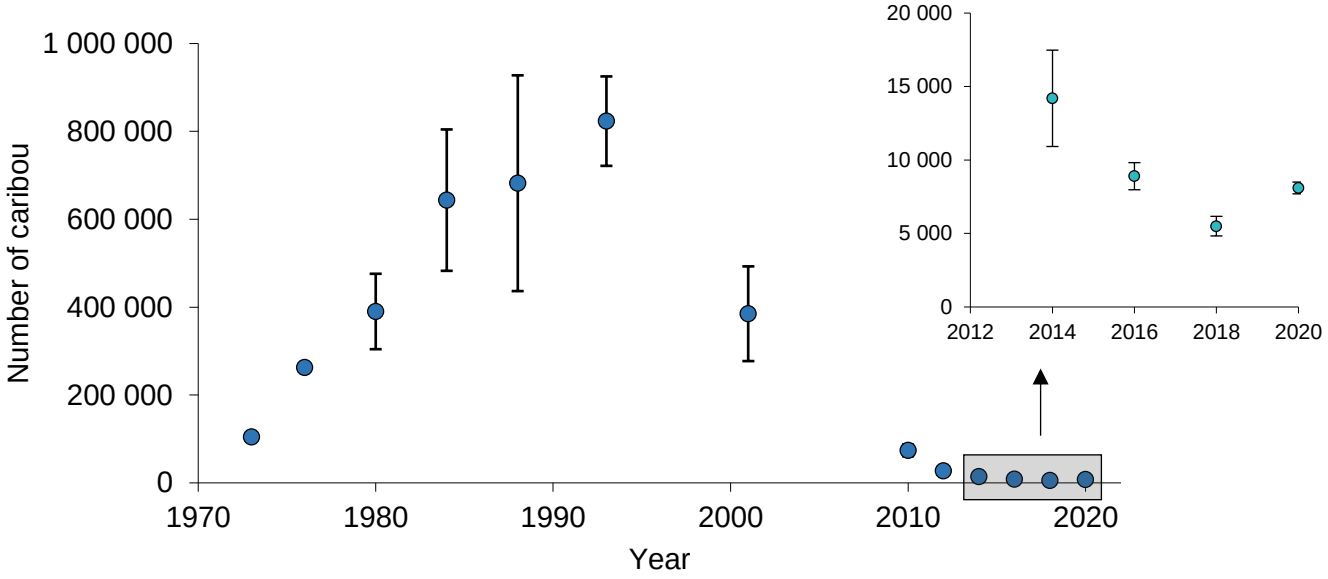

Figure 2: Results of aerial surveys specific to the GRCH since 1973. Surveys conducted since 1980 are presented with their confidence interval (α = 0.10). Confidence intervals for surveys since 2010 vary between 5% and 15% and are visible only in the inset scale of the graph.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) uses standardized population biology criteria to assess declining populations or groups of populations. In 2017, COSEWIC recommended to responsible management jurisdictions that the GRCH and LRCH, both part of the Eastern Migratory caribou designatable unit, be listed as endangered under the Species at Risk Act. Environment and Climate Change Canada is continuing its consultation process before it renders a decision. Currently in Quebec, neither migratory herd (i.e. GRCH or LRCH) has received protective status under the Act respecting threatened and vulnerable species. Newfoundland and Labrador, at the request of Indigenous communities, has chosen not to support listing of the GRCH under its Endangered Species Act at this time. Instead, the province is seeking a co-management approach to help guide recovery of the herd.

2 RUSSELL, John, Serge COUTURIER, Lennart G. SOPUK & Kristiina OVASKA. 1994. Post-calving photo-census or the Rivière George caribou herd in July 1993. Rangifer 16(4), 319-330. DOI 10.7557/2.16.4.1273.

The extent, severity and duration of the decline of the GRCH led to the closure of sport hunting in 2012 in the Québec portion of the GRCH range and eventually to a voluntary moratorium on hunting this herd by some Indigenous nations in Québec. In Labrador, in 2011 the Government of Newfoundland and Labrador (GNL&L) discontinued sport hunting, and in 2013, for purposes of conservation, enacted a legal moratorium on all hunting of GRCH caribou on Labrador provincial lands. GNL&L conducted two technical assessments of this management action in 2015 and 2018. Based on these assessments, it was determined that the moratorium should remain in effect until there is evidence of a growth trend toward recovery. Despite support for the moratorium from some Indigenous groups in Labrador, not all groups have backed the necessity of this conservation action. Various levels of harvesting by Indigenous hunters have been annually documented in Labrador despite the moratorium, and intermittently documented in the Quebec portion of the range. Such ongoing harvesting, as a direct mortality source, has contributed to the further decline of the herd through the moratorium period.

Aerial surveys based on post calving aggregations of caribou in the tundra are widely used and allow for good precision population estimates when sampling conditions are met[3]. For the GRCH, such surveys have been conducted biannually since 2010 and are coupled with annual monitoring of demographic parameters such as adult survival, recruitment, demographic composition, and habitat use as compiled from telemetry monitoring of caribou equipped with satellite collars. This intensive level of monitoring is justified given the extensive and ongoing decline of the GRCH and the requirement to support evidence based management actions.

A post-calving survey was conducted in July 2020, continuing the partnership between the governments of Newfoundland and Labrador and Quebec to jointly monitor and assess the population status of the GRCH. This survey, the focus of this report, estimates the size of the GRCH at 8,100 caribou (+/- 6%; α = 0.10) for July 2020. This result indicates that the herd increased by 47% since the previous survey in 2018 which estimated the population at 5,500 caribou (+/- 7%; α = 0.10). The findings presented in this report detail the demographic status of the GRCH at the time of survey and the methods and parameters used to generate the population estimate.

3 BOULANGER, John, Jan ADAMCZEWSKI & Tracy DAVISON (2018). Estimates of caribou herd size using post-calving surveys in the Northwest Territories and Nunavut, Canada: A meta-analysis. Rangifer, 38, (1), pp. 39-78. DOI 10.7557/2.38.1.4239

2. METHODOLOGY

During the post-calving period, migratory caribou gather in high-density groups in order to reduce their individual exposure to harassment by biting insects (Figure 3). This behaviour, when combined with a sufficient number of satellite telemetry collars (randomly deployed during previous winters) makes it possible to locate the vast majority of the population, confirm by telemetry the number of specific collared caribou within each group, and take aerial photographs of each group. When aggregation conditions are optimal, a very high proportion of the herd (~90%) can be located, photographed and accounted for.

The combination of dense caribou aggregations with sufficient representation of the population by collared caribou generates a robust and precise estimate of the population size. The estimate is based on the capture-mark-recapture principle, following the basic premises of Petersen's model as described by Brodeur *et al*[4]. The statistical calculation factors are the total number of active collars in the population, the proportion of collars confirmed by telemetry in photographed groups, and the number of caribou counted in the groups.

The number of collars must be sufficient to allow for coverage across the entire range of the population at the time of the survey, and with marked caribou randomly distributed. The aggregation behaviour must be strong enough to form groups composed of all the previously scattered caribou in the surrounding area. Based on probability, larger groups of caribou will have proportionately greater representation of collared animals. The linearity of this relationship serves as an assessment of the adequacy of the total number of collars in the population. These important premises are verified by a chi-square adequacy test on groups of more than 100 caribou to remove the irrelevant effect of lone caribou on this analyses.

The strength of the grouping behavior and the random dispersion of collars across the range can also be assessed by tracing the individual movement history of collared caribou photographed within a group. This can be done by measuring the distance between tagged caribou of the same group in the winter preceding the survey. The magnitude of this distance makes it possible to verify whether the caribou in the same group (at time of survey) show independent movements during the rest of the year and / or whether they have converged from different portions of the range.

The high resolution of the digital photographs enable accurate counting of the caribou within each group (Figure 4). The quality of the photographs also allows calves to be distinguished from adult caribou, but does not allow for adult males to be distinguished from females nor differentiate between categories of males (small, medium and large). Caribou classifications were conducted four months following the survey in November 2020 and provide an accurate measure of the demographic composition of the adult population. These classifications are conducted annually in the fall and document the proportion of females, calves, and males, with males further placed into sub-groups of small, medium, large and senescent individuals based on antler size and morphology.

The majority of classified caribou are observed from a ground position while they are moving slowly and at a very close distance to observers. This allows for careful and accurate recording of the different demographic classifications. Some smaller groups of caribou, or those located in flat open tundra areas are classified from the helicopter. The timing of the classifications coincides with the rutting period when there is maximum level of mixing of all classes across the range.

4 BRODEUR, Vincent, Stéphane RIVARD, Christian DUSSAULT, Léa HARVEY et Joëlle TAILLON (2017). The Use of Satellite Telemetry to Estimate the Abundance of a Migratory Caribou Population, ministère des Forêts, de la Faune et des Parcs, Québec, 25 p.

Figure 3: Caribou group closely together when heat and low winds lead to them being harassed by mosquitoes and other biting insects. Group 20 was one of the largest with 1,350 caribou, including 5 caribou equipped with satellite transmitter collars.

Figure 4-A: Group 20 was counted on a photo of 1,350 caribou (865 adults over 1 year old; 485 calves about 1 month old).

Figure 4-B: The enlarged high resolution image makes it possible to accurately count each caribou, even when they are densely aggregated. In this image, adults are tagged red and calves green. The angle of the photo is also important as this minimizes any visual blind spots.

FAVORABLE CONDITIONS

Caribou band together and move in groups during the summer. These groups take regular breaks during migration to feed and to minimize their exposure to biting insects. The random deployment of satellite telemetry collars results in proportionately larger numbers of collared animals being present in the larger groups of caribou. Collars transmit a GPS position twice a day via a satellite link and also emit a VHF radio signal that can be detected from a distance of several kilometers.

The grouping behaviour of caribou generally attracts all the animals over a vast area and thus provides an ideal opportunity to conduct counts (Figure 5). For the aerial survey in summer 2020, a combination of excellent aggregation conditions and adequate number of telemetry collars in the population produced a highly precise population estimate (8,100 caribou +/- 6%).

Figure 5: Caribou regularly use the last snow-covered areas to gather as a means of reducing exposure to high summer temperatures and biting insects.

3. RESULTS

The survey was carried out from July 9 to 13 by Vincent Brodeur and John Pisapio, biologists with the governments of Québec and Newfoundland and Labrador. Additional technical and planning support was provided by Sara McCarthy and Stéphane Rivard. Given precautions and requirements associated with the COVID-19 pandemic, the crew size was kept to a minimum. Under normal conditions, and as done for previous census surveys, a representative selected by the Ungava Peninsula Caribou Aboriginal Round Table (UPCART) and the Hunting, Fishing and Trapping Coordinating Committee (HFTCC) would have also participated in the survey. However, COVID related precautions and complexities around interprovincial travel at the time precluded such participation. As an additional health and safety precaution, no Indigenous communities were visited by the crew during the survey.

A base camp was selected for its proximity to the summer location of the GRCH and remote fuel caches. Sampling work was completed over 26 hours of flight time in an Astar 350 BA+ helicopter. Weather conditions were favorable for observing dense post-calving aggregations during the five days of sampling. Daily overflights were planned based on collar GPS locations, with groups finally located by radio telemetry (VHF) if they had moved since the last GPS location was transmitted.

3.1. Distribution of collars within the population

A chi-square test, performed on groups of more than 100 caribou confirmed the random distribution of collars in the population ($\chi^2 = 5.39$; dl = 12; p = 0.94) by showing that the number of collars in a group was proportional to the size of the group (Figure 6). The presence of multiple collars in the larger groups indicates that the number of collars was sufficient to represent the population.

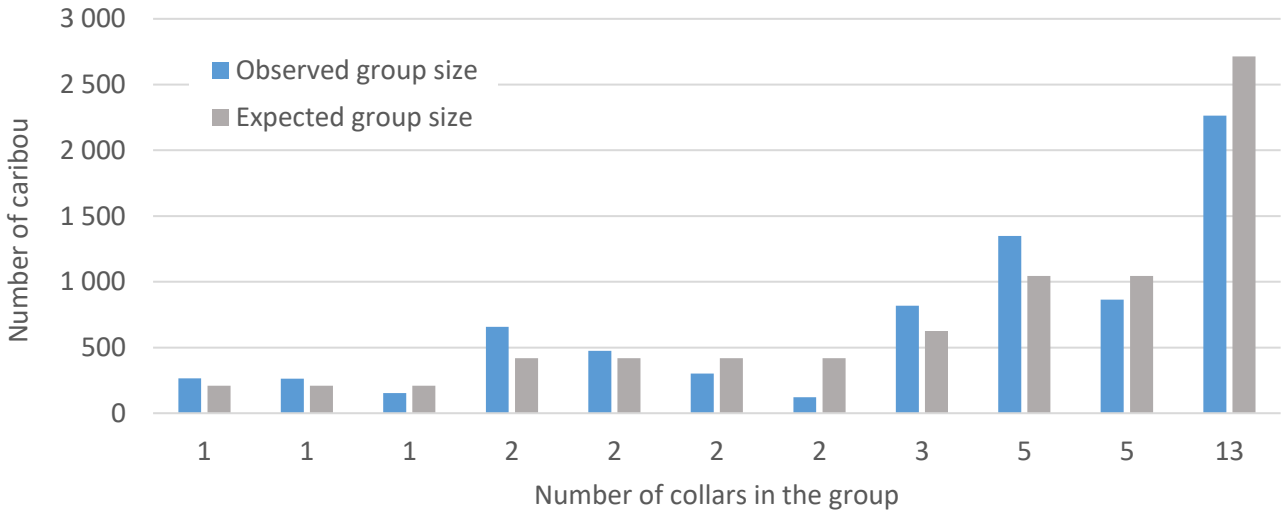

Figure 6: Comparison of the number of caribou counted in a group relative to the expected number of caribou based on the number of collars present per group. The expected number of caribou in a group is obtained by the following equation: (total caribou in all groups / total collars all in groups) x number of collars in the group. The analyses is based on groups of more than 100 caribou.

The adequacy of collar dispersion throughout the population's range can also be demonstrated by measuring the distance between the locations of marked (collared) caribou of the same group during the winter preceding the survey. For all 11 groups containing more than one collar, a location was recorded within a 13-hour interval for each tagged caribou of the same group, between January 30 and February 2, 2020.

During this period, the same caribou photographed in July as part of cohesive groups were located at an average distance of 55 kilometers (SE = 2.8 km; n = 182) apart from the other caribou of their group. The occurrence of a post-calving aggregation of caribou from different wintering areas is thereby demonstrated for all groups. The average distance between tagged individuals, calculated for each group separately, was between 41 km and 191 km ($\overline{x}$ = 73 km, SE = 13 km; n = 11).

The survey overflights totalled nearly 5,000 kilometers (Figure 7) and resulted in the observation of only five individual caribou that were not associated with collared caribou. The infrequency of these observations also indicates that the number of marked caribou was sufficient to locate groups of more than 100 caribou at the time of the survey.

3.2. Group characteristics and population estimate

The calculation of the population size estimate is based on the observation of 26 groups, which contained 52 of the 56 active collars at the time of the survey (93%), representing a total of 7,549 caribou counted in photographs (Table 1). Using these parameters, the Petersen's model estimated the size of the GRCH at 8,100 caribou (+/- 6%; α = 0.10) in 2020.

Groups were of various sizes, including several lone collared individuals (Table 1). As a result, 99.8% of the caribou counted on photographs occurred in 11 of the 26 groups composed of more than 100 caribou. These 11 groups contained 37 of the 52 collars photographed, while the remaining (15 groups) represented only 18 caribou that were distant from the large concentrations. Groups of more than 300 individuals contained at least two collared caribou and the largest group (2,263 caribou) contained 13 collars.

Groups of over 100 caribou were composed mostly of adult females and calves, and although some adult males were also photo-identified, none of these groups contained a collared male. The collared males were all observed alone and generally distant from the area frequented by large groups departing the calving grounds. In summary, 71% of the collars were sampled in high density groups, and 29% were sampled on caribou that were alone or in a group of two.

At the time of the survey, GRCH females and their calves were grouped together and moving along an established migratory corridor departing the calving grounds. Males were mostly distributed in very low density south of the females. The groups were sampled strategically against the direction of movement, which was generally south-southwest. As a result, some groups were sampled in similar areas (Figure 7), but on subsequent days. Eighteen of the 52 sampled caribou were identified in two or three different groups on different days. It is normal and expected that exchanges of individuals between groups occur when they converge during the summer migration. When a caribou equipped with a collar was sampled more than once, it was included in the analyses only in the group containing the higher number of collars (stronger aggregation conditions; see Appendix 1 for the raw data set).

Normal logistical constraints usually prevent a complete accounting for all collared caribou (52 of 56 active collars were surveyed). Three of the 4 collars that were not sampled were males located northwest of Nain at the time of the survey. One collared female was not visited or located with telemetry in the area where the large groups were sampled (Figure 8).

Table 1: Groups photographed and selected for the estimation of the population size of the George River Caribou Herd in July 2020.

Group number	Number of collars	Group size
1	2	301
2	3	817
3	2	475
6	2	658
9	1	266
12	2	122
13	1	152
14	1	1
15	1	1
16	1	2
17	1	262
18	1	1
19	1	2
20	5	1 350
21	1	2
22	1	1
23	1	1
24	1	1
25	1	1
26	1	1
27	1	1
28	13	2 263
29	5	865
30	1	1
31	1	1
32	1	1
Total 26	**52**	**7 549**

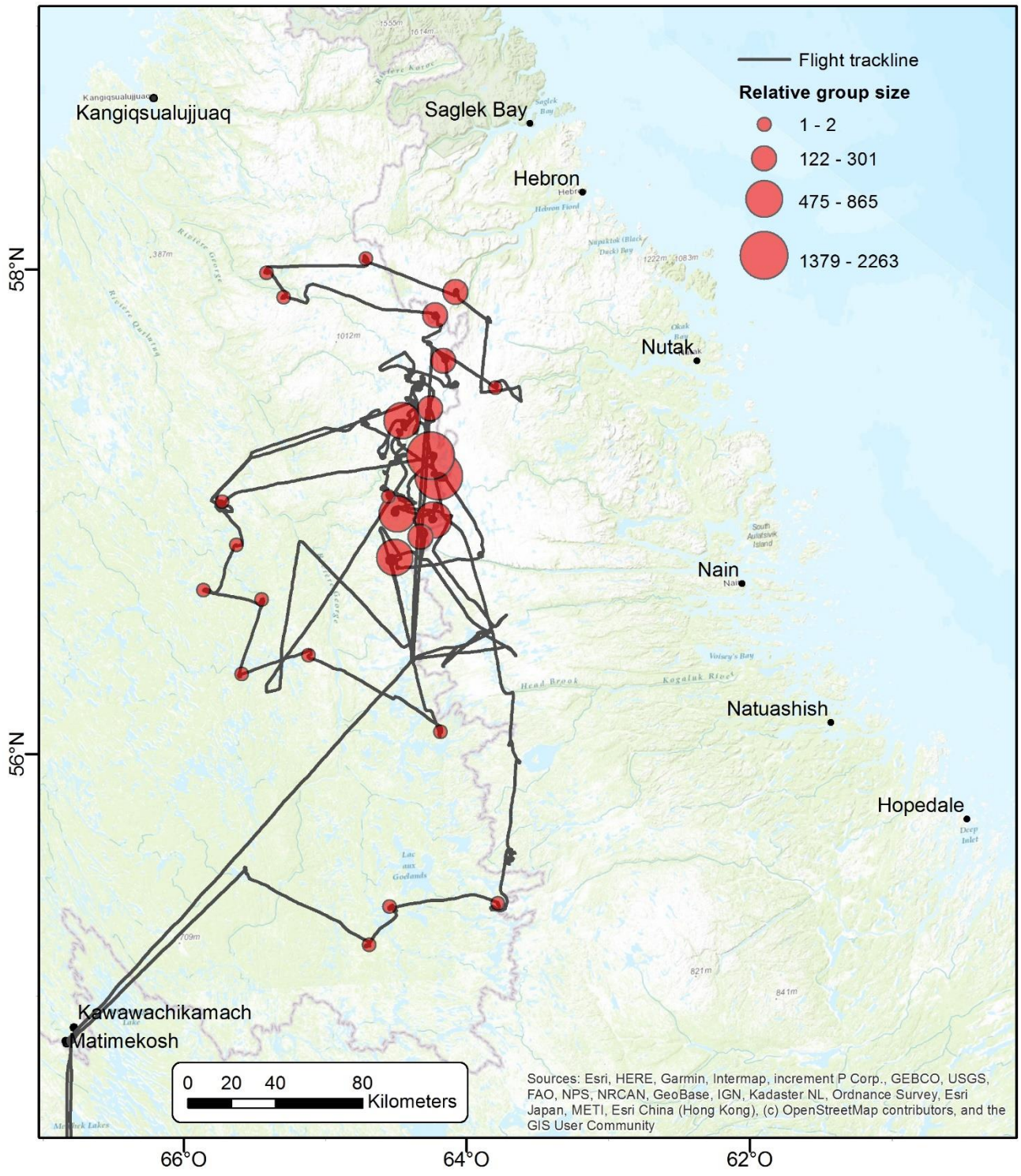

Figure 7: Location of the 26 groups of caribou selected for the analyses and the sum of the daily tracking carried out to complete the survey, totalling 26 hours of flight time and distance of about 5,000 km. The diameter of the circles is proportional to the relative size of the groups. All groups of more than 100 caribou were sampled in a southbound migratory axis where most of the population was located at the time of the survey.

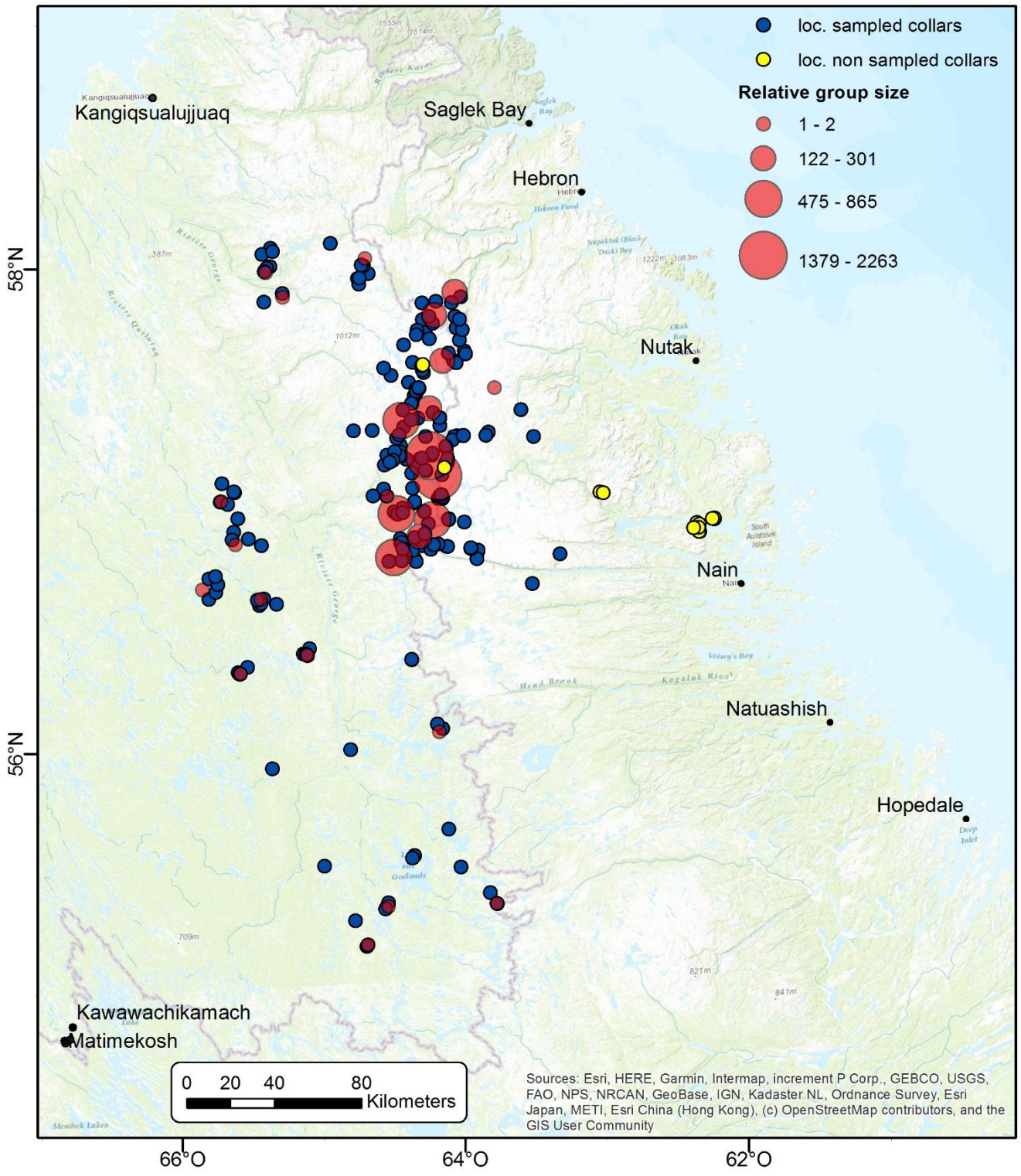

Figure 8: GPS locations transmitted by the active collars between July 8 and 13 were used to plan overflights and group sampling. Locations in yellow were transmitted during this period by the 4 collars not visited or photographed. Locations in blue were transmitted by collars that were photographed during the survey. The number of transmissions per collar varied between 2 and 6 during this period, totalling 343 locations for the 56 active collars.

Since post-calving aggregations create areas of either very low or very high caribou density, it is important that the sampling effort be representative of the spatial organization resulting from behavioural differences. Typically, low density areas are composed of few males that are slow to join the large female-dominated groups following the calving period. At the time of the survey, males represented 12 of the 56 active collars (21%) and 9 of these males were located and photographed, representing 17% of the collars sampled in the groups. This proportion of males sampled during the survey is similar to the ratio of 20 males (large and medium) per 100 females recorded in the 2020 fall classification.

The difference in aggregation behaviour of males and females is well represented by telemetric monitoring since none of the 12 tagged males were present in the large groups. The 9 tagged and sampled males were observed alone, about 100 km from the large groups dominated by females moving from the calving ground. Some tagged males were located up to 200 km south of these large groups. Although it is impossible to determine the sex of all the adults in the surveyed groups, some males were identified in the photographs of groups of more than 100 caribou largely dominated by females and calves.

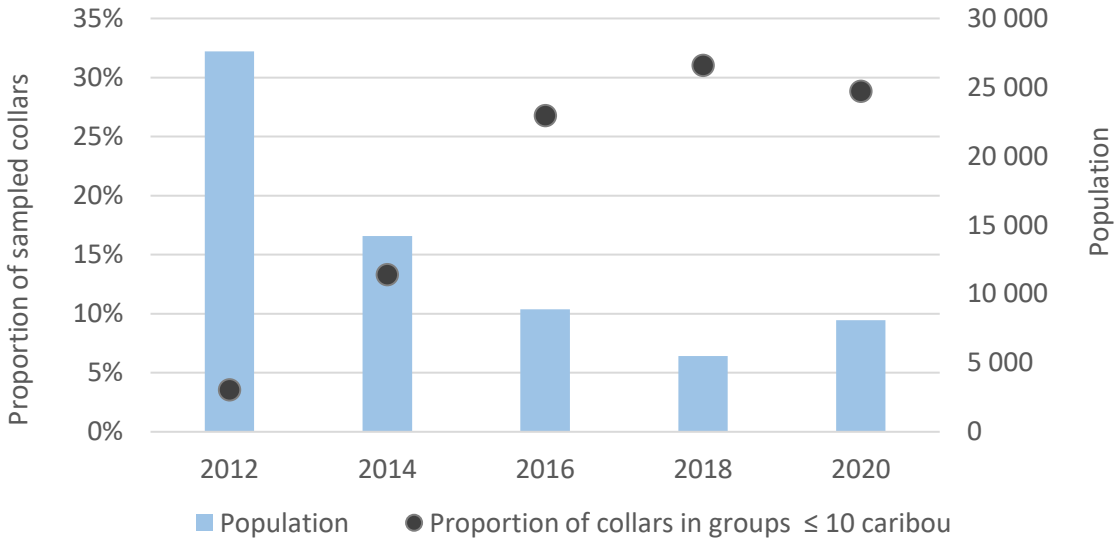

Figure 9: Change in the proportion of collars sampled in groups of 10 individuals or less in relation to population size estimates conducted since 2012.

As the GRCH population declined over the last decade to only a few thousand individuals, a higher proportion of marked individuals have been observed alone or in groups of fewer than 10 (Figure 9). Telemetric monitoring also shows that, in recent years, males have tended to disperse rather than regroup in summer. Conversely, very few females were observed alone or in relatively small groups at the time of the surveys. Because of the relatively large proportion of collared animals that are sampled alone, these individuals are included in the calculation of the population size. This adds statistical power and accuracy to the population estimate that would otherwise be overestimated.

QUALITY OF THE TELEMETRIC MONITORING

- Caribou groups contained a number of collars proportional to their size.
- The largest groups contained a large number of collars.
- Marked caribou that were photographed in the same group came from different wintering areas.
- All significant groups observed contained at least one caribou equipped with a telemetry collar.

3.3. Evaluation of the structure of the surveyed population and the demographic trend

The aerial survey determined that the population assessed in July 2020 was composed of 35% calves and 65% adults counted in the photographs of each group. In addition to the post-calving surveys, demographic monitoring of the GRCH includes annual fall classifications[5] that establish the proportion of calves, adult males (> 1 year of age) and adult females (> 1 year of age) in the population. The results of the fall classification, carried out in November 2020, were used to estimate the proportion of individuals belonging to the adult male and adult female segments of the population surveyed in July 2020 (Figure 10). This estimate assumes that the survival of males and females was proportional between the survey and the fall classification (conducted about 4 months apart). Based on the proportion of 35% calves in July 2020 and an adult sex ratio of 25 males per 100 females, it is also possible to calculate a ratio of 67 calves/100 females at the time of the July survey. Over the four months following the survey, the ratio decreased to 61 calves/100 females and calves then represented 33% of the population at the time of the fall classification.

The previous aerial survey of the GRCH, conducted in 2018, estimated the population at 5,500 caribou[6]. Since that survey, the population has increased by 47% due to the high number of calves present in summer 2020 (Figure 11). The number of adults in the population has increased by 24% since 2018 but is 27% lower than the number of adults recorded in the 2016 survey[7] when the population was estimated at 8,900 caribou. In this sense, the estimated population in 2020 is only 1% lower than the estimated population in 2016, but with a considerable shortfall and disparity in the number of adults (Figure 11).

5 TAILLON, Joëlle, Vincent BRODEUR et Stéphane RIVARD. 2016. Biological status of migratory caribou, Leaf River herd, ministère des Forêts, de la Faune et des Parcs, Québec, 69 p.

6 BRODEUR, Vincent, Stéphane RIVARD, John PISAPIO et Sara McCARTHY. 2018. Aerial survey of the George River Migratory Caribou Herd in July 2018, ministère des Forêts, de la Faune et des Parcs, Québec, et Department of Fisheries and Land Resources of Newfoundland and Labrador, 13 p.

7 https://www.releases.gov.nl.ca/releases/2016/ecc/0829n02.aspx

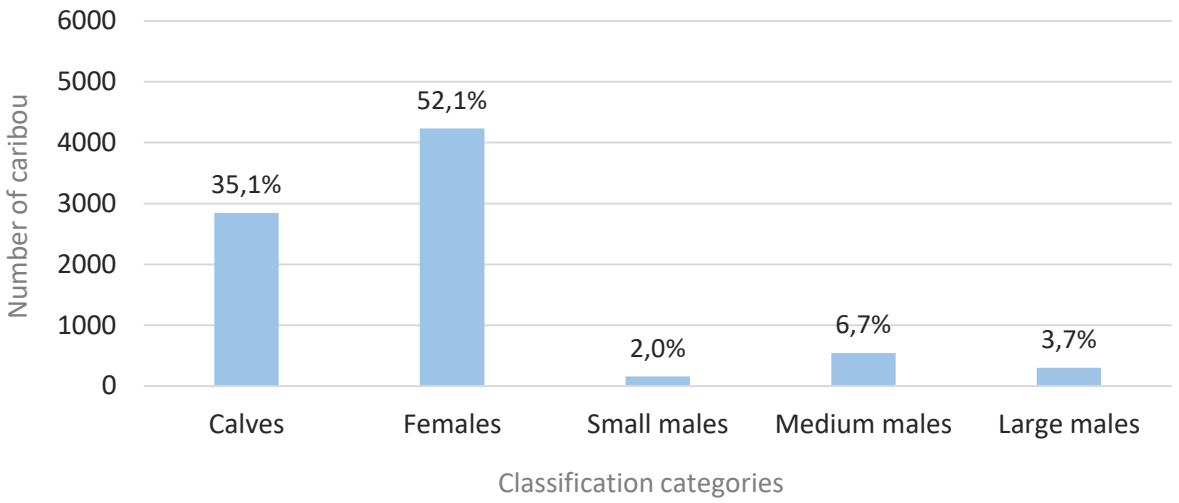

Figure 10: Estimated number of caribou for each segment of the adult population (> 1 year of age) and the number of calves in the population in July 2020. The results of the fall classification, conducted in November 2020, and the proportion of calves measured during this survey were used to distribute the estimated population size within the different age and sex categories.

The sex ratio of 7 large males/100 females in 2020 (Figure 10; 3.7% of the population and 29% of males segment) is very low for a caribou population. This segment includes the most reproductively active males although the medium males are also of reproductive age.

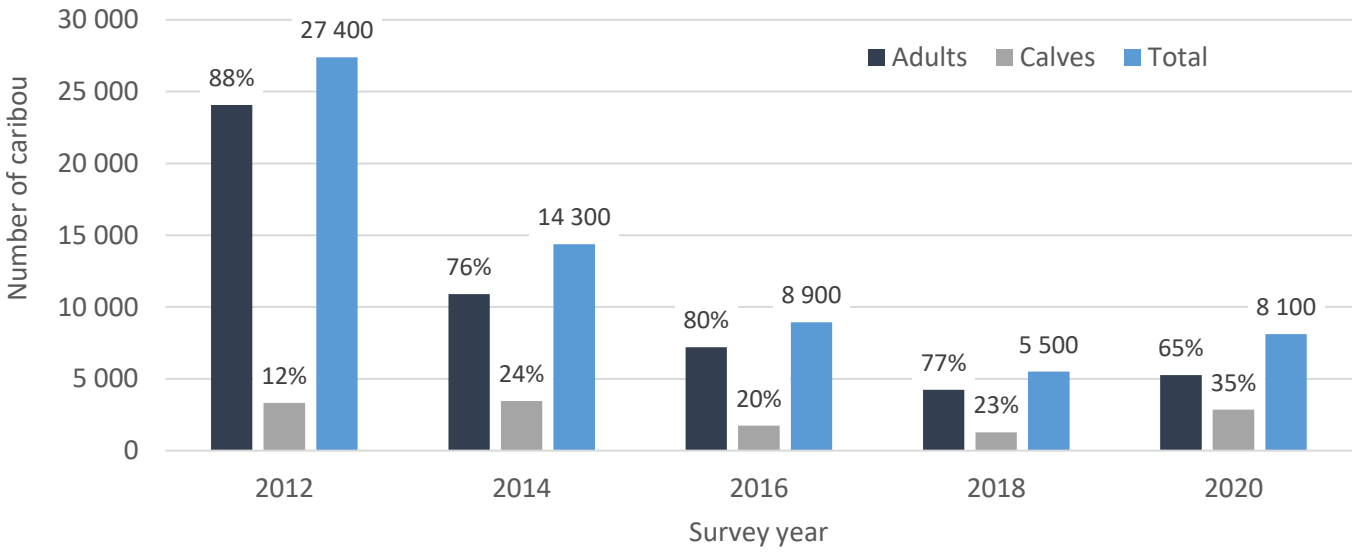

Figure 11: Estimates of the number of adults, number of calves, and the total population size of the GRCH for aerial surveys conducted between 2012 and 2020. The proportion of calves and adults counted in group photographs was used to calculate this estimate for each survey.

A SURVEY REPRESENTATIVE OF THE POPULATION

Transit overflights from one group to another were carried out at an average above ground altitude of approximately 800 to 1,500 meters. This provides an overview of the habitat used by caribou in summer and their highly localized concentration at the landscape scale. The groups are generally spotted by the crew from a few kilometers away before they are overflown to validate the identity of the marked caribou within the group. This is done by circling the group at high elevation while telemetry scanning was done of all possible active collars using the unique radio frequencies they transmit.

Overall results consistently demonstrated that collars were adequately distributed in the population in sufficient numbers at the time of the survey. It is therefore unlikely, and statistically improbable that any group of considerable size was not minimally represented by at least two collared caribou.

Figure 12: Groups are clearly defined sampling units in the landscape. In this photo, group 5, seen in the bottom portion of image, contained 911 caribou and 4 caribou equipped with a collar. The caribou in this group converged from different portions of the winter range, as shown by the average distance of 85 km separating the 4 collared caribou of this group about 5 months before the July 2020 survey.

4. DISCUSSION

4.1. Validity and robustness of the aerial survey results

The post-calving survey methodology used to count the George River Caribou Herd (GRCH) in the summer of 2020 generated a rigorous and highly accurate population estimate. Post-calving aggregations occurred at the expected time based on our experience from the five previous surveys conducted biannually since 2010. The high-density aggregations, dominated by adult females departing the calving grounds, occurred along a migration route (south-southwest) similar to previous years. The crew benefited from favourable weather conditions, a central work base, and logistical planning around the known daily position of collared caribou. Under those conditions the crew was able to accumulate the consecutive flying days (and maximal hours per day) needed to photograph the vast majority of the herd while ensuring that mixing of groups was minimal and accounted for.

There was an additional need to conduct the survey in an intensive and time compressed manner in order to take advantage of its location in the arctic tundra, north of the tree line. The methodology cannot be applied as efficiently when caribou are located below the tree line as they tend to disperse in smaller groups in forested habitats in which achieving unobstructed photographs also becomes challenging. In recent years the southward migration of the GRCH into the taiga occurred quickly through the second half of July and early August. The combination of daily migratory progression and weather delays for helicopter flying are such that the window of opportunity to conduct the survey can be potentially narrow.

The low number of non-marked caribou (n=5) encountered distant from the collared caribou groups indicates that the sample of collared caribou was representative of the population's geographic location in July 2020. The collar sample size was furthermore sufficient to identify and include representation of the small portion of the population consisting of lone animals during the post-calving aggregations. Since aggregation conditions were excellent and no other caribou were seen in the vicinity of isolated collared individuals, the documentation of these single individuals corroborates the scarcity of caribou beyond the high-density aggregations. As the population size estimate is influenced by the ratio of the number of caribou in relation to the number of collars sampled, it was important to have distributed the survey sampling effort across areas of both high and low density. Doing so accounts for and clarifies the behavioural and spatial organisation differences between males and females in estimating population size. The survey methodology thereby retains sampling rigour despite the fact that a higher proportion of individuals are isolated in summer due to the low population size and behavioural distinctions between males and females.

4.2. Demographic interpretation of the aerial survey results

In the known absence of immigration from another caribou population, the growth of the GRCH between the 2018 and 2020 surveys is attributed to an exceptionally numerous calf cohort in 2020, and generally good survival rates of adult caribou. Intensive telemetric monitoring of both the GRCH and Leaf River Caribou Herd (LRCH) clearly demonstrates the geographic separation between these two discrete populations, particularly at the time of the July 2020 survey (Figure 13). The size of the LRCH has also declined considerably over the past two decades, as it likely peaked at over 600,000 caribou in the early 2000 and was estimated at 199,000 caribou in 2016. The winter distribution area of these two populations has overlapped in the 1980s through the early 2000's when some GRCH caribou migrated much further west, some travelling all the way to the James Bay coast. Both caribou populations were abundant at that time but it is documented that, even

then, the considerable range overlap resulted in few interchanges between herds[8]. The clear spatial separation between the two herds demonstrates that there would be no interchange of caribou from one herd to the range of the other over the past decade.

With regard to the Torngat Mountains Caribou Herd, the relatively sedentary behaviour of these caribou and lack of overlap with the GRCH's range in recent years similarly indicates that there has been little or no recent exchange between these populations[9]. These regional assessments of migratory and mountain caribou spatial organization provide additional support to monitor and manage these herds as distinct populations.

The 2020 GRCH fall classification, conducted four months after the survey, provides a good proxy to estimate the demographic composition of the July 2020 population. Based on the sex ratio measured in early November, there would be only about 300 large males in the GRCH population estimated in July 2020. This low number of large males is consistent with the absence of groups of males during the 2018[10] and 2020 surveys, and further corroborates the scarcity of this segment of the population. The high calf production in 2020 indicates that the low proportion of large males in the population does not appear to have compromised the reproductive potential of the population.

A considerable part of the 47% population growth since 2018 is due to the high calf production documented in July 2020. Population trends in migratory caribou are largely dependent on recruitment of calves that survive to one year of age. The calf count at the time of the survey is highly accurate as calves are easily distinguishable from adults and more than 90% of the population is sampled in photographs.

Calves accounted for 35% of all caribou in the July 2020 survey, over a third of the population. This high abundance of calves translates to a ratio of about 67 calves/100 females at time of survey. A more precise assessment of the recruitment potential of the 2020 cohort is aided by the results of the fall classification when calves are 5 months old and have survived through the high vulnerability period of the first 6 to 12 weeks of life. The fall classification showed that calves survived well through the summer resulting in a ratio of 61 calves/100 females in November 2020. As winter survival of calves is not well known, assessing short-term recruitment effects on population trend requires caution. However, the high proportion of calves in July 2020 and their strong survival to November indicate that recruitment from the 2020 cohort should be elevated.

The number of adults increased by 24% since 2018, when the population was estimated at 5,500 caribou[11]. The change in the number of adults (> 1 year of age) between 2018 and 2020 indicates some improved survivorship in this segment of the population. However, the number of adult caribou was 27% lower in the 2020 survey (8,100 caribou) compared to the 2016 survey even though the population size was similar (8,900 caribou in 2016). In this sense, the estimated population in 2020 is only 1% lower than the estimated population in 2016, but with a considerable shortfall in the number of adults.

Monitoring the natural survival (excluding hunting) of adult females and males is done by assessing the proportion of collared caribou that survive on a monthly basis. This monitoring indicates a recent improvement in the natural survival of adult females, which remains close to the threshold typically required to support a stable or growing population. The 47% population growth since 2018 is however largely attributable to the high proportion of calves documented in July 2020.

8 TAILLON, Joëlle, Vincent BRODEUR et Stéphane RIVARD. 2016. Biological status of migratory caribou, Leaf River herd, ministère des Forêts, de la Faune et des Parcs, Québec, 69 p.

9 BÉLANGER, Édouard, LEBLOND, Mathieu & Steeve D. CÔTÉ. 2019. Habitat selection and population trends of the Torngat Mountains caribou herd. Journal of Wildlife Management 83(2) pp. 379-392. doi.org/10.1002/jwmg.21583

10 BRODEUR, Vincent, Stéphane RIVARD, John PISAPIO et Sara McCARTHY. 2018. Aerial survey of the George River Migratory Caribou Herd in July 2018, ministère des Forêts, de la Faune et des Parcs, Québec, et Department of Fisheries and Land Resources of Newfoundland and Labrador, 13 p.

11 BRODEUR, Vincent, Stéphane RIVARD, John PISAPIO et Sara McCARTHY. 2018. Aerial survey of the George River Migratory Caribou Herd in July 2018, ministère des Forêts, de la Faune et des Parcs, Québec, et Department of Fisheries and Land Resources of Newfoundland and Labrador, 13 p.

The previous population low of the GRCH occurred more than 6 decades ago, and its recovery, which led to a peak population level of more than 820,000 in the early 1990s, is poorly documented[12]. The positive growth result from the 2020 survey is the first documented increase in the GRCH in over 25 years (Figure 2). While these findings are encouraging, unsanctioned (and unreported) harvesting in Labrador, and unadvised harvesting in Québec remain a source of mortality that can jeopardize the recovery potential of the GRCH.

Despite the population growth over the past two years, the herd nevertheless remains at an extremely low level of abundance and in a highly precarious state. It will be necessary to obtain a sequence of positive population growth results before it can be determined that the GRCH is trending toward recovery. Ongoing communications between governments and Indigenous communities have raised awareness on the need for common and continuous efforts towards conservation goals in order to support the recovery of the herd.

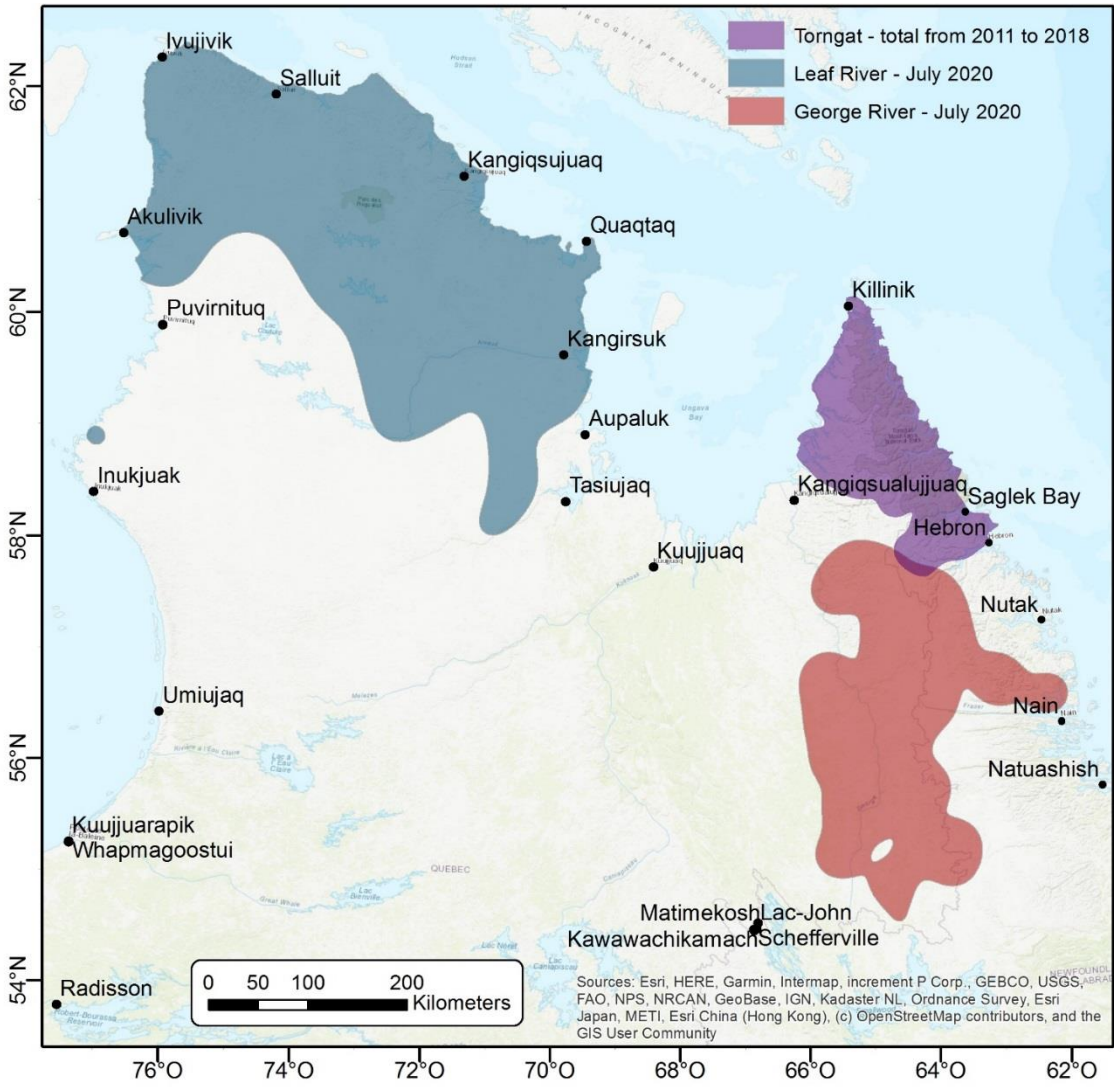

Figure 13: Distribution of the George River herd in relation to the Leaf River herd at the time of the aerial survey, represented by a density analysis (Kernel 95%) of the locations of satellite telemetry collars of males and females during July 2020 (LRCH n = 123; GRCH n = 56). The range of the Torngat Mountains Caribou Herd for the last decade is also presented based on a density analysis of all telemetric collar locations (Kernel 99%, n = 39) compiled between 2011 and 2018. However, there are no telemetric or survey data showing Torngat caribou present south of Saglek Fiord area since 2014.

12 BERGERUD, A. T., LUTTICH, S. N., & CAMPS, L. 2008. The return of caribou to Ungava. Montreal: McGill-Queen's University Press. 586 p.

SUMMARY FINDINGS

The 2020 survey estimates the size of the GRCH at 8,100 caribou (+/- 6%; α = 0.10). This result indicates that the herd has increased by 47% since 2018.

Despite a 24% increase in the number of adult caribou since 2018, the GRCH remains at an extremely low level of abundance in 2020. It will be necessary to obtain a sequence of positive population growth results before determining that the GRCH is trending towards recovery.

The number of adult caribou observed in 2020 is 27% lower than the 2016 population which was estimated at 8,900 caribou, a similar level of abundance to 2020.

There were only about 300 large males in the July 2020 GRCH population. The absence of groups of males in the 2018 and 2020 surveys further corroborates their scarcity.

Calves represented 35% of the population in the summer of 2020 and accounted for a considerable share of the growth in the population since 2018. Their strong survival to November indicates that recruitment from the 2020 cohort should be elevated.

5. APPENDIX 1

Raw data from the groups sampled during the George River Caribou Herd survey in July 2020. Some groups contained collars sampled in more than one group. These groups were removed from the analysis when all collars in the group were found in a group containing a greater number of collars. When a group contained one or more collars sampled more than once, the collar was kept in the group with the most collars (number of collars retained in group) and the size of the group from which it was removed was adjusted according to the number of caribou/collar in that group (revised group size).

Group number	Date	Number of collars in group	Number of collars retained in group	Counted adults	Counted calves	Counted group size	Revised group size
1	2020-07-09	2	2	184	117	301	301
2	2020-07-09	3	3	530	287	817	817
3	2020-07-09	4	2	636	313	949	475
4	2020-07-09	1	0	6	2	8	0
5	2020-07-09	4	0	548	363	911	0
6	2020-07-10	2	2	453	205	658	658
7	2020-07-09	7	0	400	246	646	0
8	2020-07-09	1	0	212	101	313	0
9	2020-07-10	1	1	191	75	266	266
10	2020-07-10	10	0	852	410	1262	0
11	2020-07-10	1	0	336	214	550	0
12	2020-07-10	2	2	93	29	122	122
13	2020-07-10	1	1	96	56	152	152
14	2020-07-10	1	1	1	0	1	1
15	2020-07-10	1	1	1	0	1	1
16	2020-07-10	1	1	1	1	2	2
17	2020-07-10	1	1	149	113	262	262
18	2020-07-11	1	1	1	0	1	1
19	2020-07-11	1	1	1	1	2	2
20	2020-07-11	5	5	865	485	1 350	1 350
21	2020-07-11	1	1	1	1	2	2
22	2020-07-11	1	1	1	0	1	1
23	2020-07-11	1	1	1	0	1	1
24	2020-07-11	1	1	1	0	1	1
25	2020-07-11	1	1	1	0	1	1
26	2020-07-11	1	1	1	0	1	1
27	2020-07-11	1	1	1	0	1	1
28	2020-07-12	13	13	1 467	796	2 263	2 263
29	2020-07-13	5	5	541	324	865	865
30	2020-07-13	1	1	1	0	1	1
31	2020-07-13	1	1	1	0	1	1
32	2020-07-13	1	1	1	0	1	1

Forêts, Faune
et Parcs
Québec

Newfoundland
Labrador