

ካርቲክ ንግድ ምክርታት ገደብ ልዩ ልዩ ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት

**ገጽ ቁጥር**

**ገጽ ቁጥር**

ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2

**ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት**

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**ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት**

2024-07-18 - ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2B

2024-07-24 - ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2C

2025-04-07 - ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2D

2025-04-07 - ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2E

2025-04-28 - ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2F

2025-05-07 - ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2G

2025-07-23 - ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2H

2025-08-21 - ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2I

**ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት**

2012 ገጽ ቁጥር ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት ምክርታት 2J

















ᄃᆞᆫᆫᆫ			
ᄃᆞᆫᆫᆫ 1 (1997)	ᆞᆞᆞᆞᆞᆞ	ᄃᆞᆫᆫᆫ	1,376
ᄃᆞᆫᆫᆫ 2 (1998)	ᆞᆞᆞᆞᆞᆞ	ᄃᆞᆫᆫᆫ	1,213
ᄃᆞᆫᆫᆫ 3 (1999)	ᆞᆞᆞᆞᆞᆞ	ᄃᆞᆫᆫᆫ	1,940
ᄃᆞᆫᆫᆫ 4 (2000)	ᆞᆞᆞᆞᆞᆞ	ᄃᆞᆫᆫᆫ	1,693
ᄃᆞᆫᆫᆫ 5 (2001)	ᆞᆞᆞᆞᆞᆞ	ᄃᆞᆫᆫᆫ	1,128
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July 24, 2024

Mr. Daniel Shewchuk  
Chairperson  
Nunavut Wildlife Management Board  
310-1106 Ikaktuutiak Drive  
Iqaluit NU X0A 3H0

**Re: Establishment of Basic Needs Level within the Nunavut Settlement Area**

Dear Mr. Shewchuk,

I would like to acknowledge your letter dated July 18, 2024 wherein the Nunavut Wildlife Management Board (NWMB) describes how it will address establishing Basic Needs Level (BNL) for wildlife populations or stocks that are subject to a Total Allowable Harvest (TAH).

I note in your letter the long history and the absence of consensus by co-management partners on this issue. I recognize the tremendous efforts the NWMB has made on this issue over the years, and I look forward to working together as co-management partners as we continue to take actions to fully implement Nunavut's wildlife management system.

Sincerely,

Daniel Qavvik  
Minister of Environment

Cc. Yvonne Niego, Deputy Minister, Environment







By Email

Jason Akearok, Executive Director  
Nunavut Wildlife Management Board

April 7, 2025

Dear Mr. Akearok:

**Re: BNL for Southampton Island Caribou**

I write on NTI's behalf about the Nunavut Wildlife Management Board's ("NWMB") plan to set a Basic Needs Level ("BNL") for the Southampton Island caribou herd using a calculation that would "exclude any commercial harvesting records that may be available": NWMB staff memo of January 7, 2025, *Determination of the Basic Needs Level (BNL) for Southampton Island Caribou*, p. 2. That staff memo references a July 18, 2024 NWMB policy which states that the NWMB will use the Nunavut Wildlife Harvest Study data and thereby exclude from BNL calculations "wildlife harvested in bulk for sale outside of the Nunavut Settlement Area ("Commercial Harvests)": *Re: Establishment of Basic Needs Level within the Nunavut Settlement Area*, ("July 2024 Memo"), p.4.

Whether the NWMB intends to exclude from its BNL calculation for Southampton Island caribou the harvests sold outside of Nunavut or *all* commercial harvests, NTI is deeply concerned by the methodology and the process leading up to its adoption.

**NTI's Concerns**

The NWMB started a public hearing in December 2013 to establish the BNL for Southampton Island caribou. It paused that hearing in 2014 to allow time for Nunavut's wildlife co-management partners to try and reach consensus on methodology. The NWMB's stated position was that BNL calculations must include all commercial harvesting, a position that NTI shared. However, the NWMB abandoned that position in its July 2024 Memo. It adopted a policy to exclude Commercial Harvests with no advance notice to NTI and without giving NTI and other co-management partners the opportunity to make submissions on this matter, which the NWMB had parked for a decade.

Moreover, the July 2024 Memo does not clearly explain why the BNL calculations should exclude Commercial Harvests. Does the NWMB's statement at p. 7 of the July 2024 Memo that "there is no authority within the *Nunavut Agreement* for the NWMB to modify the assumptions adopted by the Steering Committee" mean that the NWMB considers itself bound by the Steering Committee's decision? Or does it mean that the NWMB has decided that the Steering Committee interpreted Article 5 correctly? On what basis has the NWMB now rejected the 2009 legal opinion it received from Mr. Meehan, which was that BNL calculations should be based on all Inuit harvests?

BNLs have significant, long-term, food security, social and economic implications for Inuit right-holders. They may also affect the interests of non-Inuit seeking to harvest wildlife. The NWMB's

BNL decision for the Southampton Island caribou herd seems on track to be the first one to apply the policy from the July 2024 Memo. Given the significance of this BNL decision and the precedent it will set for future BNL calculations in Nunavut, procedural fairness is essential. NTI believes that fairness requires resuming and completing the public hearing the NWMB originally started to determine how to calculate BNLs.

Moreover, whether Article 5 of the *Nunavut Agreement* requires some or all Inuit commercial harvests to factor into the BNL calculation is a legal, treaty interpretation question with a correct answer. NTI urges the NWMB to take the time to re-engage with its co-management partners to support the most robust possible decision, as this should reduce the likelihood of a legal challenge and the uncertainty, delays, and expenses that would result from litigation.

### ***NTI's Proposal***

NTI requests that the NWMB pause the BNL calculation for Southampton Island caribou and first reconsider its planned exclusion of Commercial Harvests (or, according to NWMB staff, all Inuit commercial harvests) from the BNL calculation. We request that the NWMB take the following steps:

1. Provide NTI and other co-management partners with clear reasoning for its conclusion in the July 2024 Memo that BNL calculations should exclude Commercial Harvests.
2. Provide NTI and the other co-management partners with the opportunity to respond in writing to the NWMB's views and to each other's views, and then reconsider the matter based on all submissions.
3. Provide written reasons for the reconsideration decision.

NTI looks forward to your response on this matter.

Sincerely,



Gabriel Nirlungayuk  
Director, Wildlife and Environment Department  
Nunavut Tunngavik Inc.



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*Managing wildlife, guided by conservation principles, honouring the key role of Inuit in harvesting, for the well-being of current and future generations in Nunavut.*

**By Email**

April 28, 2025

Gabriel Nirlungayuk  
Director, Wildlife and Environment Department  
Nunavut Tunngavik Inc.

Dear Mr. Nirlungayuk:

**Re: BNL for Southampton Island Caribou**

I am writing on behalf of the Nunavut Wildlife Management Board (Board) in response to your letter dated April 7, 2025, regarding the Basic Needs Level for caribou on Southampton Island.

The Board’s July 2024 Memo followed a comprehensive internal review of the information, evidence, arguments, and perspectives submitted by co-management partners and other parties—regarding what types of harvests are to be included in the calculation of Basic Needs Levels—over the ten years starting from the conclusion of the Nunavut Wildlife Harvest Study (“NWHs”) in 2004 and concluding with the adjournment of the Southampton Island caribou public hearing in 2014.

Based on this review, the Board accepted as “correct”, and made the decision to rely on, the NWHs Steering Committee’s interpretation of the *Nunavut Agreement*, which recommended the exclusion of commercial harvests from consideration in the establishment of a Basic Needs Level (BNL).

The NWHs Steering Committee determined that the “primary application of the Harvest Study results was for the calculation of the basic needs levels” and concluded that:

the context of the Agreement does indicate that the basic needs level is that amount of harvest which is currently taken for domestic and cultural purposes. .... (sic) Harvesting or gathering for the purpose of obtaining skins, feathers, dog food, craft materials, etc. would all be acknowledged “basic needs” components as long as the end use occurred in the hunter’s community or entered into inter-settlement trade. Apparently, not eligible for consideration as an item of “basic need” would be material harvested or gathered for commercial sale as food outside the Nunavut Settlement Area.

The Board’s decision to defer to the expertise of the members of the Steering Committee is further supported by the fact that the membership of the Steering Committee was composed of respected and knowledgeable representatives appointed by all three Regional Wildlife Organizations and three government departments. These representatives had ample occasion to voice the positions of their respective organizations at the time the Nunavut Harvest Study was being conducted. Their recommendation reflects their understanding of the intent of these provisions of the *Nunavut Agreement*.

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310-1106 Ikaluktuutiak Aqutvik  
Iqaluit, Nunavut X0A 3H0

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Iqaluit, Nunavut X0A 3H0

(867) 975-7300  
(888) 421-9832

(867) 975-7300  
(888) 421-9832

(867) 975-7300  
(888) 421-9832











By Email

Jason Akearok, Executive Director  
Nunavut Wildlife Management Board

July 23, 2025

Dear Mr. Akearok:

**Re: BNL for Southampton Island Caribou**

This letter follows up on NTI's letter of April 7, 2025 ("April Letter") about the Nunavut Wildlife Management Board's ("NWMB") plan to set the Basic Needs Level ("BNL") for the Southampton Island caribou herd ("SHI Caribou Herd"). NTI has not yet received a response to the April Letter, but at its June 25, 2025 regular meeting, the NWMB confirmed its plan to set that BNL during its October regular meeting.

As noted in NTI's April Letter, the NWMB has departed from its previous view that Inuit commercial harvests count towards the BNL. The NWMB's approach to calculating the BNL for the SHI Caribou Herd will set a major precedent. Thus, NTI continues to urge the NWMB to be transparent about its proposed approach, including why it has changed so significantly. NTI also reiterates its request that the NWMB hold a public hearing to guide its BNL decision. Such a major decision deserves to be informed by a hearing. Moreover, NWMB never resumed the hearing it adjourned on December 11, 2013, despite repeatedly communicating its intention to do so.

***Transparency re NWMB's Proposed Approach***

NTI continues to seek clarity on the questions we asked in the April Letter, as well as on a few additional issues:

1. Does the NWMB plan to exclude from its BNL calculation only the harvests sold outside of Nunavut, or *all* commercial harvests?
  - The July 18, 2024 NWMB policy memo, *Re: Establishment of Basic Needs Level within the Nunavut Settlement Area*, ("July 2024 Memo"), states that the NWMB will use the Nunavut Wildlife Harvest Study data and thereby exclude from BNL calculations "wildlife harvested in bulk for sale outside of the Nunavut Settlement Area" (p.4.).
  - However, the NWMB staff memo of January 7, 2025, *Determination of the Basic Needs Level (BNL) for Southampton Island Caribou*, states at p. 2 that the BNL calculation will "exclude any commercial harvesting records that may be available".

2. Why has the NWMB abandoned its original interpretation of Article 5, supported by the legal opinion it secured from Mr. Meehan in 2009, that BNL calculations should be based on *all* Inuit harvests? The July 2024 Memo does not provide a clear answer.
3. Why does the NWMB intend to treat 2008-2012 as the five pre-TAH years under s. 5.6.23(b) of the *Nunavut Agreement* (NWMB April 7, 2025 letter to the Aiviit HTO at p. 1)? Given that there was an interim TAH on the SHI Caribou Herd in 2012, which presumably limited Inuit harvesting in that year, why would the NWMB not use the harvest data from 2007-2011 instead?
4. Why has the NWMB only asked the Coral Harbour for its SHI Caribou Herd harvest records, and not Rankin Inlet, Naujaat, and Chesterfield Inlet? Although the harvests by members of those communities might be relatively small, they are relevant to setting the herd's BNL.

### ***Opportunity for Co-Management Partners to Share Views***

NTI would welcome an in-person hearing to inform the NWMB's decision on the SHI Caribou Herd BNL. In addition to a hearing, or in the alternative, NTI proposes that the NWMB hold a meeting to discuss the general approach to BNL calculations with Nunavut's co-management partners: NTI, the Government of Nunavut, and the Department of Fisheries and Oceans (which is involved in setting the Kingnait Fiord char BNL).

### **Conclusion**

The SHI Caribou Herd BNL raises major questions about the interpretation of Article 5 that have essentially been dormant for years. Transparency by the NWMB with NTI and Nunavut's other co-management partners ahead of decision-making is critical. There is also real value in providing a forum for the co-management partners to share evidence, context, and interpretations of the relevant Article 5 provisions to help inform the NWMB's decision. A shared interpretation of the Article 5 provisions may still be achievable, thereby avoiding an unnecessary legal dispute, and in any event, dialogue between the co-management partners promotes collaboration and strong working relationships and, by extension, effective wildlife management.

NTI looks forward to your prompt response on this matter.

Sincerely,



Gabriel Nirlungayuk  
Director, Wildlife and Environment Department  
Nunavut Tunngavik Inc.

cc. Amy Amos, Regional Director General – Arctic Region

[amy.amos@dfo-mpo.gc.ca](mailto:amy.amos@dfo-mpo.gc.ca)

Drikus Gissing, Director Wildlife and Environment  
[dgissing@gov.nu.ca](mailto:dgissing@gov.nu.ca)















**WILDLIFE ACT**

SI-001-2012

Registered with the Registrar of Regulations

2012-07-12

**SOUTHAMPTON ISLAND CARIBOU HERD TOTAL ALLOWABLE HARVEST INTERIM ORDER  
(July 1, 2012 to June 30, 2013)**

Whereas there has been a precipitous decline in the population of the Southampton Island Caribou Herd since 1997, from more than 30,000 to fewer than 8,000 animals;

And Whereas current harvest levels of more than 2,300 caribou per year combined with a 50% reduction in the breeding success rate of the herd since 2000 and a severe outbreak of brucellosis are likely to result in extirpation of the Southampton Island Caribou Herd within three to five years if conservation measures are not taken immediately;

And Whereas the Southampton Island Caribou Herd is an important food, cultural, and economic resource for the community of Coral Harbour;

And Whereas the Coral Harbour HTO, the Nunavut Wildlife Management Board (“NWMB”), and Nunavut Tunngavik Incorporated agree that immediate conservation measures should be taken to maintain the stability and sustainability of the Southampton Island Caribou Herd until it can be determined if additional long-term conservation measures are necessary;

And Whereas the Minister is of the opinion that urgent and unusual circumstances exist requiring an immediate modification in harvesting activities with respect to the Southampton Island Caribou Herd,

The Minister, in accordance with paragraph 121(b) and section 150 of the *Wildlife Act* and every enabling power, makes the annexed *Southampton Island Caribou Herd Total Allowable Harvest Interim Order (July 1, 2012 to June 30, 2013)*.

**1.** In this Order, “Southampton Island Caribou Herd” means all caribou found on Southampton Island and White Island, being part of Wildlife Management Barren-Ground Caribou Area N/BC/12, as described in the *Wildlife Management Barren-Ground Caribou Areas Regulations*, N.W.T.Reg. R-099-98, as duplicated for Nunavut by section 29 of the *Nunavut Act* (Canada).

**2.** (1) A total allowable harvest is established for the Southampton Island Caribou Herd for the harvest year of July 1, 2012 to June 30, 2013, in accordance with this Order.

(2) The total allowable harvest from the population of the Southampton Island Caribou Herd for the harvest year is 1,000 caribou.

(3) It is presumed that the Inuit of Coral Harbour need the full amount of the total allowable harvest.

(4) The full amount of the total allowable harvest and basic needs level for the harvest year is allocated to the community of Coral Harbour.

**3.** The Coral Harbour HTO may issue tags for allocating the basic needs level among its members.

**4.** For the purposes of conservation, the harvest of the Southampton Island Caribou Herd during the harvest year is subject to the following non-quota limitations:

- (a) there shall be no harvesting of cow-calf pairs; and
- (b) there shall be no harvesting of mature bull caribou.

**5.** This Order is subject to review as soon as practicable by the NWMB in accordance with section 158 of the Act, but remains in effect until the earlier of:

Southampton Island Caribou Herd Total Allowable Harvest Interim Order (July 1, 2012 to June 30, 2013)

- (a) June 30, 2013;
- (b) registration of an Order to implement an accepted decision of the NWMB concerning the Southampton Island Caribou Herd; or
- (c) registration of a subsequent Order of the Minister.

**6. This Order comes into force on the later of July 1, 2012 and the date of registration by the Registrar of Regulations.**

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Minister James Arreak  
 Government of Nunavut  
 Department of Environment

May 15, 2013

Hand  
 Delivered.  
 May 15/13  
 TR

**Re.: Southampton Island caribou herd total allowable harvest interim order (July 1, 2012- June 20, 2013) amendment**

Dear Minister Arreak,

This letter is in response to the notification of the Government of Nunavut Department of Environment’s proposed amendment to the Southampton Island caribou herd total allowable harvest Interim Order for July 1, 2012- June 30, 2013 received by the Nunavut Wildlife Management Board (NWMB or Board) on May 3, 2013.

As noted in correspondence between senior staff of our relevant organizations dated May 3<sup>rd</sup>, 2013 the Board was unfortunately unable to provide a formal position on the issue by the end of the business day on May 3, 2013, as requested by your Department to meet Cabinet deadlines. In this correspondence, NWMB staff requested that one of the clauses on the proposed amendment be removed as the Board did not receive the results of population studies conducted by the Department of Environment, originally scheduled for June 2012, or an associated request for decision as requested by the Board in its May 30, 2012 decision letter (attached). The NWMB would like to acknowledge the response by the Department in removing this clause as requested before the proposed amendment was submitted to Cabinet for consideration.

The NWMB formally considered the request to extend the Interim Order until June 30, 2014 during Internal Meeting 005-2013, held on May 9, 2013. After careful consideration of the issue the Board passed the following resolution:

*RESOLVED that the NWMB inform the Minister of Environment that in consideration of the circumstances the NWMB is in agreement that the Total Allowable Harvest of 1000 being in effect until such time as:*

- 1) A 2013 population study is completed;
- 2) The results of that population study are distributed;
- 3) A proposal for NWMB decision is received; and
- 4) That the NWMB has made a procedurally fair decision.

As you are aware, the NWMB is required to conduct a full review of any interim decision made in response to urgent and unusual circumstances as soon as practicable thereafter (as per NLCA S. 5.3.24 and s. 158 of the Wildlife Act). Regarding a total allowable harvest for the Southampton Island caribou herd, that review will be in the form of a public hearing. The wording of the Board’s decision on this matter is intended to reflect this obligation. The

procedural requirements for NLCA Article 5 decision-making are outlined in detail in the Board's attached May 20, 2012 decision letter.

Should you have any questions or concerns, or require any additional information please feel free to contact the NWMB at your convenience.

Sincerely,



Manasie Audlakiak  
A/Chairperson  
Nunavut Wildlife Management Board

Attachments (1)

**WILDLIFE ACT - LOI SUR**

Whereas there has been a precipitous decline in the population of the Southampton Island Caribou Herd since 1997, from more than 30,000 to fewer than 7,000 animals;

And Whereas an increased harvest level combined with a 50% reduction in breeding success rate of the herd since 2000 and a severe outbreak of brucellosis are likely to result in extirpation of the Southampton Island Caribou Herd within three to five years if conservation measures are not continued;

And Whereas the Southampton Island Caribou Herd is an important food, cultural and economic resource for the community of Coral Harbour;

And Whereas the NWMB has not made any formal decision concerning the Southampton Island Caribou Herd since conservation measures were undertaken by the Minister;

And Whereas the Minister is of the opinion that urgent and unusual circumstances continue to exist requiring a continuation of the maximum allowable harvest with respect to the Southampton Island Caribou Herd,

The Minister, in accordance with paragraph 121(b) and section 150 of the *Wildlife Act* and ever enabling power, makes the annexed *Southampton Island Caribou Herd Total Allowable Harvest Interim Order (July 1, 2012 to June 30, 2013), amendment*.

Dated,  
Fait le ..... 2013.

.....  
Hon. James Arreak,  
Minister of Environment  
Ministre de l'Environnement

WILDLIFE ACT

**SOUTHAMPTON ISLAND CARIBOU HERD TOTAL ALLOWABLE HARVEST  
INTERIM ORDER (July 1, 2012 to June 30, 2013), amendment**

1. The *Southampton Island Caribou Herd Total Allowable Harvest Interim Order (July 1, 2012 to June 30, 2013)*, registered as statutory instrument numbered SI-001-2012, is amended by this Order.

2. The title of the Order is repealed and the following substituted:

**SOUTHAMPTON ISLAND CARIBOU HERD TOTAL ALLOWABLE HARVEST  
INTERIM ORDER (July 1, 2012 to June 30, 2014)**

3. Section 2 is amended:

- (a) in subsection (1) by striking out “the harvest year of July 1, 2012 to June 30, 2013” and substituting “the harvest years of July 1, 2012 to June 30, 2013 and July 1, 2013 to June 30, 2014”; and
- (b) in subsection (2) by striking out “the harvest year” and substituting “each harvest year”.

4. Section 5 is amended:

- (a) in subsection (1) by striking out “2013” and substituting “2014”;
- (b) in subsection (2) by striking out “registration” and substituting “coming into force”; and
- (b) in subsection (3) by striking out “registration” and substituting “coming into force”.

## WILDLIFE ACT - LOI SUR LA FAUNE ET LA FLORE

Whereas there has been a precipitous decline in the population of the Southampton Island Caribou Herd since 1997, from more than 30,000 to fewer than 7,000 animals;

And Whereas an increased harvest level combined with a 50% reduction in breeding success rate of the herd since 2000 and a severe outbreak of brucellosis are likely to result in extirpation of the Southampton Island Caribou Herd within three to five years if conservation measures are not continued;

And Whereas the Southampton Island Caribou Herd is an important food, cultural, and economic resource for the community of Coral Harbour;

And Whereas the NWMB has recommended that an interim harvest limit of 800 caribou be enforced for the Southampton Island Caribou Herd until a final decision is made by the NWMB;

And Whereas for the purposes of conservation it is necessary to impose a non-quota limitation prohibiting the harvesting of cow-calf pairs from the Southampton Island Caribou Herd;

And Whereas the Minister is of the opinion that urgent and unusual circumstances exist requiring an immediate modification in harvesting activities with respect to the Southampton Island Caribou Herd,

The Minister, in accordance with paragraph 121(b) and section 150 of the *Wildlife Act* and every enabling power, makes the annexed *Southampton Island Caribou Herd Total Allowable Harvest Interim Order (July 1, 2014 to June 30, 2015)*.

Attendu :

le brusque déclin de la population de la harde de caribous de l'île Southampton depuis 1997, qui est passée de plus de 30 000 individus à moins de 7 000;

que l'augmentation de la récolte, ainsi qu'une réduction, depuis 2000, de 50% du taux d'efficacité de la reproduction, et l'apparition d'un important foyer de brucellose dans la harde, entraîneront vraisemblablement la disparition de la harde de caribous de l'île Southampton d'ici trois à cinq ans si des mesures de conservation ne se poursuivent pas;

que la harde de caribous de l'île Southampton constitue une importante ressource alimentaire, culturelle et économique pour la collectivité de Coral Harbour;

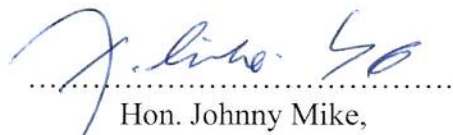
que le CGRFN a recommandé qu'une limite de récolte provisoire de 800 caribous soit mise en application pour la harde de caribous de l'île Southampton, jusqu'à ce qu'une décision finale soit prise par le CGRFN;

qu'à des fins de conservation, il est nécessaire d'imposer une limite non quantitative interdisant la récolte de couples mères-petits au sein de la harde de caribous de l'île Southampton;

que le ministre est d'avis qu'il existe des circonstances urgentes et exceptionnelles exigeant la modification immédiate des activités de récolte à l'égard de la harde de caribous de l'île Southampton,

le ministre, en vertu de l'alinéa 121b) et de l'article 150 de la *Loi sur la faune et la flore* et de tout pouvoir habilitant, prend l'*Arrêté provisoire concernant la récolte totale autorisée à l'égard de la harde de caribous de l'île Southampton (1<sup>er</sup> juillet 2014 au 30 juin 2015)*, ci-après.

Dated, *June 13*  
Fait le ..... 2014.



.....  
Hon. Johnny Mike,  
Minister of Environment  
Ministre de l'Environnement

## WILDLIFE ACT

### **SOUTHAMPTON ISLAND CARIBOU HERD TOTAL ALLOWABLE HARVEST INTERIM ORDER (July 1, 2014 to June 30, 2015)**

1. In this Order, "Southampton Island Caribou Herd" means all caribou found on Southampton Island and White Island, being part of Wildlife Management Barren-Ground Caribou Area N/BC/12, as described in the *Wildlife Management Barren-Ground Caribou Areas Regulations*, N.W.T.Reg. R-099-98, as duplicated for Nunavut by section 29 of the *Nunavut Act* (Canada).
2. (1) A total allowable harvest is established for the Southampton Island Caribou Herd for the harvest year of July 1, 2014 to June 30, 2015, in accordance with this Order.  
  
(2) The total allowable harvest from the population of the Southampton Island Caribou Herd for the harvest year is 800 caribou.  
  
(3) It is presumed that the Inuit of Coral Harbour have a basic need for the full amount of the total allowable harvest set in this Order.  
  
(4) The full amount of the total allowable harvest for the harvest year is allocated to the community of Coral Harbour.
3. There shall be no harvesting of cow-calf pairs from the Southampton Island Caribou Herd during the harvest year.
4. This Order is subject to review as soon as practicable by the NWMB in accordance with section 158 of the Act, but remains in effect until the earlier of:
  - (a) June 30, 2015;
  - (b) the coming into force of an Order to implement an accepted decision of the NWMB concerning the Southampton Island Caribou Herd; or
  - (c) the coming into force of a subsequent Order of the Minister.
5. The *Southampton Island Caribou Herd Total Allowable Harvest Interim Order (July 1, 2012 to June 30, 2014)*, registered as statutory instrument numbered SI-001-2012, is repealed.
6. This Order comes into force on the later of July 1, 2014 and the date of registration by the Registrar of Regulations.

LOI SUR LA FAUNE ET LA FLORE

**ARRÊTÉ PROVISOIRE CONCERNANT LA RÉCOLTE TOTALE AUTORISÉE À  
L'ÉGARD DE LA HARDE DE CARIBOUS DE L'ÎLE SOUTHAMPTON  
(1<sup>er</sup> juillet 2014 au 30 juin 2015)**

1. Pour l'application du présent arrêté, « harde de caribous de l'île Southampton » s'entend de tous les caribous qui se trouvent sur l'île Southampton et l'île White, faisant partie de la région de gestion du caribou des toundras N/BC/12, telle que décrite dans le *Règlement sur les régions de gestion du caribou des toundras*, Règl. T.N.-O. R-099-98, reproduit pour le Nunavut par l'article 29 de la *Loi sur le Nunavut* (Canada).

2. (1) Une récolte totale autorisée est établie pour la harde de caribous de l'île Southampton à l'égard de l'année de récolte s'étendant du 1<sup>er</sup> juillet 2014 au 30 juin 2015 en conformité avec le présent arrêté.

(2) La récolte totale autorisée au sein de la population de la harde de caribous de l'île Southampton est de 800 caribous pour l'année de récolte.

(3) Il est présumé que l'intégralité de la récolte totale autorisée qui est précisée dans le présent arrêté constitue un besoin essentiel pour les Inuit de Coral Harbour.

(4) L'intégralité de la récolte totale autorisée pour l'année de récolte est attribuée à la collectivité de Coral Harbour.

3. La récolte de couples mères-petits au sein de la harde de caribous de l'île Southampton est interdite pendant l'année de récolte.

4. Le présent arrêté est assujéti, dans les plus brefs délais, à un examen par le CGRFN conformément à l'article 158 de la Loi, mais demeure valide jusqu'à la première des dates suivantes :

- a) le 30 juin 2015;
- b) la date d'entrée en vigueur d'un arrêté visant la mise en œuvre d'une décision du CGRFN acceptée concernant la harde de caribous de l'île Southampton;
- c) la date d'entrée en vigueur d'un arrêté subséquent du ministre.

5. L'*Arrêté provisoire concernant la récolte totale autorisée à l'égard de la harde de caribous de l'île Southampton (1<sup>er</sup> juillet 2012 au 30 juin 2014)*, enregistré comme texte réglementaire sous le numéro TR-001-2012, est abrogé.

6. Le présent arrêté entre en vigueur le 1<sup>er</sup> juillet 2014 ou à la date de son enregistrement auprès du registraire des règlements, selon la date la plus tardive.



October 16<sup>th</sup>, 2015

Honourable Johnny Mike  
Minister of Environment  
Government of Nunavut

Dear Minister Mike:

**Re: Request for Harvesting Limitation Decisions from the Nunavut Wildlife Management Board for the Southampton Island Caribou Population**

**Request for NWMB Decisions**

On August 20<sup>th</sup>, 2015 the Nunavut Wildlife Management Board (NWMB or Board), received a *Proposal for Decision* (Proposal) from the Government of Nunavut-Department of Environment requesting that the NWMB establish a total allowable harvest of 1600 caribou and a non-quota limitation which prohibits the harvest of cow/calf pairs for the Southampton Island caribou herd (Appendix 1).

**NWMB Recommendation**

During an Internal In-Camera Meeting (INT 014-2015) on September 23<sup>rd</sup>, 2015 the Board passed the following resolutions:

*RESOLVED that the NWMB write to the Minister of Environment, recommending that he promptly make another reasonable Nunavut Land Claims Agreement Section 5.3.24 interim decision regarding harvesting limitations for Southampton Island caribou – with that interim decision to remain in place until such time as the NWMB completes its public hearing and Nunavut Land Claims Agreement decision-making processes with respect to Southampton Island caribou harvesting limitations.*

**RESOLVED that the NWMB:**

- (a) Organize a pre-hearing teleconference with the Southampton Island caribou hearing parties, with the objective being to promptly obtain submissions as to whether the NWMB should divide the current Southampton Island caribou public hearing into two hearings: a written hearing addressing the total allowable harvest and accompanying non-quota limitation for Southampton Island caribou, and an in-person hearing addressing the basic needs level for Southampton Island caribou; and*

*(b) In providing notice of the teleconference, the NWMB inform the parties that, if requested, it is prepared to provide additional time for the preparation and delivery of written submissions – but with the caution that the provision of additional time will necessarily result in a delay in NWMB total allowable harvest and non-quota limitation decision-making, from potentially as early as December 2015 (NWMB Regular Meeting (RM) No. 004-2015) to March 2016 (NWMB RM No. 001-2016) or later.*

In December 2013, the Board held a two day in-person hearing in Iqaluit, Nunavut, to address the level of total allowable harvest, non-quota limitations and the striking of a basic needs level for the Southampton Island caribou herd. At the end of two days, the NWMB decided to adjourn the hearing because more time was required to obtain important evidence concerning the basic needs level from co-management partners. After an adjournment of almost two years, it is still unclear how much longer the second phase of the hearing process will take.

In addition, the last interim order establishing a total allowable harvest expired on June 30<sup>th</sup>, 2015, leaving the community of Coral Harbour without any harvest restrictions in place. Given the conservation concern created by having no harvest restrictions in place and the uncertainty regarding the amount of time needed for the NWMB to complete the *Nunavut Land Claims Agreement* Article 5 decision-making process regarding Southampton Island caribou, **in these particular circumstances, the Board recommends that you proceed by way of *Nunavut Land Claims Agreement* Section 5.3.24 and make another interim decision regarding harvest limitations for Southampton Island caribou.**

To address the second resolution, NWMB staff held a pre-hearing teleconference on October 7<sup>th</sup>, 2015 to receive submissions from co-management partners as to whether the NWMB should hold a written public hearing to address the total allowable harvest and accompanying non-quota limitation and a separate in-person public hearing to address the basic needs level at a later date. Co-management partners raised no objection to holding two separate hearings. Therefore on October 9<sup>th</sup>, 2015 during an In-Camera meeting (IC 006-2015), the Board passed the following resolution:

*RESOLVED that the NWMB divide the current Southampton Island caribou public hearing into two hearings: a written hearing addressing the total allowable harvest and accompanying non-quota limitation for Southampton Island caribou, and the continuation of the in-person hearing addressing the basic needs level for Southampton Island caribou.*

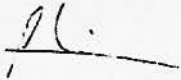
#### **NWMB-proposed Next Steps**

In terms of specific next steps, the Board recommends that you make and implement a reasonable interim decision as soon as reasonably possible regarding harvest management for the Southampton Island caribou herd.

The NWMB will initiate a written public hearing to address the Proposal from the Government of Nunavut-Department of Environment regarding a total allowable harvest and associated non-quota limitation for Southampton Island caribou as soon as possible. It is anticipated that the NWMB will consider the submissions received through the written public hearing and make a decision at its December 2015 In-Camera Meeting. This decision will promptly be forwarded to you for consideration.

If you require further information, please do not hesitate to contact the NWMB.

Yours sincerely,



Ben Kovic  
Chairperson of the  
Nunavut Wildlife Management Board

Attachments (1)

c.c. Drikus Gissing, Director of Wildlife, Government of Nunavut-Department of Environment;

## **WILDLIFE ACT - LOI SUR LA FAUNE ET LA FLORE**

Whereas there has been a precipitous decline in the population of the Southampton Island Caribou Herd since 1997, from more than 30,000 to approximately 12,000 animals;

And Whereas the Southampton Island Caribou Herd is an important food, cultural, and economic resource for the community of Coral Harbour;

And Whereas the NWMB has recommended that a reasonable interim harvest limit be enforced for the Southampton Island Caribou Herd until a final decision is made by the NWMB;

And Whereas the Minister has determined that a harvest limit of 1600 caribou is sustainable until a final decision is made by the NWMB;

And Whereas for the purposes of conservation it is necessary to impose a non-quota limitation prohibiting the harvesting of cow-calf pairs from the Southampton Island Caribou Herd;

And Whereas the Minister is of the opinion that urgent and unusual circumstances exist requiring an immediate modification in harvesting activities with respect to the Southampton Island Caribou Herd,

The Minister, in accordance with paragraph 121(b) and section 150 of the *Wildlife Act* and every enabling power, makes the annexed *Southampton Island Caribou Herd Total Allowable Harvest Interim Order*.

Attendu :

le brusque déclin de la population de la harde de caribous de l'île Southampton depuis 1997, qui est passée de plus de 30 000 individus à environ 12 000;

que la harde de caribous de l'île Southampton constitue une importante ressource alimentaire, culturelle et économique pour la collectivité de Coral Harbour;

que le CGRFN a recommandé qu'une limite de récolte raisonnable et provisoire soit mise en application pour la harde de caribous de l'île Southampton, jusqu'à ce qu'une décision finale soit prise par le CGRFN;

que le ministre a décidé qu'une limite de récolte de 1 600 caribous constitue une limite durable jusqu'à ce qu'une décision finale soit prise par le CGRFN;

qu'à des fins de conservation, il est nécessaire d'imposer une limite non quantitative interdisant la récolte de couples mères-petits au sein de la harde de caribous de l'île Southampton;

que le ministre est d'avis qu'il existe des circonstances urgentes et exceptionnelles exigeant la modification immédiate des activités de récolte à l'égard de la harde de caribous de l'île Southampton,

le ministre, en vertu de l'alinéa 121b) et de l'article 150 de la *Loi sur la faune et la flore* et de tout pouvoir habilitant, prend l'*Arrêté provisoire concernant la récolte totale autorisée à l'égard de la harde de caribous de l'île Southampton*, ci-après.

Dated,

Fait le ..... 2015.

.....  
Hon. Johnny Mike,  
Minister of Environment  
Ministre de l'Environnement

## WILDLIFE ACT

### **SOUTHAMPTON ISLAND CARIBOU HERD TOTAL ALLOWABLE HARVEST INTERIM ORDER**

- 1.** In this Order, “Southampton Island Caribou Herd” means all caribou found on Southampton Island and White Island, being part of Wildlife Management Barren-Ground Caribou Area N/BC/12, as described in the *Wildlife Management Barren-Ground Caribou Areas Regulations*, N.W.T.Reg. R-099-98, as duplicated for Nunavut by section 29 of the *Nunavut Act* (Canada).
- 2.** (1) A total allowable harvest is established for the Southampton Island Caribou Herd in accordance with this Order.

(2) The total allowable harvest from the population of the Southampton Island Caribou Herd for the harvest year is 1600 caribou.

(3) It is presumed that the Inuit of Coral Harbour have a basic need for the full amount of the total allowable harvest set in this Order.

(4) The full amount of the total allowable harvest for the harvest year is allocated to the community of Coral Harbour.
- 3.** There shall be no harvesting of cow-calf pairs from the Southampton Island Caribou Herd during the harvest year.
- 4.** This Order is subject to review as soon as practicable by the NWMB in accordance with section 158 of the Act, but remains in effect until the earlier of:

  - (a) the coming into force of an Order to implement an accepted decision of the NWMB concerning the Southampton Island Caribou Herd; or
  - (b) the coming into force of a subsequent Order of the Minister.
- 5.** The *Southampton Island Caribou Herd Total Allowable Harvest Interim Order (July 1, 2014 to June 30, 2015)*, registered as statutory instrument numbered R-019-2014, is repealed.

## LOI SUR LA FAUNE ET LA FLORE

### ARRÊTÉ PROVISOIRE CONCERNANT LA RÉCOLTE TOTALE AUTORISÉE À L'ÉGARD DE LA HARDE DE CARIBOUS DE L'ÎLE SOUTHAMPTON

**1.** Pour l'application du présent arrêté, « harde de caribous de l'île Southampton » s'entend de tous les caribous qui se trouvent sur l'île Southampton et l'île White, faisant partie de la région de gestion du caribou des toundras N/BC/12, telle que décrite dans le *Règlement sur les régions de gestion du caribou des toundras*, Règl. T.N.-O. R-099-98, reproduit pour le Nunavut par l'article 29 de la *Loi sur le Nunavut* (Canada).

**2.** (1) Une récolte totale autorisée est établie pour la harde de caribous de l'île Southampton en conformité avec le présent arrêté.

(2) La récolte totale autorisée au sein de la population de la harde de caribous de l'île Southampton est de 1 600 caribous pour l'année de récolte.

(3) Il est présumé que l'intégralité de la récolte totale autorisée qui est précisée dans le présent arrêté constitue un besoin essentiel pour les Inuit de Coral Harbour.

(4) L'intégralité de la récolte totale autorisée pour l'année de récolte est attribuée à la collectivité de Coral Harbour.

**3.** La récolte de couples mères-petits au sein de la harde de caribous de l'île Southampton est interdite pendant l'année de récolte.

**4.** Le présent arrêté est assujéti, dans les plus brefs délais, à un examen par le CGRFN conformément à l'article 158 de la Loi, mais demeure valide jusqu'à la première des dates suivantes :

- a) la date d'entrée en vigueur d'un arrêté visant la mise en œuvre d'une décision du CGRFN acceptée concernant la harde de caribous de l'île Southampton;
- b) la date d'entrée en vigueur d'un arrêté subséquent du ministre.

**5.** L'*Arrêté provisoire concernant la récolte totale autorisée à l'égard de la harde de caribous de l'île Southampton (1<sup>er</sup> juillet 2014 au 30 juin 2015)*, enregistré comme texte réglementaire sous le numéro R-019-2014, est abrogé.



December 15<sup>th</sup>, 2015

Honourable Johnny Mike  
 Minister of Environment  
 Government of Nunavut

NWMB - SENT  
 DATE: Dec 15/15  
 TF

Dear Minister Mike:

**Re: Nunavut Wildlife Management Board decisions concerning total allowable harvest and non-quota limitation for the Southampton Island caribou herd.**

**1. NWMB DECISIONS**

On October 16<sup>th</sup>, 2015, the Nunavut Wildlife Management Board (NWMB or Board) provided notice that it would be conducting a written public hearing to consider the Government of Nunavut-Department of Environment’s *Proposal for Decision* (attached). The proposal recommended a total allowable harvest of 1600 caribou and a non-quota limitation prohibiting the harvesting of cow/calf pairs for the Southampton Island caribou herd. The deadline for submissions to the hearing was November 13<sup>th</sup>, 2015. No submissions were received.

On December 2<sup>nd</sup>, 2015 at its In-Camera Meeting (007-2015), the Board passed the following resolution:

*RESOLVED that (1), pursuant to Sections 5.3.24, 5.6.16, 5.6.17(a) and 5.3.3(a) of the Nunavut Land Claims Agreement (NLCA), the NWMB modify the annual Coral Harbour level of community total allowable harvest for Southampton Island caribou to 1600, from the previous level of 800 established by the Minister of Environment on June 13<sup>th</sup> 2014, pursuant to NLCA Section 5.3.24; and (2), pursuant to NLCA Sections 5.3.24, 5.6.48 and 5.3.3(a), the NWMB maintain the prohibition on the harvest of Southampton Island caribou cow/calf pairs, also previously established by the Minister of Environment on June 13<sup>th</sup> 2014, pursuant to NLCA Section 5.3.24.*

It is the NWMB’s legitimate expectation that – in accordance with your June 13<sup>th</sup>, 2014 interim decision and your two previous interim decisions in 2012 and 2013, as well as the supporting resolution of the Aiviit Hunters and Trappers Organization relied upon in the Department’s *Proposal for Decision* – the full amount of the total allowable harvest is to be allocated to the community of Coral Harbour.

As per *Nunavut Land Claims Agreement* Section 5.6.19, the Board shall strike a basic needs level once a total allowable harvest has been determined. Therefore, following a pre-hearing teleconference with its co-management partners the Board passed the following resolution during its In-Camera Meeting (006-2015) on October 9<sup>th</sup>, 2015:

*RESOLVED that the NWMB divide the current Southampton Island caribou hearing into two hearing: a written hearing addressing the total allowable harvest and accompanying non-quota limitation for Southampton Island caribou, and the continuation of the in-person hearing addressing the basic needs level for Southampton Island caribou.*

The NWMB is planning to resume its in-person hearing to address the basic needs level in 2016.

## **2. RATIONALE FOR THE NWMB'S DECISIONS**

During its decision-making, the NWMB carefully considered the best available scientific information and Inuit Qaujimajatuqangit. A May 2015 aerial survey produced a population estimate of 12,297 caribou, demonstrating that the population had increased from the May 2013 population estimate of 7,287 caribou. This increase is believed to be in part due to an emigration event detected by Coral Harbour hunters in the winter of 2013/2014.

In addition, the Government of Nunavut-Department of Environment staff held a face to face meeting with the Coral Harbour Hunters and Trappers Organization to discuss the survey results. During this meeting the Hunters and Trappers Organization passed a motion supporting a total allowable harvest of 1600 caribou and a non-quota limitation prohibiting the harvest of cow/calf pairs for the Southampton Island caribou herd.

Given that the 2015 population survey indicates an increase in herd size and that the next aerial survey is expected to occur in May 2017, the NWMB does not feel that setting the total allowable harvest at 1600 will cause a conservation concern during this short time frame. In fact, as the most recent Interim Order for this herd expired on June 30<sup>th</sup>, 2015, leaving no legal harvest restrictions in place, the NWMB feels that setting this total allowable harvest is essential to ensure the sustainable harvesting of this herd.

## **3. Conclusion**

As per Section 5.3.8 of the *Nunavut Land Claims Agreement*, the NWMB is hereby forwarding its decision concerning the harvest management of Southampton Island caribou to you for your review and consideration. As there are currently no legal harvest restrictions in place, the NWMB looks forward to your prompt reply, ensuring that the Article 5 decision making process will be completed as soon as possible.

Should you or your officials have any questions or concerns regarding the contents of this letter, please do not hesitate to contact the NWMB.

Sincerely,

A handwritten signature in blue ink, appearing to be 'Ben Kovic', with a long horizontal flourish extending to the right.

Ben Kovic  
Chairperson of the  
Nunavut Wildlife Management Board

Enclosures (1)



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Building *Nunavut* Together  
*Nunavut* iuqatigiingniq  
Bâtir le *Nunavut* ensemble

January 14, 2015

Mr. Ben Kovic  
Chair, Nunavut Wildlife Management Board  
Box 379  
Iqaluit, NU X0A 0H0

Dear Mr. Kovic:

RE: Nunavut Wildlife Management Board final decisions concerning total allowable harvest and non-quota limitation for the Southampton Island caribou herd.

Thank you for your December 15, 2015 letter outlining the decision of the Nunavut Wildlife Management Board (NWMB) to modify the annual Total Allowable Harvest (TAH) of Southampton Island caribou.

To reiterate, the Board's decision is to increase the community TAH for Southampton Island caribou from 800 to 1600 per year. Further, the Board recommended maintaining a non-quota limitation that prohibits the harvesting caribou cow/calf pairs.

I hereby advise that, pursuant to Nunavut Land Claims Agreement Sections 5.3.9(b) and 5.3.11, I am accepting this decision.

I will direct my staff to implement the decision effective immediately, and until such time as new scientific information and/or traditional knowledge become available that will warrant a new assessment of the Southampton Island caribou TAH.

Sincerely,

Hon. Johnny Mike  
Minister of Environment









# **Long-term trends in abundance and spring distribution of the Southampton Island caribou herd: 1978 – 2023**

Government of Nunavut  
Department of Environment  
Technical Report Series – No: KIV-01-2024

**Mitch Campbell<sup>1</sup> and John Boulanger<sup>2</sup>**

<sup>1</sup>Nunavut Department of Environment, Wildlife Research Division, P.O. Box 120, Arviat, NU., X0C 0E0

<sup>2</sup> Integrated Ecological Research, 924 Innes St., Nelson B.C., V1L 5T2

**10, December, 2024**



The opinions in this report reflect those of the authors and not necessarily those of the Government of Nunavut, Department of Environment.







# SUMMARY

Barren-ground caribou (*Rangifer tarandus groenlandicus*) were reintroduced onto Southampton Island (SHI) from Coats Island in the Kivalliq Region of Nunavut in 1968, following their extirpation from SHI in the early 1950s. The ongoing assessment of this unique herd suggests large fluctuations in abundance and distributional changes since its re-establishment across SHI. The SHI caribou herd grew from the 48 animals introduced in 1968 to an estimated population of 29,425 animals by June 1997, yielding an annual rate of increase of approximately 23%. Since its re-introduction the SHI herd harvest was restricted up until 1978 when an estimate of 1,138 adult and yearling caribou suggested that numbers had recovered to a level that could once again support a limited subsistence harvest. The herd continued to grow and by 1993 the first commercial harvest was approved. After nearly 30 years of growth, herd abundance declined from the estimated high of 29,425 in June 1997, to 21,277 by June 2005, 14,389 in June 2007, 13,651 in June 2009, 8,467 in June 2011, then to 7,287 in May 2013. Herd abundance began to stabilize and by May 2015 the population had increased to 12,370. However, by 2017, the population had declined again to 9,200. During this short period of decline, caribou distribution concentrated into a core area within the south-central portion of the Island in the vicinity of the Kirchoffer River. By 2019 the estimate of herd abundance was 12,054, which was similar to the 2015 estimate suggesting stability. In 2023, herd size was estimated to be 12,651 indicating continued stability. Harvest estimates over the same periods varied widely. Following the 2011 survey, an annual Total Allowable Harvest (TAH) of 1,000 caribou was applied over the 2012 and 2013 harvesting seasons, and a TAH of 800 over the 2014 and 2015 harvesting seasons. Following the population increase detected in 2015, the TAH was increased to 1,600 caribou annually for the 2016 harvesting period only. A reduction in abundance detected in May 2017 led to the reduction in TAH back to 1,000

in an attempt to reverse or stabilize the trend. The TAH, bolstered by indications of stability in 2019 and 2023, has been maintained at 1,000 animals.

Susceptibility to disease and parasites due to low genetic heterogeneity (the population grew, from introduction, from a very small group of Coats Island caribou) has been a concern since the reintroduction of caribou to SHI, and was a likely catalyst to the wide spread infection of caribou with *Brucellosis suis* which was first detected in the population in February 2000. Prevalence of Brucellosis climbed from 1.7% in February 2000 to 58.8% in March 2011 and this increase is thought to have contributed to decreased pregnancy rates over the same period. Pregnancy rates dropped from a high of 93.1% in February 2001 to a low of 37% in March 2011. Trend analysis suggests that the SHI caribou population decreased at a rate of 9% per year between 1997 and 2013, followed by an increase due to a locally reported and genetically supported winter immigration event between 2014 and 2015. While the herd has been stable from 2015 to 2023, it is still below historic levels. Given the reliance of users on this population for subsistence and commercial harvesting purposes, continuation of the current TAH is recommended to maintain stability and continue to promote recovery over the next 2 to 3 years, at which time a reassessment of herd abundance and TAH levels should be undertaken.

Observed distributions from the 2003 survey indicated little change from distributions observed during previous surveys though localized densities had decreased when compared to 1997 results. Overall, caribou continued to heavily use the central portions of the Island along the Kirchoffer River valley and along the transition between the western flats and the eastern highlands from November 1978 through to May 2023. Small variations between years were likely the result of changes in snow cover and associated icing, with caribou feeding at higher elevations during years of early snow melt and/or reduced snow cover. The central portion of the Island, in the vicinity of the Kirchoffer River and along the general transition from the western flats to the more topographically rugged eastern highlands of the Island, have received high use by SHI caribou in the spring and during calving from introduction to present, making these areas extremely important to the long-term viability of the herd. The protection of these

areas from anthropogenic disturbance that may modify and/or impact the landscape will be a critical component of any long-term herd management plans.

The mechanisms driving the changes in abundance observed over the entire survey history of the Southampton Island caribou population are multiple, and difficult to isolate and quantify, suggesting that further research is required. It appears that the main drivers have been the disease *Brucella suis* Type IV, harvest (with emphasis on the sale of caribou meat through social media), and poor winter weather, primarily in the form of icing events in some years. Clearly the need to continue monitoring disease prevalence in SHI caribou is required if we are to understand present day infection rates and associated productivity for the herd. Recently, hunters have reported fewer caribou with signs of disease, and a noticeable increase in the number of calves observed in 2015 through 2023 which suggests that disease prevalence may be decreasing further. If this is the case, and Brucellosis no longer represents a significant mechanism of decline, then harvest, along with weather, and condition monitoring, should become the focus of future monitoring for the SHI herd. Additionally, more effective means of monitoring the harvest, and any exports of caribou meat off the island will be critical in understanding the true extent of the harvest for both subsistence and meat sales. At present these tools are not available to enforcement officers within Nunavut, suggesting that further thought and required amendments to current harvesting regulations, and perhaps the Nunavut Agreement itself, should be seriously considered by wildlife management organizations and the Government of Nunavut. Attempts to control the sale of caribou meat through social media have failed under the current Management regime and consideration should be given to addressing this issue through amendments to legislation. In recent consultations with Kivalliq community HTOs, all communities expressed a willingness to address the problem in this way, suggesting that some mutual agreement could be reached to more permanently resolve this issue. If nothing is done to monitor this novel and growing mechanism of caribou meat sales, we fear the problem will grow more serious for Nunavut's subsistence harvesters as more and more caribou populations within Nunavut will be managed through the establishment of a TAH.

# ABSTRACT

Barren-ground caribou (*Rangifer tarandus groenlandicus*) were reintroduced onto Southampton Island (SHI) from Coats Island in the Kivalliq Region of Nunavut in 1968, following their extirpation from SHI in the early 1950s. The ongoing assessment of this unique herd suggests large fluctuations in abundance and distributional changes since its re-establishment across SHI. The SHI caribou herd grew from the 48 animals introduced in 1968 to an estimated population of 29,425 animals ( $\pm 3,050$ , 95% CI; CV=5.5%) by June 1997, yielding an annual rate of increase of approximately 23%. Since its re-introduction the SHI herd harvest was restricted up until 1978 when an estimate of 1,138 (95% CI = 419.7-1,856.3; CV=63.0%) adult and yearling caribou suggested that numbers had recovered to a level that could once again support a limited subsistence harvest. The herd continued to grow and by 1993 the first commercial harvest was approved. After nearly 30 years of growth, herd abundance declined from the estimated high of 29,425 in June 1997, to 21,277 (95% CI = 18,098-24,896, CV=8.0%) by June 2005, 14,389 (95% CI = 12,684-16,325; CV=6.4%) in June 2007, 13,651 (95% CI = 12,091-15,412; CV=6.1%) in June 2009, 8,467 (95% CI = 7,558-9486, CV = 5.7%) in June 2011, then to 7,287 (95% CI = 6,580-8,071, CV = 5.0%) in May 2013. Herd abundance began to stabilize and by May 2015 the population had increased to 12,370 (95% CI = 11,140-13,736, CV = 5.1%). However, by 2017, the population had declined again to 9,200 (95% CI = 7,755-10,915; CV = 8.7%). During this short period of decline, caribou distribution concentrated into a core area within the south-central portion of the Island in the vicinity of the Kirchoffer River. By 2019 the estimate of herd abundance was 12,054 (95% CI = 10,354-14,032, CV = 7.5%), which was similar to the 2015 estimate suggesting stability. In 2023, herd size was estimated to be 12,651 (95% CI = 11,044-14,493, CV = 6.7%) suggesting continued stability. Harvest estimates over the same periods varied widely. Following

the 2011 survey, an annual Total Allowable Harvest (TAH) of 1,000 caribou was applied over the 2012 and 2013 harvesting seasons, and a TAH of 800 over the 2014 and 2015 harvesting seasons. Following the population increase detected in 2015, the TAH was increased to 1,600 caribou annually for the 2016 harvesting period only. A reduction in abundance detected in May 2017 led to the reduction in TAH to 1,000 in an attempt to reverse or stabilize the trend. The TAH, bolstered by indications of stability in 2019 and 2023, has been maintained at 1,000 animals.

Susceptibility to disease and parasites due to low genetic heterogeneity has been a concern since the reintroduction of caribou to SHI, and was a likely catalyst to the wide spread infection of caribou with *Brucellosis suis* which was first detected in the population in February 2000. Prevalence of Brucellosis climbed from 1.7% in February 2000 to 58.8% in March 2011 and this increase is thought to have contributed to decreased pregnancy rates over the same period. Pregnancy rates dropped from a high of 93.1% in February 2001 to a low of 37% in March 2011. Trend analysis suggests that the SHI caribou population decreased at a rate of 9% per year between 1997 and 2013, followed by an increase due to a locally reported and genetically verified immigration event between 2014 and 2015. While the herd has been stable from 2015 to 2023, it is still below historic levels. Given the reliance of users on this population for subsistence and commercial harvesting purposes, continuation of the current TAH is recommended to maintain stability and continue to promote recovery over the next 2 to 3 years, at which time a reassessment of herd abundance and TAH levels should be undertaken.

**Key words:** *Commercial harvest, barren-ground caribou, caribou, Rangifer tarandus, Southampton Island, Coral Harbour, Kivalliq, disease, Brucellosis suis, Nunavut, population survey, demographic studies.*

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# 1.0 INTRODUCTION

Following the extirpation of caribou from Southampton Island (SHI) in the early 1950s, there was much discussion regarding their reintroduction as well as recognition of the careful husbandry that must go hand in hand with such a program (MacPherson, 1967). Discussions continued up until 1967 at which time Northwest Territories Commissioner Stuart Hodgson along with D.S. Munro, Director of the Canadian Wildlife Service (CWS), made the decision to move forward with the reintroduction of caribou to SHI. The target group for the source population was the Coats Island Herd due to its close proximity and ecological and environmental similarities to Southampton Island. Regional Superintendent A. G. Loughery and Research Supervisor A.H. MacPherson began implementation of the program on June 7<sup>th</sup>, 1967. The very first caribou on Southampton Island following their extirpation were 48 caribou captured and transported from Coats Island.

From their start on Southampton Island caribou were watched closely by wildlife officials. The first evidence of the success of the introduction was communicated by the game Management Officer Ed Bowden who estimated between 100 and 125 caribou ranging over the southern half of the island in the winter of 1971 (Game Management Files, 1971, 1972, 1973). In November 1978 Kraft (1978) initiated the first quantitative aerial survey since the introduction, estimating 1,138 (95% CI = 420-1,856; CV = 63.0%) adult and yearling caribou. The results of the 1978 survey suggested that numbers had recovered to a level that could once again support a limited subsistence harvest. From 1978 to 1999 the Government of the Northwest Territories managed the progress of the 1967 reintroduction of caribou. From 1999 onward, the Government of Nunavut (GN) took over this responsibility. The current GN management strategy follows a management plan developed in partnership with the Coral Harbour Hunter and Trappers Organization (HTO) and consists of a program

relying upon regular aerial surveys and an extensive health monitoring program. Due to confirmed declines following the 2011 population estimate, the health monitoring component of population studies of the SHI herd, which included a one hundred animal harvest for the assessment of health and condition, has been suspended to allow all available tags to go to the hunters of Coral Harbour.

Following introduction, caribou had steadily increased to an estimated population of 29,425 animals (95% CI = 26,375-32,475; CV = 5.5%) by 1997, which represented the highest number of caribou ever recorded on the island. The 1997 estimate suggested an annual rate of increase of 23% since introduction. An aerial population survey conducted in 2003 detected the first decline of caribou since their introduction, showing a population estimate of 17,981 (95% CI = 15,854-20,108; CV = 6.0%) caribou. The population remained relatively stable between June 2003 and a follow-up survey flown in June 2005. The June 2005 abundance survey estimated 20,582 (95% CI = 17,526-23,638; CV = 7.5%) but the observed increase from the 2003 mean estimate was not found to be statistically significant. The first evidence of a significant drop in abundance since the 1997 estimate was recorded in June 2007 when survey results estimated 15,452 (95% CI = 13,594-17,310; CV = 6.0%) caribou. This confirmed a 14% decline over this 10 year period (1997-2007) (Campbell, 2015). The SHI caribou population continued its decline to 13,953 (95% CI = 12,163-15,743; CV = 7.0%) in June 2009, and to 7,902 (95% CI = 6,641-9,163; CV = 8.0%) by June 2011. The June 2011 result prompted the setting of a Total Allowable Harvest (TAH) for the 2012 harvesting season. The establishment of the TAH effectively slowed the decline and by May 2013 abundance was statistically stable at an estimated 7,287 (95% CI = 6,242-8,332; CV = 7.0%) caribou (Campbell, 2015).

A genetic study, based on the confirmation of a movement event between the mainland and SHI and first reported by local hunters in the winter of 2013, was initiated in spring 2014 and completed a year later. The study confirmed that mainland barren-ground caribou DNA came onto SHI for the first time since introduction sometime during the winters of either 2013 or 2014, following the May 2013 survey but prior to May 2015. This movement is believed to have increased the population some time prior to the May 2015 abundance survey where 12,368 (95% CI = 10,518-14,542, CV = 8.1%)

adult and yearling caribou were estimated. Since May 2015 the herd appears to have remained stable though still below historic levels. However, the potential for a founder effect for this introduced population, leading to low genetic heterogeneity and associated increased susceptibility to disease and parasites was a concern. Initial concerns surfaced in February 2000 when the reproductive disease *Brucellosis suis* was detected for the first time, growing to a prevalence of 58.8% by February 2011. High rates of *Brucellosis* in the population are thought to have been the main catalyst behind recorded declines observed following the June 1997 survey (Campbell, 2015). Reproductive disease is thought to have been a major contributor to overall population declines since the early 2000's. Pregnancy rates declined from approximately 80% in 1997, to 60% in 2003, reaching a low of 36.3% in 2008, then climbing to 55.6% in 2010, to decline again to 37.0% in 2011 (Campbell, 2015). The reproductive disease *Brucellosis suis* (*Brucella*) was first detected in February 2000 at a prevalence of 1.7% (of sampled caribou) and by March 2011, rates of infection had risen to 58.8% (Campbell, 2015). High *Brucella* infection rates raised concerns regarding human health, as well as the ability of the SHI caribou herd to sustain and recover from substantial commercial harvesting and subsistence harvesting pressures.

Health studies were first initiated in March 1993 and continued as a linked program alongside the annual commercial harvest up to and including the 2009 harvesting year. Following the cessation of the commercial harvest in 2009, health studies continued as a standalone 100 caribou harvest up until 2011. Following continued declines in SHI caribou abundance, health screening after 2011 continued in the form of harvester sample kits up to Spring 2015. Results from these studies suggest body condition did not change significantly over most years. One notable exception was that in February and March of 2011 the SHI herd was in the poorest condition reported since the initiation of the program (Campbell, 2015). During the winters of 2010 and 2011, hunters reported numerous freezing rain events and extensive icing across the island. These icing events likely made winter forage less accessible to caribou (Tyler, 2010). Icing events that reduced accessibility to food were likely associated with the observed declines in condition, which further reduced reproductive success (Cameron et al.

1993, Gerhart et al. 1997). Support for this hypothesis stemmed from numerous local reports of starving and dead caribou during mid to late winter 2011 (Campbell, 2015). Brucellosis and icing events are not the only issues threatening the SHI caribou population. Over-harvest has become a dominant threat to the long-term sustainability of this population. In particular, ongoing caribou harvest for trade or sale within Nunavut territory, is suspected of driving harvest levels beyond subsistence requirements, though as of spring 2024, the extent of this harvest relative to the current TAH is unconfirmed. Elements of this unregulated sale of caribou meat are also driving increased harvest pressure on breeding females: customers offer higher payment for fat caribou, which during the winter and spring seasons are predominantly pregnant females.

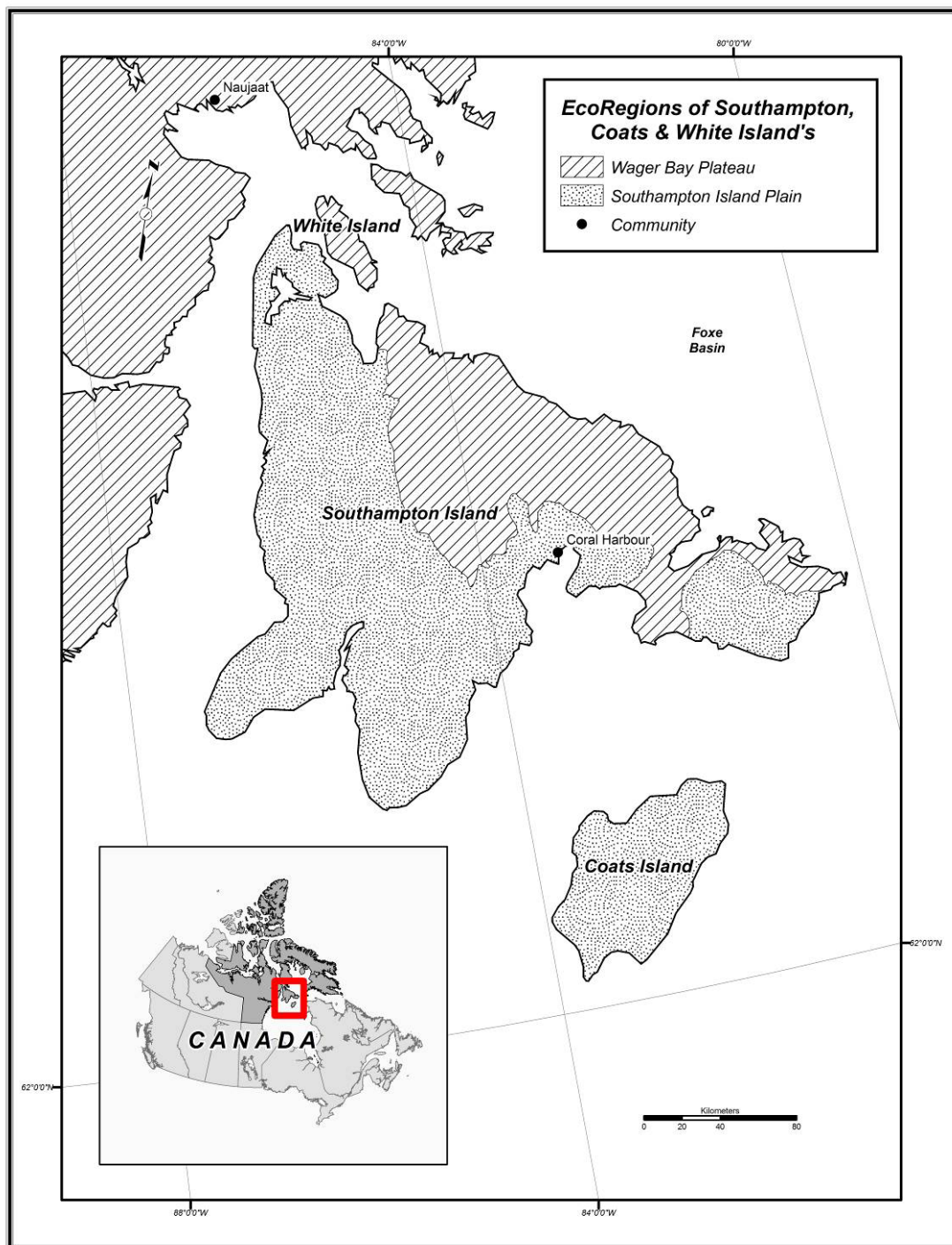
In this report we summarize the findings of 45 years of monitoring of the SHI caribou herd whose range covers the extents of Southampton and White Islands, Nunavut. We discuss trends in abundance, disease, harvest, and other long-term threats to the herd and their implications for management of this barren-ground caribou population.

## 2.0 STUDY AREA

At 43,000 km<sup>2</sup> Southampton Island is the largest island in Hudson Bay. The island is divided into the Northern and Southern Arctic ecozones. The Northern Arctic ecozone covers White Island, and the northeastern third of Southampton Island including northern Bell Peninsula and can be further divided into the Boothia-Foxe Shield eco-province and the Wager Bay Plateau ecoregion (**Figure 1**).

The Wager Bay Plateau ecoregion covers the northeastern Kivalliq Region, extending westward from the northern portion of Southampton Island on Hudson Strait to Chesterfield Inlet in the south, and as far west as the Back River (Wiken, 1986; Natural Resources Canada, 2001). The mean annual temperature of this ecoregion is approximately -11°C with a summer mean of 4.5°C and a winter mean of -26.5°C. The mean annual precipitation ranges from 200 to 300 mm. This ecoregion is classified as having a low Arctic ecoclimate and is characterized by a discontinuous cover of tundra vegetation, consisting mainly of dwarf birch (*Betula glandulosa*), willow (*Salix spp.*), northern Labrador tea (*Ledum decumbens*), mountain avens (*Dryas integrifolia*), and *Vaccinium spp.* Taller dwarf birch, willow, and alder (*Alnus spp.*) occur on warm sites, while wet sites are dominated by willow and sedge (*Carex spp.*). Lichen-covered rock outcroppings are prominent throughout this ecoregion. This ecoregion is composed of massive Archean rocks of the Canadian Shield that form broad, sloping uplands, plains, and valleys. It rises gradually westward from Chesterfield Inlet to an elevation 600 meters above sea level (ASL), where it is deeply dissected. Soils of this ecoregion are typically Turbic and static cryosols developed on discontinuous, thin, sandy moraine and alluvial deposits, while large areas of regosolic static cryosols are associated with marine deposits along the western coast. Permafrost is continuous with low ice content. Naujaat and Baker Lake are the main settlements within the ecoregion (Wiken, 1986; Natural Resources Canada, 2001).

The Southampton Island Plain ecoregion covers the remainder of Southampton Island and all of Coats and Mansel Islands (**Figure 1**). The mean annual temperature within this ecoregion is approximately  $-11^{\circ}\text{C}$  with a summer mean of  $3^{\circ}\text{C}$  and a winter mean of  $-24.5^{\circ}\text{C}$ . The mean annual precipitation ranges from 200 to 300 mm (Wiken, 1986; Natural Resources Canada, 2001). This ecoregion is classified as having a low Arctic ecoclimate and is characterized by a nearly continuous cover of low Arctic shrub tundra vegetation, consisting of dwarf birch, willow, northern Labrador tea, mountain avens, and *Vaccinium* spp. Wet sites are dominated by willow, sedge, and moss. The region is composed of the partly submerged blanket of flat-lying Paleozoic carbonate rocks and is generally less than 90 meters ASL in elevation. Bedrock outcrops are common as are Static and turbic crysol soils developed on level to undulating morainal and marine deposits. The maritime influence is limited to the late summer and early fall as coastal ice and fog persist for long periods in the summer when the sea ice is absent. The ecoregion is underlain by continuous permafrost with medium ice content composed of ice wedges. Coral Harbour is the largest settlement within this ecoregion (Wiken, 1986; Natural Resources Canada, 2001).



**Figure 1** Ecoregions of the Southampton Island, Coats Island, and White Island study areas (Wiken, 1986; Natural Resources Canada, 2001).

## **3.0 METHODS**

### **3.1 Caribou Introduction (1967)–An Historical Account**

Caribou reintroduced to Southampton Island from the Coats Island herd were initially immobilized from a G2 helicopter using a CO<sub>2</sub> gas-operated Palmer ‘Cap-chur’ gun and both 2 cc and 5 cc darts. The darts used during the initial capture contained a pre-measured dose of crystalline succinylcholine (‘Anectine’) dissolved in isotonic water at a concentration of 5mg/cc and administered at a rate of 5 mg per 100 pounds (MacPherson and Manning, 1968). The tranquilizer ‘Largactil’ at a concentration of 25 mg/cc and a dosage of 125mg per 100 pounds was used to maintain immobility. Up to seven animals were captured in this way, per day. Captured animals were taken to a base camp with an enclosure on Coats Island where they were weighed, medicated with Vitamin E and Selenium as well as an antihistaminic and anti-biotic, injected into the shoulder. Animals were held in the enclosure for up to one week. From the enclosure animals were re-captured for transport by roping or tackling, tied up in slings, tranquilized and placed in single and twin Otter fixed wing aircraft for their final transport and release onto Southampton Island in the vicinity of the Coral Harbour airport. In total, 66 caribou comprising 12 bulls, 26 cows (one pregnant), and 10 calves (8 male and 2 female), were captured and released onto Southampton Island. Of the original 66, 18 animals died, two from dart wounds, two from broken legs, and six from what appeared to be capture myopathy (CWS correspondence, 1969; MacPherson and Manning, 1968). Reasons for the remaining eight deaths do not appear in the available records. In total, 48 animals survived the reintroduction, making up the founding group of Southampton Island’s reintroduced caribou herd.

## 3.2 Aerial Surveys (1978-2023)

Survey data from all surveys were initially analyzed using Jolly's Method 2 for unequal sample sizes (Jolly 1969 *In* Norton-Griffiths 1978). Only counts of adults and yearlings were used for the final population estimates as calves are not considered fully recruited into the population until they have survived their first winter. Lake areas were not subtracted from the total area calculations used in density calculations.

### 3.2.1 Surveys pre-1990

Following their reintroduction onto Southampton Island, caribou were monitored periodically by both local and Government wildlife officials, primarily using ground-based methods. An aerial survey flown by Kraft in November 1978 was the first scientific population estimate made since the reintroduction of caribou onto SHI (Kraft, 1978; Kraft, 1981). Kraft used a stratified transect survey method to cover three (3) strata that were believed to represent the full extent of the Southampton Island Herd's fall distribution. The survey was flown between November 22<sup>nd</sup> and 25<sup>th</sup>, 1978 and utilized one observer on each of the left and right side of the single engine high wing DeHavilland Single Otter aircraft. Transects were placed 6.44 km apart for a total of 12.5 % coverage of the entire survey area. Effective strip width was a total of 800 meters, 400 meters out each side of the aircraft, while survey elevation was 122 meters AGL (above ground level) with a mean survey speed of 140 kph (Kraft, 1981). Population estimates were derived by calculating the density of caribou observed for all transect strips, and multiplying density by the total stratum area.

A second survey method was employed in June 1986 and consisted of a stratified random block survey design (Heard and Grey, 1987). The census zone was divided

into 5 strata which received differential coverage ranging from 11% to 54%. The stratification into census zones was based on a pre-survey reconnaissance, habitat and range preference delineations (Parker, 1975), and timely observational data from both local hunters, wildlife service personnel, and previous survey observations of caribou. A Bell 206B helicopter was used as the survey vehicle at variable speeds and altitudes. The survey personnel consisted of two rear seat observers, a front left seat navigator, and a pilot. Sightings from all personnel were recorded. Each caribou was approached and circled so that its sex and age class could be determined. Heard and Grey also attempted to determine sightability through the re-surveying of portions of three blocks at three times the initial survey intensity to determine the differences between the two surveys. This method of determining sightability was, however, unsuccessful due to the movement of animals between survey zones. A third survey flown June 1991 aimed at improving the 1987 survey effort. The June 1991 survey followed, for the most part, the same methodology employed in 1987 by Heard and Grey (Ouellet, 1992). The main modifications made to the 1987 methods were made to ensure complete coverage of the island, involving the delineation of two strata defined as low density, which were surveyed using an aerial strip transect survey flown with a Cessna 337 fixed-wing aircraft. Sampling intensity varied from 11% to 51% over 48 transects and/or blocks flown.

### **3.2.2 Single Observer Pair Method**

The March 1990 and 1991, July 1995, June 1997, June 2003, June 2005, June 2007, and June 2009 surveys were flown using a single observer pair stratified systematic aerial strip transect method. The specifics of each of these surveys are discussed.

#### **March 1990 and 1991**

The March 1990 survey was flown using a Cessna 337 fixed wing aircraft at 120 meters above ground level (AGL) at various speeds between 185 and 222 kilometers per hour. The survey crew included two rear seat observers, a front right seat navigator, and the pilot. The strip width on each side of the aircraft was 400 meters. The survey covered the entire Island using 18 transects, which yielded 4% coverage, leading to low survey intensity and precision (Ouellet, 1992). Because of the low precision of the 1990 estimate, the survey was repeated in 1991 utilizing a quadrat method. The 1991 survey estimate being of greater precision, has been used as representative of this period. Unfortunately little of the March 1990 Southampton Island (SHI) caribou survey method has been documented (Ouellet, 1992).

### **July 1995**

A single observer pair stratified systematic aerial strip transect survey was flown in late June and early July of 1995, however, there were serious problems with sightability due the caribou's darker summer coats following the late spring molt (May/June) of their light-colored sun-bleached winter coats (Mulders, 1995). Because of this Biologists of the time believed the 1995 estimate of 18,275 (95% CI = 16,885-19,665) to be a significant underestimate, and therefore results from this survey have been excluded from this reports summary of historical population trends. Due to the sightability issues with the 1995 survey, a specific recommendation was made to conduct surveys earlier in June or before, prior to molting (Mulders, pers. comm.). The survey to re-estimate the population was later flown in June 1997.

### **June 1995 to 2009**

Aerial surveys flown from 1997 to 2009 utilized a stratified systematic aerial strip transect method flown with a high wing single engine turbine or gas, fixed wing aircraft. During these survey years the survey crew included a pilot (front left seat), a data recorder/navigator (front right seat), a left rear seat observer and a right rear seat observer. The pilot monitored air speed and altitude while following transects using a

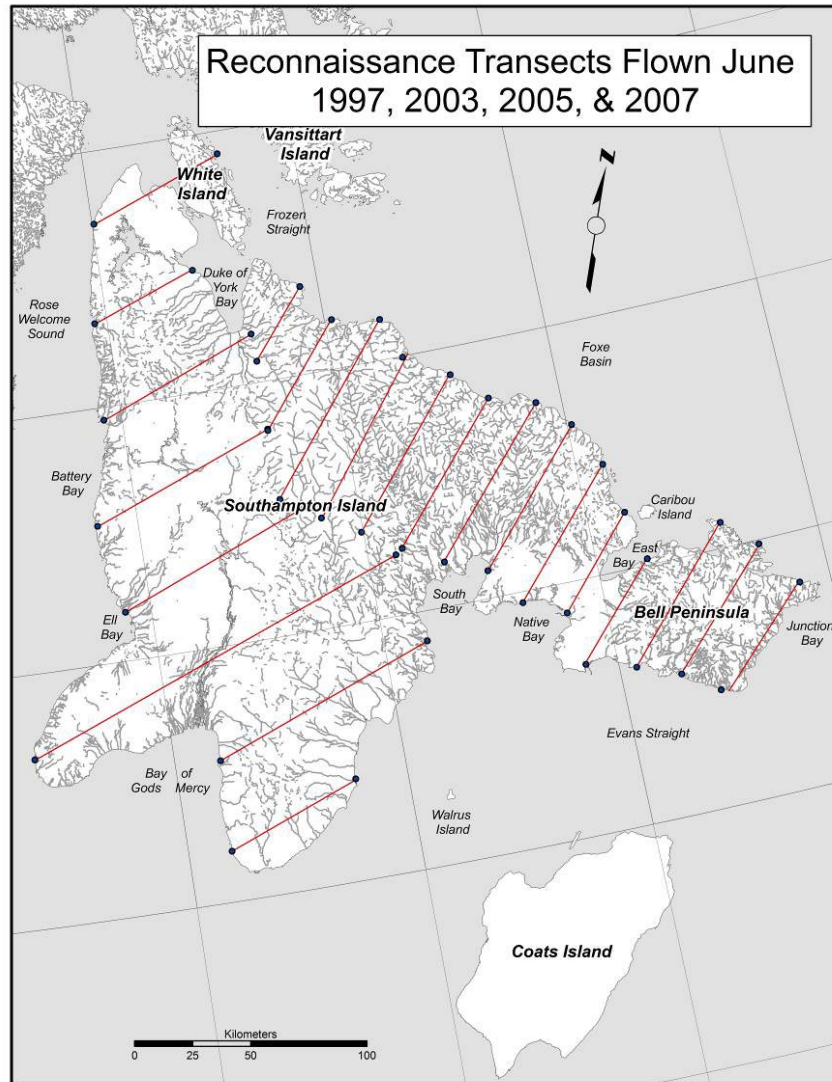
Trimble GPS (June 1995, June/July 1997), remaining survey years were navigated using cloned pre-programmed routes on two Garmin C-176 (2003 through 2009) geographic positioning system (GPS) units set to WGS 1984 datum and true north. The data recorder/navigator was responsible for recording observer observations, assisting in the navigation of transects, and monitoring a second identically programmed GPS unit for the purposes of double-checking the position, altitude, distance from transect, and ground speed (all other surveys). Geographic coordinates (waypoints) and numbers of adult and calf caribou were either recorded on compact tape recorders with associated positions marked on a map (1997), or recorded on data sheets (all other surveys). The responsibilities of the left-side and right-side observers were to monitor their 400-meter strips and call out numbers of caribou separated by adults and calves, both on and off transect as indicated by wing strut markers. The 2003, 2007, and 2009 air crews remained the same throughout the survey, while during the 2005 survey, one or more observers were changed part way through the survey. Information on the 1995, and 1997 surveys concerning consistency in air crews could not be found. Survey aircraft included a Cessna 337 during both the 1995 and 1997 surveys, a DeHavilland Turbo-Beaver during the June 2005 survey, and a Cessna grand caravan during the 2003, 2007, and 2009 surveys. Reconnaissance surveys used to delineate strata extents were flown in June of 1997, 2003, 2005, and 2007 (**Figure 2**). Transect spacing remained similar between all surveys up to 2009 (**Figure 3**). The largest single modification to strata occurred within the Low South strata in 2005 as a result of extensive flooding along the Boas River, which travels through the strata. In this case transects over the Boas River area were shortened to avoid flooded areas where caribou would not be found. Strip width ( $w$ ) for all surveys were established using dowels, or for post-2005 surveys, streamers, attached to the wing struts, based on calculations described in Norton-Griffiths (1978) (**Figure 4**).

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

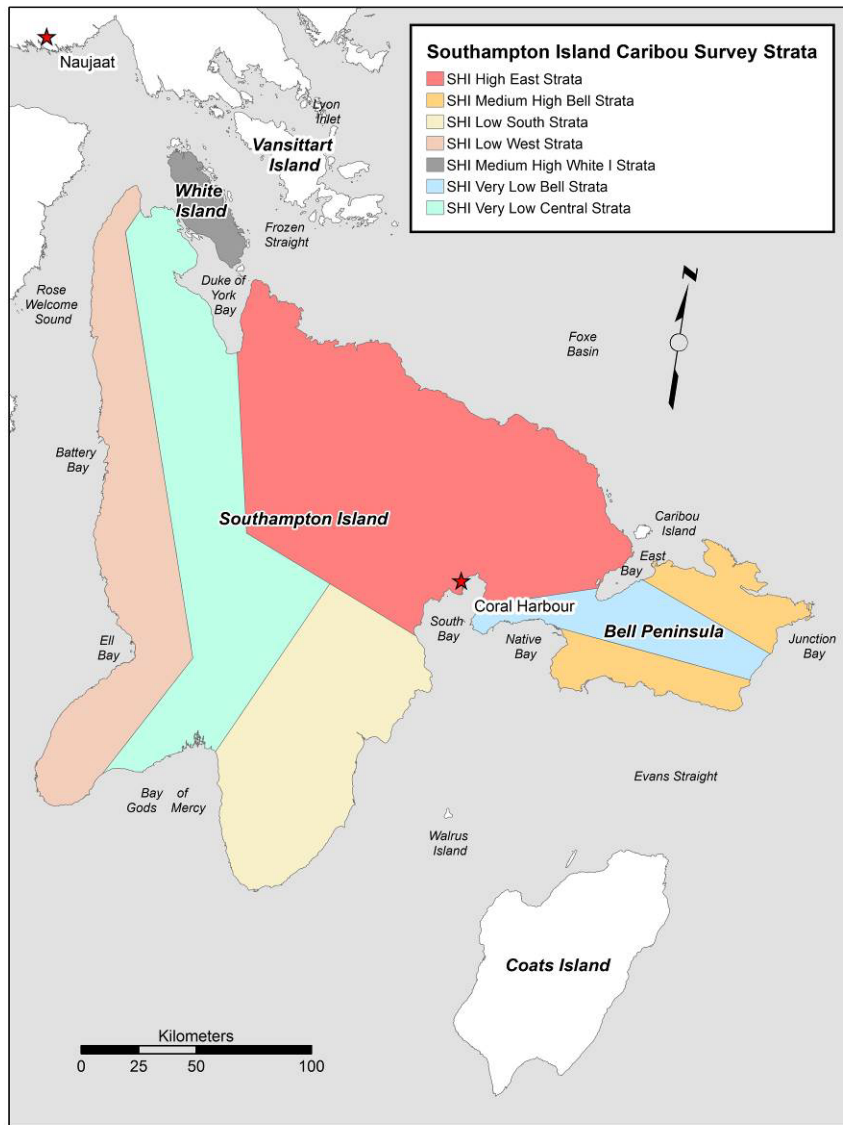
Standardized reconnaissance transects with a total observation strip of 800 meters (400 meters per side) were flown during the June 1997, 2003, 2005, and 2007 surveys

and used to stratify caribou into areas of similar relative densities used later to allocate effort for the abundance phase (Heard 1987). A stratified random transect method was then used during the abundance phase of all surveys from 2009 to present (**Figures 5 to 8**). Evidence of a distributional constancy in SHI caribou's use of spring range led to the cessation of reconnaissance surveys and the re-direction of survey effort into established abundance strata following the June 2007 survey.

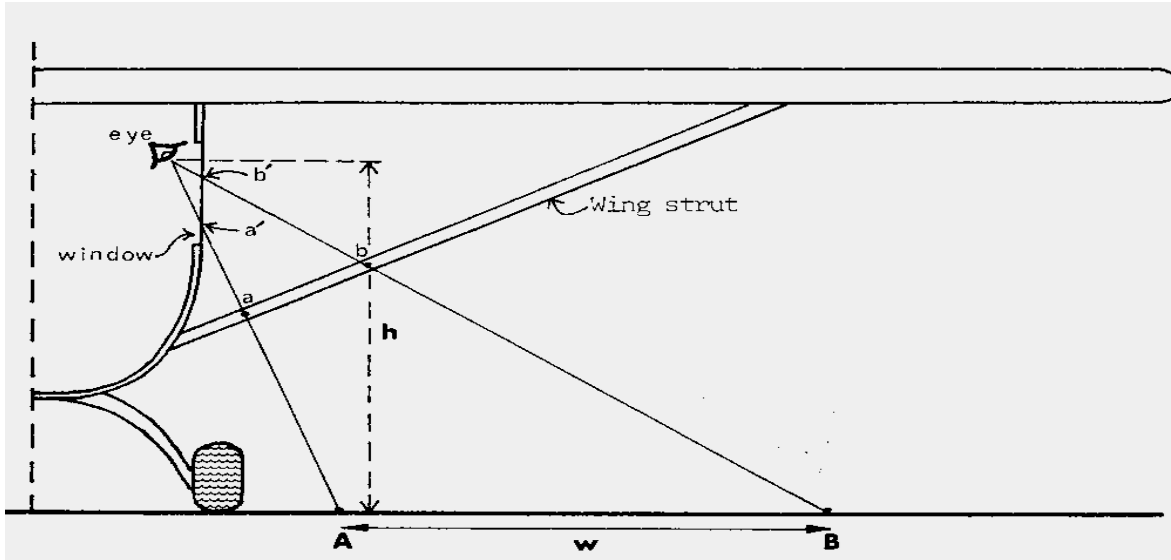
Attempts were made to maintain a constant altitude of 122 meters during all surveys prior to 2003, while a radar altimeter was employed during all remaining surveys to increase altitude precision between transects and survey years. Transect design for all surveys randomly placed the first transect within each of three strata (Low, Medium and High) along a line of latitude or otherwise randomly selected, with each sequential line being evenly spaced. Once established, the same survey transects (with small modifications during some years), were flown as caribou distributions changed little between years.



**Figure 2.** Reconnaissance transects flown in June of 1997, 2003, 2005, and 2007, to delineate abundance strata used to estimate Southampton Islands (including White Island) caribou population.



**Figure 3.** Abundance strata initially delineated using reconnaissance flights to map relative densities of caribou. As caribou distribution changed little across all survey years, these strata were utilized for all surveys post-2007.



**Figure 4.** Schematic diagram of aircraft configuration for strip width sampling (Norton-Griffiths, 1978).  $W$  is marked out on the tarmac, and the two lines of sight  $a' - a - A$  and  $b' - b - B$  established. Streamers are attached to the struts at  $a$  and  $b$ .  $a'$  and  $b'$  are the window marks.

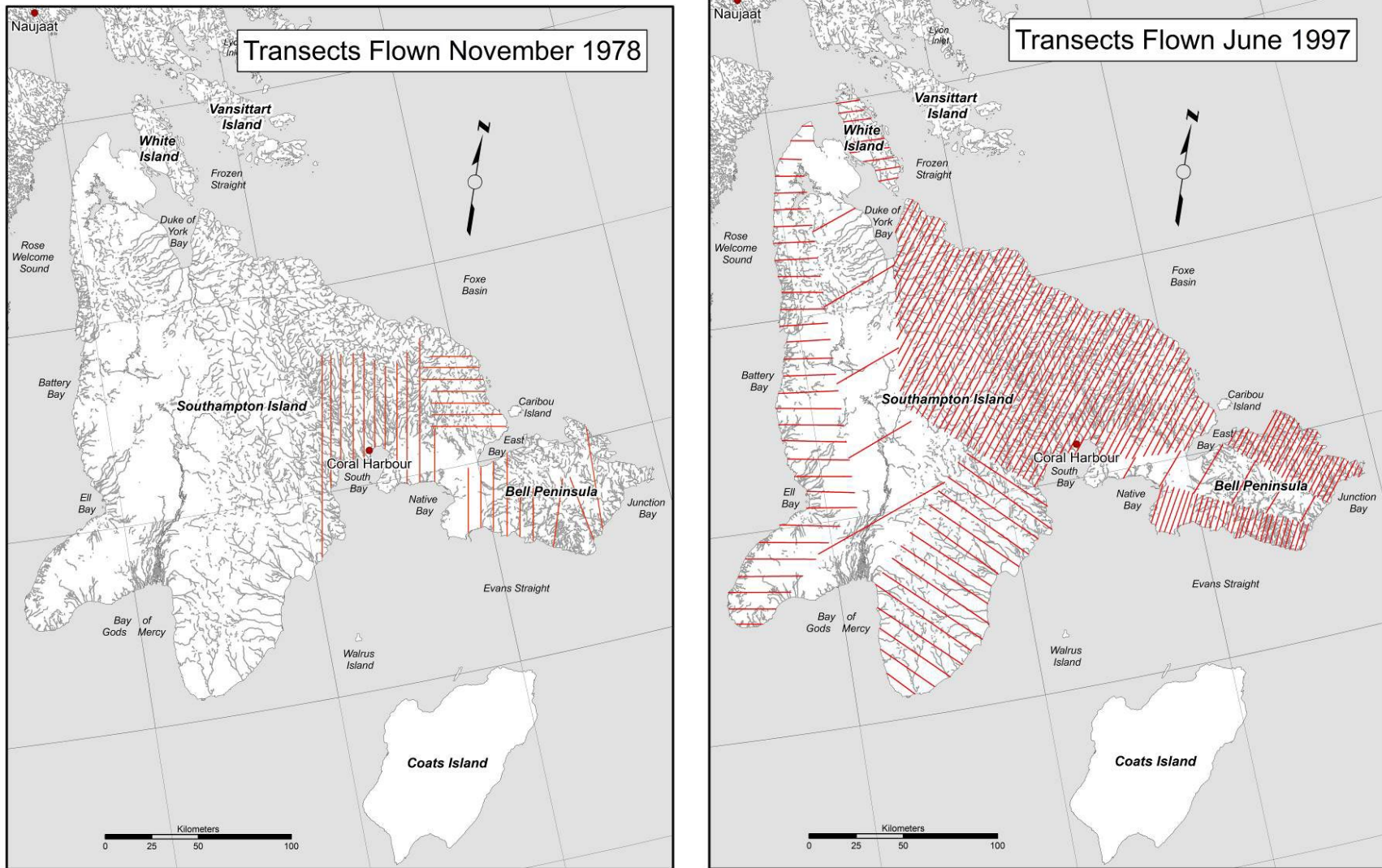
*Where:*

$$w = W * h/H$$

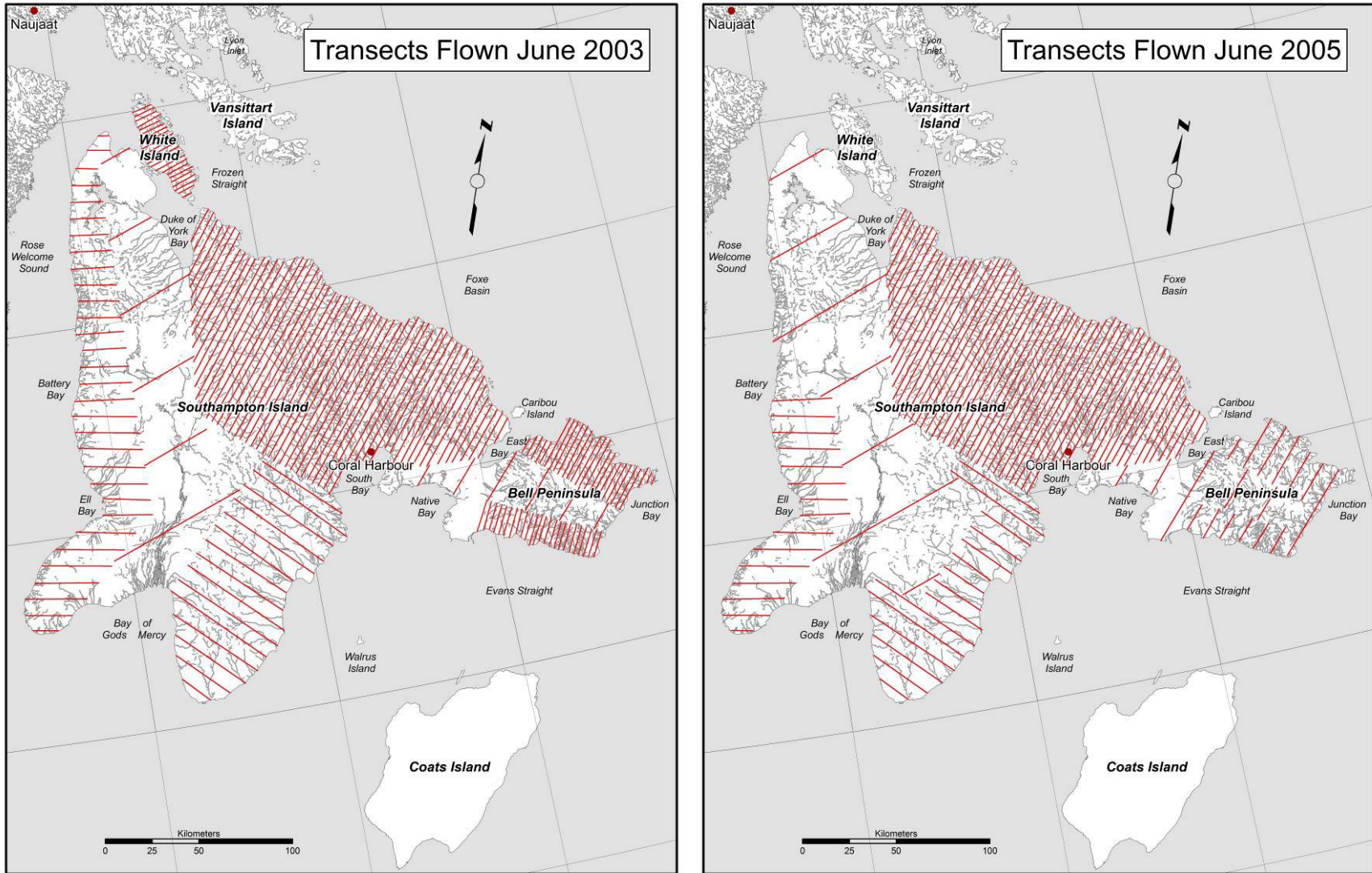
**W** = the required strip width;

**h** = the height of the observer's eye from the tarmac; and

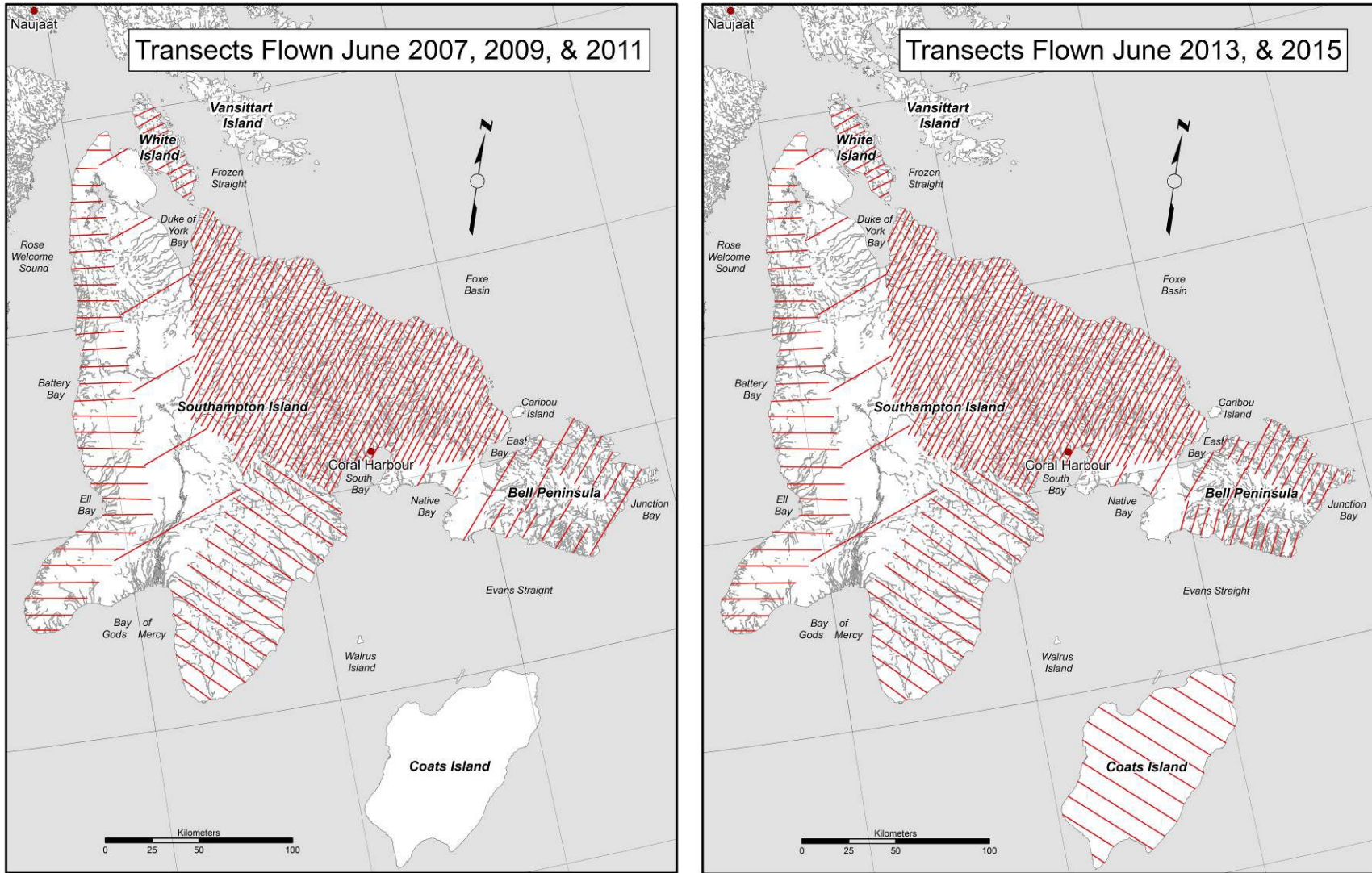
**H** = the required flying height



**Figure 5.** Stratified random transect surveys flown in November 1978 and June/July 1997.



**Figure 6.** Stratified random transect surveys flown in June 2003 and 2005.



**Figure 7.** Stratified random transect surveys flown in June 2007, 2009, 2011 and May 2013 and 2015.



**Figure 8.** Stratified random transect survey flown in May 2017, 2019, and 2023 (Note: Coats Island survey was planned but not flown in 2023 due to logistic constraints.).

### **2011 to 2023**

The June 2011 and May 2013, 2015, 2017, 2019, and 2023 surveys followed a similar methodological set up as those discussed for surveys between 1995 and 2009 with the following notable exceptions: **1-** Survey timing changed from early June to early May beginning in 2013 as weather modelling indicated more “flyable” days and the provision of more continuous snow cover for improved sightability, while maintaining distributions similar to June based strata. These changes proved successful leading to a permanent change in survey scheduling to mid to late May; **2-** The 2017, 2019 and, 2023 air crews remained the same throughout the survey, while the 2011 and 2015 surveys recorded one or more observers had changed part way through the survey; **3-** A Cessna grand caravan was used up to May 2017 at which time the aircraft type changed to a DeHavilland Twin Otter from 2019 to present; **4-** Between 2011 and 2023, strata remained similar between surveys (**Figure 3**). During this period transect spacing did increase with decreasing relative densities within the Bell Peninsula and White Island strata between 2011 and 2015, but was increased back to higher coverage from 2017 to present due to detected increases in caribou relative density; **5-** All surveys from 2011 to present were upgraded from a single-pair observer platform to a dependent double-pair observer platform to increase survey accuracy and precision, and to involve more HTO and community based participation within GN survey programs.

### **3.2.3 Dependent Double Observer Pair Method**

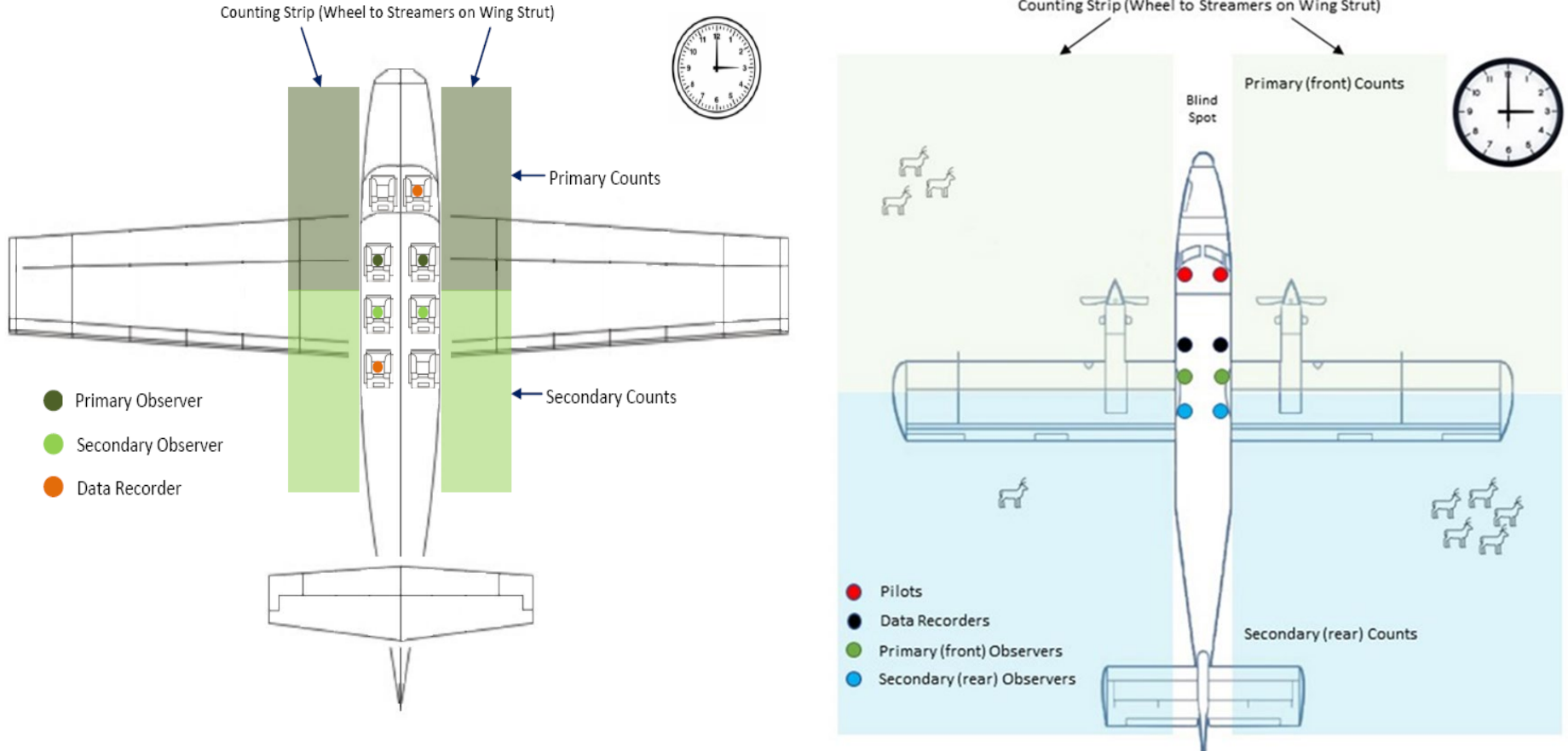
The June 2011, and May 2013, 2015, 2017, 2019, and 2023 surveys, were marked by a change in visual survey method. An additional two (2) observers and one (1) data recorder were added to the survey crew increasing the crew to seven (7) individuals including the pilot/pilots. This method, termed the dependent double observer pair method, was adopted to all Kivalliq regional ungulate surveys following its development

for Barren-ground caribou abundance surveys in June 2011 (Campbell et al. 2013). Pilot studies conducted on Muskox abundance in 2010 and barren-ground caribou abundance in 2011, confirmed fewer animals were being missed while using this new visual observation methodology. Additionally, more HTO representatives could be involved in the survey whereby four (4) dedicated observers, of which at least two (2) were experienced observers split between the left and right sides on the plane, could be involved in the aerial survey.

The dependent double-observer pair method involves one “primary” (front) observer who sits in the front seat of the plane and a “secondary observer” (rear) observer who sits behind the primary observer on the same side of the plane (**Figure 9**). One data recorder sitting on the right-hand side of the aircraft is assigned the right primary and secondary observers while the second data recorder, sitting on the left side of the aircraft is assigned the left primary and secondary observers. The method adhered to five basic rules; **1** - The primary observer called out all groups of caribou (number of caribou and location) he/she saw within the 400-meter-wide strip transect after they passed halfway between the primary and secondary observer (approximately at the wing strut). This counting included caribou groups that were between approximately 12 and 3 o'clock for right side observers and 9 and 12 o'clock for left side observers. The main requirement was that the secondary (rear) observer be given time to call out all caribou seen before the primary (front) observer called them out; **2** - The primary observer called out whether he/she saw the caribou that the secondary observer saw or did not see, and both would call out any observations of any additional caribou groups the other did not see. Both the primary and secondary observers waited to call out caribou until the group observed passed half way between observers (between 3 and 6 o'clock for right side observers and 6 and 9 o'clock for left side observer); **3** - The observers discuss any differences in group counts to ensure that they are calling out the same groups and/or different groups and to ensure accurate counts of larger groups; **4** - The data recorder categorized and recorded counts of caribou groups into “primary only”, “secondary only”, and “both”, entered as separate records; **5** - The observers switched places approximately half way through each survey day (i.e. during

re-fueling) to monitor observer ability based on position (front vs rear). The recorder noted the names and positions of the primary and secondary observers.

The sample unit for the survey was "*groups of caribou*" not individual caribou. This group-based observation method created problems for the data recorder trying to determine when a group of caribou started and ended and/or differed from individual caribou that were separated by short distances. To resolve this issue, recorders and observers were instructed to consider individuals to be those caribou that were observed independent of other individual caribou and/or groups of caribou through an estimated separation of 100 meters.



**Figure 9.** Observer position for the dependent double observer pair method employed on the 2011, 2013, 2015, 2017, 2019, and 2023 Southampton Island caribou abundance surveys for a Cessna caravan (left) and DeHavilland Twin Otter (right). The secondary observer calls caribou not seen by the primary observer after the caribou have passed through the main field of vision of the primary observer. The small hand on a clock is used to reference relative locations of caribou groups (e.g. “Caribou group at 3 o’clock” would suggest a caribou group 90° to the right of the aircrafts longitudinal axis).



### 3.3 Distribution

Distribution maps were developed to graphically summarize survey data for survey observations up to and including May 2023. The distribution maps were generated through an interpolation which provided an estimate of the number of caribou present at un-sampled locations based on the known values gathered at surrounding locations. In this study an Inverse Distance Weighted (IDW) interpolation technique was used within ArcMap's Spatial Analyst extension for surveys not employing double observer pair methods. IDW is an effective means of interpolating scattered data points. It estimates values by calculating a weighted average. The farther a sampled point is from the cell being evaluated, the less weight it has in the calculation of the cell's value (Watson and Phillip, 1985). This type of analysis generates a surface consisting of cells, each with an attribute (in this case, population density), used to interpret the spatial distribution of geographic points and then convert them into a continuous distribution reflecting estimates of point densities.

To account for null data, all survey observations were first buffered to ten kilometers. To account for nil records, those portions of the transect not covered by the observation buffers were then divided into 1-kilometer (km) segments with the first starting 1-km from the edge of the nearest buffered observation or transect starting point. At each division between 1-km segments, a point with an observed value of zero was inserted. The analysis was then run using the survey observation values as well as the newly populated zero values. The analysis requires that a series of parameters be defined. The parameters, along with a description and the settings used are summarized in **Table 1**.

The resulting surfaces were themed by the population density attribute and overlaid on a base map of Southampton and White Islands. Density class or "bins" are developed to reveal the most visual information and highlight and estimate

distributional changes between surveys. As area estimates of relative densities on Southampton Island are mostly aggregated in the 0 to 5 caribou/km<sup>2</sup> class, the bins were developed to accentuate these lower relative densities.

**Table 1.** Inverse distance weighting (IDW) analysis parameters employed in the analysis of Southampton Island caribou densities from 1978 through 2023.

Parameter	Description	Settings
Z Value Field	The Z value is the attribute being used to derive the interpolated surface.	The population attribute stored in the field Number.
Power	The higher the Power value, the greater the influence of values closest to the interpolated point. The most common value for the Power parameter is 2.	A value of 2 was selected.
Search radius type	The search radius can be either variable or a fixed distance.	As the sample points were not evenly distributed, a variable search radius was used that assessed the data points nearest to the particular cell of interest.
Search radius setting	The search radius setting specifies either the maximum distance of a fixed radius search or the number of points for a variable type.	The number of points considered in each of the analyses was 12.
Output cell size	The resolution (or cell size) of the grid (the surface) resulting from the analysis.	An out-cell size of 100 m <sup>2</sup> was specified resulting in a population density of animals per hectare.

## **3.4 Statistical Analysis of Abundance and Trend**

### ***3.4.1 Strip transect surveys (1997-2023)***

The standard Jolly estimator (Jolly 1969, Krebs 1998) was applied to the strip transect data for all years using an assumed strip width of 800 meters with the single exception of the 2017 survey year where the strip width was 918 meters. Strip transect data for 2017 was created using distance sampling, where the first 2 observation bins of data for both sides of the aircraft, equaled an 800-meter strip. For all year's strata were estimated separately and then combined for a total estimate of the SHI herd. Coats Island was also surveyed in 2013, 2015, and 2017 and was excluded from the South Hampton Island estimate. Log-normal confidence limits were generated for all estimates (Thompson 1992).

### **3.4.2 Double observer/strip transect analyses (2011-2023)**

Because this method assumes equal sightability between observers it is essential that the observers switch seats over the course of a survey day (preferably) or periodically (Cook and Jacobsen 1979). Estimates of herd size and associated variance were measured using the mark-recapture distance sampling (MRDS) package (Laake et al. 2012) in the program R (R Development Core Team 2009). In MRDS, a full independence removal estimator, which models sightability using only dependent double observer pair information (Laake et al. 2008a, Laake et al. 2008b) was used, making it possible to derive dependent double observer pair strip transect estimates. Strata-specific variance estimates were calculated using the formulas of Innes et al.

(2002). Data were explored graphically using the ggplot2 (Wickham 2009) package in R.

### **Modelling of sighting probability variation**

One assumption of the dependent double observer pair method is that each caribou group observed had an equal probability of being sighted. To account for differences in sightability we also considered the following sightability covariates in the MRDS analysis (**Table 2**). Each observer pair was assigned a binary individual covariate and models were introduced that tested whether each pair had a unique sighting probability. Previous analyses (Campbell et al. 2012; Boulanger et al. 2014) suggested that the size of the group of caribou had strong influence on sighting probabilities and therefore we considered linear and log-linear relationships between group size and sightability (**Table 2**). Cloud and snow cover were recorded by data recorders as they changed and were included in the analysis as ordinal rankings. We suspected that sightability was most likely lowest in mixed snow cover conditions and therefore we considered both categorical and linear models to describe variation in sightability caused by snow cover. Cloud cover could also influence sightability by causing glare, flat light, or variable lighting. We used the same basic strategy to model cloud cover variation as we did for snow cover variation.

The fit of models was evaluated using the Akaike Information Criterion and corrected for small sample size ( $AIC_c$ ). The model with the lowest  $AIC_c$  score was considered the most parsimonious, thus minimizing estimate bias and optimizing precision (Burnham and Anderson 1998). The difference in  $AIC_c$  values between the most supported model and other models ( $\Delta AIC_c$ ) was also used to evaluate the fit of models when their  $AIC_c$  scores were close. In general, any models with a  $\Delta AIC_c$  score of less than 2 between them were considered to have equivalent statistical support.

**Table 2.** Covariates used to model variation in sightability of caribou for the dependent double observer pair analysis conducted on the abundance survey of the Southampton Island caribou herd.

<b>Covariate</b>	<b>Acronym</b>	<b>Description</b>
Observer pair	observers	each unique observer pair
Group size	size	size of caribou group observed
	Log(size)	Natural log of group size
Snow cover	snow	snow cover (0,25,75,100 % )
	snowc	continuous
Cloud cover	cloud	cloud cover (0,25,75,100 % )
	cloudc	continuous

### 3.4.3 Distance sampling analyses (2017)

For the 2017 survey only, distances of caribou groups from the survey planes were binned into intervals (0-200m, 201-400m, 401-600m, 601-1000m, and 1001m-1500m), based upon markers on the wing struts of the survey plane, as was done in the 2014 Baffin Island caribou survey (Campbell et al. 2015). In addition, the dependent double observer pair also assessed sightability of caribou in the 0–200-meter strip closest to the aircraft.

A combined distance sampling and mark-recapture approach was used to estimate abundance for the 2017 data set. The basic approach involved using mark-recapture analytical methods to estimate the probability of detection of caribou at 0 distance from the survey plane, and distance sampling methods to estimate the decrease in probability of detection at greater distances from the plane. This approach ensured a more robust estimate than using distance sampling methods alone which assume that the probability of detection of caribou groups at 0 distance from the plane is 1 (Borchers et al. 1998, Buckland et al. 2004, Laake et al. 2008a, Laake et al. 2008b, Buckland et al. 2010, Laake et al. 2012).

As with the dependent double observer pair analysis, the MRDS R package (Laake et al. 2012) was used to build mark-recapture and distance sampling models. The general approach used was to build distance sampling models with the mark-recapture model parameters held constant. Once a parsimonious distance sampling model was identified, the mark-recapture model was built to further assess sightability of caribou in immediate proximity to the aircraft. The same general set of covariates used in the dependent double observer pair analysis (**Table 2**) were used for both the dependent double observer pair and distance sampling models. As with the dependent double observer pair analysis, AIC methods were used to assess model fit. Overall model fit was also assessed using goodness of fit tests as well as graphical comparison of detection functions with histograms of frequencies of observations from the survey.

### 3.4.4 Trend analyses

We used log-linear models to analyze trends for the increase and decrease phase of the caribou abundance dataset (McCullough and Nelder 1989, Thompson et al. 1998, Williams et al. 2002). Our models assumed an underlying quasi-Poisson distribution of estimates with population change occurring on the exponential scale. Abundance survey estimates were weighted by the inverse of their variance therefore giving more weight to the more precise estimates. A log-link was used for the analysis allowing direct estimates of yearly rate of change as one of the regression  $\beta$  terms. Additive terms were used to estimate phase-specific trends and the effect of a possible immigration event, likely occurring between May 2013 and May 2015 surveys, on SHI herd trend.

### **3.5 Disease Monitoring**

The health and condition of SHI caribou was monitored through the collection of harvest samples, beginning in 1995 and ending in 2015 (Campbell, 2015). Disease monitoring began as a standard commercial harvest protocol whereby the Canadian Food Inspection Agency (CFIA) randomly collected between 300 and 400 blood samples from commercially harvested animals from 1993 through 2007. From 2007 to 2011, blood samples were obtained by GN biologists from animals collected for health and condition harvests from remaining ventricular and/or arterial blood. Sampled blood was drained into red topped vacutainers, left to stand approximately two hours at between five and ten degrees Celsius, then spun down in a centrifuge for approximately ten to fifteen minutes to separate the serum from cellular material. Individual serums were poured off into new sterile red-topped vacutainers, carefully packed and allowed to freeze at approximately -20° to -30° degrees Celsius. Frozen blood serums were then transported first to labs in Lethbridge Alberta for Brucellosis and Tuberculosis screening, then to the CFIA lab in Ontario for further disease testing. Adult female reproductive tracts were also collected in 2005 for the purposes of identifying reproductive stress and/or disease. All sampling pre-2009 was carried out in conjunction with the commercial harvest which collected samples between mid-February and early April up to 2009 and continued as a smaller research based harvest up to 2011. The GN did not have access to all CFIA test results. A smaller hunter based sampling program continued from 2011 to spring 2015. Samples collected during the hunter based sampling program included the lower jaw, the left kidney including fat, filter paper and vacutainer sampling of ventricular and/or arterial blood, sex, estimated age, and reproductive status, and any evidence of disease and parasites.

Additional variables measured included a ratio of bare kidney to kidney fat index, the recording and sampling of any apparent disease and/or diseased tissue, the recording

and sampling of parasitic infections, the measurement of back fat, bone marrow condition (in some years), pregnancy rates, fetal sex (in some years), and age through the analysis of cementum-annuli from the sampling of I-1 (the first incisor) from the lower jaw. In the case of the GN health studies, all anatomical components of an individual caribou being sampled and/or measured were recorded along with a common tag number and the associated harvest year. This common tag number allowed for the pooling of analysis results to provide a comprehensive description of the health, age, and sex of the individual being sampled. From 1995 through 1999, and in association with a community based annual commercial harvest, approximately 400 animals per year were sampled in this way up to 2009.

Sampling across February and March 2000 through 2009 was reduced to approximately 200 to 300 animals (excluding 2001, 2002 and 2003). Following the closing of the commercial harvest in 2009, disease monitoring was reduced to 100 animals in 2010 and 2011. Following the 2011 survey results and subsequent application of a total allowable harvest (TAH) in 2012, the community of Coral Harbour requested that the health monitoring harvest be suspended so that all TAH allocations could be provided to the community. Only *Brucella* results are provided in this report while a summary of condition through time can be obtained in Campbell (2015).

### **3.6 Genetic Analysis – Movement**

Over the winter of 2014, Coral Harbour hunters reported caribou tracks crossing the ice from the mainland across to the northwestern extents of SHI. Though no estimates of the total number of caribou involved in this crossing were communicated beyond “hundreds”, local hunters had observed more calves in June 2014 and increased densities of caribou in the following harvesting year compared to preceding hunting seasons. Results from the May 2015 abundance survey estimated a significant

increase in SHI caribou abundance of both adults and calves compared with 2013 results. This population increase was theorized by both the community of Coral Harbour and Wildlife officials' to be related to the immigration of mainland caribou onto SHI. We set out to further investigate this hypothesis using population genetics.

We engaged Wildlife Genetics International (WGI) to pursue this question using the clustering programs Structure and Genetix, which produce accessible visual summaries of the results (Paetkau, 2015; Paetkau 2003). Caribou tissue collected on SHI in 2004, and 2014, as well as tissue samples collected from hunters in the Naujaat area in 2014, were compared for assessments of ancestry. Additionally, WGI used archived samples from the Qamanirjuaq caribou herd for added comparative analysis with the SHI herd. WGI used GeneClass2 to assess ancestry hypotheses explicitly (Paetkau, 2003; Paetkau, 2004; Paetkau, 2015). Initial explorations included data from South Baffin Island, Melville Peninsula, and the Ahiak and Beverly herds of barren-ground caribou, but these explorations did not identify any associations of relevance to SHI. Genotyping used a standard set of 18 highly variable microsatellites that they had consistently employed for other barren-ground caribou genetic analyses in Nunavut and the Northwest Territories. The analysis proceeded in two rounds of 9 markers (including gender markers), as all 18 markers cannot be loaded into a single sequencer lane. After completing a first pass with all 18 markers, WGI did a round of reanalysis ('cleanup') of individual data points that were scored with low confidence (1) during the first pass (Paetkau, 2015). This reanalysis used 5 µL of DNA per reaction, up from the 3 µL used for first pass. In some cases, multiple attempts were made to confirm problematic data points. At the end of the cleanup phase, 6 samples from SHI still had low-confidence scores in their genotypes (Paetkau, 2015). In total, WGI was able to successfully genotype complete 18-locus genotypes for 37 samples from Naujaat, and 131 from SHI. With genotyping completed, WGI defined an individual for each unique multilocus genotype, taking identifiers from the first sample to be assigned to each individual, of which 37 samples from Naujaat were assigned to 34 individuals (10M:24F), and the 131 samples from SHI in 2014 were assigned to 127 individuals (76M:51F). None of these animals had previous detections in the greater Nunavut

dataset including samples from the 2004 harvesting season. Paetkau (2015) then used resampling in the software GeneClass2 to generate 10,000 simulated mainland and island genotypes, and plotted the distribution of the island/mainland likelihood ratio to produce critical values for statistical testing (Paetkau *et al.* 2004 *Mol. Ecol.*). By way of example, 99% of simulated island genotypes had a log likelihood ratio in excess of 9.

## 4.0 RESULTS AND DISCUSSION

### 4.1 Population Distribution

It is important to note that although an island population, some exchange of SHI caribou with the mainland likely occurred on a very small scale during rare winters when an ice bridge had formed across Roes Welcome Sound (Local Knowledge). According to island residents, during most winters, Roes Welcome sound does not freeze over completely creating an effective barrier to caribou movement. If such an ice bridge was to form however, this exchange would most likely have been with the Wager Bay population of caribou occupying the Lyon Inlet area due to its closer proximity to SHI (**Figure 10**). Though caribou tracks have been observed on the ice of Roes Welcome Sound in late winter in this same area (going both east to the island and west from the island), there has been no direct evidence of large-scale successful crossings prior to 2014.

Between 1968 and 1978, the first ten years of caribou occupancy on SHI following re-introduction, monitoring was mainly conducted using ground observations. During this period observations of caribou taken during patrols, whether by ground or by air, suggested caribou had spread extensively across the Island (**Figure 11**). Using Inverse Distance Weighting (IDW), it was determined that caribou were largely aggregated in the shoulder area east and northeast of Coral Harbour, the south shore of Bell Peninsula, and along the coast just south of the town of Coral Harbour, all areas still occupied by the herd to date (**Figure 12**). No animals were observed by hunters or aerial reconnaissance conducted in previous years anywhere further north or west of the areas indicated in **Figure 12**.

After the examination of all available observational data up to 1987, Heard and Gray (1987) concluded that there always appeared to be caribou in the core areas of Bell Peninsula and the Kirchoffer River uplands northeast of Coral Harbour prior to and since re-introduction (Heard and Grey, 1987; Heard and Ouellet, 1994). Observations made during their 1987 aerial population estimate showed an expansion of the herd further north and west, and throughout the coastal habitats of Bell Peninsula. Unfortunately, point data are not available from this survey for a more precise summary of caribou distribution. Observations of caribou distribution on SHI in June 1991 was similar to that recorded in 1987. Ouellet (1992) suggested that caribou range did not appear to expand between 1987 and 1991 even though their numbers increased substantially, suggesting that to accommodate growth, densities simply increased within the existing seasonal range. Once again, point data is not available for either of Ouellet's 1990 or 1991 surveys. All surveys conducted from 1997 to present have point data from which to base more detailed spatial assessments of distribution. Aerial survey results from June 1997 also showed little in the way of distributional change since Ouellet's observations in 1992 although caribou densities had continued to increase significantly. Densities and associated abundance estimates tracked during surveys are further displayed and substantiated using Inverse Distance Weighting (IDW) methods (**Table 3**) (**Figure 12**).

A continued assessment of distributional change following introduction was made using IDW methods on aerial survey point data (**Figures 12, 13, 14, 15, 16, and 17**). These analyses suggests that caribou distribution increased across the Island from the point of introduction, up to the 1987 survey year at which time the now rapidly increasing population stopped expanding its range, suggesting that the herd had reached full occupancy of usable caribou habitat on the island. Caribou had occupied the southern portions of the island including Bell Peninsula and inland toward the central portions of the island along the Kirchoffer River watershed by as early as 1983. As observed by Ouellet (1992), densities increased over the same geographic areas from 1987 up until a period between 1998 and 2002, at which time densities over the same areas decreased

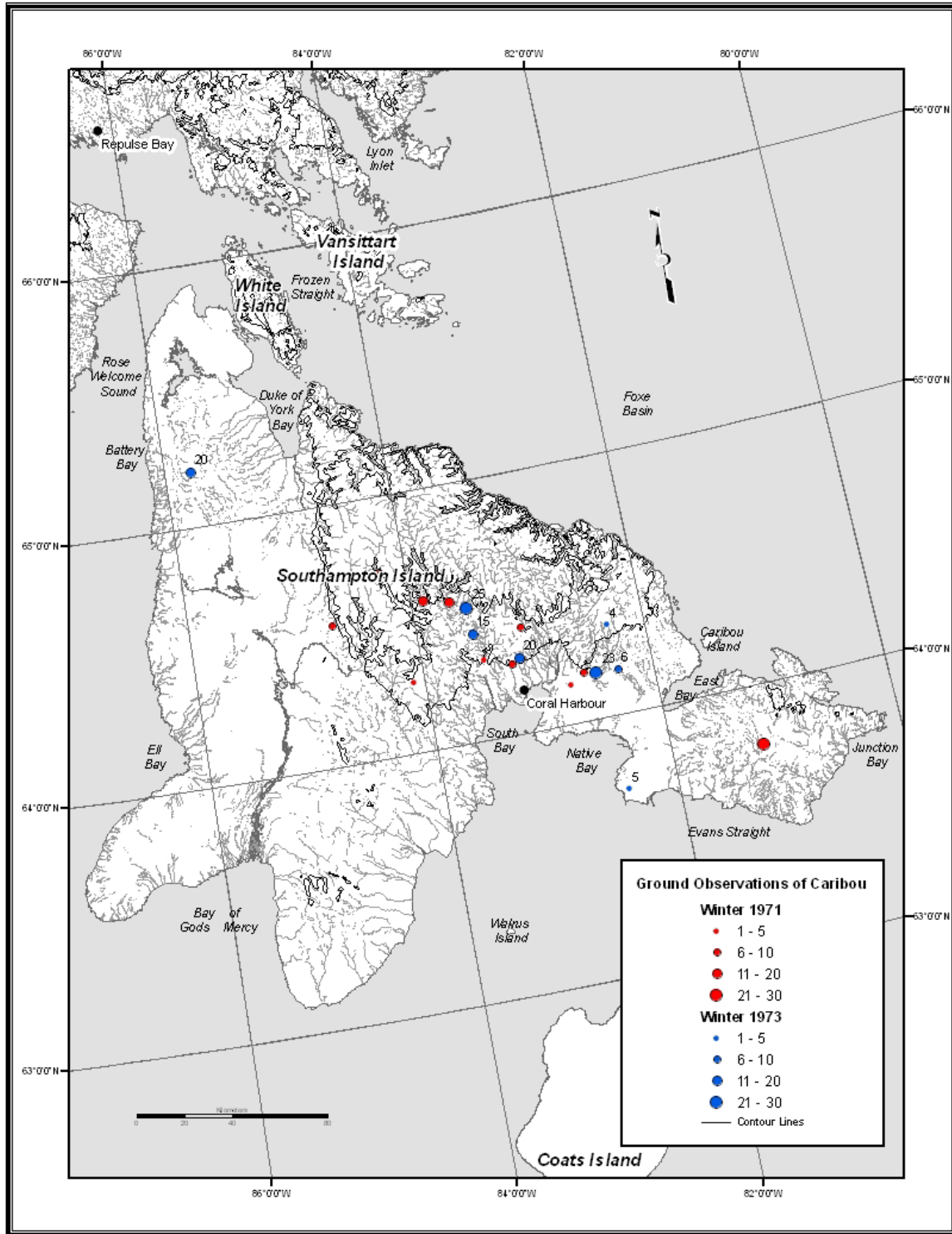
significantly. The most dramatic decrease in densities was on Bell Peninsula between the 2005 and 2007 survey years (**Figure 13 and 14**). According to survey density estimates, this declining trend on Bell Peninsula continued through to June 2015, and was also reported by local hunters. Caribou had all but abandoned the area, likely as a result of overgrazing from the previous years of higher relative densities. Today the central portion of the island remains the most highly used habitat by SHI caribou. Ecologically, this area is where the western flats meet the eastern highland, creating an ecotone between the Wager Bay Plateau and Southampton Island Plain Ecoregions. This area and its west south western exposed hills tend to melt out and expose vegetation in spring well before surrounding habitats.

Observed distributions from the 2003 survey indicated little change from distributions observed during previous surveys though localized densities had decreased. Overall, caribou continued to heavily use the central portions of the Island along the Kirchoffer River valley and along the transition between the western flats and the eastern highlands from November 1978 through to May 2023 (**Figures 12 to 17**). Small variations between years were likely the result in changes in snow cover and associated icing, with caribou feeding at higher elevations during years of early snow melt and/or reduced snow cover.

In summary, the central portion of the Island, in the vicinity of the Kirchoffer River and along the general transition from the western flats to the more topographically rugged eastern highlands of the Island, have received high use by SHI caribou in the spring and during calving from introduction to present, making these areas extremely important to the long-term viability of the herd. The protection of these areas from anthropogenic disturbance that may modify and/or impact the landscape will be a critical component of any long-term herd management plans.



**Figure 10.** Likely routes used by both emigrating and immigrating caribou both off of, and onto Southampton Island (based on hunter reports of tracks across sea ice). Most notable track observations were in winter 2014.



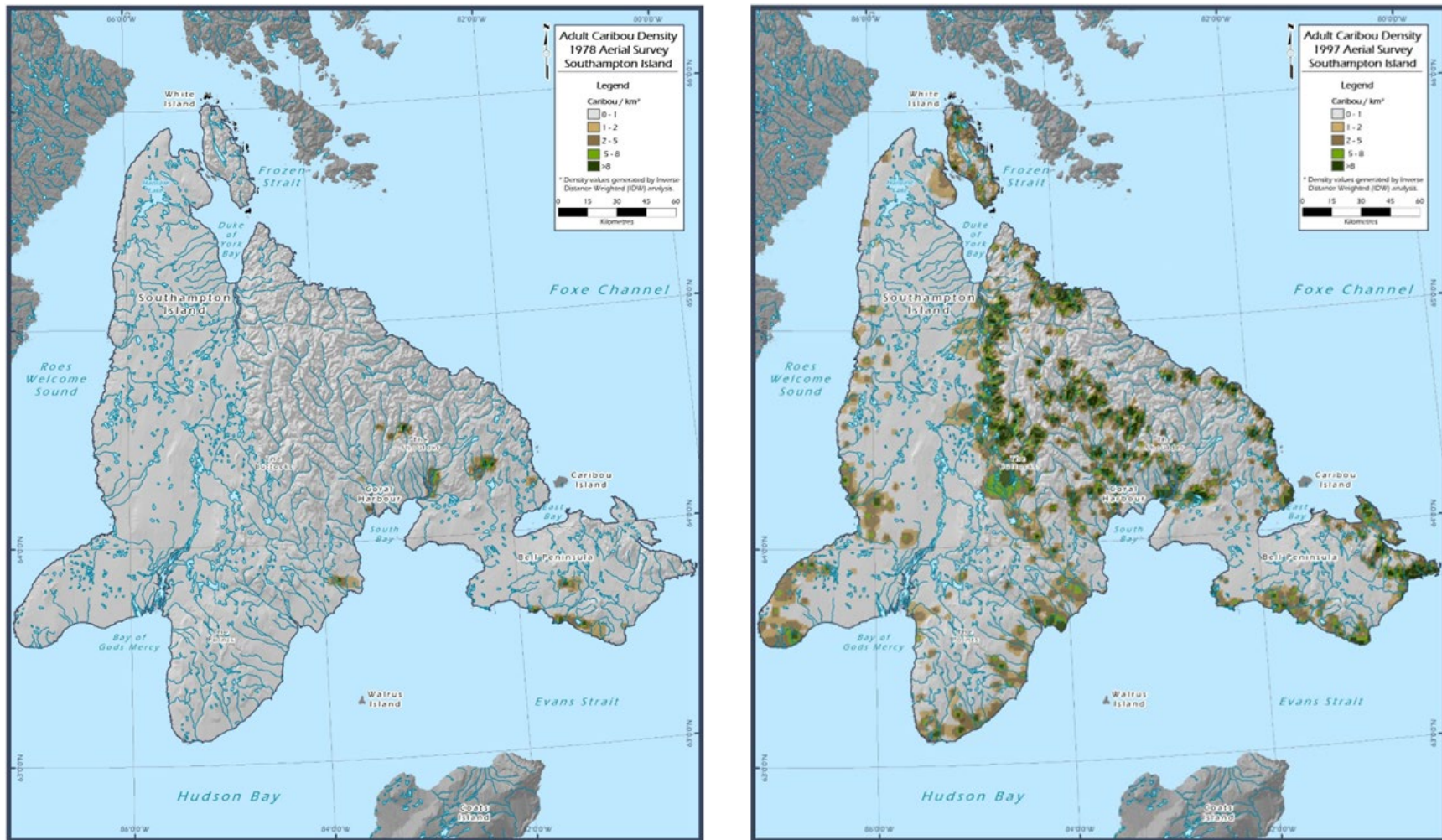
**Figure 10.** Observations of caribou on Southamptton Island (1971 to 1973). Note that group sizes and locations were provided in 1973 reports, but not in 1971.

**Table 3.** Inverse distance weighting (IDW) values for the entire Southampton Island study area including White Island and Bell Peninsula showing changes in adult caribou density through time. Results from June 2005 were removed as White Island was not surveyed in that year.

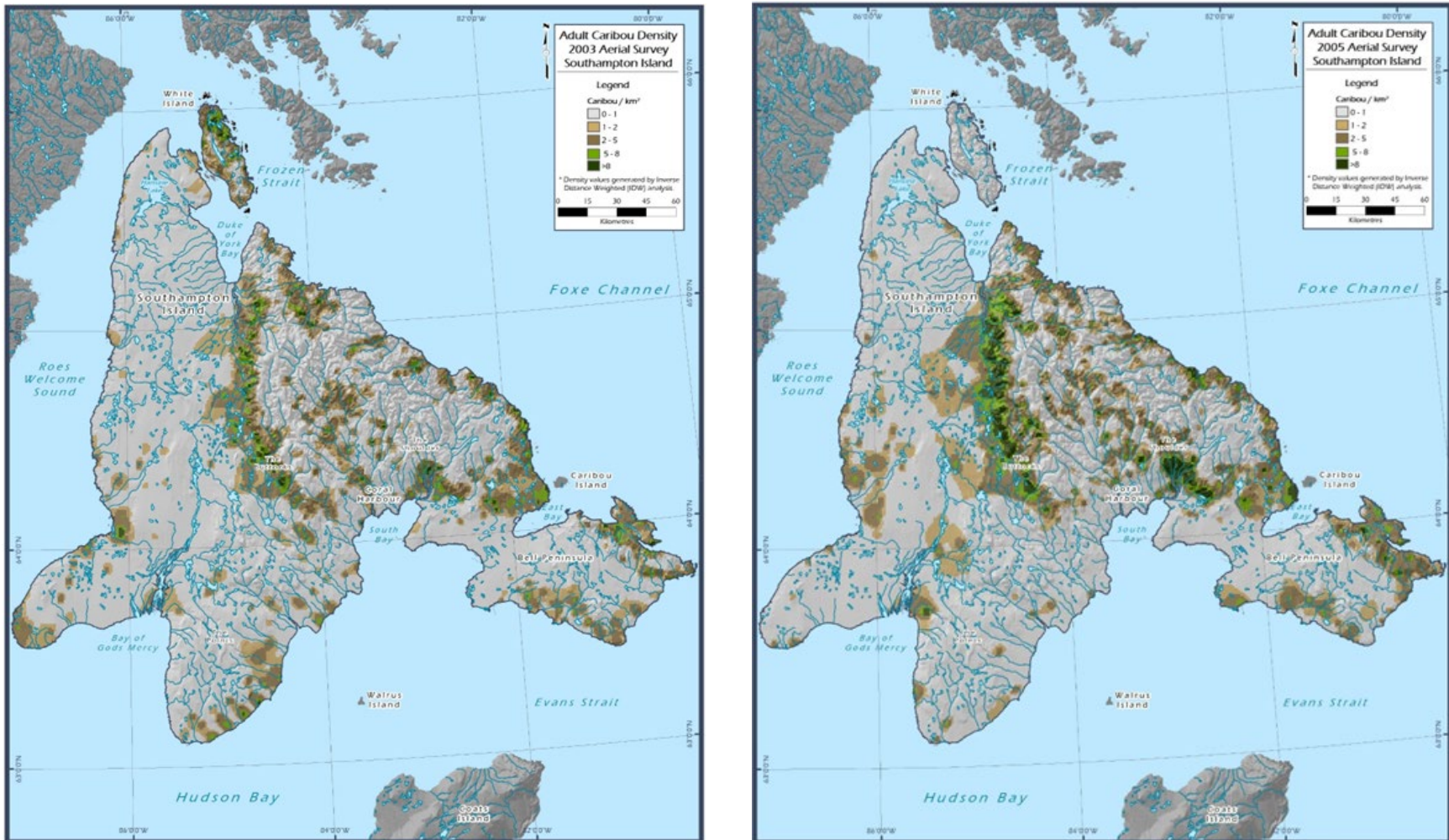
Caribou/km <sup>2</sup>	Percent Area By Class										
	1978	1997	2003	2007	2009	2011	2013	2015	2017	2019	2023
<b>0-1</b>	98.2	69.8	72.6	80.8	83.3	88.9	89.2	85.8	82.0	86.7	85.2
<b>1-2</b>	0.9	11.0	12.0	9.2	8.9	7.0	4.0	5.2	6.7	5.2	6.1
<b>2-5</b>	0.6	11.5	12.2	8.2	6.9	3.7	4.8	7.1	8.4	5.7	6.2
<b>5-8</b>	0.2	3.7	2.5	1.5	0.7	0.3	1.4	1.4	2.2	1.5	1.6
<b>&gt;8</b>	0.1	4.0	0.7	0.4	0.2	0.0	0.6	0.5	0.7	0.8	0.9

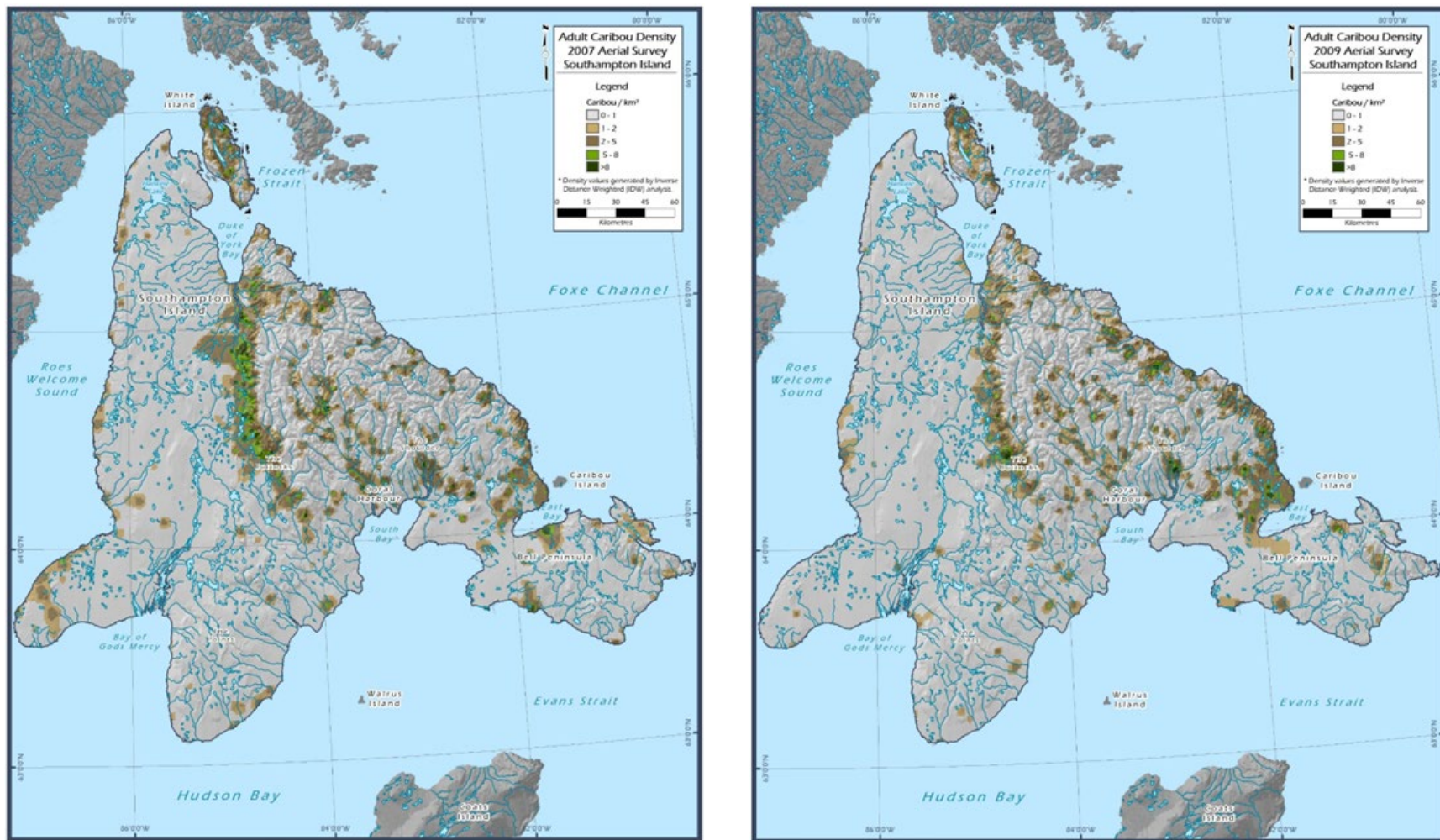
Caribou/km <sup>2</sup>	Percent Change										
	1978 to 1997	1997 to 2003	2003 to 2007	2007 to 2009	2009 to 2011	2011 to 2013	2013 to 2015	2015 to 2017	2017 to 2019	2019 to 2023	1997 to 2023
<b>0-1</b>	-28.4	2.8	8.2	2.5	5.6	0.3	-3.4	-3.8	4.7	-1.5	15.4
<b>1-2</b>	10.1	1.0	-2.8	-0.3	-1.9	-3.0	1.2	1.5	-1.5	0.9	-4.9
<b>2-5</b>	10.9	0.7	-4.0	-1.3	-3.2	1.1	2.3	1.3	-2.7	0.5	-5.3
<b>5-8</b>	3.5	-1.2	-1.0	-0.8	-0.4	1.1	0.0	0.8	-0.7	0.1	-2.1
<b>&gt;8</b>	3.9	-3.3	-0.3	-0.2	-0.2	0.6	-0.1	0.2	0.1	0.1	-3.1
<b>Net Change &gt; 1 caribou/km<sup>2</sup></b>	28.4%	-2.8%	-8.1%	-2.6%	-5.7%	-0.2%	3.4%	3.8%	-4.8%	1.6%	-15.4%



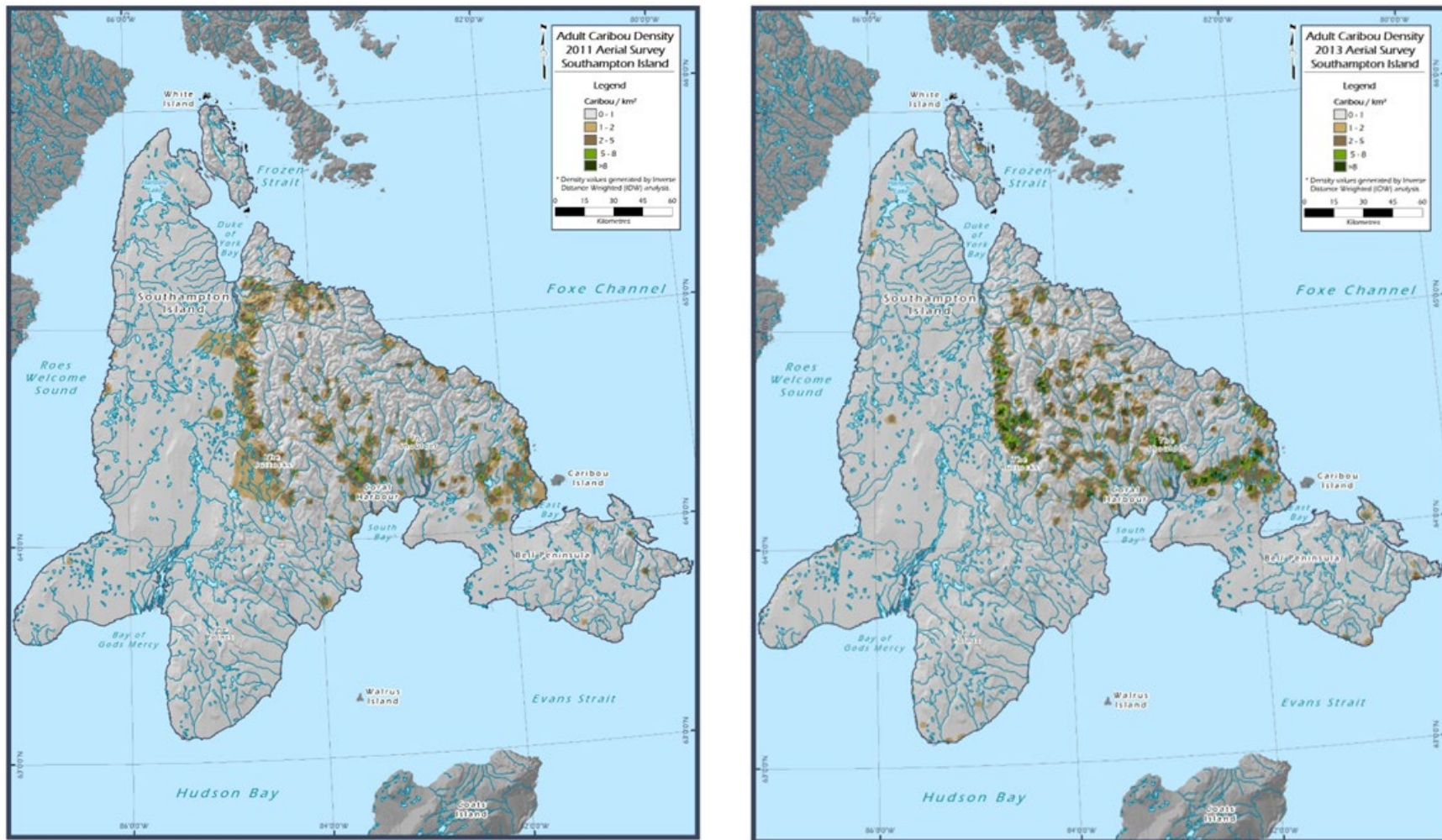
**Figure 11.** Results of the inverse distance weighted (IDW) interpolation technique applied to the November 1978 and June 1997 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.



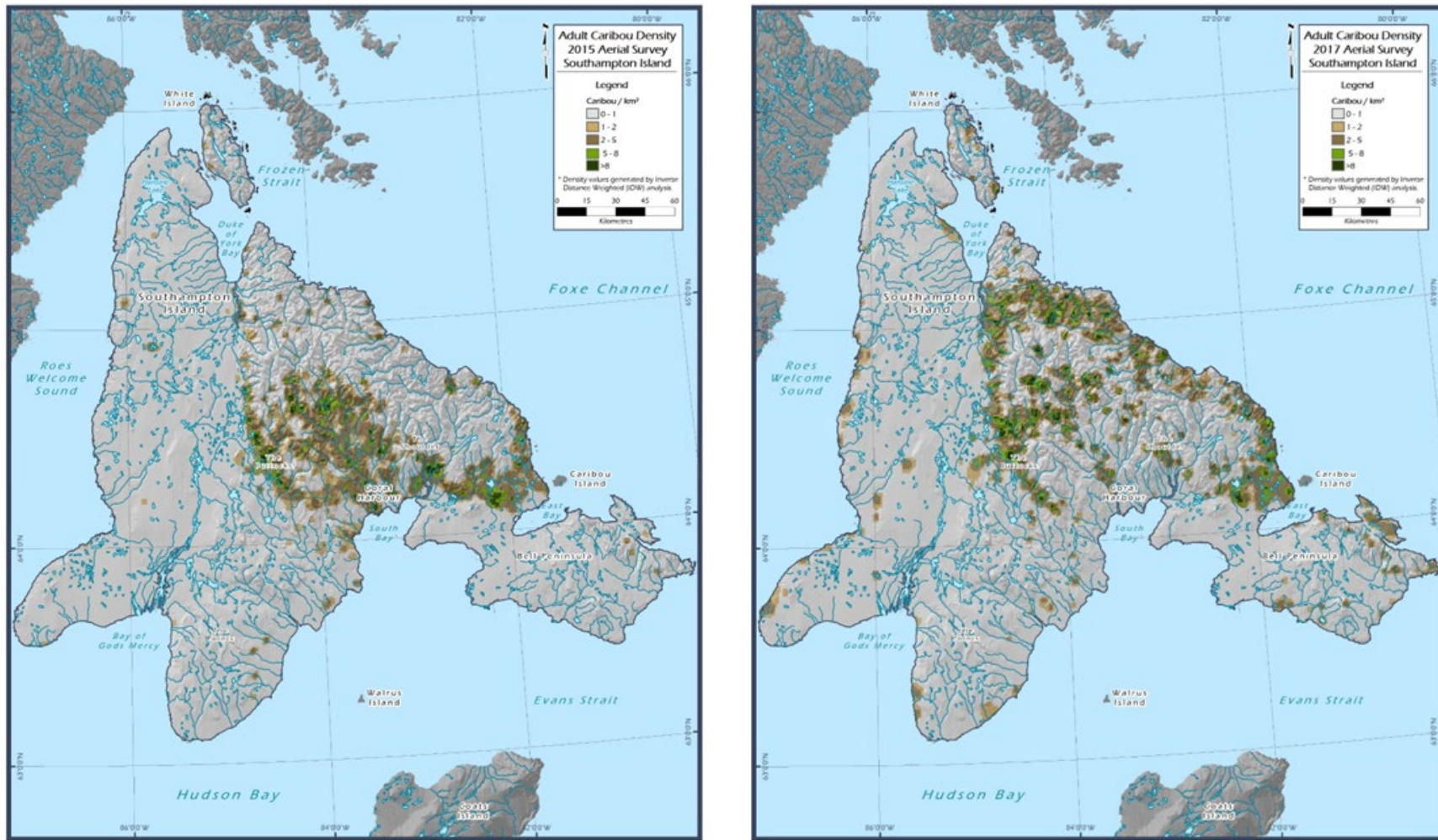
**Figure 12.** Results of the inverse distance weighted (IDW) interpolation technique applied to the June 2003 and June 2005 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.



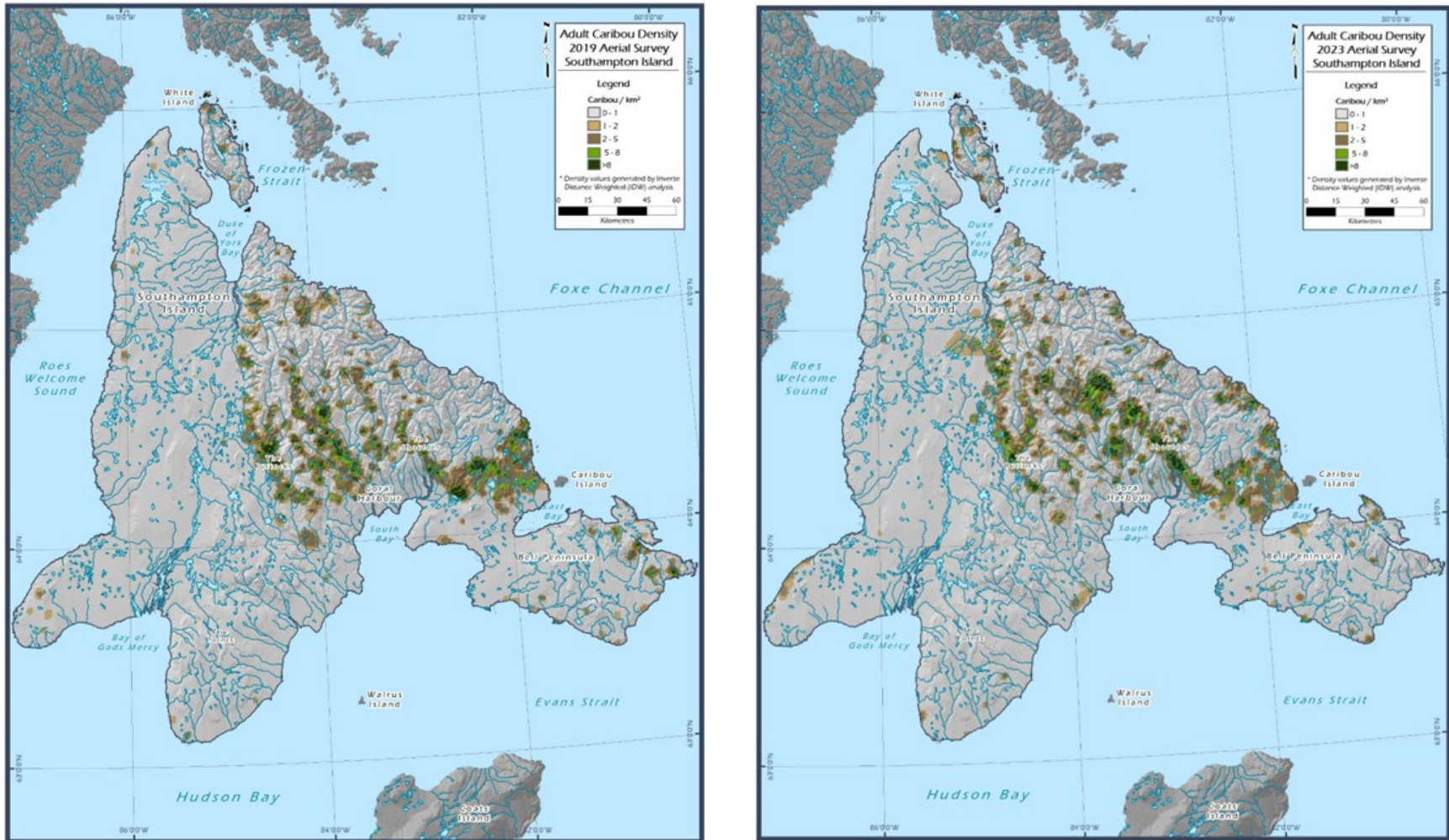
**Figure 13.** Results of the inverse distance weighted (IDW) interpolation technique applied to the June 2007 and June 2009 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.



**Figure 14.** Results of the inverse distance weighted (IDW) interpolation technique applied to the June 2011 and June 2013 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.



**Figure 15.** Results of the inverse distance weighted (IDW) interpolation technique applied to the June 2015 and May 2017 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.



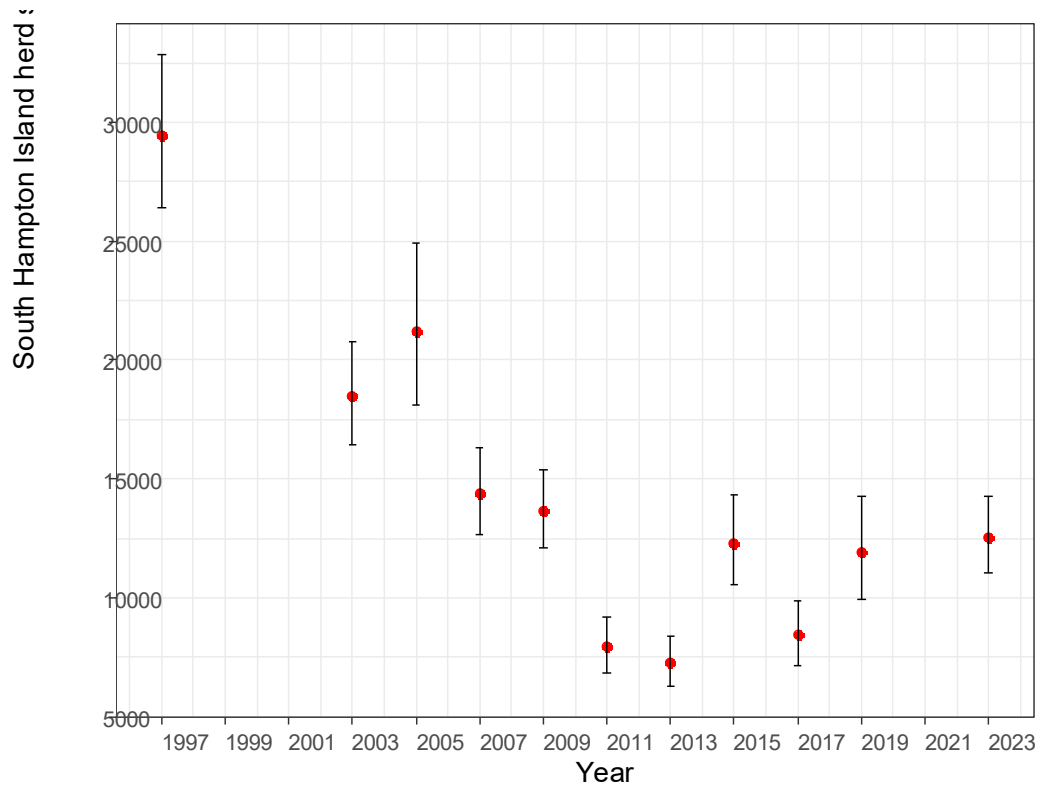
**Figure 16.** Results of the inverse distance weighted (IDW) interpolation technique applied to the May 2019 and May 2023 abundance survey observations showing relative density of barren-ground caribou (*Rangifer tarandus*) on Southampton Island.

## 4.2 Strip Transect Surveys

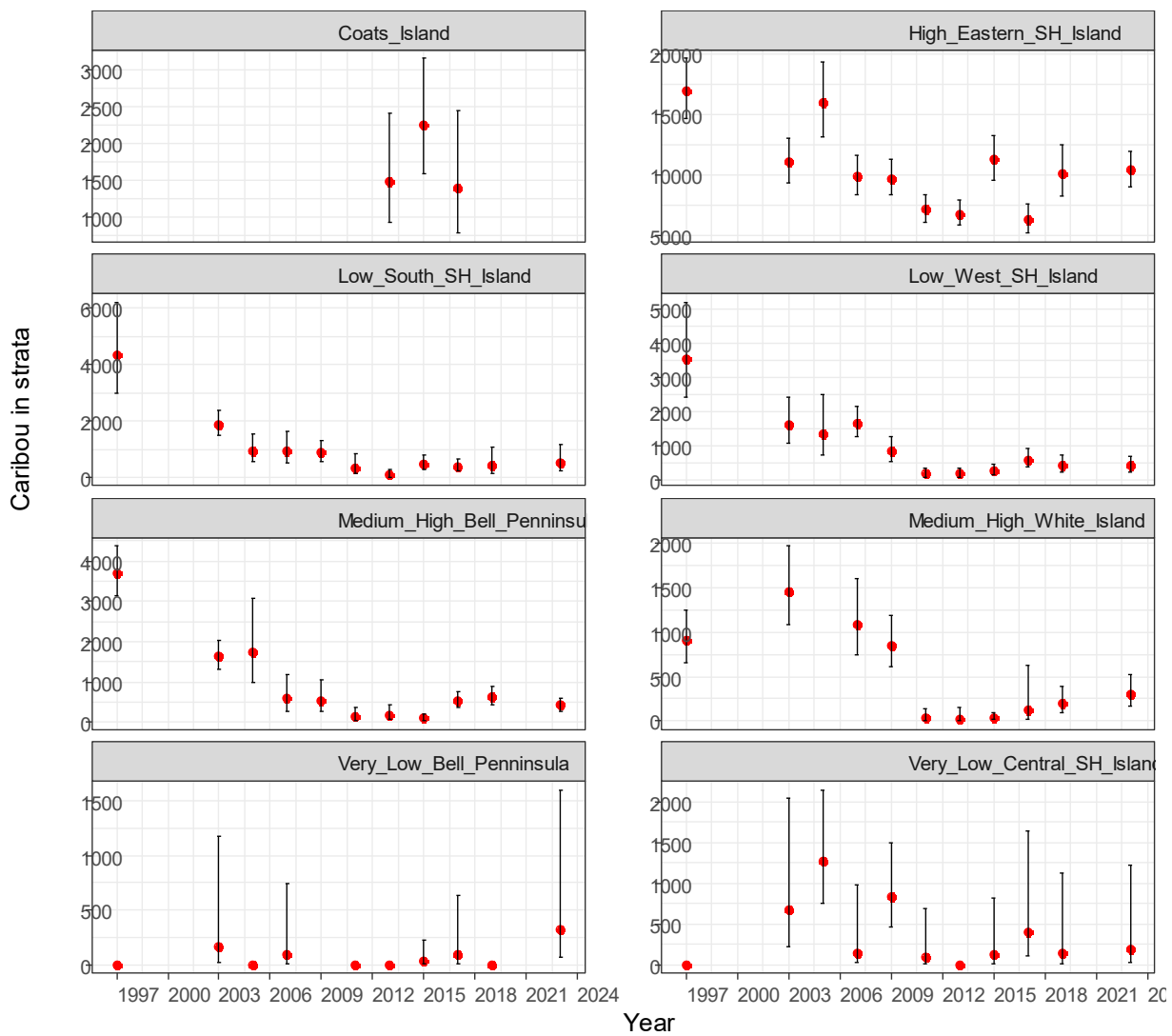
Population estimates from 1997 to 2023 were reasonably precise, with Coefficients of Variation (CVs) of less than 10% in all years (**Table 4, Figure 18**). **Figure 18** is a visual representation of **Table 4** while strata-specific estimates are shown in **Figure 19**. Coats Island is included in **Figure 19** based on the Coral Harbour Hunters and Trappers organizations (HTO) requests to include, however, it is important to note that it was not included in overall Southampton Island estimates. Population declines occurred in all strata from 1997 to 2013, started increasing between 2013 and 2015, then remained relatively stable between 2015 and 2023. The use of different scales on the graph in **Figure 19** aids in interpretation of stratum-specific trends but it is also misleading in terms of the relative abundance of caribou in each stratum. For this reason, the same estimates of caribou numbers are plotted on the same scale (**Figure 20**), clearly indicating that the majority of caribou on SHI occurred on the High Eastern SHI strata in all years.

**Table 4.** Strip transect estimates of caribou on Southampton Island, showing the number of strata sampled each year, the number of caribou counted on transect, and population estimates with descriptive statistics (SE = standard error, CV = coefficient of variation) are given for each year of surveys from 1997 through 2023.

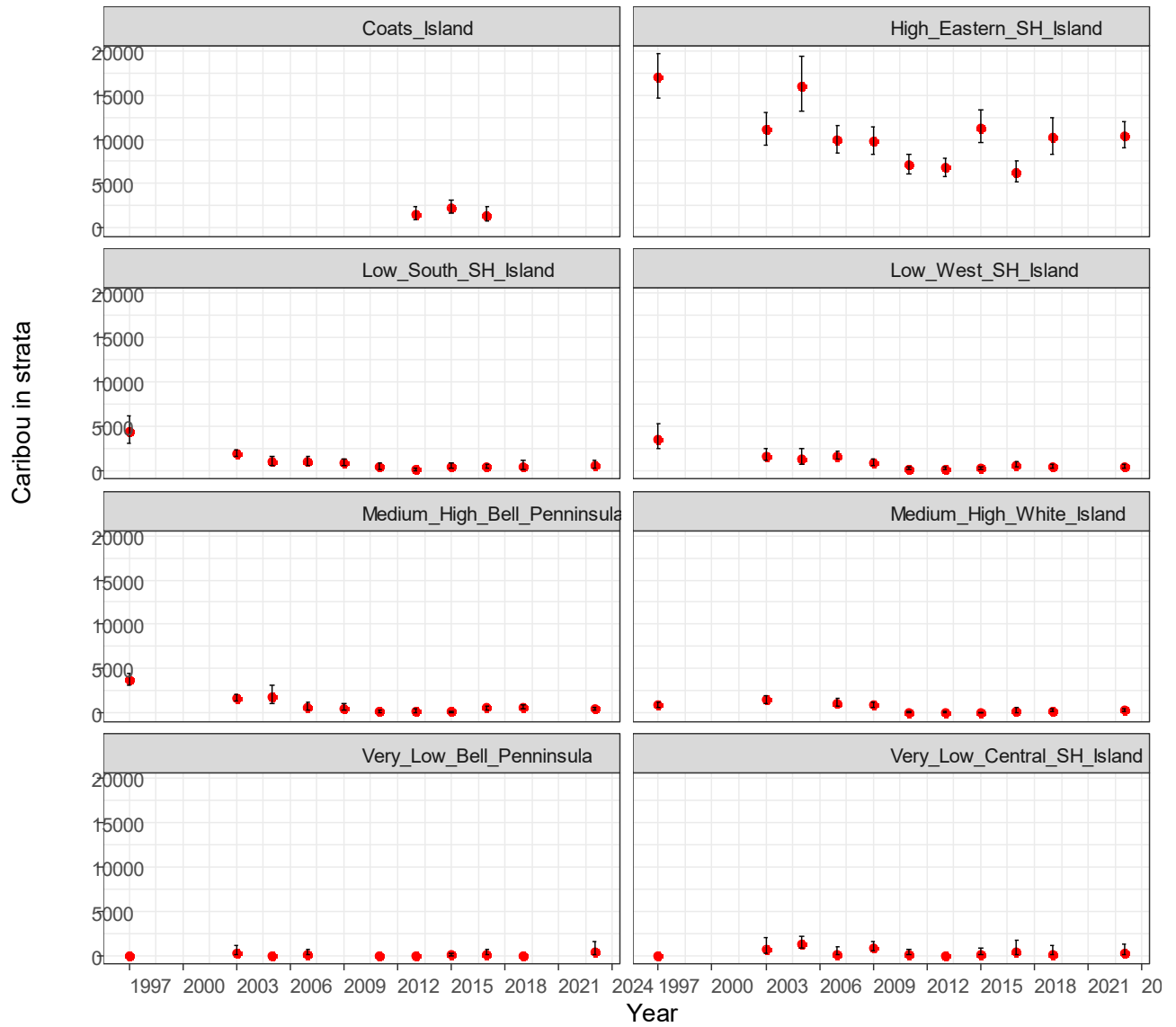
Year	Strata sampled	Caribou Counted	Strip transect estimates				
			N	SE	Confidence Limits	CV	
1997	7	5777	29,425	1622.5	26,375	32,827	5.5%
2003	7	3833	18,479	1099.8	16,420	20,797	6.0%
2005	6	4079	21,227	1701.8	18,098	24,896	8.0%
2007	7	2689	14,389	914.6	12,684	16,325	6.4%
2009	6	2521	13,651	833.1	12,091	15,412	6.1%
2011	7	1667	7,937	580.4	6,861	9,182	7.3%
2013	7	1597	7,284	525.3	6,307	8,413	7.2%
2015	7	3068	12,319	931.6	10,591	14,328	7.6%
2017	7	1685	8,436	680.8	7,184	9,906	8.1%
2019	7	2551	11,944	1080.8	9,972	14,305	9.1%
2023	7	2610	12,565	801.9	11,066	14,266	6.4%



**Figure 17.** Population abundance estimates of the Southampton Island caribou herd using a strip transect estimator, according to strata listed in Table 4.



**Figure 18.** Strata-specific estimates of strata sampled using a strip transect estimator. Note that the y-scales are different for each graph.



**Figure 20.** Strata-specific estimates of strata sampled using a strip transect estimator with the same scale used on each graph.

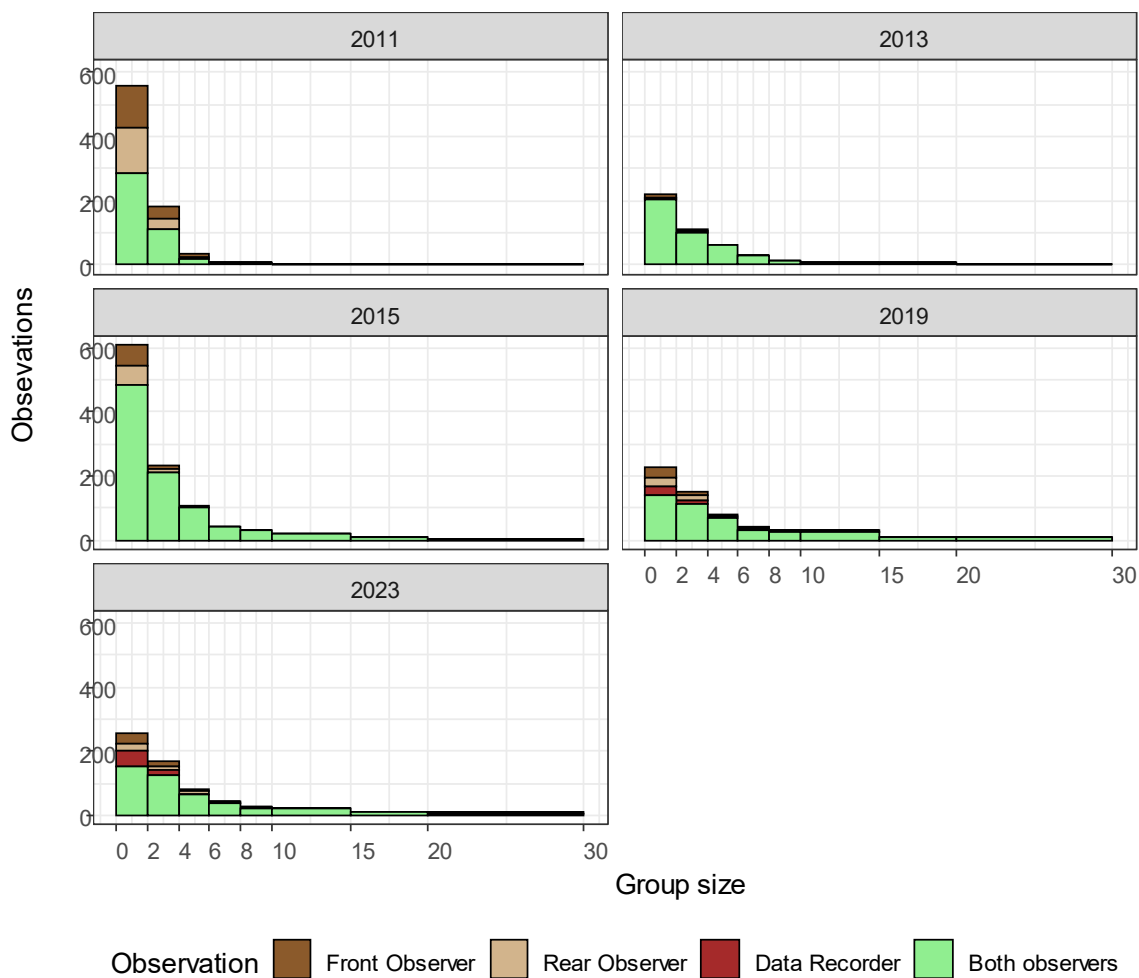
### 4.2.1 Dependent double observer analyses (2011-2015,2019, 2023)

Dependent double observer pair data were collected using fixed-wing aerial surveys in 2011, 2013, 2015, 2019, and 2023. In 2017, we used binned distance markers on wing struts to allow for distance sampling methods, as described in the methods section of this report. Survey conditions, group sizes, and observer efficiency varied between each survey year. These data were explored graphically to help assess dominant forms of variation prior to identifying a statistical model for population estimates derived from the dependent double observer pair method. The distribution of group sizes was relatively similar during each survey year with larger groups observed in 2015 (**Figure 21**).

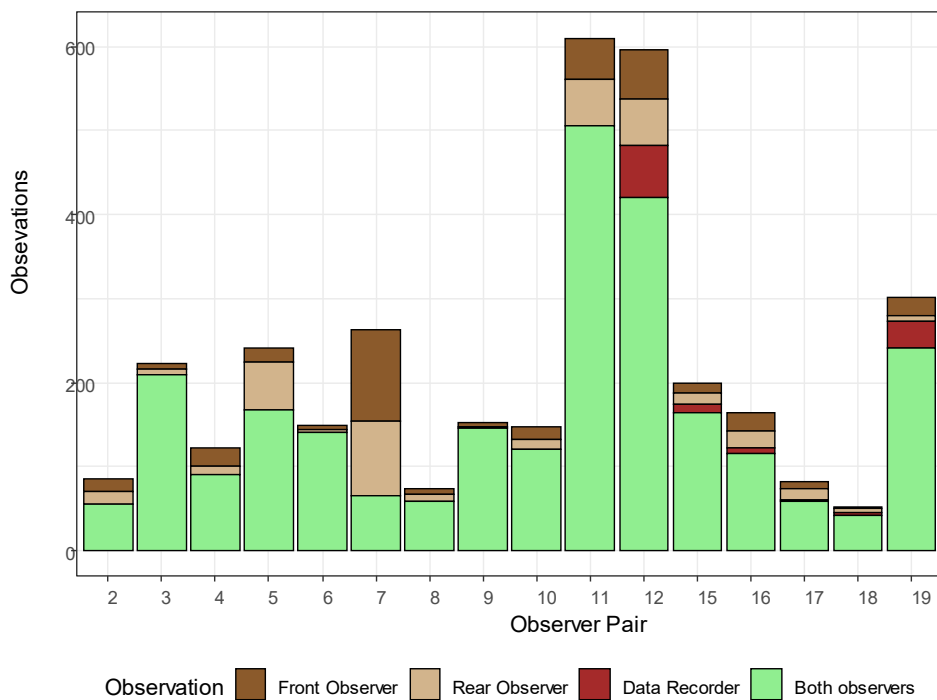
In general, smaller group sizes were more likely to be seen only by a single observer. Observers were placed into 19 pair combinations of which 11 observer pairs switched between primary and secondary roles, and 8 did not. The assumption of the dependent double observer pair method is that the two same-side observers have similar sighting probabilities and therefore, estimates may be biased when observers do not switch places during the survey. The sighting probability of pairs varied between observers for some pairs (i.e. in particular for pair 7) showing a higher relative frequency of only one observer seeing a group of caribou (**Figure 22**).

Between 1997 and 2011, all surveys were flown in early June close to or during the onset of spring melt. From 2013 to present, survey deployment was changed to early to mid-May (see methods) though no detectable variation in relative densities and their related strata were found. Regardless, snow cover varied each survey year with 2011 having a full range of snow cover and other years showing primarily high elevation snow cover, particularly 2013 and on, following the change in survey timing (approximately 20 days earlier) to May (**Figure 23**). Cloud cover also varied for each year (**Figure 24**), with no discernable patterns. Sighting probabilities were lower in 2011 as shown by higher frequencies of single observer sightings (**Figure 25**).

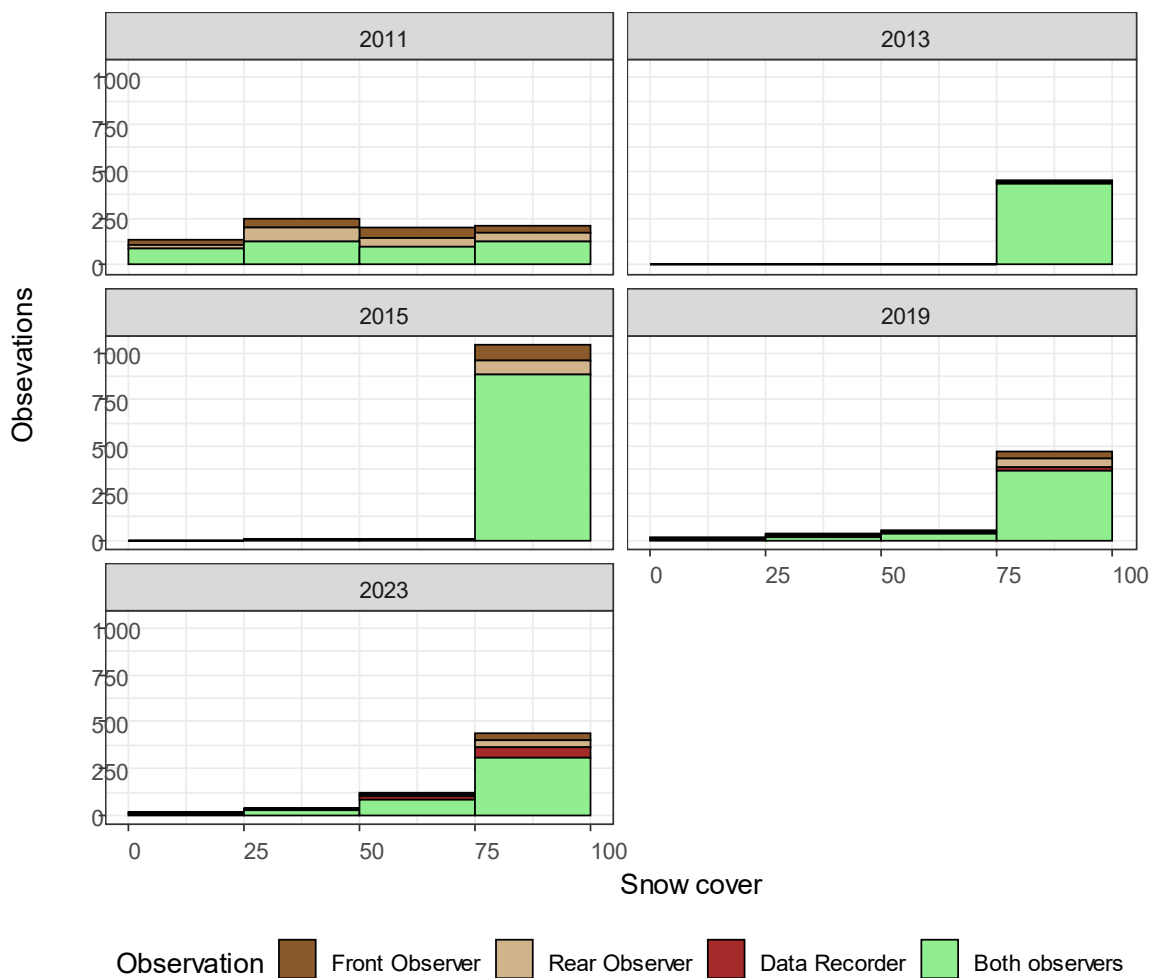
Dependent double observer pair model selection, performed by sequentially calculating differences in Akaike's information criterion (AICc), suggested that sighting probabilities varied according to a combination of observer, year, size of caribou groups observed, and cloud categorized in 25% intervals, and an interaction of snow cover and group size (**Table 5**). Two models were supported by differences in AICc values of less than 2. The support for year as a sightability term suggested that there were year-specific factors affecting sightability that were not accounted for by other covariates. Observer pairs in the analyses were reduced to the main pairs that exhibited lower sighting probabilities, given that a model with all observer pairs parameterized did not converge. Using this strategy, the main observer pairs that displayed lower or higher probabilities were accounted for with other observer pairs set to a mean value. The predictions of the most supported model (model 1 in **Table 5**) are shown graphically, demonstrating that sightability was lower in only 2011 and 2019, for both observer pairings and as a function of cloud and snow cover (**Figure 26**).



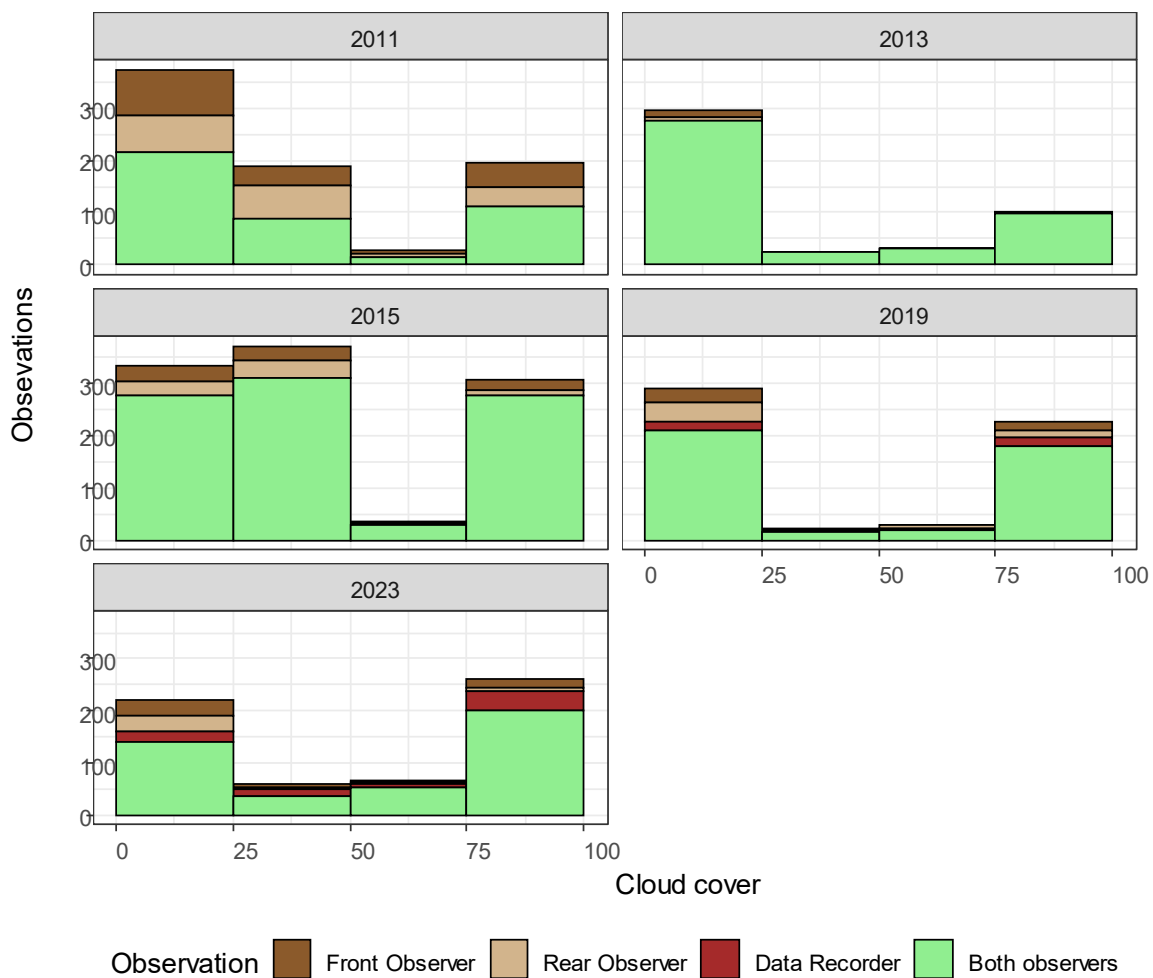
**Figure 21.** Group sizes of caribou observed each year for surveys conducted in 2011, 2013, 2015, 2019, and 2023, with frequency of sightings made by front, rear, data recorder and both observers.



**Figure 19.** Observer pairings with frequencies of sighting by front, rear, data recorder, and both observers (2011-2023).



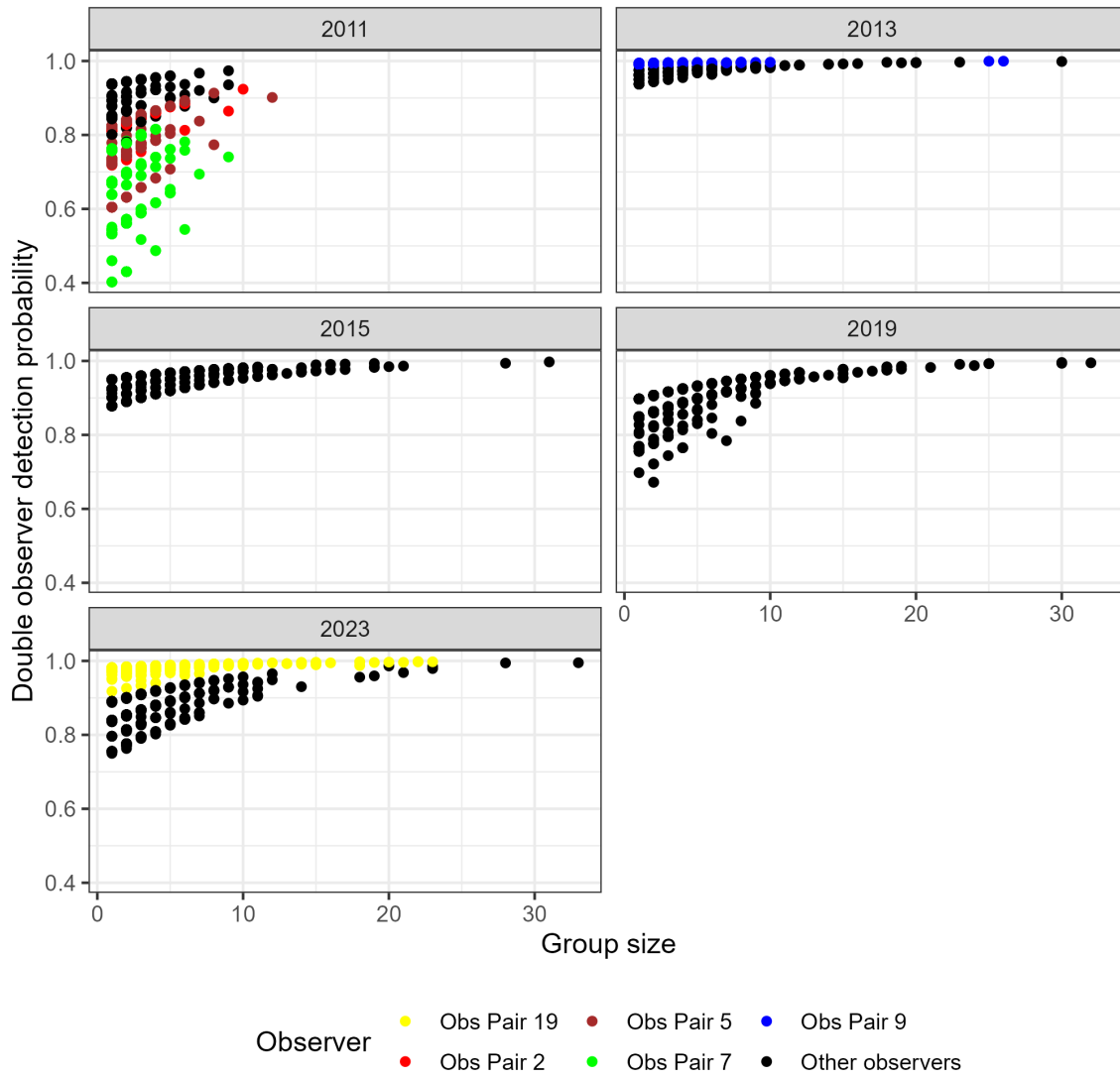
**Figure 20.** Snow cover during each year of the survey with frequencies of sightings by front, rear, data recorders, and both observers (2011-2023).



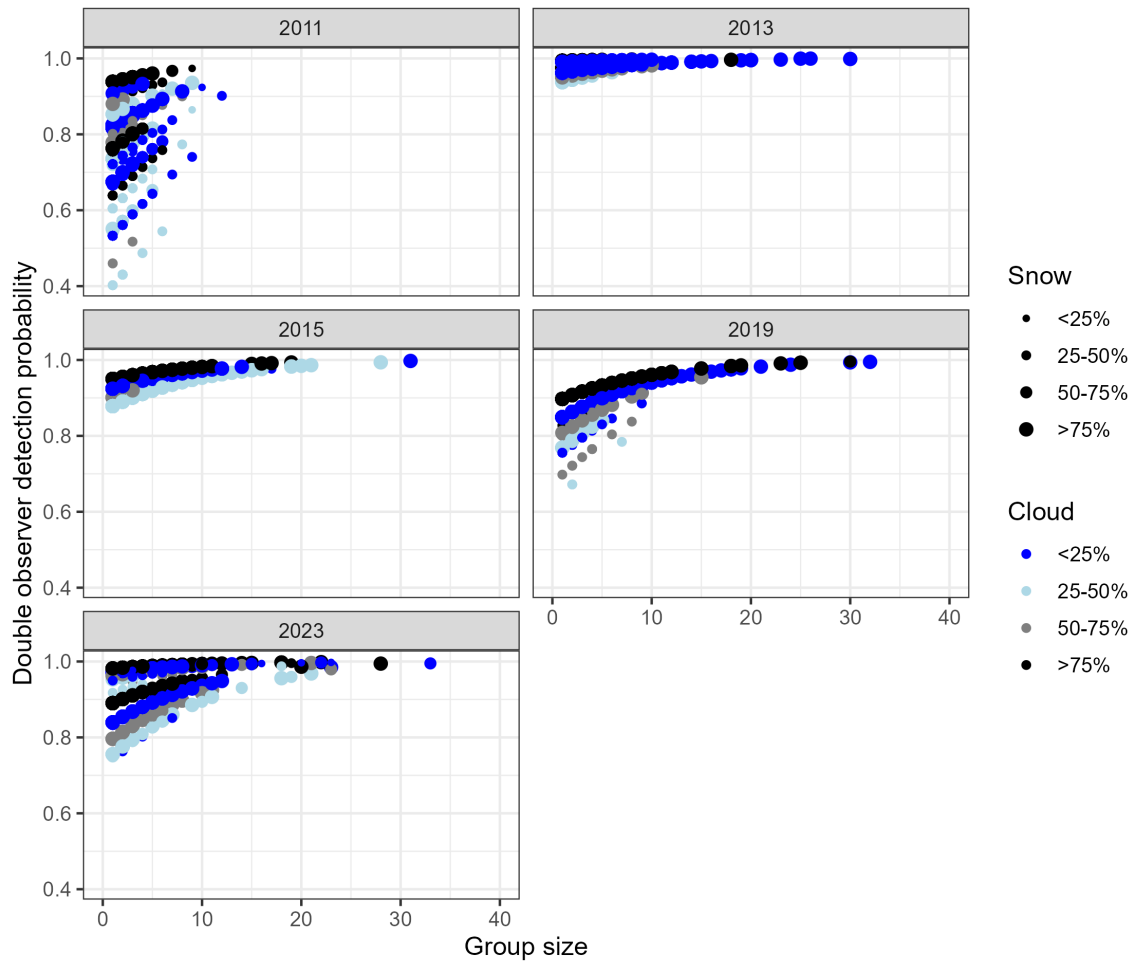
**Figure 21.** Cloud cover during each year of the survey with frequencies of sightings by front, rear, data recorders and both observers (2011-2023).

**Table 5.** Dependent double observer model selection results (2011-23). Sample size adjusted Akaike Information Criterion (AICc), the difference in AICc between the most supported model. For each model ( $\Delta AIC_c$ ), AICc weight ( $w_i$ ), number of model parameters (K), and deviance is given. See **Table 2** for covariate definitions

No	Model	AICc	$\Delta AIC_c$	$w_i$	K	LL
1	observers (reduced) +Year + size + cloud +snowc*size	1916.82	0.00	0.47	16	-942.3
2	observers (reduced) +Year + size + cloud	1917.00	0.19	0.43	15	-943.4
3	observers (reduced) +Year + size + cloud+Year*size	1919.93	3.11	0.10	18	-941.8
4	Year + size + cloud + snow	1946.30	29.48	0.00	11	-962.1
5	observers (all)	2007.52	90.70	0.00	15	-988.7
6	size + snow + cloud	2018.84	102.02	0.00	4	-1005.4
7	YearF	2020.53	103.72	0.00	8	-1002.2
8	snow + cloud	2049.87	133.06	0.00	7	-1017.9
9	snow	2060.00	143.18	0.00	4	-1026.0
10	snowc + cloudc + snowc * cloudc	2092.56	175.74	0.00	4	-1042.3
11	size	2132.15	215.33	0.00	2	-1064.1
12	logsize	2138.00	221.18	0.00	2	-1067.0
13	cloud_factor	2166.28	249.46	0.00	4	-1079.1
14	constant	2180.59	263.78	0.00	1	-1089.3



**Figure 22.** Dependent double observer detection probabilities as a function of year, group size, for selected observer pairs (2011-2023).



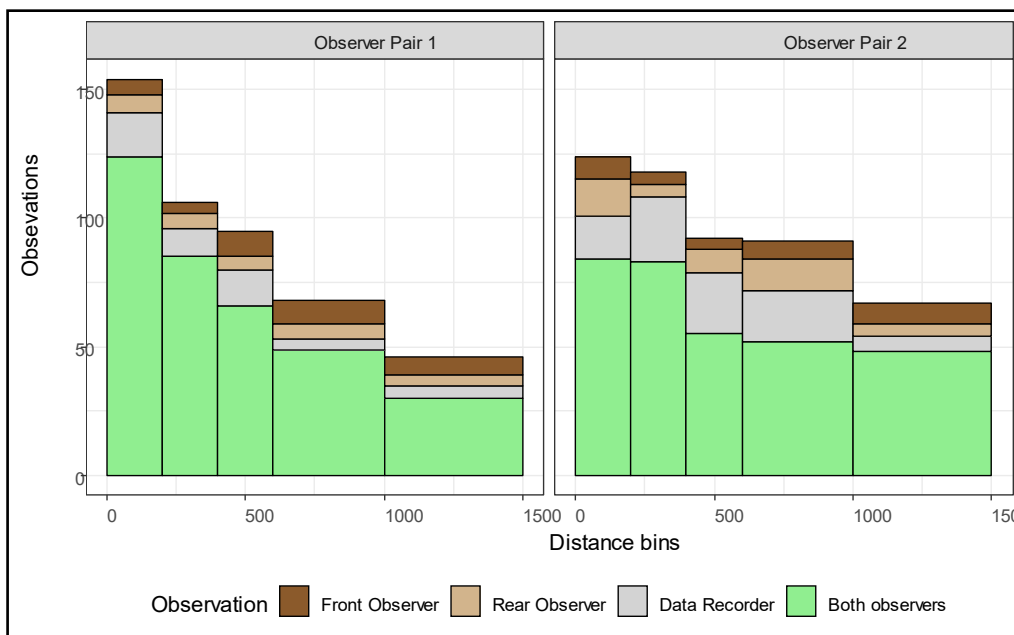
**Figure 23.** Dependent double observer probabilities as a function of year, group size, snow and cloud cover (2011-2023).

## 4.2.2 Distance sampling/double observer pair sampling in 2017

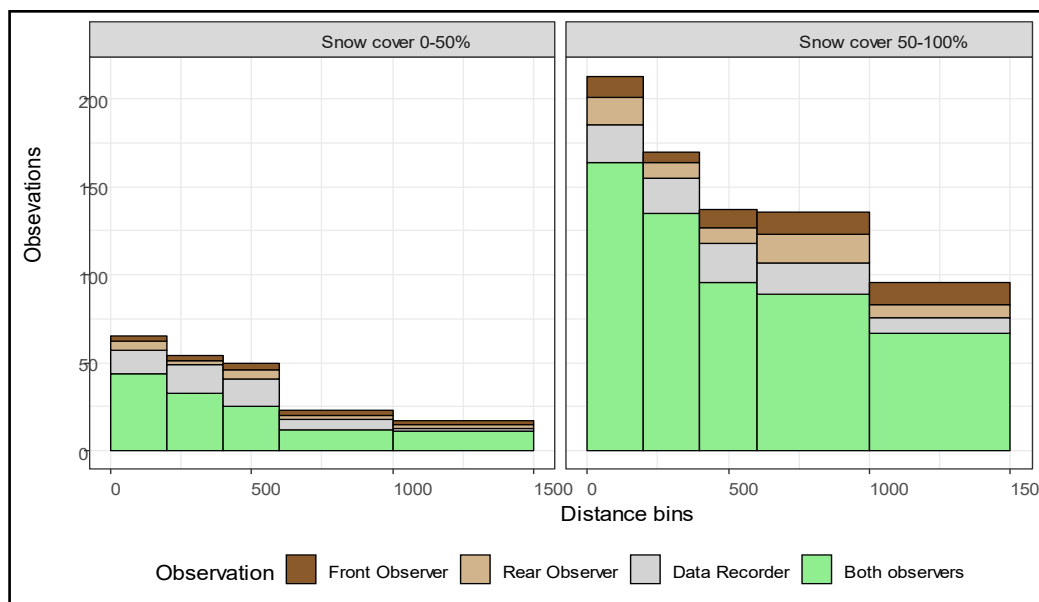
During the 2017 survey, frequencies of observations by distance bins revealed different detection probability curves between observer pairs 1 and 2. Observer pair 1 had a higher frequency of observations near the aircraft whereas observer pair 2 had a higher frequency away from the plane. Compared to previous years of dependent double observer pair sampling, there was a higher frequency of observations from data recorders in 2017, suggesting a higher level of observation experience by the data recorders. To utilize these recorder observations, we categorized them as single observer observations and assumed that the data recorder had similar sighting probabilities to the other observers (**Figure 27**). Snow cover was greater than 50% in the area of most observations, and the results of the 2017 observations suggested that sightability was lower when snow cover conditions were below 50% (**Figure 28**).

Model selection was proceeded by building distance sampling models with the mark-recapture model parameters held constant, and by initially comparing half normal and hazard rate models. Of these, the hazard rate model was the most supported, with observer pair and snow (continuous cover) as covariates. Once this model was selected, dependent double observer pair mark-recapture models were compared with observer pair and snow, as well as the most supported covariates. Group size (log transformed) was also supported as a distance sampling covariate (Model 1, **Table 6**). Goodness-of-fit for model 1 was marginal (chi-square=19.8, df=7, p=0.006), however most of the lack of fit came from the 600-1,000-meter distance bin which would have less influence on estimates given low observation frequency rates in this bin (**Figure 29**). An additional analysis was conducted, which used the first 2 distance bins of data to fit dependent double observer pair only models to the data, without the distance component (**Table 7**). The same suite of dependent double observer pair models was applied to the data set as used in previous years analysis and as listed in **Table 6**. According to this

subsequent analysis, a model with observer, snow (continuous) and the log of group size was most supported. Population abundance estimates from this model were thus compared to the distance sampling and strip transect estimates from other survey years.



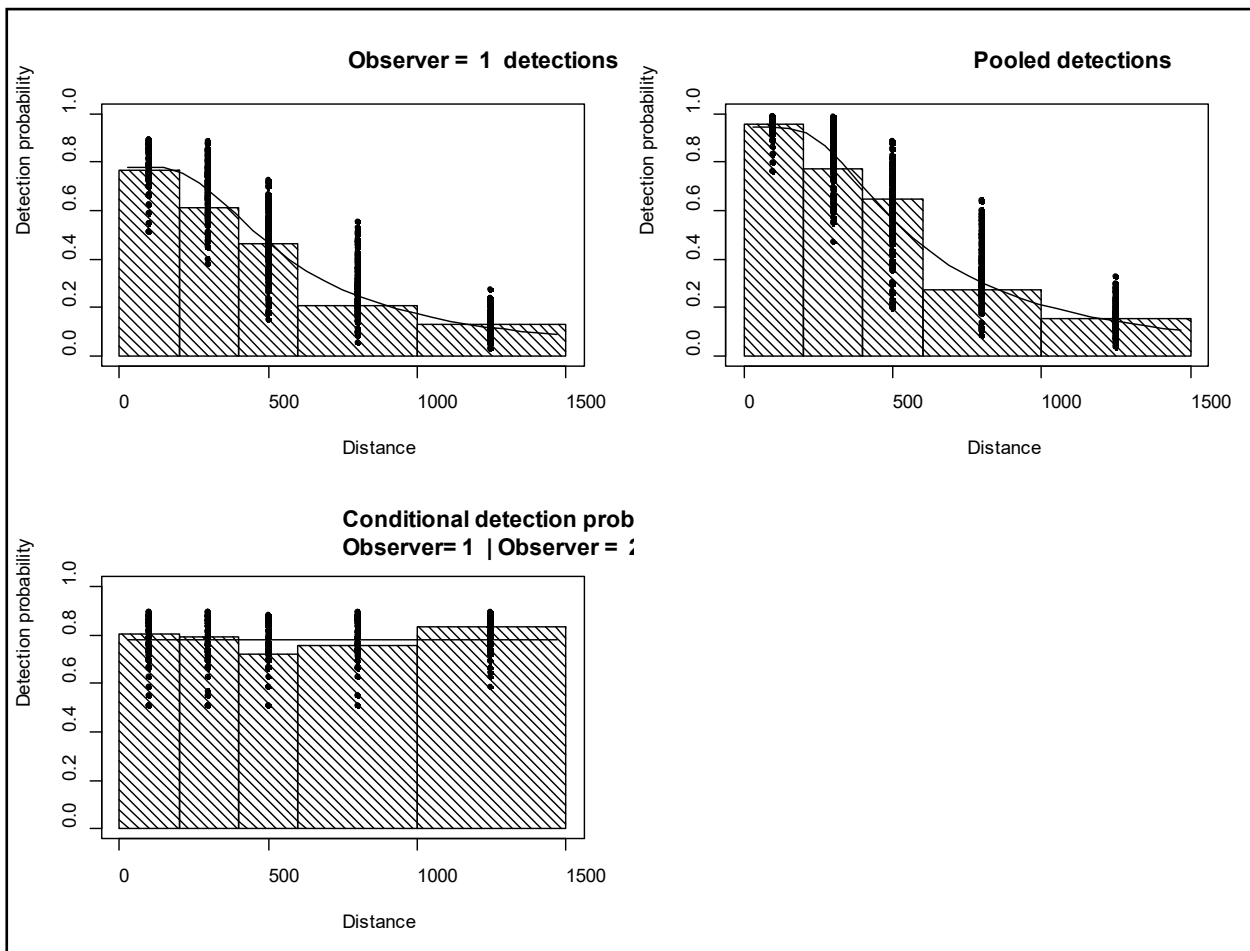
**Figure 24.** Frequencies of observations by distance bin for the 2 observer pairs in May 2017.



**Figure 25.** Frequencies of observations by distance bin for 2 levels of snow cover in May 2017.

**Table 6.** Dependent double observer model selection results for May 2017. Sample size adjusted Akaike Information Criterion (AICc), the difference in AICc between the most supported model for each model ( $\Delta AICc$ ), AICc weight ( $w_i$ ), number of model parameters (K) and deviance is given. See **Table 2** for covariate definitions.

No.	DF	Distance sampling Distance covariates	2x observer covariates	Model fit				
				AIC <sub>c</sub>	$\Delta AIC_c$	$w_i$	K	LL
<b>Distance /Double observer models</b>								
1	HR	obs+snowc+log(size)	obs+snowc	4000.0	0.00	0.95	8	-1992.
2	HR	obs+snowc+log(size)	obs+snow	4006.6	6.59	0.04	10	-1993.
3	HR	obss+snowc+size	obs+snow	4009.3	9.24	0.01	10	-1994.
4	HR	obs+snowc	obs+snow	4010.8	10.75	0.00	9	-1996.
5	HR	obs+log(size)	obs+snowc	4012.7	12.66	0.00	7	-1999.
6	HN	obss+snowc+logsize	obs+snow	4019.2	19.16	0.00	9	-2000.
7	HN	obs+snowc	obs+snow	4019.8	19.71	0.00	8	-2001.
8	HR	obss+snowc	obs	4020.1	20.04	0.00	6	-2004.
9	HR	obss+snowc	size	4028.0	27.94	0.00	6	-2008.
<b>Distance sampling models</b>								
10	HR	obss+snowc	constant	4031.2	31.14	0.00	5	-2010.
11	HN	obss+snowc	constant	4040.2	40.11	0.00	4	-2016.
12	HN	obs+snowc+size	constant	4040.2	40.15	0.00	5	-2015.
13	HR	obs	constant	4041.7	41.66	0.00	4	-2016.
14	HN	snowc	constant	4045.3	45.28	0.00	3	-2019.
15	HR	size	constant	4047.0	46.96	0.00	4	-2019.
16	HR	constant	constant	4047.3	47.27	0.00	3	-2020.
17	HN	obs	constant	4061.1	61.09	0.00	3	-2027.
18	HN	constant	constant	4067.3	67.22	0.00	2	-2031.
19	HN	size	constant	4067.9	67.89	0.00	3	-2031.



**Figure 26.** Graphical representation of goodness-of-fit of the most supported double observer model for May 2017 (Model 1, Table 7).

**Table 7.** Dependent double observer model selection results for 2017. Sample size adjusted Akaike Information Criterion (AIC<sub>c</sub>), the difference in AIC<sub>c</sub> between the most supported models for each model ( $\Delta$ AIC<sub>c</sub>), AIC<sub>c</sub> weight ( $w_i$ ), number of model parameters (K), and deviance is given. See **Table 2** for covariate definitions

No	Model	AIC <sub>c</sub>	$\Delta$ AIC <sub>c</sub>	$w_i$	K	LL
1	obs+snowc+log(size)	1,193.0	0.00	0.40	4	-592.5
2	obs+snowc+size	1,193.1	0.07	0.38	4	-592.5
3	obs+snowc	1,194.7	1.70	0.17	3	-594.3
4	obs+snow_factor	1,197.8	4.75	0.04	5	-593.8
5	obs+snow_factor+cloud_factor	1,200.3	7.26	0.01	8	-592.0
6	constant	1,208.7	15.73	0.00	1	-603.4

### 4.2.3 Comparison of estimates from strip transect, dependent double observer pair, and distance sampling

Comparison of strip transect single observer pair, dependent double observer pair, and distance sampling estimates suggests reasonable agreement between estimates, with the confidence intervals from each method all overlapping.

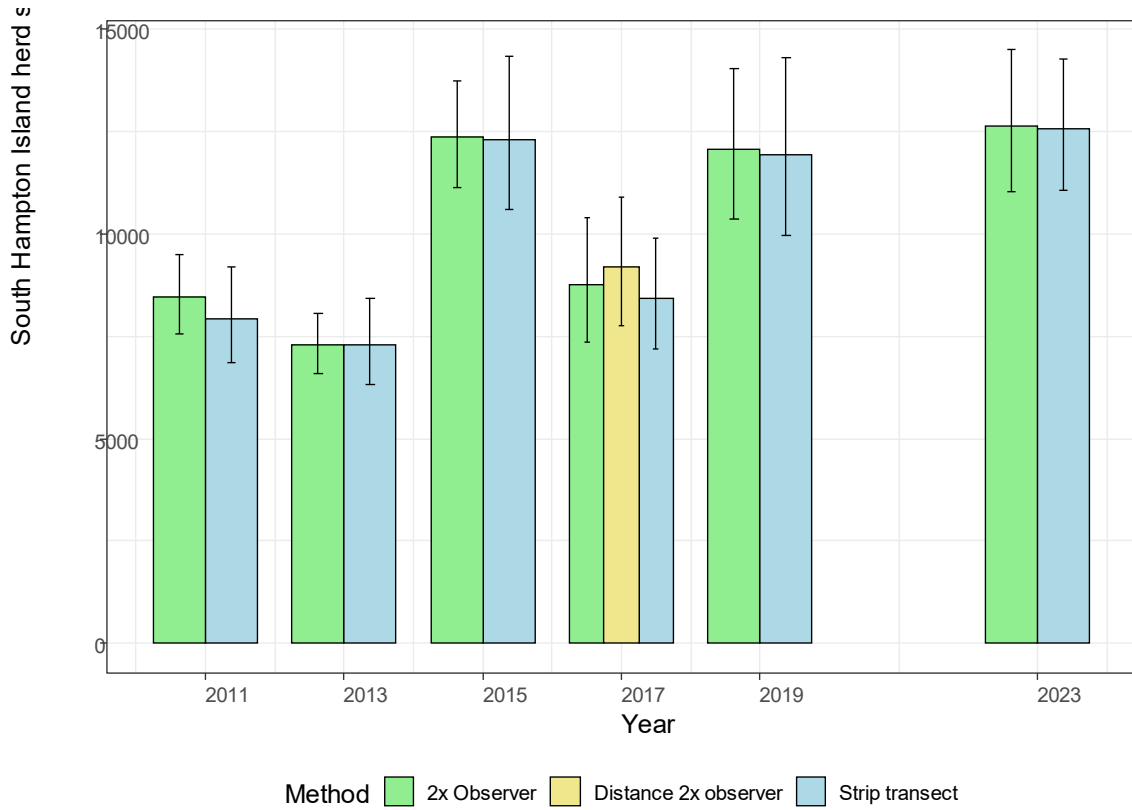
Further inspection of estimates suggests that the assumption of perfect sightability on the 400-meter survey strip was met in only 2013 and 2015 with estimates being close for dependent double observer pair and strip transect estimates (**Figure 30**). In 2011, variability in observers and snow cover reduced the strip transect estimates compared to the dependent double observer pair estimates. In this context, the dependent double observer pair method provided a test of assumptions of the strip transect method and corrected estimates when the assumption of perfect sightability was violated. Estimates from the dependent double observer pair method when compared with the single observer pair jolly estimator were 6% higher in 2011, similar in 2013 and 2015, and 4% higher in 2017. A similar comparison for 2019 and 2023 showed double observer pair estimates 5.0 % higher in May 2019 and only 1% higher in May 2023, suggesting sightability was likely improved during the May 2023 survey.

In 2017, distance sampling estimates were higher than dependent double observer pair and strip transect estimates. This may have been due to one of the observer pairs not putting enough survey effort into the distance bins closer to the aircraft (**Figure 27**), as indicated by different shapes of the detection histograms for the two observer pairs. This would have caused a negative bias in both strip transect and dependent double observer pair estimates and illustrates a potential issue with distance sampling; observers spending too much time looking out at further bins which are often easier to view than the closer bins. In the case of conditions of excellent sightability, this can lead to a significant over estimate. The dependent double observer pair method partially accounted for this by also estimating the sighting probabilities of observers near the survey line. The dependent double observer pair method assumes that the

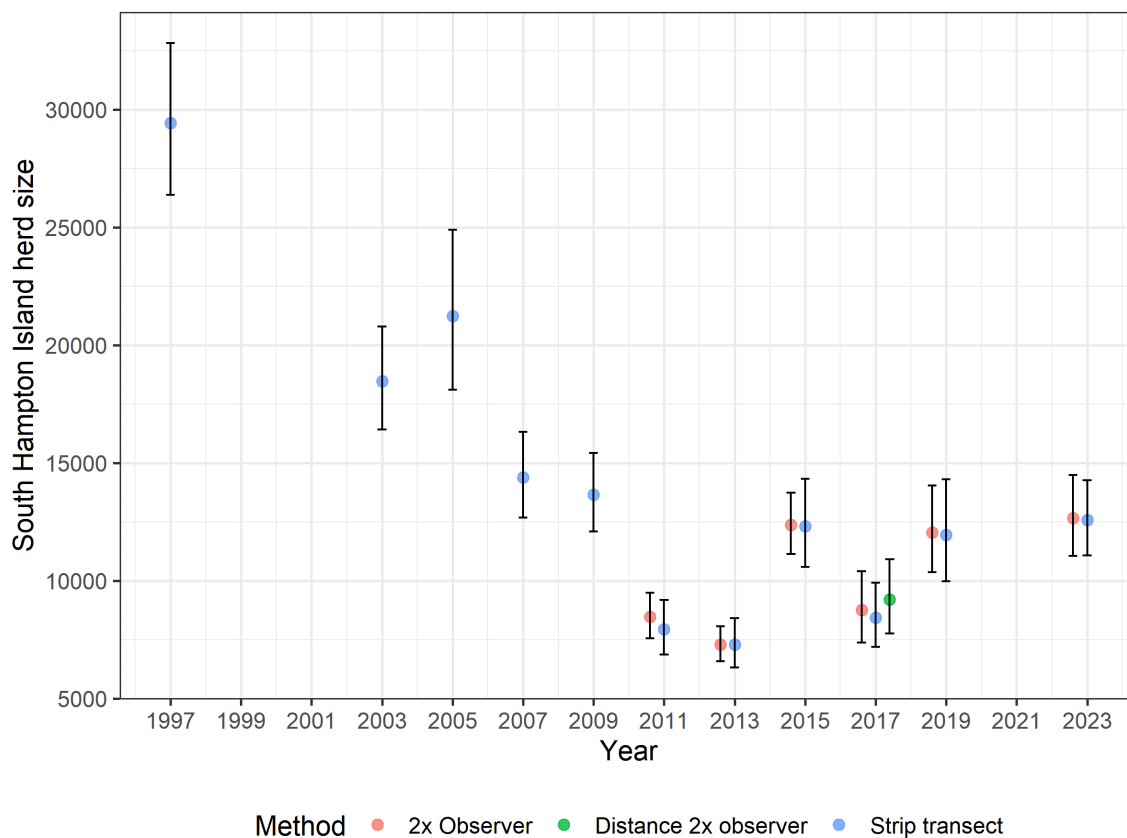
two observers in a pair have equal sighting probabilities. It is therefore essential that observers switch places half way through the day to ensure robust estimates from this method. Of the 19 observer pairings across all surveys, 11 switched places which may have affected the overall quality of the dependent double observer pair estimates. If observers cannot switch places, then an independent observer method should be considered especially when caribou density is not high.

**Table 8.** Comparison of estimates of Southampton Island caribou using strip transect, double observer, and distance sampling/double observer (2017 only).

Year and Method		Caribou counted	N	SE	Conf. Limit		CV
2011	Strip transect	1667	7,937	580.4	6,861	9,182	7.30%
2011	2x Observer strip transect	1667	8,467	479.9	7,558	9,486	5.67%
2013	Strip transect	1597	7,284	525.3	6,307	8,413	7.20%
2013	2x Observer strip transect	1597	7,287	365.6	6,580	8,071	5.02%
2015	Strip transect	3068	12,319	931.6	10,591	14,328	7.60%
2015	2x Observer strip transect	3068	12,370	681.3	11,140	13,736	5.14%
2017	Strip transect	1685	8,436	680.8	7,184	9,906	8.10%
2017	Distance 2x observer	1653	9,200	796.4	7,755	10,915	8.70%
2017	2x Observer strip transect	1665	8,752	759.5	7,365	10,399	8.70%
2019	Strip transect	2512	11,521	1063.3	9,583	13,852	9.20%
2019	2x Observer strip transect	2512	12,054	901.9	10,354	14,032	7.48%
2023	Strip transect	2610	12,565	802.0	11,066	14,266	6.40%
2023	2x Observer strip transect	2610	12,651	851.0	11,044	14,493	6.70%



**Figure 30.** Comparison of more recent South Hampton Island caribou herd abundance estimates between June 2011 and May 2023, from strip transect, dependent double observer, and 2017 only distance sampling/double observer analyses.



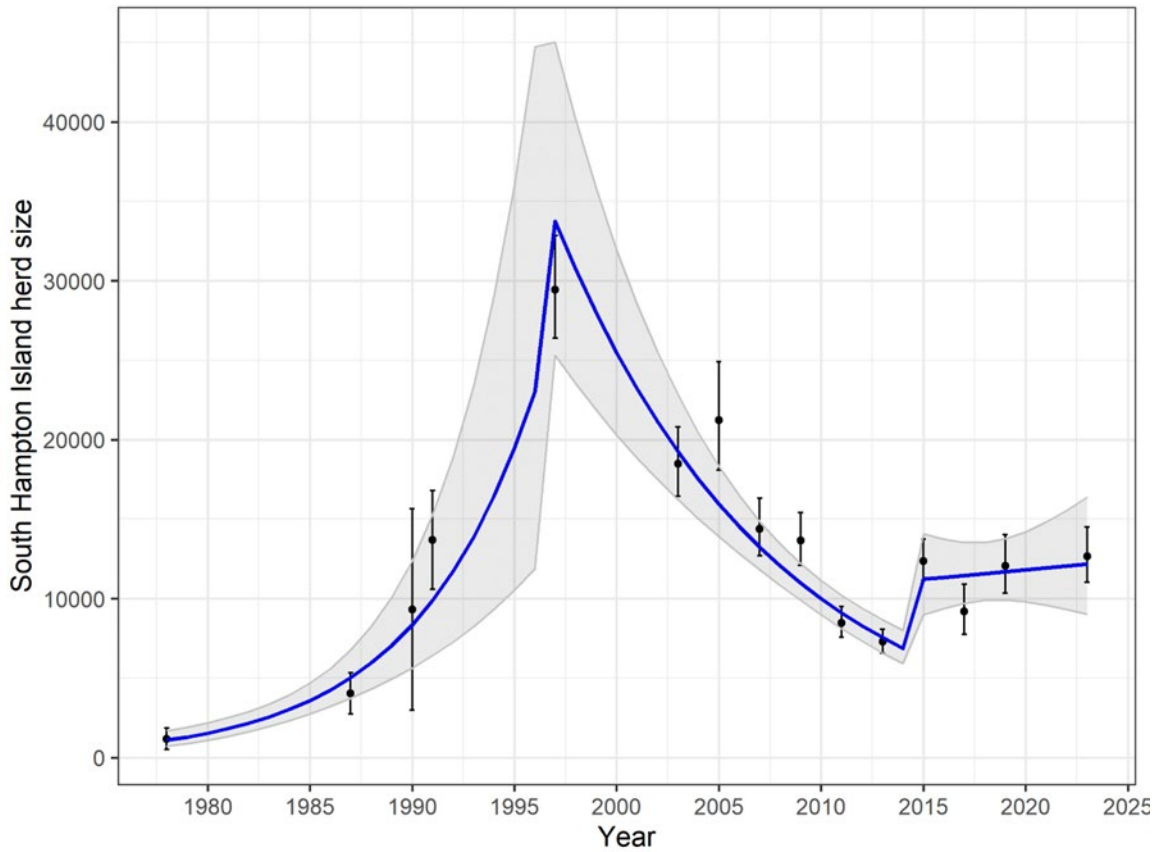
**Figure 31.** A long-term comparison of strip transect, dependent double observer pair, and distance sampling (2017 only)/double observer pair estimates from June 1997 through May 2023.

### 4.3 Trend estimates:

Our trend analyses cover three separate phases of Southampton Island caribou abundance: **1**- prior to 1997 when herd abundance was increasing; **2**- from 1997 to 2017 when the herd was declining, and from 2017 to 2023 when estimates indicated stability.

#### 4.3.1 Trend from 1978 to 1997(the increase phase)

The historic data set (1978-1991) was added to the analysis to obtain an estimate of trends in the SHI caribou population during the phase of increase that occurred from 1978 to 1997. This was accomplished by adding terms to account for the decrease phase, which allowed us to estimate an annual rate of increase of 1.18 (CI=1.12-1.25), or, 19% (CI=16-22%), from 1978 to 1997 (**Table 9**). A plot model for these predictions is shown in **Figure 32**.



**Figure 27.** Predictions of herd size of the Southampton Island from the log-linear model (Table 11) which assumes a constant decline in population size after 1997 with an immigration event that occurred before the 2015 survey.

**Table 9.** Log-linear model parameter estimates for trend analysis (1978-2023).

Term	$\beta$	SE ( $\beta$ )	t	p-value	Conf. Limit	
(Intercept)	927.28	0.24	28.30	0.0000	558.53	1444.60
Trend (1978-1997)	1.18	0.03	6.31	0.0001	1.12	1.25
Decrease-intercept	236.37	0.44	12.41	0.0000	98.93	558.71
Immigration (2015)	0.04	1.15	-2.90	0.0175	0.00	0.34
Trend (1998-2014)	0.77	0.03	-9.02	0.0000	0.73	0.81
Trend (2015-2023)	1.01	0.03	3.59	0.0059	0.95	1.07

### 4.3.2 Trend from 1997 to 2023 (the decline phase)

Data from 1997 to 2023 included strip transect, dependent double observer pair, and distance sampling surveys. The use of different methods had minimal effects on the overall abundance trends identified. However, the best estimates for 2011, 2013, and 2015, based on model fit and lowest CV's, were dependent double observer pair estimates which accounted for sightability, especially in 2011. For 2017, the distance sampling estimate was least biased because of observer error. For this reason, we used strip transect data for estimates from surveys up to 2009, followed by dependent double observer pair estimates for 2011 to 2015, 2019 and 2023, and distance sampling estimates for 2017.

T-tests were initially used to compare the significance of the difference between sequential estimates (**Table 10**). Of the 8 survey estimate comparisons the 1997 to 2003, 2005 to 2007, 2009 to 2011, 2013 to 2015, 2015 to 2017, and 2017 to 2019 periods showed statistically significant change, with no significant change being detected between 2019 and 2023. Of these comparisons, only the 2013 to 2015, and 2017 to 2019 estimates showed a statistically significant increase in the SHI caribou population, all others, with the exception of 2019 to 2023, displayed significant declines. Annual change in population size, based on a year-to-year comparison of estimates (expressed as ratios), varied between 0.79 and 1.30. SHI caribou abundance estimates from 1997 to 2023 are shown graphically in **Figure 33**.

A log-linear model was then applied to further assess trend. To estimate the effect of a potential immigration event on the overall trend, prior to the 2015 survey, an additive term was applied to model use to generate the 2015-2017 survey estimates. This term basically assumed that the SHI population was increased by a constant amount during this time due to immigration. These terms were both found to have a significant effect on the trend in caribou abundance (**Table 11**). The year term provided an estimate of long-term annual rate of change for the SHI population (0.91 CI=0.89-0.93) which was not, overall, affected by the immigration event. This translates to a 9% (CI=7-11%)

decline in caribou abundance each year, from 1997 through 2017. A trend term for the period of 2015 to 2023 was not significant.

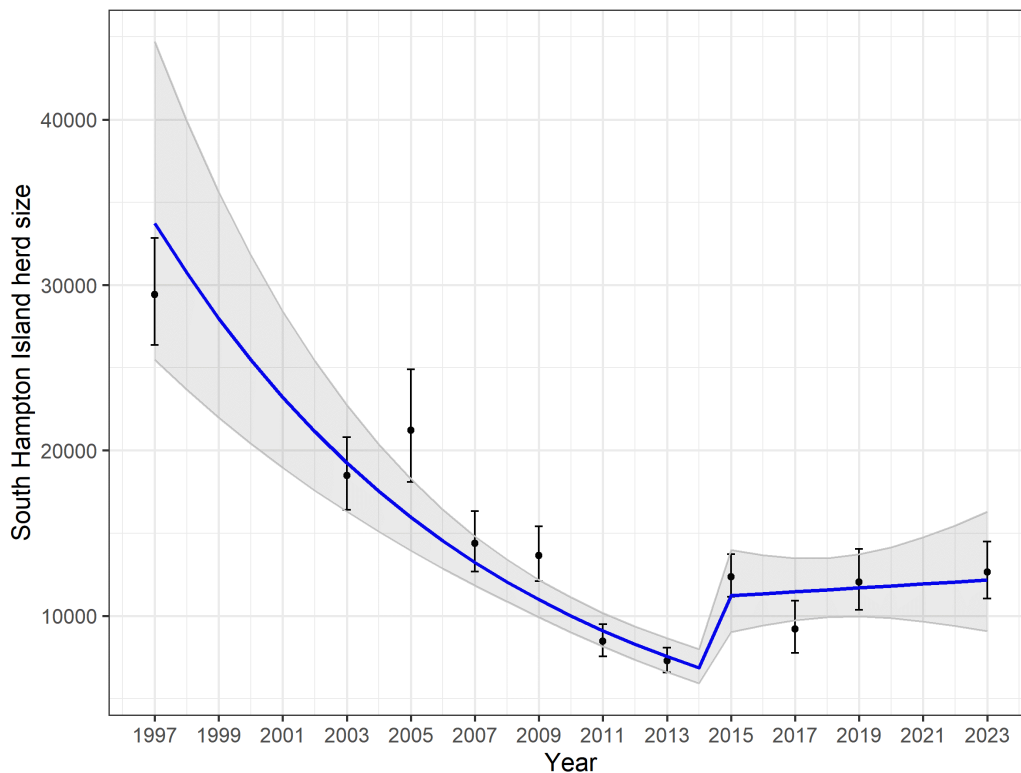
A plot of model predictions reveals good fit of the model to estimates with predictions intersecting the confidence limits of all 10 estimates (**Figure 33**). Namely, the model suggests that the herd declined at a constant rate from 1997-2014, followed by an immigration event sometime between May 2013 and May 2015 (Paetkeau, 2015), and then continued to decline at a similar rate as it had previously, from 2015-2017 (**Figure 33**). Using this model, and assuming a constant rate of decline (9%) over the period, we estimated that approximately 5,024 caribou would have had to immigrate to SHI between May 2013 and May 2015 to account for the increased number of animals observed in May 2015.

**Table 10.** Estimates used for the 1997 to 2023 trend analysis of Southampton Island caribou abundance, with the results of t-tests comparing the estimates of successive surveys. Also shown are estimates of gross and annual change based on the ratios of successive estimates.

Year	method	N	SE	CV	df	t-test	df	p-value	Gross change	Annual change
1997	Strip transect	29,425	1622.5	5.5%	93					
2003	Strip transect	18,479	1099.8	6.0%	90	-5.58	163	0.0000	0.63	0.93
2005	Strip transect	21,227	1701.8	8.0%	76	1.36	132	0.1774	1.15	1.07
2007	Strip transect	14,389	914.6	6.4%	88	-3.54	117	0.0006	0.68	0.82
2009	Strip transect	13,651	833.1	6.1%	80	-0.60	168	0.5514	0.95	0.97
2011	2x Observer	8,467	479.9	5.7%	52	-5.39	122	0.0000	0.62	0.79
2013	2x Observer	7,287	365.6	5.0%	32	-1.96	83	0.0539	0.86	0.93
2015	2x Observer	12,370	681.3	5.5%	31	6.57	48	0.0000	1.70	1.30
2017	Distance 2x observer	9,200	796.4	8.7%	134	-3.02	122	0.0030	0.74	0.86
2019	2x Observer	12,054	901.9	7.5%	33	2.37	91	0.0198	1.31	1.14
2023	2x Observer	12,651	851.0	6.7%	39	0.48	71	0.6314	1.05	1.01

**Table 4.** Log-linear model parameter estimates for trend analysis (1997-2019).

Term	$\beta$	SE ( $\beta$ )	t	p-value	Conf. limit	
Intercept	37053.14	0.15	68.31	0.0000	27104.24	49599.61
Trend $\lambda$ (1997-2015)	0.91	0.01	-8.41	0.0001	0.89	0.93
Immigration (2015)	0.25	0.60	-2.31	0.0540	0.08	0.82
Trend $\lambda$ (2015-2019)	1.01	0.03	0.39	0.7112	0.96	1.06



**Figure 28.** Predictions of herd size of the Southampton Island caribou population from the log-linear model (Table 11), which assumes a constant decline in population size with an immigration event that occurred before the 2015 survey. Confidence limits are provided as shaded regions on the plots.

## 4.4 Effect of Disease on Abundance:

Brucellosis is an infectious disease caused by the Bacteria Genus *Brucella*. Many different animal species including humans can become infected. The form of Brucellosis known to occur in wild caribou is *Brucella suis* Type IV. In caribou this bacterium occurs primarily within tissues of the reproductive system but also commonly occurs within leg joints (Williams and Barker, 2001; O'Reilly, 1992; Corbel, 2006). The bacteria can also be found in the milk, blood, urine and semen of infected animals (O'Reilly, 1992; Corbel, 2006). Animals can be infected by the bacteria by either oral ingestion, direct contact with the mucus membranes of the eyes, nose, or mouth, or through breaks in the skin. *Brucella* can also be transmitted by contaminated objects (fomites) (Corbel, 2006). Some animals are carriers and can have the bacteria without showing signs of the illness. Animals in these cases can shed the bacteria into the environment for long periods, infecting other animals in the herd. Brucellosis can cause reproductive problems such as abortions, still birth and infertility. Other signs can include arthritis, swelling of the joints and testicles, and udder infections (mastitis) (Williams et al. 2001; CDC 2016; Corbel, 2006). Tissues and fluids associated with the amniotic sac, drainage of fluid from swollen joints, vaginal discharge, fetal fluids, and semen can be highly infective and can spread the bacterium into the immediate environment where uninfected animals can become infected through the ingestion of infected tissues and contaminated objects such as plants. The potential for environmental concentration of this disease makes Brucellosis a density-dependent disease. Areas of concentration such as migratory corridors, rutting areas and particularly calving grounds, would represent some of the higher risk seasonal range for the spreading of this disease (Williams et al. 2001; O'Reilly, 1992; Corbel, 2006). Predation and scavenging of diseased tissue can also contribute to the bacterium's spread throughout the environment.

By 1995, the condition and productivity of the herd had changed little, an assessment that would remain up until the 2000 harvesting season when CFIA random blood

testing identified the beginning of what would become a rapid induction of the bacterial disease *Brucella suis* serovar 4 in the SHI caribou herd (**Figure 34**). There is no evidence of this disease within this population prior to the 2000 harvesting season. Susceptibility to disease and parasites due to low genetic heterogeneity has been a concern for the SHI herd since the introduction of caribou to SHI, and was a likely catalyst to the wide spread infection of caribou with *Brucellosis suis* first detected in the population February 2000, and followed by a recorded decline in abundance. Prevalence of Brucellosis climbed from 1.7% in February 2000 to 58.8% by March 2011 and this increase is thought to have contributed to decreased pregnancy rates over the same period. Pregnancy rates dropped from a high of 93.1% in February 2001 to a low of 37% in March 2011.

Health monitoring of the SHI barren-ground caribou had its beginnings in 1988 when D. Heard (departmental correspondence) sampled 20 cows in March to determine their reproductive status and general condition. These small condition studies continued through 1991 (Jan Adamczewski and Douglas Heard unpublished data) at which time the condition studies were discontinued. The analysis of condition was started up again in February 1996 in association with the initiation of the large-scale commercial harvest on the Island in March 1993. Due to the small sample sizes collected during this period little weight could be put on their influence on overall trends in condition. The first samples did, however, give results that were consistent with hunter reports of caribou on SHI in excellent health and condition during this period.

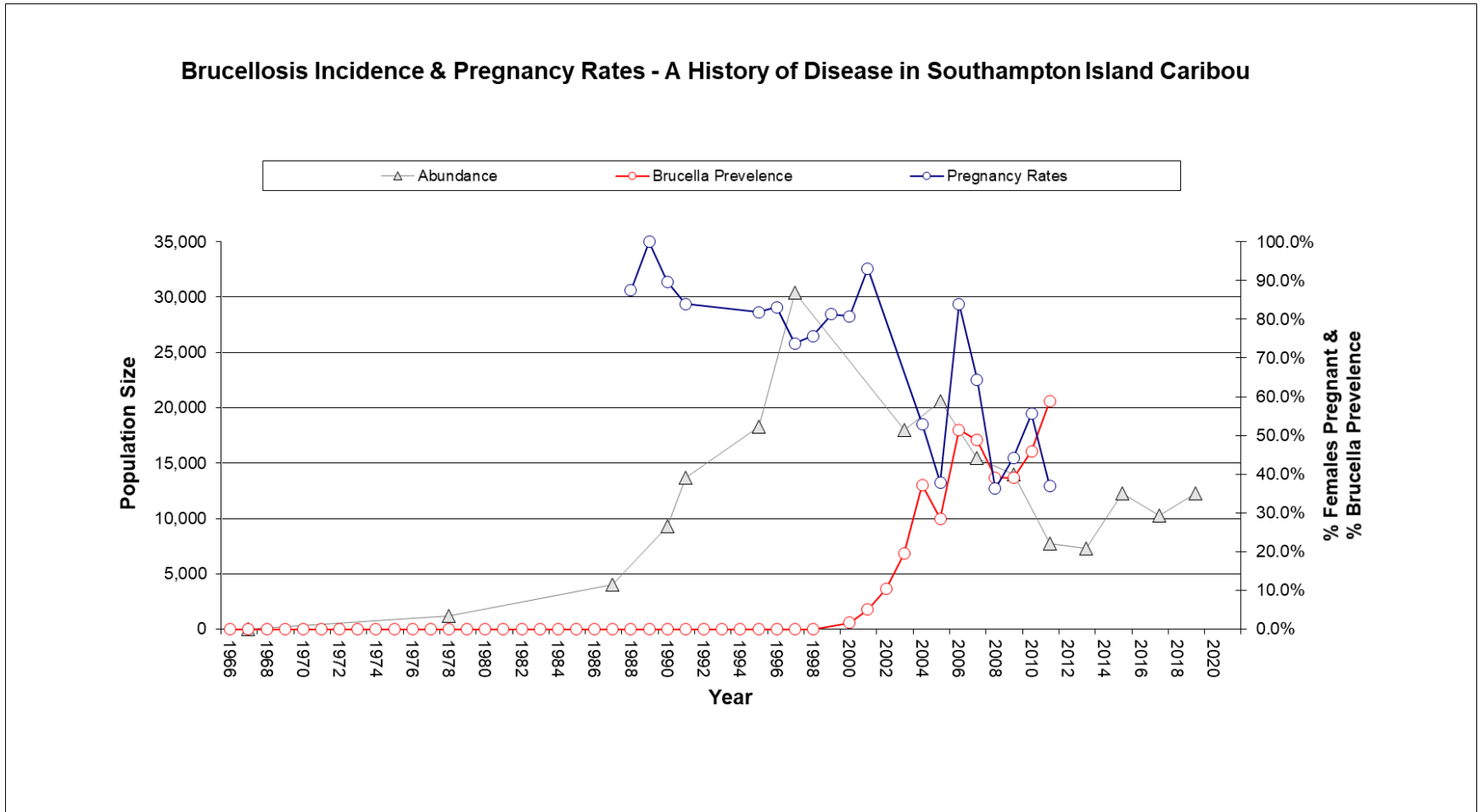
Based on the CFIA testing of 400 caribou annually between 2000 and 2009, and 100 caribou tested annually between 2009 and 2011, the first cases of *Brucella suis* were reported during the 2000 harvest year (1.7% of 400 animals tested ) and had reached a prevalence of 19.5% in 2003, 28.6% in 2005, 48.8% by 2007, 39.1 % by 2009 and 58.8 % by 2011. Pregnancy rates initially dropped from 93.1% in 2001 to 37.9% in 2005, and then increased to 64.4% in 2007. The hopes that the disease was declining in the population were dashed when a 2009 screening showed pregnancy rates dropping further to 44.3%. The last major condition study conducted in March 2011, prior to the application of a TAH, recorded pregnancy rates of 37% (**Figure 34**).

In 1992 the Canadian Polar Commission released a status report on Brucellosis in the Circumpolar Arctic (O'Reilly, 1992). In the report, O'Reilly summarized the incidence of Brucellosis across the Circumpolar arctic (**Table 12**). Brucellosis prevalence within the Southampton Island population reached a high of 58.9% in 2011 which represents the highest prevalence amongst any caribou and/or reindeer populations' worldwide (O'Reilly, 1992). Currently levels are unknown due to a cessation of the annual caribou condition harvest. With the human health issues associated with Brucellosis through either the consumption or handling of infective tissues, Coral Harbour residents are concerned over the future of their caribou herd. Though disease screening has not taken place since 2011, an increase in population abundance was recorded in June 2015. This finding, coupled by hunter reports of fewer infected caribou and more calves, suggests that the disease prevalence has been dropping from 2015 to present. Disease screening is planned to be continued beginning in the 2025 harvesting season.

#### 4.4.1 Brucellosis and herd trend

Concurrent with the rising prevalence of the reproductive disease *Brucella suis* was the reported declines in abundance from 1997 through 2013 (**Figure 34**). It appears clear that Brucellosis was a contributing factor to the steady declines observed in this population of caribou. However, with high commercial harvest rates of the SHI herd up to 2009, it is likely that both commercial hunting pressure and disease together, contributed significantly to a declining trend in caribou abundance up to 2013. By 2003, three years following the first confirmed cases of Brucellosis in SHI caribou, pregnancy rates were still over 85% and the population was still over the hypothesized carrying capacity of the island, theorized to be 15,000 animals (Ouellet et al. 1996). With Brucellosis being a density dependent disease, it was decided by all co-managers that a further reduction in caribou abundance would be beneficial to the long-term viability of the SHI population hence the continuation of the commercial harvest up to the 2009

harvesting season. Abundance monitoring every two years was continued up to 2019 and again most recently in 2023, and associated adjustments to a Total Allowable Harvest (TAH) was utilized to help recover the declining trend of the herd. Relative stability between 2013 and 2015 suggested the situation was improving and that the disease was having less of an impact on the herd. We believe that there is definitive evidence of an immigration event onto SHI that likely occurred during the winter of 2014. We further believe that this genetically verified influx of more disease resistant mainland caribou played an important role in the reduction in hunter observed disease prevalence as evidenced by hunter reports and the cessation in herd decline first realized in 2015.



**Figure 29.** A history of abundance, pregnancy rates and *Brucellosis suis* prevalence for the Southampton Island caribou herd originally introduced onto the island from Coats Island in 1968.

**Table 5.** Circumpolar Incidence of Brucellosis in barren-ground caribou and reindeer across arctic North America (after O'Reilly, 1992).

<b>Herd</b>	<b>Incidence (%)</b>	<b>Date</b>	<b>Remarks</b>	<b>Source</b>
Southampton	Not Present	1990	75 samples	(NWT Wildlife notes)
Qamanirjuaq	4%	1966-68		(NWT Wildlife notes, 1983)
Beverly	< 2%	1983	118 samples	(Goldfarb, 1990)
Bathurst	Present	1981-1983	3 samples	(NWT Wildlife notes, 1983)
Baffin Island	14-35%	Mid-1980s	N Baffin highest	(O'Reilly, 1992)
Melville/Boothia	20-35%	1980s	17 samples	(O'Reilly, 1992; Gunn et al. 1991)
Ahiak	?			
Porcupine	15-20%	1980s	?	(O'Reilly, 1992)
Central Arctic	15-20%	1980s	?	(O'Reilly, 1992)
Western Arctic	<= 30%	1960-1980	?	(O'Reilly, 1992; Neiland et al. 1968)
Nechina	1-6.5%	1962-65	?	(Neiland et al. 1968)
George River	Not Present	1987-88	?	(Forbes 1991; Greenberg et al. 1958)
QEI Peary	Present	1980s	1 sample (P. of W. Island)	(Forbes, 1991)

## 4.5 Harvest

Throughout the reintroduction of barren-ground caribou to SHI, wildlife managers of the time were vigilant in their on-going management of the herd. Management recommendations were, in all cases, based on research results, and in particular, quantitative population estimates. In February 1978, the first caribou hunt since the 1968 introduction was carried out on SHI. The quota was set at 25 bulls and was based on observations from a reconnaissance survey flown in 1977 that sighted a total of 172 caribou, 79 of which were adult males, 54 adult females, and 39 yearlings, suggesting a sex ratio skewed towards males (Kraft, 1978; Gates, 1988) (**Table 13**) (**Figure 35**). In August 1979, the TAH (quota) for bulls was increased to 50 based largely on the findings of the November 1978 population survey which estimated 1,138 adult and yearling caribou (Kraft, 1978). Early in 1983 the first cow harvest was approved with a TAH set at 20. Regulations were developed along with this new TAH stipulating those 10 cows be harvested in the spring and the remaining 10 in the fall. The TAH was then raised from 50 to 250 bulls, and from 20 to 50 cows, based on recommendations generated following the 1987 population estimate though the estimate was inconclusive (Heard and Grey, 1987; Heard and Ouellet, 1994).

During the 1988 harvesting year, concerns regarding the accidental harvesting of females seem to have led to the removal of the female quota and an increase in the male quota to 300 animals sometime in 1988. At this time, it was clearly indicated in the regulations that; "hunting zone J/2 (Southampton Island) was restricted to 300 male caribou." In 1989 recommendations to increase the TAH to 400 caribou, of which 100 could be female, were made. These recommendations were supported by GNWT Biologist Doug Heard who indicated the proposed increases were based on sound ecological principles and quantitative survey results (Renewable Resources Official Correspondence 140 007 005 & 150 001 005, October, 1989). Seasons for this new quota were recommended to be from October 1<sup>st</sup> to October 31<sup>st</sup> for males and April 1<sup>st</sup> to May 31<sup>st</sup> for females. By 1993, and in response to rapid population growth

reported by Ouellet in 1991, the TAH was removed (Ouellet, 1992) (**Table 14**). From 1993 up until the 2012 harvesting season subsistence harvest was not accurately monitored. In Nunavut, monitoring of caribou harvest in the absence of a TAH is not mandatory. Although the 1991 Nunavut Wildlife Management Board (NWMB) Harvest Study attempted to quantify wildlife harvest through hunter interviews, it is generally agreed that the final harvest study estimates may not be entirely accurate in some cases. For SHI, however, accurate records of commercial harvest numbers and sex ratios were kept from 1992 through to 2009.

The first commercial quotas were established in 1992 and were set at 250 animals (gender breakdown unknown). Despite the 1992 commercial allocation, it was not until 1993 that the first five caribou (of unknown gender) were harvested commercially. Commercial quotas continued to rise to 1,000 animals in 1993, 5,000 in 1994, and 6,000 by 1997 (Junkin, 2003). Since 1993 there have been annual commercial harvests up to and including the 2009 harvesting season. Interestingly, a non-sex-selective subsistence quota of 1,000 animals was re-instated in 1994 in an effort to offset an increase in the commercial quota from 1,000 to 5,000 over the same period (Junkin, 2003). By 1997, in response to survey results indicating the continued rapid growth of the population to 30,381 animals (Mulders, 1995), concerns about the caribou population having exceeded the Islands hypothesized carrying capacity of 15,000 caribou were being realized (Ouellet et al 1994, Ouellet et al 1993). In response to these concerns, the wildlife regulations were once again amended to allow an unlimited subsistence harvest and a non-sex-selective commercial quota of 6,000 caribou.

Overall, the commercial harvest was successful in reducing the population to the estimated carrying capacity of the Island of 15,000 caribou (Ouellet et al. 1996). Concerns of the time, however, were that continued high harvest rates, in excess of 6,500 caribou over the 2006 and 2007 harvesting seasons, would drive the population too low to sustainably maintain the estimated subsistence harvest rate of 1,500 to 2,000 caribou annually. Additionally, there was the concern of rising *Brucella* prevalence and its observed impact on the reproductive potential of the SHI herd. The

continued decline of SHI caribou following the 2003 survey estimate only heightened these concerns, and by 2007, when the population had dropped further to an estimated 14,389 adult and yearling caribou, discussions on ending the commercial harvest had begun. However, the harvest employed many local people and the political will to continue the harvest was high. Despite these pressures, the harvest was cancelled by the Coral Harbour HTO in 2008 and only a small harvest of 843 was undertaken in March 2009. Between 1978 and 2009 an estimated total of 27,400 caribou had been harvested for subsistence purposes and 42,000 for commercial purposes yielding a total harvest of 69,400 caribou, of which 61% were taken for commercial purposes. Since 2009 there has been no commercial caribou harvest. Results from the 2009 aerial abundance estimate showed no significant change between survey periods suggesting that the cessation of the harvest was having the net effect of slowing and/or stabilizing the population decline.

Unfortunately, the stabilizing effect lasted only a short period and by June 2011 estimates of population abundance dropped further to 8,442 adults and yearlings. With the commercial harvest having been stopped, and the subsistence harvest remaining relatively constant at an estimated 1,500 to 2,000 caribou annually there was little more managers could do address anthropogenic causes of decline other than reduce the subsistence harvest. The reasons for this rapid decline appeared to now be related to the reported high prevalence of the reproductive disease Brucellosis. By March 2011, Brucellosis disease prevalence had reached a high of 58.8% and spring pregnancy rates had declined to 37% (**Figure 34**). In addition to high rates of disease, around this time, and despite the cessation of the commercial harvest, a new method of selling country foods was gaining popularity and increasing harvests of SHI caribou. This new harvest pressure was developing from the growing demand for the sale of caribou meat on social media within Nunavut. A lucrative market had opened up on Baffin Island where Baffin communities were struggling with declining caribou populations as well. When sales of caribou meat from SHI first took hold on social media, 24,764 kilograms of caribou meat, representing an estimated 710 caribou, were sold and shipped from SHI in the first 8 months of sales (**Figure 36**). Unfortunately, the data provided by the airline to assess the shipment of caribou meat off SHI was cutoff in January 2012,

removing our ability to further quantify and monitor the internet sales and harvest totals, through export traffic, for the months of heaviest harvesting (March, April, and May).

#### **4.5.1 Harvest Management and Planning 2011 to present**

Meetings in the summer and fall of 2011 between the Government of Nunavut (GN) Department of Environment (ENV) and the Coral Harbour HTO, and additional meetings with all stakeholders in the winter of 2012, led to a formal request by the Coral Harbour HTO to the GN and the NWMB to apply a TAH of 4 caribou per household (1,000 caribou) in an attempt to stabilize the decline through subsistence harvest management.

Another product of these meetings was the development of the *Southampton Island Barren-ground Caribou Population Management Plan (2012)*, which was submitted to the NWMB for decision in March 2012. The plan outlined an agreement to establish a TAH of 1,000 caribou and a Non-Quota Limitation (NQL) protecting cow/calf pairs. Also in the plan was the specification of continued harvester-supported monitoring, and the continued assessment of SHI caribou population abundance every 2 years. The urgency of the situation led to the NWMB supported, and community requested, establishment of a Ministerial Management Initiative (through the Nunavut *Wildlife Act*) to immediately assign a temporary TAH of 1,000 caribou for the SHI caribou population.

By June 2013, the herd had further declined to an estimated 7,287 adult and yearling caribou, prompting the GN ENV to recommend a further reduction to 2 caribou per household (500 caribou) with 100 caribou held back for the HTO to use as deemed appropriate, for a total of 600 caribou. The community rejected this recommendation, preferring to wait until the May 2015 abundance estimate had been completed to make a final decision. The community based its decision on hunter observations of reduced signs of Brucellosis within their catch and a general thought that herd health and

pregnancy rates were improving. Continued reports of healthy caribou, fewer signs of disease, several reports of a possible movement of caribou onto the Island over the winters of 2014 and 2015, and a noticeable increase in calves in June 2014, preceded the May 2015 abundance survey. Consistent with community reports, the 2015 survey estimated a significant increase in adult and yearling caribou. In two years, the population had increased by 5,081 animals to 12,368 caribou, an estimate believed higher than could be accounted for by reproduction alone. The community of Coral Harbour was not surprised with the result, attributing the increase to what they believe was the movement of a large group of caribou from the mainland onto the north end of the island during the winter of 2014. In an attempt to verify these accounts, the GN conducted a genetic analysis using SHI hunter provided tissue samples from 2014 and then comparing them to SHI samples from 2004 and samples collected on the mainland in the vicinity of Naujaat in 2014. This analysis quantitatively confirmed, for the first time, the presence of mainland barren-ground caribou genetic markers on SHI in 2014.

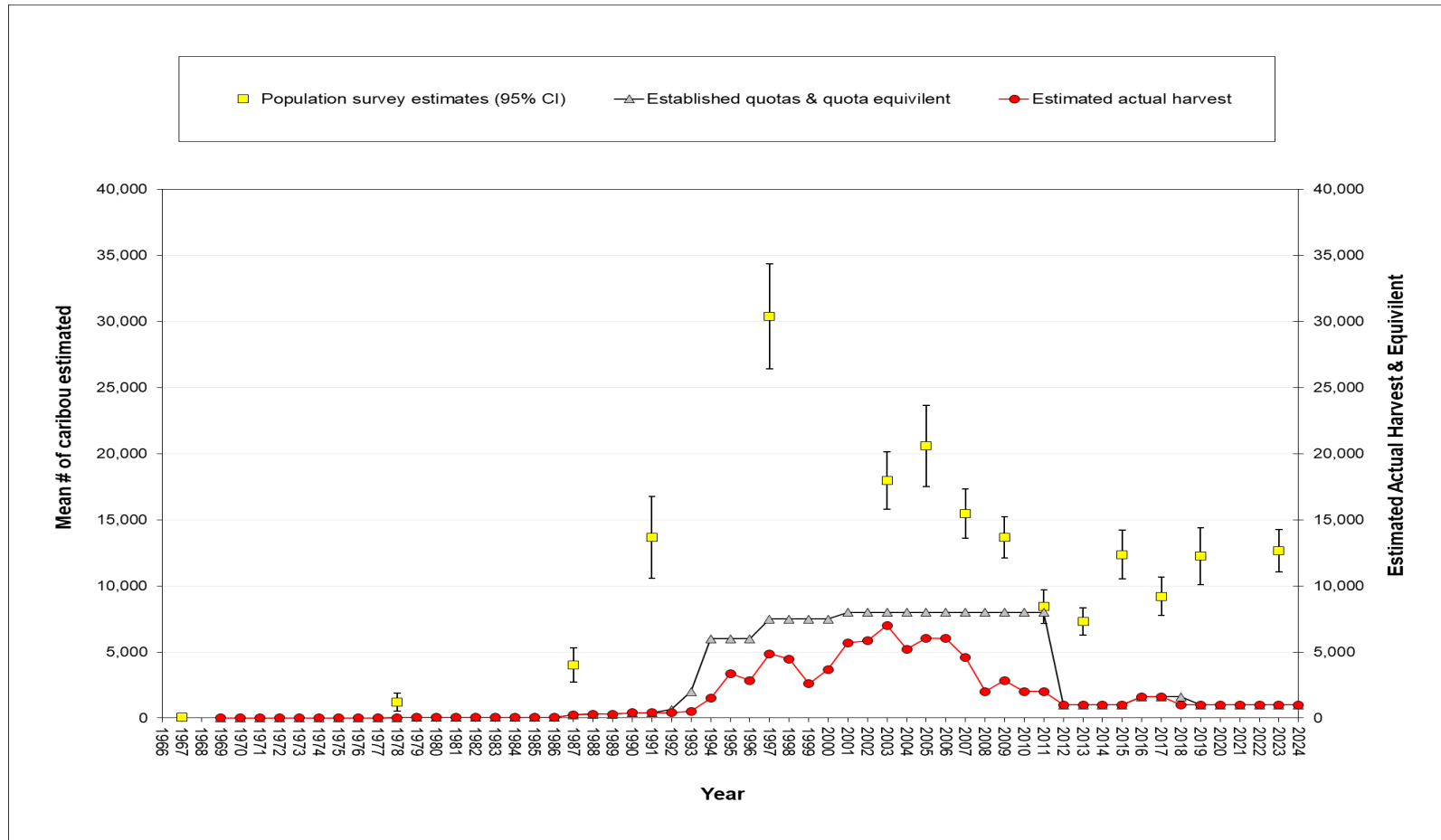
The observed increase documented in 2015 lead to a temporary increase in TAH to 1,600 caribou with a NQL protecting cow/calf pairs (**Table 14**). This increased TAH continued through the 2016 and 2017 harvesting years after which the 2017 survey results, indicating a significant decline in abundance, saw the SHI TAH lowered back to 1,000 caribou/year which has remained to present.

**Table 6.** History of the Southampton Island assigned subsistence harvest quotas (TAH) prior to 1992. Harvest management prior to the first commercial allocation in 1992 (subsistence harvest estimated using government reports, HTO correspondence and personal communications with wildlife staff).

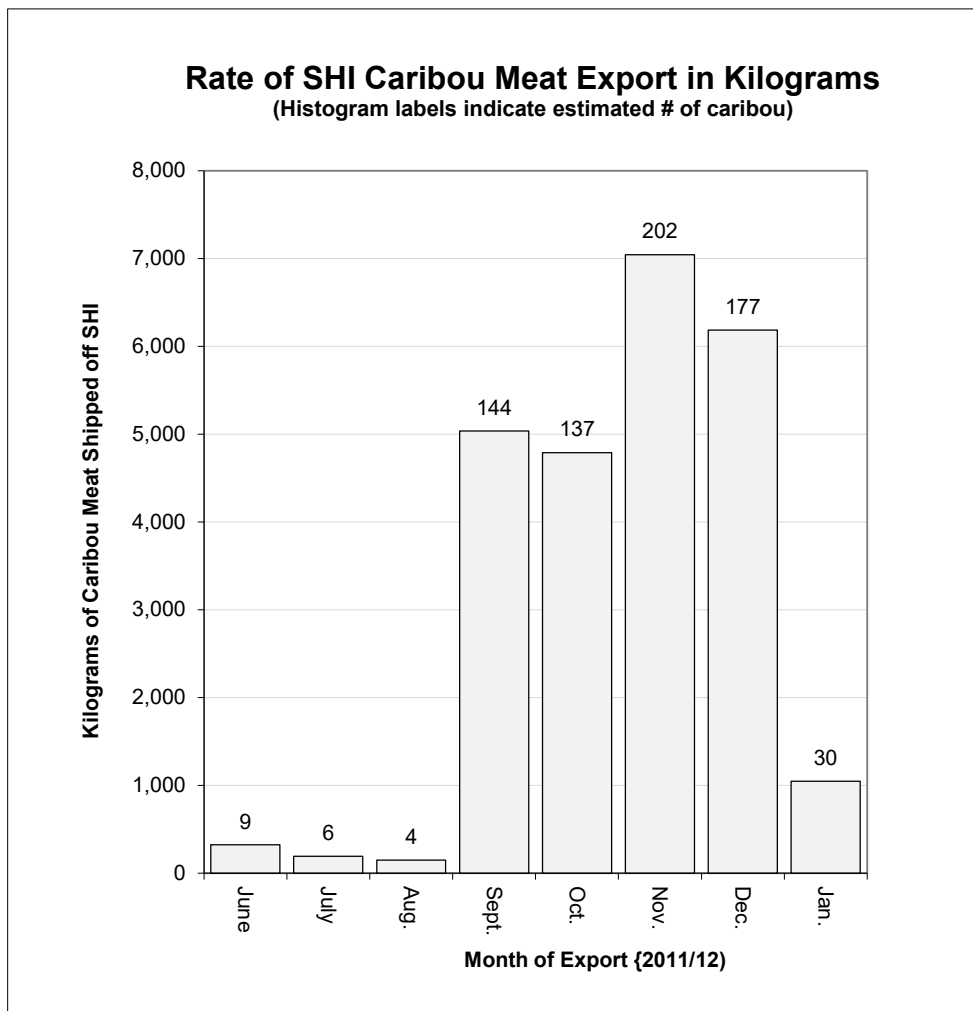
YEAR	Regulated Quotas (TAH)						Total Allowable Harvest (TAH)
	Subsistence				Commercial		
	Female (#)	Male (#)	No Sex Selection (#)	Total (#)	No Sex Selection (#)	Total	
1978	0	25	0	25	0	0	25
1979	0	50	0	50	0	0	50
1980	0	50	0	50	0	0	50
1981	0	50	0	50	0	0	50
1982	0	50	0	50	0	0	50
1983	20	50	0	50	0	0	50
1984	20	50	0	50	0	0	50
1985	20	50	0	50	0	0	50
1986	20	50	0	50	0	0	50
1987	50	250	0	250	0	0	250
1988	0	300	0	300	0	0	300
1989	100	300	0	300	0	0	300
1990	0	400	0	400	0	0	400
1991	0	400	0	400	0	0	400

**Table 7.** History of the Southampton Island harvest assigned commercial and subsistence Quotas (TAH) from 1992 to present (subsistence harvest estimated using government reports and submissions, NWMB meeting correspondence and Harvest Study (2004), HTO correspondence, and personal communications with wildlife staff).

YEAR	Regulated Quotas (TAH)						Total Allowable Harvest (TAH)
	Subsistence				Commercial		
	Female (#)	Male (#)	No Sex Selection (#)	Total (#)	No Sex Selection (#)	Total	
1992	0	400	0	400	250	250	650
1993	no limit	no limit	no limit	no limit	1,000	1000	no limit
1994	NA	NA	1,000	1,000	5,000	5,000	6,000
1995	NA	NA	1,000	1,000	5,000	5,000	6,000
1996	NA	NA	1,000	1,000	5,000	5,000	6,000
1997	no limit	no limit	no limit	no limit	6,000	6,000	no limit
1998	no limit	no limit	no limit	no limit	6,000	6,000	no limit
1999	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2000	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2001	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2002	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2003	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2004	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2005	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2006	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2007	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2008	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2009	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2010	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2011	no limit	no limit	no limit	no limit	6,000	6,000	no limit
2012	NA	NA	1,000	1,000	0	0	1,000
2013	NA	NA	1,000	1,000	0	0	1,000
2014	NA	NA	1,000	1,000	0	0	1,000
2015	NA	NA	1,000	1,000	0	0	1,000
2016	NA	NA	1,600	1,600	0	0	1,600
2017	NA	NA	1,600	1,600	0	0	1,600
2018	NA	NA	1,000	1,000	0	0	1,000
2019	NA	NA	1,000	1,000	0	0	1,000
2020	NA	NA	1,000	1,000	0	0	1,000
2021	NA	NA	1,000	1,000	0	0	1,000
2022	NA	NA	1,000	1,000	0	0	1,000
2023	NA	NA	1,000	1,000	0	0	1,000



**Figure 30.** An examination of quota adjustment and actual harvest based on population estimates (Quota equivalents = estimated maximum subsistence harvest substituted for “no-limit” quota allowance values, Tables 13 and 14).



**Figure 31.** Caribou exports off Southampton Island primarily to Baffin Island communities. Data collected over an 8-month period in 2011/12.

## 4.6 Population Genetics

The 2015 abundance survey results showed a statistically significant mean increase of 5,081 caribou from the previous survey in 2013, an increase that would be difficult to account for through reproductive rates alone. The GN, in partnership with the Coral Harbour HTO, set out to try and confirm the possible mechanism of this increase. Based on information collected over two meetings with the Coral Harbour HTO, the primary mechanism forwarded by the HTO was the movement of caribou onto SHI. Hunter reports of many tracks coming onto the Northwest end of the island from across the sea ice suggested immigration was likely the mechanism causing the increase in caribou abundance. We sought to verify these observations through a genetic analysis of SHI tissue samples from 2014 (collected just following the reported movement) and 2004 (collected a decade prior to the suspected movement). Both these samples would then be compared with archived Qamanirjuaq caribou samples collected in 2012, and caribou samples collected in the vicinity of Naujaat during the winter of 2014, both used to represent eastern Kivalliq mainland herds. The Naujaat samples represented barren-ground caribou closest to SHI though separated by Rose Welcome Sound. We employed Wildlife Genetics International (WGI) to analyze the samples and test the validity of this immigration event hypothesis as the cause of the observed increase in caribou abundance on SHI.

Using Qamanirjuaq Herd samples and samples collected in the vicinity of Naujaat (Repulse Bay) to represent the mainland populations, and starting out by using only the Southampton data from 2004, WGI noted that the dramatic separation of mainland and island populations was not perfectly reflected across all individuals, even in 2004 (Paetkau, 2015) (**Figure 37**). Specifically, a Qamanirjuaq individual C45 (partially red bar in group 2) and an SHI individual 155 (partially green bar in group 4) were estimated to have ~ 35% ancestry in the 'wrong' population. These unusual individuals were previously dismissed as outliers, but that may have been premature: the stark

differences in allele frequencies should have allowed accurate assessments of ancestry using 18 markers (Paetkau, 2015). Upon examining the 2014 samples, WGI found a marked shift between the 2004 and 2014 SHI genotypes, with 3% of the 2004 caribou being estimated to have < 90% SHI ancestry, versus 35% of individuals collected between 2013 and 2014 having < 90% SHI ancestry. Assuming that this shift is not the result of a change in sampling location — the NW region of SHI might show more mainland influence than the south — this change in the genetic composition of the population over the course of a decade is dramatic (Paetkau, 2015).

According to Paetkau (2015), the temporal shift was strong enough to leave little doubt that geneflow had occurred from the mainland to the island sometime after 2004 but prior to 2015. To address the question of ancestry, Paetkau (2015) calculated the likelihood that each genotype in the dataset would have been drawn from either the mainland (using Qamanirjuaq and Naujaat caribou herd DNA samples for allele frequencies) or the Southampton Island group (using 2004 data for SHI) (Paetkau, 2003) (**Figure 38**). Paetkau concluded that with  $P < 0.01$  that any genotype with a lower ratio did not have pure island ancestry, while ratios in excess of -7.8 ( $P < 0.01$ ) had ancestry other than pure mainland.

With consideration to the number of tests conducted and associated hypothesis testing framework, WGI assessed the risk that the outliers are simply Type I errors. Having tested 86 individuals from the mainland, and 58 SHI individuals from 2004, a correction for multiple tests indicated critical values of 0.0006 and 0.0009, respectively, in order to achieve an ‘experimentwise’  $P = 0.05$ , suggesting a genotype with a more extreme  $P$  than those that would be expected to occur through Type I error in 5% of similar datasets (Paetkau, 2015). The  $P$ -values estimated by GeneClass2 for C45 and 158 were 0.0003 and 0.0000, respectively, so these 2004 outliers cannot be explained by chance, even after correcting for the number of individuals tested (Paetkau, 2015). Paetkau therefore concluded that the evidence of movement in both directions (onto and off of the mainland) by 2014, was statistically meaningful. Indeed, both SHI individuals are statistically excluded as purebred members of either source population

(mainland or island), indicating that they are members of the F1, or subsequent, hybrid generation (Paetkau, 2015).

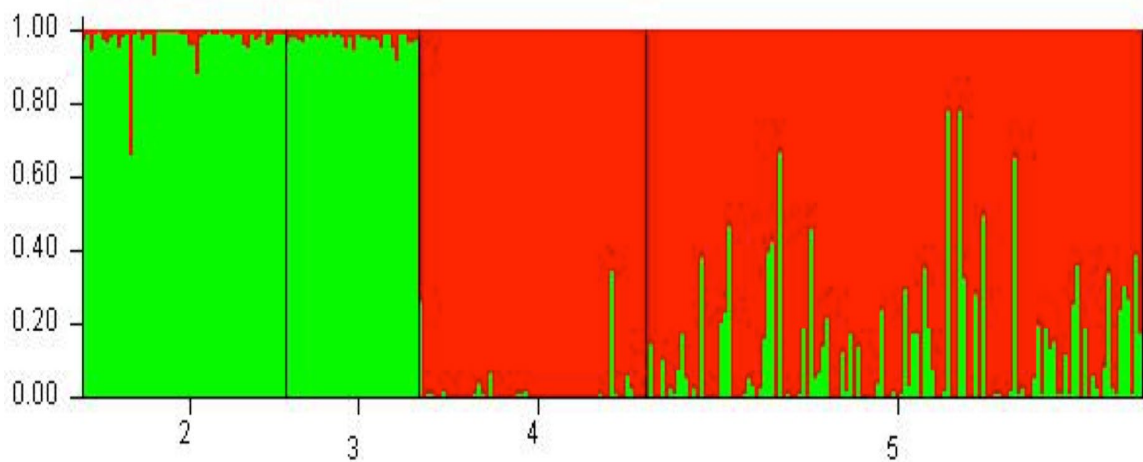
Moving forward a decade, Paetkau (2015) found that 19 of the 127 new 2014 SHI caribou had a likelihood of  $P < 0.01$  that they were from “pure” SHI caribou as represented by the 2004 samples. According to Paetkau 23 individuals produced a  $P$  between 0.05 and 0.01 which individually could be explained as outliers (Type I error). As a group, however, Paetkau believed there were too many outliers to be so easily dismissed, as a Type I error for a dataset of 127 pure SHI animals. In total, Paetkau observed 19 individuals beyond the critical ratio for  $P = 0.01$ , and 42 beyond  $P = 0.05$  suggesting a substantial mainland influence present in 2014 but not present in 2004.

Though the results do not support that a pulse of mainland individuals had moved onto Southampton Island recently, they also do not support that genetic isolation of the island herd has been maintained. Paetkau (2015) points out that samples collected on SHI between 2013 and 2015 did not appear to include any F0 (parental generation) immigrants from the mainland. Paetkau concluded that the analysis has documented that a large proportion of 2014 SHI caribou samples (about 1/3 of the current set) are of F1 (offspring generation) or subsequent-generation hybrid ancestry.

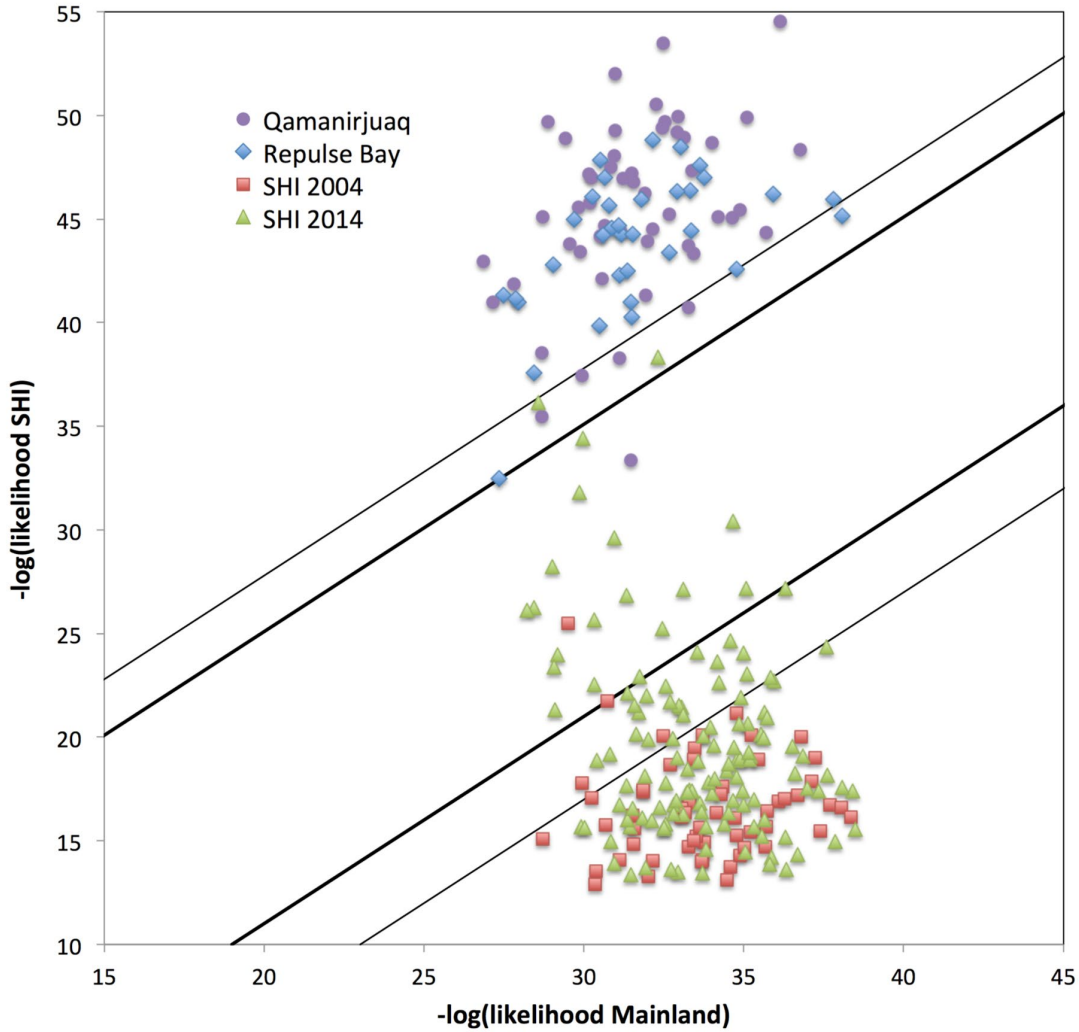
One possible explanation of the absence of apparent F0 immigrants from the mainland could be that such individuals arrived at the northwest corner of the island and took a generation or more to reach as far south as the region where the hunter samples were collected, which is more towards the southcentral extents of SHI. This however, cannot explain the statistically significant increase in caribou abundance along with the local reports of mainland caribou migrating onto SHI between the May 2013 and 2015 surveys. Possible reasons for this finding could be related to a sampling bias whereby hunter samples collected from early 2014 could have missed an immigration event occurring later in the winter. Though unlikely, consideration must also be given to the mainland comparative samples. Most of the samples were collected from areas close to Naujaat creating a second possible sampling bias that could have excluded more northern groups of caribou as potential source populations, such as caribou in the

vicinity of Lyon Inlet. The overall findings seem to suggest that at some point after 2004, SHI caribou likely emigrated to the mainland returning to SHI at some point prior to 2015.

Clearly, additional genetic analysis needs to be undertaken to more accurately determine the cause of the hybridization event documented sometime between 2004 and 2015. Overall, we suggest that local hunter knowledge, and scientific evidence to date, all point to the arrival of a large contingent of caribou onto SHI from an area or areas on the mainland not covered by SHI aerial survey extents.



**Figure 32.** Structure results using 2014 genetic samples. Each column represents an individual, with its estimated proportion of mainland ancestry coded green, and SHI ancestry red. The ‘populations’ are Qamanirjuaq (2; w9741), Naujaat (3; g1616), SHI 2004 (4; w9741) and SHI 2014 (5; g1616) (Paetkau, 2015).



**Figure 33.** Likelihoods of occurrence based on mainland and (2004) island allele frequencies of caribou according to genetic analysis from different populations and years. Resampling in GeneClass2 indicated that 95% of purebred individuals are expected to have likelihood ratios outside the light lines, while 99% should sit beyond the heavy lines. Individuals between the heavy lines, including C45 (purple circle) and 155 (orange square) have genotypes that are rarer than 99% of individuals of either pure mainland or pure island ancestry. These include seventeen 2013–2014 SHI caribou (Paetkau, 2015).

## 5.0 CONCLUSIONS & RECOMMENDATIONS

### 5.1 Aerial Survey Methods

Overall, survey efforts from 1997 to 2023 were relatively precise (CV = 0.055 to 0.087) and were able to track two decades of decline followed by a period of stability within the Southampton Island caribou population. Methods changed over the period, namely from single observer pair configurations from 1997 through 2007, to dependant double observer pair configurations in 2009 to 2015, 2019, and 2023, and to a composite of dependant double observer pair and distance sampling configurations in 2017.

The dependant double observer pair configuration proved to be the most advantageous method, given that front and rear observers switch positions half way through each survey day, and that both front and rear observers are given the prescribed opportunities (see methods) to see the groups while flying along transects. Ensuring that at least one of the observers is experienced for each pair helps ensure unbiased estimates using this approach. The method reduced sightability errors common to the single observer pair method, and provides more precise estimates of wildlife populations. This method was the most effective at correcting estimates when the assumption of perfect sightability was violated. The dependant double observer pair method had other advantages. Incorporating more involvement of community members in research builds local support for the method and survey results, increases training opportunities for observers, improves research capacity in the territory, and incorporates co-management partners in research aspects of wildlife management.

Although the addition of distance sampling methods can further improve survey precision, the task of the observers becomes more challenging, and problems can

arise when using observers with limited experience. In 2017, distance sampling estimates were higher than dependent double observer pair and strip transect estimates. This may have been due to one of the observer pairs not putting enough survey effort to the bins near the aircraft (**Figure 27**) as indicated by different shapes of the detection histograms for the 2 observer pairs. This would cause a negative bias in both strip transect and dependent double observer pair estimates. This illustrates a potential issue with distance sampling, observers spending too much time looking out at further bins which are often easier to view than the closer bins, rather than surveying one strip more thoroughly. The dependant double observer pair method partially accounted for this by also estimating the sighting probabilities of observers near the survey line. In the 2017 case, the observer was identified using dependant double observer records and the error addressed.

Based on our analyses and experience, we suggest that the dependant double observer pair method is the most appropriate method to meet the rigours of quantitative caribou abundance assessments while promoting collaboration with co-management partners. Distance sampling methods, though exceptional in many respects, should only be deployed when experienced observers occupy all observer positions, and, in combination with the dependant or independent double observer pair configuration. If abundance was to decline further on Southampton Island, greater consideration should be given to incorporating distance sampling into survey methods. This may mean working closely with community HTOs to ensure only experienced observers are chosen, to reduce errors which contradict the assumptions of statistical models used in population estimates.

## 5.2 Herd Trend

The SHI caribou population peaked sometime between 1995 and 2000, and has since then declined by an estimated 9% annually up until the 2017 survey estimate. A probable immigration event sometime between May 2013 and May 2015 likely helped to significantly increase abundance by an estimated 5,082 caribou, however, by May 2017 the population trajectory seems to have fallen back into the 9% annual rate of decline trend that was documented up until 2013. This decline turned around between May 2017 and May 2019, when abundance increased to levels similar to 2015 results suggesting stability across the period. Reasons for the decline detected in May 2017 are likely related primarily to three separate mechanisms including harvest, Brucellosis prevalence, and icing and its effects on forage availability during some winters. The increases detected in May 2019 were likely related to the HTO directed reduction in harvest over that period, and possibly a second immigration event, though studies have yet to confirm such an event. Conditions over the 2-year period were favorable with no indications of icing or other extreme weather events. Any one or part of these metrics could have led to the increases observed in 2019.

Brucellosis likely had little influence on abundance trend until 2004 when disease prevalence reached an estimated 40%. As a result, we believe harvest was the main mechanism of decline between 1997 and 2004. One must keep in mind, however, that the reduction in abundance was the goal during this period, as the population was believed to be well beyond the island's carrying capacity of 15,000 caribou (Ouellet, 1993). Since 2004, both the reproductive disease Brucellosis and harvest combined, were likely the main mechanisms of decline. Unfortunately, at this point we are unable to ascribe which of these two primary mechanisms may have had the greater effect on the decline in abundance of SHI caribou. This being said, by 2005, abundance was still above the hypothesized carrying capacity of SHI (Ouellet, 1993), so the management goal of reducing the SHI caribou population remained unchanged. By 2007, herd estimates were below the estimated carrying capacity of 15,000 caribou, however, declines in abundance seemed to slow between 2007 and 2009, based on survey results. Additionally, Brucellosis prevalence was declining by 2009 and, based on hunter reports, general condition/health was increasing. As Brucellosis prevalence

had been steadily decreasing from 2006 through 2009, and the declines over the same period were slowing, the management goals were amended by the Coral Harbour HTO to reduce the Islands commercial harvesting rather than impact the subsistence harvest. Agreement was reached amongst all co-management partners to suspend the commercial harvest after 2009, in an attempt to further stabilize the decline and maintain an abundance that could support the subsistence harvest. Between 2009 and 2011, however, the caribou population significantly dropped by 5,209 animals, the greatest observed decline over any 2-year period. During this period trends in Brucellosis prevalence reversed and climbed to the highest recorded, and pregnancy rates dropped to below 40%, the second lowest recorded since 2000. Additionally, the unanticipated sale of caribou meat through social media, a new form of commercial harvesting protected as a right under the Nunavut Agreement, began in 2010 and reached levels believed to have exceeded the subsistence harvest over the 2011/2012 harvesting season. It appears that during this period, disease and harvest together were driving the population down. With the formal commercial harvest already stopped in 2009, the Coral Harbour HTO and GN had little option but to apply a TAH to reduce the subsistence harvest as an attempt to control the sale of caribou meat, primarily to Baffin communities, through social media.

The statistically significant increase in the SHI caribou population between May 2013 and May 2015, subsequent decline of an estimated 9% between 2015 and 2017, and 9% increase between 2017 and 2019, has been difficult to explain based on survey results and/or reproductive rates alone. Genetic studies conducted as a follow-up to hunter observations of an immigration event between the winters of 2013 to 2015, suggest a large group of caribou had come onto the island from the mainland. Further analysis found that the caribou that immigrated onto SHI maintained SHI lineage, suggesting an emigration event of SHI caribou off SHI to the mainland prior to the 2013-2014 sampling program but after the 2004 sampling. Further analysis will be required to provide insight as to whether a similar migration event could have had a similar effect on the increases detected between 2013 and 2015, and 2017 and 2019.

However, the genetic work did indicate that sometime between 2004 and 2015, a significant mixing of mainland and SHI caribou occurred.

The recent 2023 results suggest little has changed since 2019 with the population showing stability. More analysis comparing consecutive years of SHI genotypes, with a more geographically broad collection of caribou genetic samples from coastal areas bordering SHI, will be necessary in order to more effectively explore possible mainland connections and reduce potential sampling bias that may be masking actual events. Although it is only a remote possibility, we believe that SHI caribou reproductive potential alone is unlikely to have accounted for the 41% increase estimated between 2013 and 2015, though would not be out of the realm of possibility to have accounted for the increases observed between 2017 and 2019.

### **5.3 Future Management**

Another survey proposed for May 2026 will further assess the maintenance of the detected stability between May 2015 and May 2023. Should a renewed decline be observed, discussions with the Coral Harbour HTO and other stakeholders regarding the consideration of a further reduction in TAH will have to be arranged shortly following the surveys completion, in an attempt to try and safeguard against associated long-term hardship to the residents of Coral Harbour. Should survey results suggest continued stability, or an increase in caribou abundance, consultations on maintaining the current TAH (in the case of stability), or increasing and/or removing the TAH, (wholly dependant on the magnitude of any detected increase), will be discussed with all stakeholders.

The mechanisms driving the changes in abundance observed over the entire survey history of the Southampton Island caribou population are multiple, and difficult to isolate and quantify, suggesting that further research is required. It appears that the

main drivers have been the disease *Brucella suis* Type IV, harvest (with emphasis on the sale of caribou meat through social media), and poor winter weather, primarily in the form of icing events in some years. Clearly the need to continue monitoring disease prevalence in SHI caribou is required if we are to understand present day infection rates and associated productivity for the herd. Recently, hunters have reported fewer caribou with signs of disease, and a noticeable increase in the number of calves observed in 2015 through 2023 which suggests that disease prevalence may be decreasing further. If this is the case, and Brucellosis no longer represents a significant mechanism of decline, then harvest, along with weather, and condition monitoring, should become the focus of future monitoring for the SHI herd. Additionally, more effective means of monitoring the harvest, and any exports of caribou meat off the island will be critical in understanding the true extent of the harvest for both subsistence and meat sales. At present these tools are not available to enforcement officers within Nunavut, suggesting that further thought and required amendments to current harvesting regulations, and perhaps the Nunavut Agreement itself, should be seriously considered by wildlife management organizations and the Government of Nunavut. Attempts to control the sale of caribou meat through social media have failed under the current Management regime and consideration should be given to addressing this issue through amendments to legislation. In recent consultations with Kivalliq community HTOs, all communities expressed a willingness to address the problem in this way, suggesting that some mutual agreement could be reached to more permanently resolve this issue. If nothing is done to monitor this novel and growing mechanism of caribou meat sales, we fear the problem will grow more serious for Nunavut's subsistence harvesters as more and more caribou populations within Nunavut will be managed through the establishment of a TAH.

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September 26, 2025

## **NTI Submission for NWMB Regular Meeting 003-2025, Agenda item 4: Establishing the Basic Needs Level for Southampton Island Caribou**

### **Overview of NTI's Position**

Nunavut Tunngavik Inc. (NTI) maintains its request that the Nunavut Wildlife Management Board (NWMB or Board) postpone the Southampton Island Caribou Basic Needs Level (BNL) decision in order to resume the hearing for this matter that it started in December 2013 and adjourned in 2014. NTI originally made this request in its April 7, 2025 letter to the NWMB and in its follow up letter of July 23, 2025.

NTI understands and respects the NWMB's intent to resume making BNL decisions for terrestrial wildlife and fish. However, there is no urgency to the Southampton Island Caribou BNL decision, particularly since the 2019 Total Allowable Harvest remains in place to address conservation concerns. In contrast, making the BNL decision now will have two detrimental consequences:

1. Proceeding to a major, precedent-setting decision about how to calculate BNLs under Article 5 of the *Nunavut Agreement* without first completing the public hearing that the NWMB paused in 2014 will breach procedural fairness.
2. It will preclude the opportunity for NTI and the Governments of Nunavut and Canada to seek to reach consensus on a proposal, for the NWMB's consideration, on how to interpret and implement Article 5 BNL provisions, and instead put this matter on track for potential litigation, which entails costs, uncertainty and delays.

### **Procedural Fairness**

As the NWMB's July 18, 2024 "Basic Needs Level Policy Memo" (2024 BNL Memo) notes, the question of how to calculate BNLs has been contentious. The Board's own views on the matter have changed over time. Its previous position, prior to the 2024 BNL Memo, was that all Inuit commercial harvesting is included in the BNL, regardless of where wildlife is sold: the NWMB adopted that interpretation of Article 5 in its 2009 BNL decision for Kinngait char (which the Minister of the Department of Fisheries and Oceans then rejected).

While the 2024 BNL Memo communicates the NWMB's changed position on how to calculate BNLs, it does not explain why it has adopted the Steering Committee's interpretation of what the BNL includes. In NTI's view, this lack of transparency on such a major issue as well as the failure to complete the paused Southampton Island Caribou BNL in order to inform the NWMB's decision, breach the principles of procedural fairness.

The NWMB has also not yet indicated how it intends to address the widely acknowledged shortcoming of the Nunavut Wildlife Harvest Study (Harvest Study), namely its inaccurate capture of Inuit harvest levels, even with respect to the Steering Committee's own direction of which harvests were to be recorded for the purpose of informing BNL calculations. NTI urges the NWMB to invite submissions from all parties on how to establish BNLs that implement Inuit priority access to wildlife, a fundamental right that is critical to Inuit food security, economic security, and well-being in a way that fully achieves the Article 5 objectives in light of the limitations of the Harvest Study.

### **Creating the Opportunity for Consensus-Building**

The NWMB should create space and opportunity for NTI and the Governments of Nunavut and Canada to develop a shared proposal for how to interpret and implement the Article 5 BNL provisions, for the NWMB's consideration. A consensual outcome on this critical aspect of wildlife management would be far preferable to litigation and the costs, uncertainty, and delays associated with resolving the matter in court.

Litigation is not inevitable. Although it is true that NTI, the Government of Nunavut, and the Government of Canada have not yet reached a shared understanding of how to calculate the BNL since the NWMB suspended the Southampton Island Caribou hearing in early 2014, this is not because wildlife co-management partners hit an impasse. Rather, the issue went dormant after the NWMB suspended the Southampton Island Caribou hearing and the parties turned their attention to other wildlife management issues. Over a decade has passed, and it is worth creating a final opportunity for consensus-seeking, especially in light of changed circumstances and the progress that has been made in Crown-Inuit reconciliation. For example:

- NTI, the Government of Nunavut, and the Department of Fisheries and Oceans have established a collaborative and productive working relationship co-developing Nunavut Fishery Regulations, and they are building consensus on challenging Article 5 implementation issues. This gives the parties a strong foundation upon which to explore their respective views, interests and concerns in relation to the BNL methodology. NTI is keen for dialogue, as confirmed in our correspondence to the NWMB and in informal outreach to the Government of Nunavut and the Department of Fisheries and Oceans (DFO). DFO may also be willing to explore this issue, and hopefully the Government of Nunavut is as well, at least once its election period is over.
- In 2023, the federal Crown adopted *Canada's Collaborative Modern Treaty Implementation Policy*, which provides new guidance for interpreting and implementing modern treaties. Sections 3.8, 3.9, 3.10, 4.1 and 4.3(d) of that Policy in particular suggest Canada may be willing to return to the BNL issue and

seek to reach consensus with Inuit on how to interpret and implement those Article 5 provisions.

The NWMB would only need to defer its BNL decision for a relatively brief time period to provide the opportunity for consensus building on this significant Article 5 issue. NTI would welcome the NWMB setting a time limit within the coming months on the window for consensus-seeking to keep this matter on track for decision.

### **NTI's Requests**

In summary, NTI requests that the NWMB:

1. postpone its BNL decision for Southampton Island Caribou;
2. resume the hearing on this matter that it paused in 2014 to hear submissions from its wildlife co-management partners; and
3. encourage NTI, the Government of Nunavut and the Government of Canada to seek to build consensus on a proposal for interpreting and applying the Article 5 BNL provisions in advance of the hearing.

Respectfully submitted by:



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