

## INUIT HARVEST DATA IN QIKIQTAIT PROTECTED AREA DEVELOPMENT

SANIKILUARMIUT HARVEST DATA FOR QIKIQTAIT PROTECTED AREA  
DEVELOPMENT: EXPLORING THE CAPACITY OF SIKU TO SUPPORT  
INUIT-LED CONSERVATION

By REGENA SINCLAIR, B.A.S, A.D.G.I.S.A

A Thesis submitted to the School of Earth, Environment, and Society in partial fulfillment of  
the requirements for the Degree Master of Arts

**McMaster University** © Copyright Regena Sinclair, January 2024

McMaster University MASTER OF ARTS (2024) Hamilton, Ontario (Geography)

TITLE: Sanikiluarmit harvest data for Qikiqtaik Protected Area development: Exploring the capacity of SIKU to support Inuit-led conservation AUTHOR: Regena Sinclair, B.A.S (University of Guelph), A.D.G.I.S.A (Vancouver Island University) SUPERVISOR: Professor G. Ljubicic NUMBER OF PAGES: xix, 263

## **LAY ABSTRACT**

Inuit-led conservation initiatives are recognized as a component of Inuit self-determination. This project aims to support the development of the Inuit-led Qikiqtait Protected Area (Qikiqtait) around the Belcher Islands Archipelago, Nunavut. Harvest data for 14 key species was collected by Sanikiluarmit (people of Sanikiluaq) from April 1, 2020 – March 31, 2022 using SIKU: The Indigenous Knowledge Social Network. This harvest data was used to:

1. Contribute to a harvest resource inventory using Inuit harvester data;
2. Compare the harvest resource inventory data to Qikiqtait management priorities;
3. Explore the capacity of SIKU as a tool to contribute to community-based monitoring and Inuit-led protected area development and management.

Results added to a baseline harvest resource inventory and identified harvest seasonality, showing that SIKU is an effective tool to use in Qikiqtait planning. This research contributes to the body of work supporting long-term Inuit-led environmental monitoring to promote Inuit decision-making.

## ABSTRACT

Inuit-led conservation initiatives are being increasingly recognized for their ability to engage community members, support the harvesting of country food, support long-term environmental monitoring, and promote Inuit self-determination. My MA research was conducted in partnership with the Arctic Eider Society and the Sanikiluaq Qikiqtait Steering Committee. The goal was to support the development of the Inuit-led Qikiqtait Protected Area (Qikiqtait) around the Belcher Islands Archipelago, Nunavut, using harvester data collected on SIKU: The Indigenous Knowledge Social Network. Sanikiluarmit (people of Sanikiluaq) harvest data for 14 key species collected from April 1, 2020 – March 31, 2022, was used to address the following research objectives: i) contribute to the Qikiqtait harvest resource inventory using Inuit harvester data collected on SIKU; ii) compare the harvest resource inventory data to Qikiqtait management priorities; and, iii) explore the capacity of SIKU as a tool to contribute to a community environmental monitoring approach to Inuit-led protected area development and ongoing management. A temporal and spatial analysis was conducted to show harvest density patterns and changes over time. These results showed a change in harvest timing and location for most species over the analysis period and identified the seasonality of Sanikiluarmit harvesting. This harvest resource inventory creates baseline data for key species that can be used to identify and assess harvesting trends over time. The results of a comparative spatial analysis revealed that the harvest data could complement previously identified Qikiqtait priority areas. The results of this research showed that SIKU is an effective tool to use in Qikiqtait development and can support long-term wildlife monitoring. Recommendations are made to further increase the capacity of the app to address community priorities. This research contributes to the body of work supporting long-term Inuit-led environmental monitoring to promote Inuit decision-making.

## ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisor, Gita Ljubicic, for her support, encouragement, kindness, and fathomless patience (which I tested frequently) throughout my time in this master's. This research would not have been possible without her knowledge, direction, and contributions. What I learned from you transcends the boundaries of this project, and I hope to emulate the strength and compassion you bring to your work and the way you make those around you feel respected and valued.

Thank you to my research partners at the Arctic Eider Society and the Sanikiluaq Qikiqtait Steering Committee for welcoming me into this project. Firstly, thank you to Joel Heath, who invited me to be part of the Qikiqtait project, and was my main contact throughout this research. Your guidance and feedback were invaluable, and I appreciate the opportunity to work together to support Qikiqtait priorities. Lucassie Arragutainaq, your dedication to fostering Inuit-led research is an inspiration, and I am thankful to have had the opportunity to learn from you. Johnny Kudluarok, thank you for your support during my ArcticNet 2022 presentation, and offering your expertise throughout the project. Lucassie and Johnny, your feedback was instrumental in this research, and I am so grateful I had the chance to meet you and review maps together in-person in Toronto. Thank you to Mick Appaqaq for offering your knowledge and helping me along with species identification in the early stages of this project. The dialect and translation work completed by Lisi Kavik-Mickiyuk added an important element to this research, and I am grateful to Lisi and Ilia Nicoll for all your efforts to improve Inuktitut language options on SIKU. It was wonderful to watch you work, and to spend time with such warm, lovely people.

It was terrific to be involved in this project, and to learn from all of you.

This research was supported by funding from McMaster University Graduate Scholarships and the Canadian Research Chair Program (Dr. Ljubicic).

Some of the spatial data used in this project was provided by the Nunavut Planning Commission (NPC). Thank you to Adrian Gerhartz for supplying this data, and to the NPC for supporting this research.

The StraightUpNorth (SUN) Team was a constant source of motivation, and I want to say a special thank you for all the helpful feedback, learning opportunities, and occasions to get to know all of you wonderful people. I look forward to losing more board games in the future.

To my parents, Shawn Sinclair and Eileen Isaac, thank you for always supporting me. It means the world to me that you are my biggest fans. Dad, thanks for always taking care of my vehicles, and reminding me to see the joy in the everyday. Mom, thanks for always being my favourite teacher and pushing me to new levels in academia and life. I love you both so much.

Last, but not least, thank you to my fiancé, Jordan Heppell, for keeping me fed and loved through the stress, all-nighters, and the emotional roller coaster ride that was the past three years. You always believe in me, even when I do not believe in myself. I love you and your distractions from here to space, space, space.

A special mention to Beau, Sacha, Kalti, and Lana for always being such good dogs. You will always have my heart. 🐾

## TABLE OF CONTENTS

Lay Abstract.....	iv
Abstract .....	v
Acknowledgements.....	vi
Table of Contents .....	viii
List of Illustrations .....	xii
List of Appendices .....	xvii
List of Abbreviations .....	xviii
<b>1 Introduction.....</b>	<b>1</b>
1.1 Project Evolution .....	11
1.2 Project Goals.....	13
1.3 Research Question and Objectives.....	14
1.4 Positionality Statement .....	15
1.5 Thesis Outline .....	17
<b>2 Literature Review .....</b>	<b>18</b>
2.1 Conservation Methods and Programs in Canada .....	18
2.1.1 History of Canadian Conservation Policy.....	18
2.1.1.1 The New Paradigm .....	19
2.1.1.2 Wildlife Management .....	21
2.2 Inuit-led Conservation Initiatives .....	22
2.2.1 Nunavut Governing Bodies and Agreements .....	22
2.2.2 Inuit Co-managed National Parks and Marine Protected Areas .....	23
2.2.3 Indigenous Protected and Conserved Areas.....	25
2.2.4 Conservation Economies .....	26
2.3 Components of Indigenous Monitoring in Conservation Initiatives.....	28
2.3.1 Indigenous Community-Engaged Research.....	28
2.3.2 Distinguishing Indigenous Harvester Knowledge and Citizen Science .....	31
2.3.3 Use of Indigenous Community-Based Monitoring for Conservation.....	33
2.3.4 Data Ownership and Sovereignty .....	36
2.3.5 Use of GIS and Mobile Smartphone Apps in Conservation .....	38
2.4 Drivers of Qikiqtait Development.....	41
<b>3 Methods.....</b>	<b>44</b>

3.1	Research Partners .....	44
3.2	Research Approach .....	44
3.2.1	COVID-19 Pandemic and Communications.....	50
3.3	Data Sources and Permissions .....	52
3.3.1	SIKU and the Qikiqtait Project .....	52
3.3.2	Community-identified Priority Areas for Qikiqtait .....	59
3.3.3	Ethics and Project Approvals.....	60
3.3.4	Handling of Sensitive Information.....	62
3.4	Data Preparation.....	63
3.4.1	Temporal Scope .....	63
3.4.2	Species Selection .....	64
3.4.3	Qikiqtait Project Users .....	65
3.4.4	Quality Control/Quality Assurance Process and Results.....	67
3.5	Data Analysis and Visualization .....	77
3.5.1	Temporal Visualization.....	77
3.5.1.1	Harvest Posts and Harvest Totals per Day .....	78
3.5.1.2	Three-Day Moving Window Average of Total Annual Harvest .....	78
3.5.1.3	Percentage of Total Annual Harvest per Day .....	79
3.5.1.4	Harvest Seasonality .....	80
3.5.2	Spatial Analysis .....	80
3.5.2.1	Harvest Post Location Density .....	84
3.5.2.2	Harvest Location Density .....	85
3.5.2.3	Inter-annual Harvest Density Change.....	85
3.5.2.4	Harvest Density Comparison to Community-Identified Priority Areas.....	86
<b>4</b>	<b>Results and Discussion.....</b>	<b>87</b>
4.1	Data Interpretation Considerations .....	87
4.2	Harvesting Overview .....	88
4.2.1	Harvest Posts and Harvest Totals per Day.....	88
4.2.2	Percentage of Total Annual Posts and Harvest.....	90
4.2.3	Harvest Seasonality.....	95
4.2.4	Harvest Spatial Distribution (Harvest Post and Harvest Density) .....	99
4.2.5	Inter-annual Harvest Density Change.....	102

4.2.6	Harvest Density Comparison to Community-Identified Priority Areas.....	104
4.3	Arctic Char Harvest .....	110
4.3.1	Harvest Post Totals .....	110
4.3.2	Daily Average of Annual Harvest Totals.....	112
4.3.3	Percentage of Total Annual Harvest per Day .....	113
4.3.4	Harvest Spatial Distribution (Post and Harvest Density) .....	114
4.3.5	Inter-annual Harvest Density Change .....	115
4.3.6	Harvest Density Comparison to Community-Identified Priority Areas.....	119
4.4	Common Eider Harvest.....	122
4.4.1	Daily Average of Annual Harvest Totals.....	122
4.4.2	Percentage of Total Annual Harvest per Day .....	122
4.4.3	Harvest Spatial Distribution (Harvest Density) .....	123
4.4.4	Inter-annual Harvest Density Change .....	124
4.4.5	Harvest Density Comparison to Community-Identified Priority Areas.....	126
4.5	Ringed Seal Harvest.....	128
4.5.1	Daily Average of Annual Harvest Totals.....	128
4.5.2	Percentage of Total Annual Harvest per Day .....	130
4.5.3	Harvest Spatial Distribution (Harvest Density) .....	131
4.5.4	Inter-annual Harvest Density Change .....	132
4.5.5	Harvest Density Comparison to Community-Identified Priority Areas.....	134
4.6	Canada/Cackling Goose Harvest .....	137
4.6.1	Daily Average of Annual Harvest Totals.....	137
4.7	Berry Harvest .....	139
4.7.1	Harvest Seasonality .....	139
4.7.2	Harvest Spatial Distribution (Harvest Density) .....	140
4.8	Considerations When Using SIKU and Harvester-collected Data in Qikiqtait and Other Community-Based Conservation Monitoring Projects .....	141
4.8.1	User Contributions to the Qikiqtait Project and SIKU App .....	141
4.8.2	Data Accuracy and Usability .....	143
4.8.3	Data Sensitivity Considerations .....	145
4.8.4	Support for Community-based Conservation Projects .....	146
<b>5</b>	<b>Conclusions.....</b>	<b>148</b>

5.1	Significance of Work .....	148
5.2	SIKU and Protected Area Decision-making .....	149
5.2.1	Qikiqtait Project Data .....	149
5.2.2	Community Engagement .....	151
5.2.3	Contribution to Long-term Environmental Monitoring.....	152
5.2.4	SIKU as a Tool to Support Protected Area Projects .....	153
5.3	Future Considerations and Recommendations.....	154
5.3.1	For SIKU.....	154
5.3.1.1	Community Engagement in Decision-making .....	156
5.3.1.2	User Training and Workshops .....	156
5.3.1.3	Simplified Graphic User Interface.....	158
5.3.1.4	Additional Bulk Harvest Reporting Parameters .....	159
5.3.1.5	Language/Dialect Improvements.....	161
5.3.2	For the Sanikiluaq Qikiqtait Steering Committee.....	162
5.3.2.1	Trip Analysis .....	162
5.3.2.2	Egg/Down Analysis and Hatching Timing Analysis.....	163
5.3.2.3	Age and Sex Metrics in Harvesting Analysis .....	163
5.3.2.4	Capture Method Analysis Based on Quality Control/Quality Assurance, Seasonality or Photograph.....	164
5.3.2.5	Observation Analysis.....	164
5.3.2.6	Analysis to Support Harvesting .....	165
5.3.2.7	Include Interviews, Historic Material and Traditional Harvesting Area Data in Analysis.....	165
5.3.2.8	Including Biological Parameters.....	167
5.3.2.9	Arctic Char Analysis.....	167
5.3.2.10	Compare to Other Wildlife Research and Government Sources .....	168
5.3.2.11	Compare Harvest Data to Satellite Data of Sea Ice .....	169
5.3.3	For Government, Non-governmental Organizations, and Researcher Partners .....	170
5.4	SIKU Supporting the Vision for Qikiqtait .....	171
<b>6</b>	<b>References .....</b>	<b>174</b>

## LIST OF ILLUSTRATIONS

### TABLES

<b>Table 2.1:</b> Location of some co-managed National Parks and Marine Protected/Conservation Areas in Inuit Nunangat.....	24
<b>Table 3.1:</b> Key partners and their respective roles and responsibilities in this research project .....	45
<b>Table 3.2:</b> Description of the methods of recording data available on the SIKU platform .....	54
<b>Table 3.3:</b> List of analysis species.....	66
<b>Table 4.1:</b> Percentage of annual posts by species recorded in the Qikiqtait Project.....	91
<b>Table 4.2:</b> Harvest post and harvest total difference per species between years .....	92
<b>Table 4.3:</b> Percentage of annual harvest by species recorded in the Qikiqtait Project .....	93
<b>Table 5.1:</b> Thesis contributions for various audiences.....	150
<b>Appendix Table 5.1:</b> Species search keywords used in the Qikiqtait Project.....	216
<b>Appendix Table 8.1:</b> Kernel Density tool parameters – Post and Harvest Density.....	241
<b>Appendix Table 8.2:</b> Locate Regions tool parameters.....	242

## FIGURES

<b>Figure 1.1:</b> Map of the Belcher Islands Archipelago and the Hamlet of Sanikiluaq .....	4
<b>Figure 1.2:</b> Proposed Qikiqtait Protected Area boundaries .....	10
<b>Figure 3.1:</b> Iterative research approach used in this project .....	50
<b>Figure 3.2:</b> Completed SIKU Wildlife Hunting Story Post .....	55
<b>Figure 3.3:</b> Completed SIKU Trip .....	56
<b>Figure 3.4:</b> SIKU Qikiqtait Project approach .....	57
<b>Figure 3.5:</b> Qikiqtait Project user homepage .....	58
<b>Figure 3.6:</b> Community-identified priority areas for Qikiqtait Protected Area .....	61
<b>Figure 3.7:</b> User posting frequency in the Qikiqtait Project .....	68
<b>Figure 3.8:</b> Harvest post and harvest totals in the Qikiqtait Project for the two-year analysis period prior to, and after the QC/QA process .....	75
<b>Figure 3.9:</b> Harvest post totals in the Qikiqtait Project for the two-year analysis period prior to, and after the QC/QA process .....	76
<b>Figure 3.10:</b> Harvest post and harvest total difference in the Qikiqtait Project for the two- year analysis period prior to, and after, the QC/QA process .....	77
<b>Figure 3.11:</b> Built up areas around the Hamlet of Sanikiluaq and the Sanikiluaq airport that were excluded from analysis.....	83
<b>Figure 4.1:</b> Bird, fish, and mammal species daily harvest post and daily recorded harvest totals .....	89
<b>Figure 4.2:</b> Seasonal harvesting wheel of key species to Sanikiluarmitut.....	96
<b>Figure 4.3:</b> Average harvest windows for all analysis species .....	97
<b>Figure 4.4:</b> Density of Qikiqtait Project harvest posts for all 14 analysis species for both analysis years .....	101
<b>Figure 4.5:</b> Harvest density of all 14 analysis species for both analysis years .....	103
<b>Figure 4.6:</b> Harvest density difference over time for all 14 analysis species .....	105
<b>Figure 4.7:</b> Top five harvest intensity regions for all 14 analysis species compared to community-identified priority areas .....	108
<b>Figure 4.8:</b> Overlap between the harvest intensity regions for all 14 analysis species combined and the community-identified priority areas .....	109
<b>Figure 4.9:</b> Arctic char daily harvest post totals .....	111

<b>Figure 4.10:</b> Three-day moving average of daily Arctic char harvest .....	113
<b>Figure 4.11:</b> Daily percentage of the total annual harvest for Arctic char.....	114
<b>Figure 4.12:</b> Density of Qikiqtaik Project harvest posts for Arctic char for both analysis years .....	116
<b>Figure 4.13:</b> Arctic char harvest density for both analysis years .....	117
<b>Figure 4.14:</b> Harvest density difference over time for Arctic char .....	118
<b>Figure 4.15:</b> Top four harvest intensity regions for Arctic char compared to community- identified priority areas .....	120
<b>Figure 4.16:</b> Overlap between the top four harvest intensity regions for Arctic char and the community-identified priority areas.....	121
<b>Figure 4.17:</b> Three-day moving average of daily common eider harvest .....	123
<b>Figure 4.18:</b> Daily percentage of the total annual harvest for common eider.....	124
<b>Figure 4.19:</b> Common eider harvest density for both analysis years .....	125
<b>Figure 4.20:</b> Harvest density difference over time for common eider .....	127
<b>Figure 4.21:</b> Top six harvest intensity regions for juvenile and adult common eider compared to community-identified priority areas.....	129
<b>Figure 4.22:</b> Overlap between the top six harvest intensity regions for common eider and the community-identified priority areas.....	130
<b>Figure 4.23:</b> Three-day moving average of daily ringed seal harvest.....	131
<b>Figure 4.24:</b> Daily percentage of the total annual harvest for ringed seal .....	132
<b>Figure 4.25:</b> Ringed seal harvest density for both analysis years .....	133
<b>Figure 4.26:</b> Harvest density difference over time for ringed seal .....	135
<b>Figure 4.27:</b> Top five harvest intensity regions for ringed seal compared to community- identified priority areas .....	136
<b>Figure 4.28:</b> Overlap between the top five harvest intensity regions for ringed seal and the community-identified priority areas.....	137
<b>Figure 4.29:</b> Three-day moving average of daily Canada/cackling goose harvest .....	138
<b>Figure 4.30:</b> Seasonal harvest curves for blueberry, cloudberry, crowberry, and lingonberry .....	140
<b>Figure 4.31:</b> Blueberry harvest density for both analysis years.....	142
<b>Appendix Figure 1.1:</b> SIKU platform Terms of Use, as of September 2023.....	195
<b>Appendix Figure 1.2:</b> SIKU Privacy Policy, as of September 2023.....	200

<b>Appendix Figure 2.1:</b> SIKU promotional image.....	203
<b>Appendix Figure 2.2:</b> Example of a SIKU user profile.....	204
<b>Appendix Figure 3.1:</b> Thesis project Letter of Information.....	205
<b>Appendix Figure 3.2:</b> Thesis Project Summary.....	208
<b>Appendix Figure 6.1:</b> Three-day moving average of daily harvest for all 14 analysis species.....	218
<b>Appendix Figure 6.2:</b> Three-day moving average of daily harvest for blueberry.....	219
<b>Appendix Figure 6.3:</b> Three-day moving average of daily harvest for cloudberry.....	220
<b>Appendix Figure 6.4:</b> Three-day moving average of daily harvest for crowberry.....	221
<b>Appendix Figure 6.5:</b> Three-day moving average of daily harvest for lingonberry.....	222
<b>Appendix Figure 6.6:</b> Three-day moving average of daily harvest for Arctic scallop...	223
<b>Appendix Figure 6.7:</b> Three-day moving average of daily harvest for blue mussel.....	224
<b>Appendix Figure 6.8:</b> Three-day moving average of daily harvest for green urchin....	225
<b>Appendix Figure 6.9:</b> Three-day moving average of daily harvest for Arctic fox.....	226
<b>Appendix Figure 6.10:</b> Three-day moving average of daily harvest for bearded seal...	227
<b>Appendix Figure 6.11:</b> Three-day moving average of daily harvest for whitefish.....	228
<b>Appendix Figure 7.1:</b> Daily percentage of the total annual harvest for all 14 analysis species.....	229
<b>Appendix Figure 7.2:</b> Daily percentage of the total annual harvest for blueberry.....	230
<b>Appendix Figure 7.3:</b> Daily percentage of the total annual harvest for cloudberry.....	231
<b>Appendix Figure 7.4:</b> Daily percentage of the total annual harvest for crowberry.....	232
<b>Appendix Figure 7.5:</b> Daily percentage of the total annual harvest for lingonberry.....	233
<b>Appendix Figure 7.6:</b> Daily percentage of the total annual harvest for Arctic scallop..	234
<b>Appendix Figure 7.7:</b> Daily percentage of the total annual harvest for blue mussel....	235
<b>Appendix Figure 7.8:</b> Daily percentage of the total annual harvest for green urchin...	236
<b>Appendix Figure 7.9:</b> Daily percentage of the total annual harvest for Arctic fox.....	237
<b>Appendix Figure 7.10:</b> Daily percentage of the total annual harvest for bearded seal..	238
<b>Appendix Figure 7.11:</b> Daily percentage of the total annual harvest for Canada/cackling goose.....	239
<b>Appendix Figure 7.12:</b> Daily percentage of the total annual harvest for whitefish.....	240
<b>Appendix Figure 9.1:</b> Cloudberry harvest density for both analysis years.....	243
<b>Appendix Figure 9.2:</b> Crowberry harvest density for both analysis years.....	244

<b>Appendix Figure 9.3:</b> Lingonberry harvest density for both analysis years.....	245
<b>Appendix Figure 9.4:</b> Arctic scallop harvest density for both analysis years.....	246
<b>Appendix Figure 9.5:</b> Blue mussel harvest density for both analysis years.....	247
<b>Appendix Figure 9.6:</b> Green urchin harvest density for both analysis years.....	248
<b>Appendix Figure 9.7:</b> Arctic fox harvest density for both analysis years.....	249
<b>Appendix Figure 9.8:</b> Bearded seal harvest density for both analysis years.....	250
<b>Appendix Figure 9.9:</b> Canada/cackling goose harvest density for both analysis years.....	251
<b>Appendix Figure 9.10:</b> Whitefish harvest density for both analysis years.....	252
<b>Appendix Figure 10.1:</b> Harvest density difference over time for blueberry.....	253
<b>Appendix Figure 10.2:</b> Harvest density difference over time for cloudberry.....	254
<b>Appendix Figure 10.3:</b> Harvest density difference over time for crowberry.....	255
<b>Appendix Figure 10.4:</b> Harvest density difference over time for lingonberry.....	256
<b>Appendix Figure 10.5:</b> Harvest density difference over time for Arctic scallop.....	257
<b>Appendix Figure 10.6:</b> Harvest density difference over time for blue mussel.....	258
<b>Appendix Figure 10.7:</b> Harvest density difference over time for green urchin.....	259
<b>Appendix Figure 10.8:</b> Harvest density difference over time for Arctic fox.....	260
<b>Appendix Figure 10.9:</b> Harvest density difference over time for bearded seal.....	261
<b>Appendix Figure 10.10:</b> Harvest density difference over time for Canada/cackling goose.....	262
<b>Appendix Figure 10.11:</b> Harvest density difference over time for whitefish.....	263

## LIST OF APPENDICES

<b>APPENDIX 1: SIKU Policies.....</b>	<b>195</b>
<b>APPENDIX 2: SIKU Interface .....</b>	<b>203</b>
<b>APPENDIX 3: Project Letter of Information and Project Summary.....</b>	<b>205</b>
<b>APPENDIX 4: SIKU Post Quality Control/Quality Assurance and Data Preperation</b> <b>Workflow .....</b>	<b>209</b>
<b>APPENDIX 5: SIKU Post Species Keywords.....</b>	<b>216</b>
<b>APPENDIX 6: Three-Day Moving Window Average of Total Annual Harvest</b> <b>Graphs .....</b>	<b>218</b>
<b>APPENDIX 7: Percentage of Total Annual Harvest per Day Graphs .....</b>	<b>229</b>
<b>APPENDIX 8: Mapping Parameters.....</b>	<b>241</b>
<b>APPENDIX 9: Harvest Location Density Maps.....</b>	<b>243</b>
<b>APPENDIX 10: Inter-annual Harvest Density Change Maps .....</b>	<b>253</b>

## LIST OF ABBREVIATIONS

AES	Arctic Eider Society
EBSA	Ecologically and Biologically Significant Area
ECCE	Environment and Climate Change Canada
CBD	Convention on Biological Diversity
CBMN	Community-Based Monitoring Network
CPAWS	Canadian Parks and Wilderness Society
DFO	Department of Fisheries and Oceans
GIS	Geographic Information System
GPS	Global Positioning System
GUI	Graphic User Interface
HTA	Hunters and Trappers Association
ICCA	Indigenous and Community Conserved Areas
ICE	Indigenous Circle of Experts
IDS	Indigenous Data Sovereignty
IK	Indigenous Knowledge
IPA	Indigenous Protected Area
IPCA	Indigenous Protected and Conserved Area
IPCCA	Indigenous People's and Community Conserved Area
IQ	Inuit Qaujimajatuqangit
ITK	Inuit Tapiriit Kanatami
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Areas
KDE	Kernel Density Estimation
NCRI	Nunavut Coastal Resource Inventory
Nautsitsuqtiit	Nautsitsuqtiit/Guardians Pilot Program
NPC	Nunavut Planning Commission
NRI	Nunavut Research Institute
NTK	Nunavuummi Tasiujarjuamiuguqatigiit Katutjiqatigiingit (Nunavut Hudson Bay Inter-Agency Working Group)
NWMB	Nunavut Wildlife Management Board
PAR	Participatory Action Research
PAC	Priority Areas for Conservation
QC/QA	Quality Control/Quality Assurance
QIA	Qikiqtani Inuit Association
Qikiqtait	Qikiqtait Protected Area
SQSC	Sanikiluaq Qikiqtait Steering Committee
SIKU	SIKU: The Indigenous Knowledge Social Network
TAH	Total Allowable Harvest
TEK	Traditional Ecological Knowledge
TEKMS	Traditional Ecological Knowledge and Management Systems

TRC	Truth and Reconciliation Commission
UNDRIP	United Nations Declaration on the Rights of Indigenous Peoples
WWF	World Wildlife Fund

## 1 INTRODUCTION

Conservation and protected area programs in Canada have often excluded Indigenous Knowledge (IK)<sup>1</sup>, management approaches, and priorities (Indigenous Circle of Experts [ICE], 2018; Langdon et al., 2010). These initiatives are often focused on protecting the environment from human activity and safeguarding natural resources (Eichler & Baumeister, 2018; Foster, 1978; ICE, 2018; Stevens, 2014a). There is currently a shift toward Indigenous-led conservation and protected area initiatives, partly in response to Aichi Target 11 developed by the United Nation's Convention on Biological Diversity (CBD) and the Pathway to Target 1 presented by the Indigenous Circle of Experts (ICE) (Canadian Parks and Wilderness Society [CPAWS], 2022; CBD, 2020; ICE, 2018). Within Canada, Indigenous-led conservation has taken many forms, from Indigenous land guardian programs, such as the Coastal Guardian Watchman Program (Coastal First Nations, 2022), co-managed National Parks such as Gwaii Haanas National Park Reserve, National Marine Conservation Area Reserve, and Haida Heritage

---

<sup>1</sup> The terms IK, Traditional Ecological Knowledge (TEK), Traditional Knowledge (TK), and Inuit Qauijimajatuqangit (IQ) are used frequently in literature to encompass Indigenous worldviews, knowledge, ways of knowing, and ways of being. It is important to note that there are many Indigenous knowledge systems (Dei, 2008), and that these terms often group values from a range of communities under one umbrella. The Hamlet of Sanikiluaq does not universally identify with any of the above terms, so in this paper, I strive to refer to the SIKU data for this project as Sanikiluarmit knowledge. Additionally, the SIKU data used in this project represents only some aspects of IQ and does not represent the full dynamic and holistic nature of IQ data. In broader discussions around literature, policy, and knowledge from several communities or regions, I use the terms IQ to refer to Inuit knowledge or IK to refer to knowledge of multiple Indigenous groups.

Site (Parks Canada, 2019), Indigenous Protected and Conserved Areas (IPCAs<sup>2</sup>) like Edézhíe IPCA (Dencho First Nations, 2023), as well as organizations like the Reconciliation through Conservation Partnership (Conservation through Reconciliation Partnership, n.d.). The Canadian government has recognized the importance of this new paradigm and has invested heavily in Indigenous-led conservation programs (CPAWS, 2022; Environment and Climate Change Canada [ECCC], 2023; Parks Canada, 2018a, 2018b). This has increased the capacity for Indigenous community-based protected area and conservation initiatives.

Conservation in the northern regions of Canada has frequently involved Inuit in the management of National Parks. Inuit co-manage Quttinirpaaq (Parks Canada, 2023b) and Auyuittuq (Parks Canada, 2023a) National Parks in Nunavut, Torngat Mountains National Park (Parks Canada, 2023c) in Newfoundland and Labrador, and Inuit and First Nation peoples inform decision-making at Ivvavik National Park in the Yukon (Parks Canada, 2022b). Inuit have also begun developing IPCAs, such as the Aviqtuuq (Awan et al., 2023), and Arqvilliit IPCAs (Arqvilliit Indigenous Protected and Conserved Area Establishment Project, n.d.) to further affirm their environmental and wildlife decision-making rights (Buschman & Sudlovenick, 2022; Stevens, 2014a; Youdelis et al., 2021). Inuit are especially concerned with how conservation takes place in their homelands due

---

<sup>2</sup> The use of terms for Indigenous-led conservation initiatives varies throughout regions and policy, including: Indigenous People's and Community Conserved Areas (IPCCAs), Indigenous and Community Conserved Areas (ICCAs), Indigenous Protected Areas (IPAs), Indigenous Protected and Conserved Areas (IPCAs), and Tribal Parks. This paper uses the term IPCA throughout but acknowledges that Indigenous-led conservation can take many forms.

to their dependance and connection to country food (edible game, seafood, and flora) and the increasingly intense effects of climate change on the northern environment (Awan et al., 2023; CPAWS, 2022).

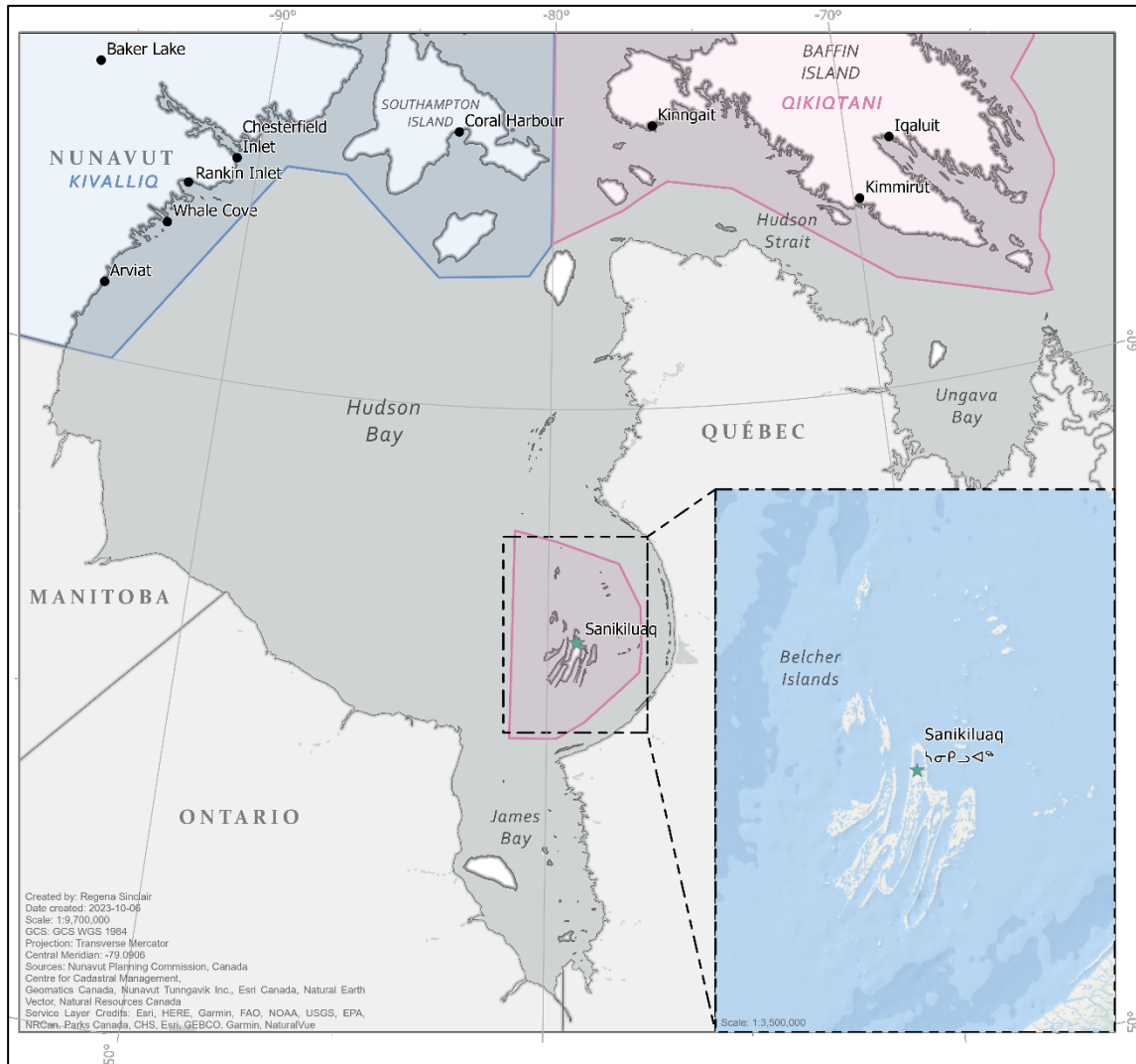
The CBD (2009) states that Inuit ways of being and biodiversity are strongly connected. Due to these relationships with the land<sup>3</sup> and wildlife, Indigenous environmental monitoring using Indigenous methodology, and Indigenous governance using IK are vital for healthy conservation programs (Secretariat of the CBD, 2009). In a northern context, the holistic and relational worldview of Inuit brings a perspective to conservation that is often missed by Western management initiatives (ICE, 2018). Conservation initiatives have the capacity to support Indigenous self-determination through wildlife management and land stewardship (ICE, 2018; Qikiqtani Inuit Association [QIA], 2020).

The territory of Nunavut was created in 1999 and encompasses 21% of Canada's total land and marine area (Kikkert, 2023). The majority of Nunavut is located above the 60th parallel and the landscape is mainly comprised of tundra, with some boreal forest (or taiga) areas located on the southern mainland regions (Lands Directorate, 1986). The territory is home to a population of approximately 36,858, with 83.7% identifying as Inuit (Statistics Canada, 2023). The area is home to several at-risk species, including polar bear, caribou, walrus, beluga whale, narwhal, and ivory gull (ECCC, 2021). The Hamlet of Sanikiluaq is located on the Belcher Islands, in the southeast of Hudson's Bay in the

---

<sup>3</sup> The term "land" may encompass land, water, and ice landscapes in an Inuit context (Robertson & Ljubicic, 2019).

Qikiqtani region (Figure 1.1) and is the southernmost community in Nunavut (Government of Nunavut, 2013).



**Figure 1.1:** Map of the Belcher Islands Archipelago and the Hamlet of Sanikiluaq

As of 2021, the population of Sanikiluaq was 1,010 (Statistics Canada, 2023). Approximately 90.6% of the population primarily speak Inuktitut, and approximately 96% of the community speak Inuktitut and English or English only (Statistics Canada,

2023). The Department of Fisheries and Oceans (DFO) Canada (2011b) has identified the Belcher Islands as an Ecologically and Biologically Significant Area (EBSA) for its critical beluga, polar bear, and common eider duck habitat, as well as its high levels of benthic diversity and productivity. Environment and Climate Change Canada (ECCC) (2012) has also labelled it an important area for birds because of the important common eider duck winter and nesting habitat. This area currently is not covered by any type of protected area (World Wildlife Fund [WWF] Canada, 2019).

The Hudson and James Bay regions have been experiencing extensive environmental change due to industrial practices in northern Manitoba, Ontario, and Québec, primarily from the increased implementation of hydroelectric dams, ongoing mining activity (Hudson Bay Consortium, 2022; McDonald et al., 1997; Rustad, 2015; Sanikiluaq Qikiqtait Steering Committee [SQSC], 2019), and the effects of climate change (Kuzyk & Barber, 2018; SQSC, 2019a). Inuit and Cree communities in this area expressed concern about the impact these industries have had on wildlife, climate, and sea ice, and the presence of contaminants in water sources and country food (Kuzyk & Barber, 2018; McDonald et al., 1997). This concern, coupled with the lack of action taken by the federal and territorial government to investigate these issues, resulted in the Traditional Ecological Knowledge and Management Systems (TEKMS) study from 1992-1995 (McDonald et al., 1997). TEKMS was a community-initiated and community-led study involving interviews in 28 communities (McDonald et al., 1997). This work resulted in the comprehensive book *Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay Bioregion* (McDonald et al., 1997), an

extensive resource of Traditional Ecological Knowledge (TEK) regarding the changes to the environment and wildlife of the Hudson Bay bioregion. The importance of monitoring these changes cannot be overstated. As noted by Lucassie Arragutainaq, “the environment must remain healthy because people have to rely on it for food. The animals are part of our life, and have to be looked after very carefully...” (McDonald et al., 1997, p. 6). Sanikiluarmit (people of Sanikiluaq) have been noticing significant changes to wildlife populations, including a reduction in the number of Canada geese that arrive in the spring migration (McDonald et al., 1997), and an alarming reduction in walrus presence around the islands (Hudson Bay Consortium, 2022). Work like this highlighted the need for a more formal protection strategy for the Belcher Islands.

Sanikiluaq has been very active in Inuit-led research initiatives. Sanikiluarmit have strong ties with their Hudson Bay neighbours, Cree Nations in Ontario and Québec to the south and Inuit communities in Nunavik to the east. These communities have worked collaboratively in the past on projects involving environmental health, wildlife monitoring, and IK (Kuzyk & Barber, 2018; McDonald et al., 1997). Sanikiluaq is the home of the Arctic Eider Society (AES), and the community has been leaders and partners in numerous projects since the 1990s, including the Northern Contaminants Program, the Nunavut General Monitoring Program, studies of sea ice ecology with Environment Canada, Inuit knowledge documentation and transfer initiatives, and sea ice monitoring projects, as well as leading wildlife surveys and taking part in various climate change monitoring initiatives (AES, 2023b; SQSC, 2021). The community also established the Nunavuummi Tasiujarjuamiuguqatigiit Katutjiqatigiingit (NTK) to

support Indigenous stewardship of the Hudson Bay region (SQSC, 2021), although this organization dissolved in 2011. Sanikiluaq has also recently started to explore the potential for a shellfish fishery to support a sustainable, land-based economy (AES, 2022; Rogers, 2021). A priority of Sanikiluaq is the establishment of a conservation economy to financially support community members by creating jobs in areas of research and environmental monitoring (AES, 2022; Enuaraq-Strauss & Arragutainaq, 2021; SQSC, 2019b).

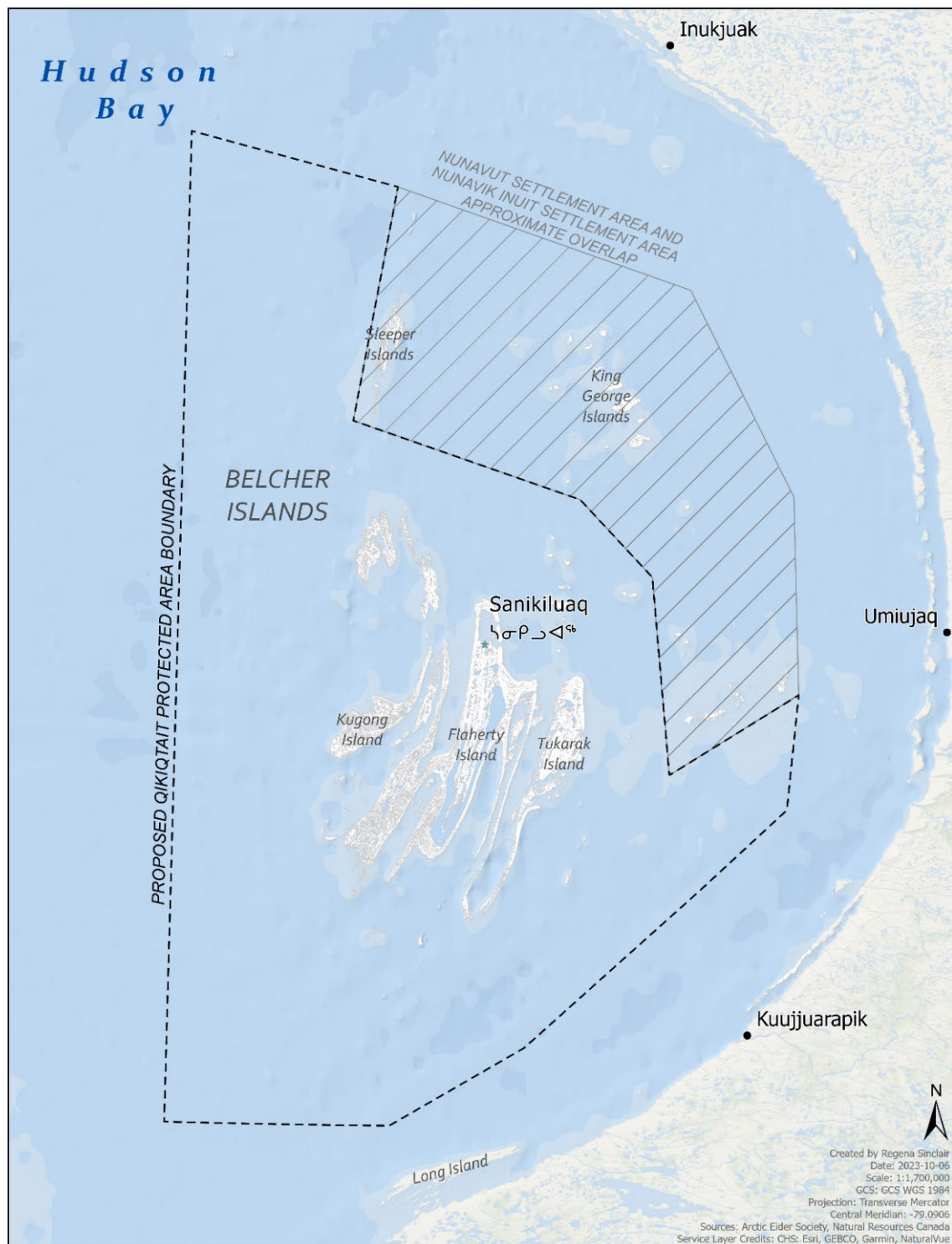
The AES is a registered Canadian charity established in 2011, developed to continue to support community-engaged research and Inuit priorities, such as those established by the NTK and documented in the award-winning 2011 film, *People of a Feather* (AES, 2020). The AES was created as an Inuit-led organization to work across jurisdictions with communities around Hudson Bay and Inuit Nunangat (Inuit homelands in Canada) to address long outstanding community priorities focusing on environmental and social justice issues in the Arctic. The AES applies Indigenous-driven solutions with programs that build capacity and self-determination. The charity is based on three pillars: community-driven research, education, and outreach and stewardship (AES, 2023a). The AES has played a leadership and mentorship role in numerous community-led research projects. The AES was a key collaborator in the creation of the Hudson Bay Consortium, a stewardship body that brings together community members, rights holders, Indigenous organizations, and government departments from around the Hudson Bay and James Bay region to work together on issues of climate, research, environmental stewardship, and Inuit knowledge (AES, 2023c; Hudson Bay Consortium, 2023). In 2019, the AES

launched SIKU: The Indigenous Knowledge Social Network, an interactive app and web platform, which was the winner of the 2017 Google.org Impact Challenge in Canada (SIKU & AES, 2020). SIKU — which means sea ice in Inuktitut — aims to connect Inuit knowledge of the environment with technology in order to address issues of climate change, facilitate knowledge transfer and documentation, support community-based research, encourage Indigenous languages use, and act as an education tool for Indigenous youth (Enuaraq-Strauss & Arragutainaq, 2021; SIKU & AES, 2020). SIKU provides a toolset for community members to share their knowledge and collect data on environmental and species observations, as well as hunting stories, and trips (SIKU & AES, 2020). The SIKU app is free to the public and supports Indigenous self-determination in community-led projects while upholding the components of Indigenous Data Sovereignty (IDS) (Section 2.3.4; 3.3.1; Appendix 1; Enuaraq-Strauss & Arragutainaq, 2021; SQSC, 2021).

The protection of the Belcher Islands has been of high priority for the community of Sanikiluaq for many years (AES, 2022; Appaqaq et al., 2020; SQSC, 2019a). The Inuit-led Qikiqtait Protected Area pilot project (hereafter referred to as “Qikiqtait”) is a holistic approach to conservation that aims to support environmental and Sanikiluarmiut cultural health (AES, 2020, 2022; SQSC, 2019b). Qikiqtait, meaning “islands”, is the result of years of extensive work by the community of Sanikiluaq and their partners to add levels of protection to the entire Belcher Islands terrestrial and marine region (Figure 1.2) (AES, 2018, 2022; SQSC, 2019b). The formal planning process for Qikiqtait began in 2018, and is supported by several organizations, including the Hamlet of Sanikiluaq, the AES, the

Sanikiluaq Hunters and Trappers Association (HTA), Qikiqtani Inuit Association (QIA), and the Canada Nature Fund (AES, 2020; SQSC, 2021). At this time, the development of the Nautsitsuqtiit/Guardians Pilot Program (hereafter referred to as Nautsitsuqtiit) began to support the capacity of environmental monitoring within the community (SQSC, 2021). Since 2018, several meetings have been held with the SQSC, AES, Sanikiluaq Hamlet Council, the Sanikiluaq HTA, the DFO, QIA, ECCC, the Canadian Wildlife Service, Nunavut Tunngavik Inc, and QIA, to establish collaborative working relationships between agencies to support the Sanikiluarmiut-led Qikiqtait project (AES, 2018; SQSC, 2019b, 2021). The Qikiqtait development strategy revolves around a whole-of-community approach Inuit-led decision-making to address community priorities (Appaqaq et al., 2020; Enuaraq-Strauss & Arragutainaq, 2021; SQSC, 2019b, 2021). In an effort to provide protection and management for the unique environment of the Belcher Islands, Qikiqtait will cover 33,000 km<sup>2</sup> (AES, 2022), 7% of which will include terrestrial areas and 93% of which will be marine areas (QIA, 2020). More than 5,000km of coastline will be included in Qikiqtait (QIA, 2020).

Qikiqtait is utilizing the Qikiqtait Project on SIKU as a tool to collect Sanikiluarmiut harvester data to build a recorded base of harvesting knowledge to aid Qikiqtait development and management priorities (Appaqaq et al., 2020; Enuaraq-Strauss & Arragutainaq, 2021; SQSC, 2021). The focus of this thesis is to support the development of this Indigenous conservation initiative by mapping Inuit harvester data collected in the Qikiqtait Project on SIKU and exploring the capacity of an Inuit-designed data collection tool to further Qikiqtait management priorities. My thesis is in partnership



**Figure 1.2: Proposed Qikiqtaaluk Protected Area boundaries<sup>4</sup>**

with the Sanikiluaq Qikiqtait Steering Committee (SQSC) and supported by the AES. I worked closely with the SQSC following a community-engaged<sup>5</sup> research framework (discussed in Section 3.2) that supported Qikiqtait priorities.

## **1.1 Project Evolution**

As I began my graduate degree, I expressed interest in Inuit-led conservation. Reflecting on potential research topics, my supervisor, Dr. Gita Ljubicic, reached out in December 2020 to one of her long-term research partners and the Executive Director of the AES, Dr. Joel Heath. The SQSC expressed interest in having me contribute to the analysis of Qikiqtait Project data to support an Inuit-led approach to using the SIKU app for the development of a Qikiqtait resource inventory. Shortly thereafter, Dr. Ljubicic and I had an introductory meeting with Dr. Heath and began developing a project plan. From a meeting held on January 27<sup>th</sup>, 2021, and a report by AES (2022), some of the broad goals of the SQSC that were communicated include:

---

<sup>4</sup> The Proposed Qikiqtait Protected Area boundaries used in this thesis were developed from the Nunavut Settlement Area boundaries, excluding areas of overlap with Nunavik.

<sup>5</sup> The term “community” can be used in several contexts and refer to groups of people or organizations based on many different parameters. Use of the term “community” does not necessarily mean that an entire community was part of a research project (Johnson et al., 2015). Engaging with and including the priorities of every member of the Sanikiluaq community was beyond the scope of this project. Therefore, the “community” referred to in this project will be defined as the Qikiqtait Committee, as I was in regular contact with Committee members and worked towards the priorities established for Qikiqtait.

- The development of a conservation economy by building job capacity in areas of environmental monitoring, natural history, filmmaking, and research;
- Engagement of community members across multiple demographics;
- The development of a harvest inventory; and,
- The creation of an updated seasonal food visualization based on seasonal harvesting data.

A priority for the SQSC was the building of a resource inventory (including harvesting information) for key species found in the Belcher Island region to support the IPCA development process (Objective 3) (AES, 2022). The SQSC had established a harvesting and observation data collection process within the Qikiqtait Project with Nautsituqtiit, with the goal of establishing baseline data for species throughout the year (SQSC, 2021). After an initial examination of the structure of SIKU and the available reporting fields, and conversations during the first meeting about Qikiqtait needs and resource inventory goals, I suggested some analysis options that I could complete for Qikiqtait as part of my thesis. From January – April 2021, I completed some initial work for the SQSC focussing on Qikiqtait Project berry harvesting posts (see Section 3.3.1 for an explanation of methods of recording data of SIKU) collected on SIKU as part of a McMaster University course project. Using the berry harvesting posts of four berry species (blueberry, cloudberry, crowberry, and lingonberry), I used Geographic Information System (GIS) software ESRI ArcGIS Pro 3.0.3 to complete a draft map of berry harvesting locations, and Microsoft Excel to complete draft graphs showing berry harvest seasonality for each species. This analysis was presented during my first meeting

with the SQSC on May 25, 2021, to show some examples of analysis methods for other species that I could complete in my Master's project and to gather preliminary feedback on the methodology and direction of the project. This initial work was vital to a collaborative approach to building this project, as it gave space to evaluate how my skills could be used to support SQSC priorities. It also supported discussion about potential analysis avenues for the data and allowed the SQSC to determine how Sanikiluaarmiut data would be used. This approach to Inuit-led conservation planning means that discussions around how data can be communicated to community, regional, and federal audiences can benefit from collaboration and research partners. Based on the preliminary results that were presented, and my skillset with geospatial analysis, it was agreed that a thesis project could support Qikiqtait Objectives 3 and 4 above.

This thesis journey followed the guidance of the SQSC and the AES by responding to the needs of the SQSC as identified during meetings throughout the research process. The initial priorities and analysis goals of this project were co-developed over three meetings with my SQSC and AES partners, and further refined throughout the lifespan of the project with input from all my project partners. Further elaboration of my research approach is presented in Section 3.2.

## **1.2 Project Goals**

The overarching aim of this research project is to contribute meaningfully to an Inuit-led and managed conservation initiative by supporting existing community priorities. The significance of this project includes:

- Contributing to the Qikiqtait goal of the future protection of an ecologically and culturally significant archipelago;
- Supporting the establishment of a harvest resource inventory using data collected through SIKU to assist Qikiqtait development and management decisions; and,
- Furthering the understanding of the potential for SIKU to inform and contribute to Qikiqtait conservation goals.

The goal of this project is to explore the capacity of harvester data collected within the Qikiqtait Project using the SIKU app to support Inuit-led protected area design, implementation, and management by investigating how Sanikiluarmit monitoring data collected on the app can be used to meet the SQSC priorities. This is an important part of understanding the influence of Sanikiluarmit knowledge on shaping protected area design and implementation. This research project contributes to efforts to improve collaborative and Inuit-driven approaches to developing protected areas by:

- Examining the potential of new technology to support Indigenous governance and conservation initiatives;
- Exploring methods of weaving Inuit and scientific knowledge together in conservation planning; and,
- Supporting Inuit self-determination in conservation projects.

### **1.3 Research Question and Objectives**

My thesis research is driven by the question: “How can harvester data recorded using SIKU support a community approach to Inuit-led protected area development and

ongoing management?” Together with my research partners, the following objectives were developed to address this question, including to:

1. Contribute to the Qikiqtait harvest resource inventory using Sanikiluarmit harvesters and environmental monitor data collected on SIKU;
2. Compare how the harvest resource inventory data aligns with, and can support, Qikiqtait management priorities; and
3. Explore the capacity of SIKU as a tool to contribute to a community environmental monitoring approach to Inuit-led protected area development and ongoing management.

#### **1.4 Positionality Statement**

It is important that researchers recognize their cultural lens and how their experiences and worldview shape their research (Cochran et al., 2008; Kovach, 2009). Positionality was therefore a vital component of my research, as I had to be aware of the factors that influenced my relationships, knowledge production, research approach and methodology.

I am a cisgender, native English-speaking, non-Indigenous woman of Scottish and English heritage. I grew up in the Hamlet of Coboconk, Ontario, in the Kawartha Lakes region, on the territories of the Wendake-Nionwentsio, Mississauga, and Anishinabewaki and on Treaty 20 land. I am aware that my ancestors took part in acts of colonialism in what is now called Canada that have had lasting impacts on Indigenous peoples. I am single child of self-employed parents and was home-schooled until I began university. I

was homeschooled using an interpretive curriculum adapted from a Western education curriculum and continued into the Western academic structure of university. I acknowledge that I come from a position of privilege and was raised with a Western worldview. I acknowledge that there exists a power imbalance between academia and Inuit communities, and my experiences within academia have influenced my worldview. My ways of learning and knowledge sharing may be different than those of my research partners, and it is important to prioritize the knowledge systems of the leaders of this project, my research partners. I have strived to learn from my work as a GIS consultant with First Nations in British Columbia but recognised through this work that I still have much to experience. It is vital that I continue to learn from my research partners, and Indigenous leaders, knowledge holders, teachers, scholars, authors, artists, harvesters, and activists, in order to engage in decolonizing research to the best of my ability.

I am a southern Ontario-based researcher who has never hunted, although this project works with Inuit hunter and harvester knowledge. I acknowledge that this is a limitation (among others) in my education, and I must defer to the knowledge of my research partners to ensure their data is represented appropriately. I have attempted to address this limitation (to the best of my ability) by actively listening to my community research partners throughout this project, learning from coursework centred in community-engaged research and Indigenous methodologies, and continuous self-reflection on my positionality, privileges, and ways of knowing. Most importantly, my research project does not attempt to represent community voices but aims to support community priorities through advancing Inuit voices.

## **1.5 Thesis Outline**

This thesis is divided into six chapters. Chapter one introduces Qikiqtait and the project partners, overall project significance, and the project objectives. Chapter two is a literature review of topics pertaining to my project, including an overview of conservation initiatives in Canada, and the use of technology in community-led conservation projects. An overview of the variety of research methods used in this thesis is presented in chapter three. The spatial and graphical results of SIKU harvester data are presented in chapter four, followed by a discussion focussing on SIKU as a tool in community-led conservation programs. The discussion also includes an examination of the areas where data collected with SIKU is valuable to the Qikiqtait program, and where improvements to the Qikiqtait Project on SIKU could support a more robust analysis. Finally, in chapter five, I discuss the key takeaways of the projects, as well as future considerations and recommendations.

## **2 LITERATURE REVIEW**

### **2.1 Conservation Methods and Programs in Canada**

#### **2.1.1 History of Canadian Conservation Policy**

Formal conservation policy has a long history in Canada, most of which involves a traumatic, exploitive, and complicated relationship with Indigenous peoples (ICE, 2018). Canada's first conservation policies were framed around principles that influenced what is now known as the North American Model of Wildlife Conservation (Eichler & Baumeister, 2018), a type of framework that is often viewed as colonial (Eichler & Baumeister, 2018; Stevens, 2014b; Youdelis et al., 2021). Conservation programs that followed this model were characterized by a strict focus on nature preservation without human interference (Eichler & Baumeister, 2018; Stevens, 2014b), and the commoditization of wildlife as natural resources (Eichler & Baumeister, 2018). The term 'fortress conservation' has been used for this type of restrictive conservation methodology (Nokmaq et al., 2021), which prohibited Indigenous harvesting practices within conservation area boundaries (Tauli-Corpuz et al., 2020). Conservation initiatives based on 'fortress' methodologies have experienced biodiversity loss and other ecological failures (Stevens, 2014c; Tauli-Corpuz et al., 2020). The Canadian National Park system has been part of this type of management, and as of 2013, 43% of National Parks were experiencing a decline in the health of their ecosystems (Office of the Auditor General of Canada, 2013).

The National Parks system in Canada is managed federally by the Parks Canada Agency (Parks Canada) and is also responsible for engagement and consultation with

Indigenous peoples whose interests overlap National Parks (Thomlinson & Crouch, 2012).

The removal of Indigenous peoples and their rights from National Park lands was not uncommon during the late 19<sup>th</sup> and early 20<sup>th</sup> centuries (Indigenous Circle of Experts, 2018; Parks Canada, 2022a) and may have been used — among other methods — to control Indigenous communities (Sandlos, 2014; Stevens, 2014b). For example, Banff National Park, established in 1885 as Canada's first National Park, resulted in the removal of the Stoney Nakoda Nation from their ancestral land (Langdon et al., 2010). Harvesting and cultural practices were also not allowed in National Park systems (ICE, 2018; Sandlos, 2014; Stevens, 2014a), creating barriers to knowledge transmission and also increasing food insecurity within communities (Thomlinson & Crouch, 2012). In Canada's northern regions, Indigenous harvesting needs were not considered in conservation programs (Sandlos, 2014). This approach to conservation created friction between the National Parks and Indigenous peoples (Youdelis et al., 2021), and eventually led to a restructuring of the Canadian conservation system.

#### *2.1.1.1 The New Paradigm*

The 5<sup>th</sup> World Parks Congress in 2005, held by the International Union for Conservation of Nature (IUCN), resulted in the Durban Accord (Stevens, 2014a). Widely recognized as a turning point in conservation ideology (Indigenous Circle of Experts, 2018; Stevens, 2014a; Zurba et al., 2019), it promotes a management approach that supports decolonizing conservation (Nokmaq et al., 2021; Stevens, 2014a; Zurba et al., 2019). The new paradigm of conservation rebalances the relationships between humans and the environment by acknowledging the pivotal component Indigenous peoples play in

ecosystem health (Youdelis et al., 2020), and reasserts Indigenous rights (Stevens, 2014a). Non-Indigenous worldviews do not place as much emphasis on the relationship between people and the environment as Indigenous worldviews (Smith et al., 2020). The emphasis on this reciprocal relationship is of benefit in conservation initiatives; Indigenous-led conservation brings an important holistic aspect to management decisions that was missing in previous conservation policy management decisions (Nokmaq et al., 2021).

The Durban Accord's acknowledgment of the importance of Indigenous-led conservation has had implications for Canadian conservation approaches. Canadian government and organizations are starting to recognize the importance of Indigenous monitoring and observation data in protected area and wildlife management initiatives (CPAWS, 2022; DFO, 2011; Parks Canada, 2010, 2018a, 2022) and there has been an increase in investments in Indigenous stewardship of conserved lands (Awan et al., 2023; Galloway, 2018; Parks Canada, 2018b). Parks Canada policy now places greater emphasis on collaboration with other organizations (including Indigenous communities), involving Indigenous knowledge in management decisions (Parks Canada, 2018a, 2022a), and aiming to support Indigenous economies (Parks Canada, 2018a). The recommendations outlined by ICE to achieving Canada's Pathway to Target 1 conservation goal have shaped the National Parks conservation strategy, opening doors for Indigenous involvement (Parks Canada, 2018a). This approach requires continued refinement, as Indigenous voices are not always given equal space and weight within conservation decisions (ICE, 2018; Sandlos, 2014; Youdelis et al., 2021).

#### *2.1.1.2 Wildlife Management*

Wildlife management is not always associated with an established conservation program but is a method of conservation of its own. In Canada, there have been tensions between biologists and non-Indigenous wildlife decision-makers and Indigenous peoples due to conflicting views surrounding wildlife management (MacDonald, 2018; Sandlos, 2014). The term “management” itself is contentious, as it references a state of control over wildlife that is contrary to Inuit beliefs (McDonald et al., 1997).

The management practice that carries the most criticism throughout Canadian history is harvest restrictions (Dowsley & Wenzel, 2008; Keenan et al., 2018; Kourantidou et al., 2021a; L. Arragutainaq, personal communication, September 17, 2021; McDonald et al., 1997; Nielsen & Meilby, 2013; Snook et al., 2018; Tejsner, 2014; Tester & Irniq, 2008; Tyrrell, 2006, 2007). Lucassie Arragutainaq explains the feelings of powerlessness related to wildlife management:

“The government took over our animals, and started making laws according to the knowledge of scientists and wildlife officers. They make laws without listening to us even though we have our own traditional knowledge of the environment and wildlife. It’s not surprising we’re never satisfied with the laws they make because we already have our own knowledge of the animals. There are so many pages that we have to follow according to the government laws.” (as cited in McDonald et al., 1997, p. 59)

Wildlife management has been “run by the numbers”, while traditional Inuit management is “run by the feeling” because wildlife management is “life itself” (L. Arragutainaq, personal communication, September 17, 2021). Opposed to restrictive wildlife management methods that use “punishment” (such as fines) to regulate harvesting (L. Arragutainaq, personal communication, September 17, 2021), there is a

push for local Inuit-led wildlife management initiatives that are based on Inuit Qaujimajatuqangit (IQ) (Henri et al., 2020b; Keenan et al., 2018; G. Ljubicic et al., 2018; Sandlos, 2014; Tyrrell, 2007) and the implementation of wildlife co-management options (Henri et al., 2020b; Kenny et al., 2018; Snook et al., 2020).

Wildlife co-management initiatives have not always incorporated Inuit knowledge or management approaches effectively (Ljubicic et al., 2018; Robertson & Ljubicic, 2019). Effective co-management must consider the necessities of open communication and consultation, building trust between management partners, long-term support for local management leadership, and of respecting the many dimensions of IQ (Ljubicic et al., 2018). It is important for co-management regimes to work together to bridge the gap between Inuit and non-Inuit knowledge systems, instead of co-opting Inuit knowledge and using it without context or understanding (Mantyka-Pringle et al., 2017).

## **2.2 Inuit-led Conservation Initiatives**

### **2.2.1 Nunavut Governing Bodies and Agreements**

Wildlife co-management policy between federal organizations and Inuit were part of the modern treaty process that occurred in Inuit Nunangat (Etiendem et al., 2020). The Nunavut Land Claims Agreement, which resulted in the official creation of the territory of Nunavut, reaffirms hunters' rights, and the rights of Inuit to manage their wildlife (Nunavut Tunngavik Inc., & Minister of Indian Affairs and Northern Development and Federal Interlocutor for Métis and Non-Status Indians, 2010; Tyrrell, 2007). From Article 5 and 15 of this Agreement, the Nunavut Wildlife Management Board (NWMB) was development to support these rights and affirm decision-making control (Nunavut

Tunngavik Inc., & Minister of Indian Affairs and Northern Development and Federal Interlocutor for Métis and Non-Status Indians, 2010; Sandlos, 2014). The Nunavut Marine Council, a joint council comprised of the Nunavut Planning Commission (NPC), the Nunavut Impact Review Board, the Nunavut Water Board, and the NWMB, has the additional capacity to inform management decisions regarding marine areas (Nunavut Tunngavik Inc., & Minister of Indian Affairs and Northern Development and Federal Interlocutor for Métis and Non-Status Indians, 2010). The NTK was established to further monitor the Hudson Bay region (Benoit, 2011; SQSC, 2021).

In Nunavut, Inuit rights to harvest are reinforced with the Nunavut Land Claims Agreement, however, Total Allowable Harvest (TAH) restrictions (often informally referred to as harvest quotas), are still set for several important species, such as polar bears and migratory birds, as well as harvest restrictions on the down from eider ducks (Nunavut Tunngavik Inc., & Minister of Indian Affairs and Northern Development and Federal Interlocutor for Métis and Non-Status Indians, 2010). The NWMB implements the TAH restrictions, which provides an opportunity to make wildlife management and conservation decisions based on Inuit needs (Etiendem et al., 2020; Nunavut Tunngavik Inc., & Minister of Indian Affairs and Northern Development and Federal Interlocutor for Métis and Non-Status Indians, 2010; Tyrrell, 2007).

### 2.2.2 Inuit Co-managed National Parks and Marine Protected Areas

Conservation initiatives not involving Indigenous peoples have not always been able to achieve their priorities (Stevens, 2014c). To address this issue, new Canadian National Park objectives responded to calls for engagement with, and access for,

Indigenous communities and the incorporation of IK (Devin & Doberstein, 2004; ICE, 2018; Parks Canada, 2010, 2022; Waithaka, 2010). These calls have resulted in the development of co-managed National Parks and Marine Protected Areas in Inuit Nunangat (Table 2.1), such as Anguniaqvia niqiqyuam Marine Protected/Conservation Area (Awan et al., 2023), Tallurutiup Imanga National Marine Conservation Area (Awan et al., 2023), Quttinirpaaq National Park (Parks Canada, 2023b), Auyuittuq National Park (Parks Canada, 2023a), and Torngat Mountains National Park (Parks Canada, 2023c).

**Table 2.1:** Location of some co-managed National Parks and Marine Protected/Conservation Areas in Inuit Nunangat

<b>National Park/Protected Area</b>	<b>Location</b>
Anguniaqvia niqiqyuam Marine Protected Area	Inuvialuit (Northwest Territories)
Tallurutiup Imanga National Marine Conservation Area	Nunavut
Quttinirpaaq National Park	Nunavut
Auyuittuq National Park	Nunavut
Torngat Mountains National Park	Nunatsiavut (Newfoundland and Labrador)

Co-management in National Parks conservation systems was not introduced until 1984 (Langdon et al., 2010), and since then there has been a significant transformation towards Indigenous co-management in conservation and the incorporation of IK in management strategies (Devin & Doberstein, 2004; ICE, 2018; Langdon et al., 2010; Parks Canada, 2022). Parks Canada policy now stipulates that Park managers must consult with Indigenous communities when making wildlife and environmental management decisions (Langdon et al., 2010; Parks Canada, 2010). However, some have argued that decision-making power in co-management groups rests with non-Inuit

scientists, indicating that additional work needs to be done to reaffirm Inuit governance (Sandlos, 2014). Torngat Mountains National Park was the first instance of an all-Inuit management committee, providing a roadmap for the structure of other management committees (Sandlos, 2014).

### 2.2.3 Indigenous Protected and Conserved Areas

Although the co-management of conservation initiatives is a positive move forward in conservation methodologies, this approach does not fully return decision-making control back to Indigenous communities. A step beyond co-management is IPCAs, developed after the importance of Indigenous-led conservation was recognized by the IUCN in 2008 (Stevens, 2014b, 2014a). IPCAs are structured around Indigenous governance, values, and knowledges, and are long-term commitments to the preservation of peoples, cultures, and the environment (ICE, 2018; The Indigenous Leadership Initiative, 2022). The proposed Inuit-led Aviqtuuq (Awan et al., 2023), and Arqvilliit IPCAs (Arqvilliit Indigenous Protected and Conserved Area Establishment Project, n.d.) are examples of how IPCAs approach conservation from a more holistic manner that places value on protecting the health of people and culture in addition to the environment (The Indigenous Leadership Initiative, 2022; Zurba et al., 2019). Indigenous-led conservation programs reaffirm Indigenous sovereignty and self-determination (Buschman & Sudlovenick, 2022; Stevens, 2014a; Youdelis et al., 2021). The development of IPCAs also contributes to the establishment of conservation economies (AES, 2022; Nature Canada, 2020; Parks Canada, 2018a) along with the creation of environmental monitoring and research jobs (ICE, 2018). IPCAs are also a way to address

climate action while supporting Indigenous relationships with the land and cultural resiliency (Smith et al., 2020). Qikiqtait, although not officially designated as an IPCA at this stage of development, aims to become an IPCA and will uphold the rights of Sanikiluaarmiut (SQSC, 2019b). Part of this will be achieved through the protection of the area for future generations to continue to harvest, and maintain cultural and spiritual relationships with the land, without the restrictions often associated with conservation programs.

Canada has invested more than \$1.35 billion into conservation programs led by Indigenous groups across the country (Awan et al., 2023). Additionally, Parks Canada policy now states that the organization actively advances IPCA projects (Parks Canada, 2018a, 2022a). Some of these advances are related to the Government of Canada's commitment to protect 30% of its land and marine environment by 2030 (Awan & Twigg, 2023; CPAWS, 2022; Reuters, 2020; Singh & Hopton, 2022). However, since there is great potential for terrestrial conservation initiatives in Nunavut (CPAWS, 2022), Nunavut Premier Joe Savikataaq has suggested that Canada has used Inuit lands to meet quickly meet conservation goals through the creation of large protected areas (Bell, 2020). This again brings into focus the necessity of Inuit-led conservation programs like IPCAs to support Inuit self-governance and decision-making.

#### 2.2.4 Conservation Economies

Economically, Indigenous-led conservation initiatives have proven to support Indigenous communities both financially and culturally. A recent review of the Coastal Guardian Watchman program, which is a partnership between seven First Nations on the

west coast of British Columbia, examined the economic value generated according to specific values important to the participating Nations (Ecoplan International Inc, 2016). The result was a range from 10:1 to 20:1 return on investment per year (Ecoplan International Inc, 2016). Some of these returns on investments included the creation of economic opportunities or jobs and training within the communities, land stewardship, supporting self-determination in governance, and supporting cultural health (Ecoplan International Inc, 2016).

Food insecurity is prevalent in Nunavut (NPC, 2021; Tagalik et al., 2023). Increased harvesting of country food is a way to address Inuit food insecurity (Henri et al., 2020b). The harvesting of country food is a significant part of many Inuit economies, despite the costly equipment required to harvest (Awan et al., 2023; Etiendem et al., 2020; Quigley & McBride, 1987; van Luijk et al., 2022). More Inuit communities are becoming interested in how they can harvest sustainably in a greater capacity to support their communities while monitoring their environment. Conservation economies are one way to potentially support these goals.

The hiring of local environmental monitors, the implementation of country food processing facilities, and increased environmental tourism are key components of a conservation economy (Awan et al., 2023; QIA, 2020). Conservation economies are supported through a relationship with the environment when natural resources are used and conserved in ways that address community priorities (Awan et al., 2023). The creation of local jobs and increased accessibility to nutritious and culturally significant foods within communities provides opportunities for economic growth that also promote

Inuit and environmental well-being (Awan et al., 2023; QIA, 2020). Blue (or marine-based) conservation economies can align with IQ (Awan et al., 2023; QIA, 2020).

Qikiqtait aims to foster a blue conservation economy by supporting Inuit environmental stewardship and governance in order to financially support community members while engaging with and stewarding the land (AES, 2022; Appaqaq et al., 2020; Hudson Bay Consortium, 2022). A goal of SIKU is to be a useful tool in developing and supporting northern conservation economies and food security (Appaqaq et al., 2020; Enuaraq-Strauss & Arragutainaq, 2021; Pedersen et al., 2020a; SIKU & AES, 2020) making it a complementary tool for conservation initiatives like Qikiqtait.

## **2.3 Components of Indigenous Monitoring in Conservation Initiatives**

### **2.3.1 Indigenous Community-Engaged Research**

Research within Inuit Nunangat (Inuit homelands) in the Canadian Arctic (Inuvialuit, Nunavut, Nunavik, and Nunatsiavut) must involve meaningful collaboration, work to support community management and priorities, and follow an Inuit methodology (Inuit Tapiriit Kanatami [ITK], 2018; ITK & Nunavut Research Institute [NRI], 2006; Wilson et al., 2020). Research should also include early and ongoing communication with community partners (Henri et al., 2020a; ITK & NRI, 2006; Ljubicic et al., 2022; Pearce et al., 2009; Tondu et al., 2014). Research in collaboration with communities requires extra time — beyond that which is often allocated for academic research — to devote to the trust and relationship building required for mutually beneficial research project outcomes (Castleden et al., 2012; McGrath, 2019). Tondu et al. (2014) further discuss the important themes of participatory research, which include building trust and forming

relationships, and the vital requirement of spending time with community partners (Section 3.2). Although this time can be difficult to allocate in the rigid academic structures, it is necessary to ensure a mutually beneficial research project (ITK, 2018).

Collaborative research methodology based around research questions developed with the community, and that address community priorities, is a way to shift the benefit of research back into the communities (Brunet et al., 2016; Ferrazzi et al., 2018; Kovach, 2009). Building social capital (which encompass is feelings of trust and reciprocity) between research partners is vital to a positive research relationship, meaningful results, and productive research (Brunet et al., 2016). One way to increase social capital is through participatory research, where southern-based researchers take on more of a facilitating or mentorship role, following decisions of Indigenous community partners (Carter et al., 2019; Ljubicic et al., 2022; Wilson et al., 2020).

It is important to recognize that between Indigenous and Western knowledge systems there exists an inequity and epistemological dominance towards Western knowledge within academia (Ahenakew, 2016; Ferrazzi et al., 2020; Kovach, 2009). Knowledge coproduction and the entwining of these knowledge systems must be mutually beneficial and safe otherwise research may be extractive of IK (Ahenakew, 2016). Community-based research can help to address some of the power imbalances that exist between Indigenous communities and researchers by focusing on mutually beneficial outcomes (Carter et al., 2019; Castleden et al., 2012; Ferrazzi et al., 2018; Ljubicic et al., 2022; Wilson et al., 2020).

Visiting researchers must work to gain as much community context as possible before research commences (Aaluk et al., 2018; Grimwood et al., 2012; ITK, 2018; ITK & NRI, 2007; Pedersen et al., 2020b). In addition to monitoring local news outlets and social media, *Voices from the Bay* (McDonald et al., 1997) provided local context and knowledge to guide my research. In particular, this seminal work by Miriam McDonald, Lucassie Arragutainaq, and Zack Novalinga, presented an ecological history of the Belcher Islands, including Inuit-created food webs, harvesting seasonality, and some of the environmental issues and concerns of the community. Inuit experiences from Inuit voices, such as in the books by McDonald et al. (1997) and Watt-Cloutier (2015) and in the film *People of a Feather* (2011), provided insight and context that is often missing from academic literature.

Studies have shown that community participation in the research process and frequent communication are the most important aspects of working in partnership with Indigenous communities (Brunet et al., 2016; Henri et al., 2020a; ITK & NRI, 2006; Ljubicic et al., 2022; Pearce et al., 2009; Tondu et al., 2014). Communities are frequently overwhelmed with research projects whose results are either not shared or do not contribute significantly to community priorities (Felt & Natcher, 2011) which leads to research saturation (Brunet et al., 2016). A common sentiment in Indigenous communities is that the researcher benefits more from the research than the actual community, as researchers usually receive academic or institutional acclaim from published works (Brunet et al., 2016; Gearheard & Shirley, 2007). Building relationships with community

partners and engaging in a collaborative research process promotes research that is beneficial to all parties (Felt & Natcher, 2011).

The inclusion of Indigenous communities, epistemology, and sovereignty within research are central to decolonizing research (Held, 2020). Research is linked to capacity building and Indigenous self-determination (Belaid et al., 2022; Cochran et al., 2008; ITK, 2018; ITK & NRI, 2007; Secretariat of the Convention on Biological Diversity, 2009; Wilson et al., 2020). McGregor et al. (2010) assert that Indigenous research is “in itself an enactment of governance” (pg. 103). Researchers can facilitate the research and management already present within communities in an effort to: i) amend the power imbalances within traditional research settings; and, ii) involve community in every step of the project (Cochran et al., 2008; McGregor et al., 2010). Researchers must make space for Inuit voices, epistemologies, worldviews, and knowledge in research by supporting Inuit decision-making and governance rights (Wilson et al., 2020).

### 2.3.2 Distinguishing Indigenous Harvester Knowledge and Citizen Science

Community-based research can include citizen science, a broad and subjective definition that can indicate that data is partially or fully collected by members of the public that are not formal research participants or leaders of a project (Haklay et al., 2021; Santori et al., 2021). Citizen science is recognized as an important instrument of conservation (Barr et al., 2021; Key Biodiversity Areas [KBA] Standards and Appeals Committee, 2020; Parks Canada, 2010; The National Advisory Panel, 2018). There are advantages to citizen science, including broader data collection (i.e., data collected over a greater temporal or spatial scale) (Álvarez Larrain & McCall, 2019), and more cost-

effective research methodology to collect a large amount of data (Santori et al., 2021; Wiggins & Crowston, 2011). This approach is useful in situations where research funding and resources are limited (Barr et al., 2021).

It is important to note that even though community-based research can involve Inuit community members, Inuit harvester data is not citizen science. Inuit hunters are experts in their environment as required to travel safely and harvest successfully in challenging Arctic environments (Watt-Cloutier, 2015). Inuit knowledge cannot be confined to the English vocabulary, or the static terminology used in Western settings. Therefore, this literature review recognizes the relational, place-based, and experienced-based nature of Inuit knowledge is not exhaustive and varies between communities — it should not be taken to represent a pan-Inuit culture. IQ is a holistic, evolving concept that encompasses, but is not limited to, Inuit ways of being, values, relationships, customs, and knowledge (Ferrazzi et al., 2020; Karetak & Tester, 2017; Keenan et al., 2018; McDonald et al., 1997; McGrath, 2003; Pedersen et al., 2020b; Wenzel, 1999). IQ encompasses lived, experienced knowledge that has been developed on through continual observation and practice, guided by the teachings of other knowledge holders. Qaujimajatuqangit means “that understanding which is known for a long time” (Felt & Natcher, 2011, p. 113) and represents a more seamless understanding of the interconnectedness of knowledge that cannot be defined by Western standards (Tester & Irniq, 2008). IK and TK are often considered components in the concept of TEK (Tester & Irniq, 2008; Wenzel, 1999) and IQ includes the knowledge represented in all three above terms, as well as the additional components of Inuit ways of life and values (Pedersen et al., 2020b). My research project

will not draw on all the facets of IQ, however, the components of IQ inherent in Sanikiluarmit harvest data are related and situational, and my research must respect the holistic nature of IQ and the Inuit methods of knowledge production.

Those who share IQ in a project are key project contributors (Healy & Tagak Sr., 2014); therefore, the Inuit knowledge holders who contributed their harvest data in this project are valued environmental monitors. This data is not the same as citizen science because Sanikiluarmit are experts in the harvesting of their local wildlife and of their environment. Sanikiluarmit also have a vested interest in the results of this research project and therefore have a stronger connection to both the subject matter and the priorities of this thesis. The data used in this project is representative of the expertise of the users who contributed to the Qikiqtait project using the SIKU app.

### 2.3.3 Use of Indigenous Community-Based Monitoring<sup>6</sup> for Conservation

Lucassie Arragutainaq asks, “What will motivate you to have me involved in my own environmental assessment?” (“Workshop #2: Community Updates and Priorities,” 2022). Researchers often travel to communities to make the same observations that Inuit have been making for generations (ITK & NRI, 2007). Indigenous peoples are perfectly situated for monitoring their local environments (Artelle et al., 2019; Duerden & Kuhn, 1998; Johnson et al., 2015; Sheil et al., 2015), and the importance of Indigenous community-based monitoring is being increasingly recognized (CPAWS, 2022; Wong &

---

<sup>6</sup> Community-based monitoring can be referred to as participatory action research (PAR), participatory monitoring, collaborative monitoring, or locally based monitoring (among others) in research. Within this thesis, I will use the term “community-based monitoring”.

Murphy, 2016). More than 120 Indigenous monitoring initiatives in the form of guardian programs are operating in Canada and support Indigenous governance (The Indigenous Leadership Initiative, 2022). Research that includes Indigenous monitoring of the environment is being furthered within the Canadian context partially due to pressures from international agreements, as well as from the growing self-determination in research and governance by Indigenous peoples (Alexander et al., 2019).

Indigenous-led stewardship and conservation not only benefits from extensive past and current knowledge, but as Artelle et al. (2019) suggests, Indigenous communities, more than other conservation partners, are directly impacted by the decisions made in conservation initiatives. The success or failure of environmental stewardship is not only vital to present Indigenous communities, but also for future generations (Artelle et al., 2019). This means that the relationship between Indigenous communities and lands and wildlife stewardship is deep rooted and pivotal to ecological security and a healthy environment (McDonald et al., 1997). As Lucassie Arragutainaq states:

“We should not depend just on southern expertise. Our traditional knowledge has value to be shared with the South. Wildlife scientists and southern politicians are the architects who introduced wildlife legislation. But, we have to be actively involved too. There has to be a balance of information in terms of the environment and wildlife. Inuit [and Cree] traditional knowledge will have to be part of the process.” (as cited in McDonald et al., 1997, p. 65)

The call for Inuit community-based wildlife monitoring is growing (Johnson et al., 2015; Keenan et al., 2018; NTK, 2008; Sandlos, 2014; Tyrrell, 2007; Wong & Murphy, 2016), and studies have already involved Inuit in monitoring projects of such species as polar bear (Wong & Murphy, 2016), caribou (Kendrick, 2013), and snow and Ross’s geese (Henri et al., 2020b). The NWMB launched the Community-Based Monitoring

Network (CBMN) program in 2012 in an attempt to situate Inuit harvesters in the Nunavut environmental monitoring process (Etiendem et al., 2020). Since then, CBMN data has contributed to management decisions of the NWMB regarding the identification of key harvesting and management areas, and species populations (Etiendem et al., 2020). It is important to note that “community-based” monitoring does not necessarily mean that the entire community is engaged with a monitoring project in an Arctic context, but instead relies on the participation and contributions of key knowledge holders with the community (Johnson et al., 2015).

Community-based monitoring has the capacity: i) for data collection outside structured survey times; ii) to increase the amount of data collected; iii) for data to advise wildlife management decisions; and iv) to bridge communication and knowledge gaps between Inuit and scientists (Wong & Murphy, 2016). Inuit monitoring programs can contribute to a conservation economy, while being avenues of intergenerational Inuit knowledge transfer (Awan et al., 2023). Although Sanikiluarmit have a long history of monitoring their environment and were involved in the ELOKA (Exchange for Local Observations and Knowledge of the Arctic) Project (Pulsifer et al., 2012), the Qikiqtait Project on SIKU represents a new opportunity for communities to record their knowledge, build wildlife monitoring capacity, and demonstrate the return on investment of such programs (AES, 2022; Appaqaq et al., 2020; Enuaraq-Strauss & Arragutainaq, 2021). Qikiqtait Project data has already supported reindeer management decisions by the Sanikiluaq HTA (AES, 2022).

#### 2.3.4 Data Ownership and Sovereignty

Article 31 of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) states that:

“Indigenous peoples have the right to maintain, control, protect and develop their cultural heritage, traditional knowledge and traditional cultural expressions, as well as the manifestations of their sciences, technologies and cultures, including human and genetic resources, seeds, medicines, knowledge of the properties of fauna and flora, oral traditions, literatures, designs, sports and traditional games and visual and performing arts. They also have the right to maintain, control, protect and develop their intellectual property over such cultural heritage, traditional knowledge, and traditional cultural expressions.” (United Nations, 2023, p. 15)

The Canadian government has affirmed that Indigenous peoples have the right to protect and control their data and develop their knowledge as they see fit (Rowe et al., 2020).

However, little progress has been made to execute the UNDRIP articles (United Nations, 2023), along with the Calls to Action developed by the Truth and Reconciliation Commission (TRC) (2015) in a meaningful way (Rowe et al., 2020). Research must actively strive to reaffirm Indigenous sovereignty (Buschman & Sudlovenick, 2022; ITK, 2018).

Indigenous data governance encapsulates control over the data collection, analysis and application of the results processes in order to represent Indigenous epistemologies, values, worldviews, cultures, and priorities (Walter, 2018). Research decisions must be made by Indigenous communities in order to uphold Indigenous sovereignty (Held, 2020). Research completed by Inuit within their own communities can ensure that Inuit retain ownership and access to their data (Wilson et al., 2020). Data that is analyzed and

interpreted by Inuit also allows to appropriate and correct representation of IQ (Wilson et al., 2020).

Data sovereignty is intrinsically linked to self-determination (Kukutai & Taylor, 2016; Snipp, 2016; Williamson et al., 2022) and building research paradigms around IDS is an act of decolonization (Tsosie, 2020). IDS supports Indigenous control, sharing, evaluation, storage and access, and interpretation of their data within the sphere of research (Kukutai & Taylor, 2016; Snipp, 2016; Walter et al., 2021; Williamson et al., 2022). IDS represents the governing and control of data in research, as well as the safeguarding of the cultural aspects (such as historical oral narratives) included in, and entwined with, Indigenous data (Marley, 2020). A key component of IDS is the ability of Indigenous peoples to make choices regarding their participation in research initiatives (Tsosie, 2020). Indigenous data governance is supported by increased community engagement within research, and Indigenous-led projects in Canada are further promoting IDS (Rowe et al., 2020).

Recommendations have been made to guide researchers when working with Indigenous data (Carroll et al., 2020; ITK & NRI, 2006; The First Nations Information Governance Centre, 2023; Wilson et al., 2020). Inuit access, ownership and control over the use and dissemination of IQ in research has been identified as integral to decolonizing research in Inuit Nunangat (ITK, 2018; ITK & NRI, 2007; Rowe et al., 2020; Wilson et al., 2020). The principals presented by the Inuit Tapiriit Kanatami (ITK) and the Nunavut Research Institute (NRI) (ITK, 2018; ITK & NRI, 2007) are similar to the objectives of OCAP® (ownership, control, access, and possession): to promote respect, self-

determination, intellectual property ownership, and data integrity (The First Nations Information Governance Centre, 2023). OCAP® has been influential in moving forward conversations regarding IDS (Rowe et al., 2020). The principals put forward in OCAP® and by the ITK influenced the development of the CARE (collective benefit, authority to control, responsibility, and ethics) Principals for Indigenous Data Governance (Carroll et al., 2020). The CARE Principals further stress the importance of IDS and offer a framework for researchers to engage in CARE full research and support Indigenous self-determination (Carroll et al., 2020). Any project involving Indigenous data must be based on “respect, reciprocity, and responsibility, and the recognition of the importance of relationships and accountability within the context of data production” (Pulsifer et al., 2011, p. 121).

Extra care must be taken when Indigenous data is stored online, as this data is more easily accessed, undermining IDS (Marley, 2020; Pulsifer et al., 2011). SIKU already has data sovereignty and knowledge protections built into the interface, allowing each user to retain rights to their knowledge and specify the sharing rights for each post (Section 3.3.1; Appendix 1). The data collected on SIKU used in my research has already been shared with the Qikiqtait project by the users, and all updated data that has gone through the quality control/quality assurance (QC/QA) (Section 3.4.4) process and all results will be returned to the community upon completion of my thesis.

### 2.3.5 Use of GIS and Mobile Smartphone Apps in Conservation

The use of IQ can bolster the adaptive capacity of communities that are increasingly impacted by climate change (Pearce et al., 2015; Watt-Cloutier, 2015). Felt & Natcher

(2011) state that the importance of a translation bridge is to connect IQ and Western scientific knowledge in ways that support policy development in areas such as climate change and natural resource management. Pedersen et al. (2020b) also refers to cross-cultural knowledge as ScIQ (science + IQ). Youth are in a unique position to facilitate relationships between researchers and Elders with ScIQ due to their cross-cultural education and use of technology (Pedersen et al., 2020b; Sadowsky et al., 2022).

Technology is increasingly used as an aid in the transmission of IQ, and often facilitates cross-cultural knowledge production of ecological knowledge (Pearce et al., 2015).

Mapping has the potential to facilitate this knowledge production (Robertson, 2012) and support the priorities of Indigenous peoples (Laidler et al., 2010; Olson et al., 2016).

Indigenous-led mapping has the capacity to give voices to youth and support their training (Nirwansyah et al., 2023; Thumbadoo & Taylor, 2022).

GIS holds the capability to store and present Indigenous data in a way that is easy to access, creates a platform to support intergenerational knowledge transfer, and opens opportunities for new data visualization and analysis options (Williamson et al., 2022). Therefore, the platform is being increasingly used by Indigenous peoples (Williamson et al., 2022). Research using GIS should strive to be Indigenous-led and have components of IDS built into the GIS methodology, as when Indigenous peoples are not in control of their spatial data, the data can be used in an extractive manner (Williamson et al., 2022).

GIS can support climate change adaptation initiatives by combining Indigenous cultural values with Indigenous environmental monitoring data and environmental data from other sources (Williamson et al., 2022). GIS has been used by Indigenous

communities around the world in areas of wildlife management (De Freitas & Tagliani, 2009; Fisher et al., 2021; Gearheard et al., 2010; Parretti et al., 2023; Robertson, 2012), land use mapping (Duerden & Kuhn, 1996; Olson et al., 2016), conservation (Cotrinas-Sanchez et al., 2023; Ramirez-Gomez et al., 2013; Thumbadoo & Taylor, 2022), and natural resource management (De Freitas & Tagliani, 2009; Duerden & Kuhn, 1996; Government of Nunavut, 2010; Nirwansyah et al., 2023; Thumbadoo & Taylor, 2022), and is integral in the process for identifying Key Biodiversity Areas (KBA) (KBA Standards and Appeals Committee, 2020).

With the advancement of technology, handheld tools like Garmin inReach devices have been used by Inuit to support safe travel (Simonee et al., 2021) and to collect environmental and wildlife monitoring data (Paquette et al., 2023). The development of mobile smartphone applications (apps) are opening doors for new methods of data collection. The NWMB's CBMN has designed apps with Inuit to document harvest and travel information (Etiendem et al., 2020). A small group of Sanikiluarmit harvesters took part in this project and used the harvest recording app from 2012 – 2015 (Etiendem et al., 2020). During this period, 1061 harvest trips were made and 2073 harvests were recorded (Etiendem et al., 2020). Accessible apps used in conservation initiatives allow users to connect the environmental data they are recording with lived experiences (Raschke et al., 2022). Apps can also introduce new ways of information sharing and knowledge transfer (McCann et al., 2016). Smartphone apps can encourage community engagement and data collection in conservation initiatives (Drakopoulos et al., 2022; Raschke et al., 2022).

## 2.4 Drivers of Qikiqtait Development

Polar regions are predicted to experience the effects of climate change more intensely and dramatically than other parts of the world (DFO, 2011). The effects of climate change include the reduction of sea ice extent and thickness, increase in permafrost temperatures, and changes to wildlife populations, among others (Kuzyk & Barber, 2018; McDonald et al., 1997; Secretariat of the CBD, 2009; Watt-Cloutier, 2015). Inuit and Cree communities have been noticing changes to their environment in Hudson and James Bays for years, which have often been attributed to climate change, the implementation of hydroelectric dams (Kuzyk & Barber, 2018; SQSC, 2019a), and mining development and operations (AES, 2018; McDonald et al., 1997; SQSC, 2019a). Hydroelectric and mining operations greatly motivated the research in *Voices from the Bay* (1997) due to Sanikiluaarmiut environmental concerns. Hydroelectric dams can have negative impacts on the environment, including wildlife entrapments (George, 2013; Rustad, 2015), wildlife disturbance (McDonald et al., 1997; Schneider-Vieira et al., 1994; Wein et al., 1996), changes to water salinity (George, 2013; Ridenour et al., 2019; Rustad, 2015), the release of mercury from permafrost (LaSalle, 2022), changes to sea ice formation and composition (Ridenour et al., 2019; Rustad, 2015; Schneider-Vieira et al., 1994; Wein et al., 1996), and alterations to sea currents (Lyle, 2020; Schneider-Vieira et al., 1994; Wein et al., 1996). Potential issues involving mining can include the release of mercury from permafrost (Whittington, 2013), pollution (Sumi et al., 2001), critical habitat loss and disturbance (Gregoire, 2014; Sumi et al., 2001; van Luijk et al., 2022), increased shipping traffic (Gregoire, 2014; Haddaway et al., 2019), and land degradation

(Sumi et al., 2001; Whittington, 2013). These impacts align with the common concerns expressed by Hudson and James Bay communities, which include changes to wildlife, food insecurity, changes to sea ice, and changes to river flow and ocean currents (Hudson Bay Consortium, 2022). Sanikiluarmit have already noticed a transformation in the salinity of Hudson Bay (Eastwood, 2018; McDonald et al., 1997), which results in marine mammals (such as beluga and seals) sinking during harvest, before they can be retrieved (Hudson Bay Consortium, 2022).

The Belcher Islands are home to the entire population of the Hudson Bay subspecies of common eider duck (DFO, 2011b; Mallory & Fontaine, 2004; Nakashima, 1991; QIA, 2020), and is important habitat for beluga whale, Atlantic walrus, and polar bear (DFO, 2011; QIA, 2020). The marine area around the islands contains polynyas (open water areas within sea ice) in the winter, vital to marine and eider species survival (DFO, 2011; Gilchrist & Robertson, 2000; McDonald et al., 1997; QIA, 2020). Sanikiluarmit culture is linked with eider duck, as the down are used to make warm winter clothing (Appaqaq et al., 2020; Heath & Community of Sanikiluaq, 2011; McDonald et al., 1997; Quigley & McBride, 1987; SQSC, 2021). The health of the environment and wildlife populations are vital to Sanikiluarmit, both for their current and future generations (McDonald et al., 1997; NTK, 2008). As Lucassie Arragutainaq emphasizes, “Hudson Bay is our home, and we are not going to leave” (“Workshop #2: Community Updates and Priorities,” 2022).

Sanikiluarmit involvement in monitoring initiatives like CBMN, the Northern Contaminants Program, the Nunavut General Monitoring Program, and eider duck

surveys, as well as generations of making environmental observations have led to the development of Nautsituqtiit in 2020 as one part of the whole-of community approach to Qikiqtait (SQSC, 2021). Nautsituqtiit currently supports a group of hunters to record baseline resource data in the Qikiqtait Project on SIKU (among other objectives) by providing a small honorarium (up to \$50 per day – determined based on the mode of transportation) that aims to help cover the cost (e.g. fuel, equipment maintenance) of harvesting trips (SQSC, 2021). This program has been effective in fostering community engagement, environmental stewardship, and Inuit-led research, as well as supporting harvesting, increasing food security, and introducing additional training opportunities (SQSC, 2021). The implementation of governance for Qikiqtait will provide another avenue for wildlife management at a local level, and use of harvester-collected data has tremendous potential to inform local decision-making.

### **3 METHODS**

#### **3.1 Research Partners**

My thesis is a collaborative partnership with the SQSC and the AES, and is supported by several people across institutional, non-governmental and community spheres. The key community partners identified for this project were either SQSC members or employed by the AES. Not all research partners were involved in every meeting for this project due to individual availability and area of expertise. My key partners guided my research stages, and these research stages and associated discussion topics influenced who was present at each meeting. The primary research partners and their roles in this project are presented in Table 3.1. Research partners were involved in key decisions surrounding this thesis work and were involved in communicating feedback on methodology and draft results.

#### **3.2 Research Approach**

Western academia is not always well suited to work with Indigenous methods of knowledge production. However, research can play a crucial role in promoting the capacity within communities, which in turn supports Indigenous self-determination (Cochran et al., 2008; ITK, 2018; ITK & NRI, 2006; Secretariat of the CBD, 2009). Decolonizing research can come in many forms, such as Inuit-led research, facilitating the unlocking and furthering of community capacity, and promoting Inuit knowledge rights and data ownership. Castleden et al. (2012) state that research using a collaborative

**Table 3.1:** Key partners and their respective roles and responsibilities in this research project

Name	Background	Role
Regena Sinclair	I am a Master of Arts student in the School of Earth, Environment & Society at McMaster University, Ontario, Canada. I am a GIS and research consultant and have experience with treaty, lands, archaeology, language revitalization and conservation projects. I am passionate about building bridges between Indigenous and scientific knowledge systems in environmental, conservation, wildlife, and climate change issues.	<ul style="list-style-type: none"> <li>- Build relationships with project partners</li> <li>- Facilitate meetings</li> <li>- Co-produce research objectives and methodology with project partners</li> <li>- Complete QC/QA for Qikiqtait Project data from SIKU</li> <li>- Complete analysis under the guidance of project partners</li> <li>- Complete literature review</li> <li>- Complete dissertation</li> <li>- Share results with project partners and the community of Sanikiluaq</li> <li>- (Active in project from 2020-2023)</li> </ul>
Dr. Gita Ljubicic	Gita Ljubicic is a Professor in the School of Earth, Environment & Society at McMaster University, and my Master's supervisor. She is the leader of the StraightUpNorth Research Team and holds a Canada Research Chair (Tier 2) in Community-Engaged Research for Northern Sustainability position. Dr. Ljubicic's research focusses on the junction of cultural and environmental geography in collaboration with communities across Inuit Nunangat.	<ul style="list-style-type: none"> <li>- Supervise my Master's academic requirements,</li> <li>- Facilitate relationship building between myself and project partners</li> <li>- Facilitate meetings</li> <li>- Guide research methodology</li> <li>- Contribute feedback and advice on research project</li> <li>- (Active in project from 2020-2023)</li> </ul>

Dr. Joel Heath	Joel Heath is the Executive Director and co-founder of the AES, a SQSC member, as well as the co-founder of SIKU, and award-winning filmmaker of <i>People of a Feather</i> (2011). His work supports Inuit and Cree environmental stewardship and monitoring initiatives.	<ul style="list-style-type: none"> <li>- Take part in meetings</li> <li>- Co-produce research objectives and methodology</li> <li>- Aid in data interpretation</li> <li>- Contribute feedback and advice on research project</li> <li>- (Active in project from 2020-2023)</li> </ul>
Lucassie Arragutainaq	Lucassie Arragutainaq is a board member and co-founder of the AES, the manager of the Sanikiluaq HTA, and chair of the SQSC. He has contributed to IK transfer projects, such as Hudson Bay Programme and the NTK, or Nunavut Hudson Bay Inter-Agency Working Group, and the production of the book <i>Voices from the Bay</i> (1997). He is a leader in research and land stewardship initiatives and received the 2022 Northern Science Award for his work furthering Inuit-led research and environmental stewardship.	<ul style="list-style-type: none"> <li>- Take part in meetings</li> <li>- Co-produce research objectives and methodology</li> <li>- Aid in data interpretation</li> <li>- Contribute feedback and advice on research project</li> <li>- (Active in project from 2020-2023)</li> </ul>
Johnny Kudluarok	Johnny Kudluarok is on the Board of Directors for the AES, is a SQSC member, and was a lead production assistant/story consultant for <i>People of a Feather</i> (2011). He is a skilled hunter and contributes his expertise in several research projects around the Belcher Islands.	<ul style="list-style-type: none"> <li>- Take part in meetings</li> <li>- Co-produce research objectives and methodology</li> <li>- Aid in data interpretation</li> <li>- Contribute feedback and advice on research project</li> <li>- (Active in project from 2020-2023)</li> </ul>

Mick Appaqaq	Mick Appaqaq is a SQSC member, a Qikiqtait Environmental Technician, and was a SIKU Technician for the AES until 2022. His expertise was used to facilitate SIKU workshops, teach environmental monitoring skills, and administer presentations and press events related to SIKU and the Qikiqtait program.	<ul style="list-style-type: none"> <li>- Take part in meetings</li> <li>- Co-produce research objectives and methodology</li> <li>- Aid in data interpretation</li> <li>- Contribute feedback and advice on research project</li> <li>- (Active in project from 2020-2021)</li> </ul>
Jordan Heppell	Jordan Heppell is a biologist specializing in ecology and conservation. He held a Research Assistant position with McMaster University for this project from November 15, 2021 – February 18, 2022. He now works with the AES to support SIKU development.	<ul style="list-style-type: none"> <li>- Complete QC/QA for Qikiqtait Project data from SIKU</li> <li>- Supported the temporal analysis and R coding processes</li> <li>- (Active in project from 2021-2023)</li> </ul>
Lisi Kavik-Mickiyuk	Lisi Kavik-Mickiyuk is the Inuit Nunangat SIKU Coordinator for the AES. She holds extensive language and harvester knowledge.	<ul style="list-style-type: none"> <li>- Translate species terms into Sanikiluaq dialect of Inuktitut</li> <li>- (Active in project in 2023)</li> </ul>

approach to community engagement can act as a decolonizing method within academia. Undertaking a community-engaged approach challenges the conventional Western structure of academia and creates space for Inuit knowledge within the academic setting. Although my project used only secondary data collected as a part of the Qikiqtait Project with the SIKU mobile app and platform, ongoing and collaborative engagement with my research partners was a key component in creating useful results for Qikiqtait.

My community-engaged approach to research focused on working with the SQSC as research partners, rather than trying to engage the community of Sanikiluaq more

broadly. The SQSC are stewards of the Qikiqtaik project data, so it was most appropriate to ensure my research methodology was co-determined with their ongoing input and feedback. My approach was inspired by the Sikumiut model that was co-developed by the community of Mittimatalik (Pond Inlet), Nunavut (Wilson et al., 2020). This model acts as a guide for non-Indigenous researchers to structure their research in a way that supports Inuit voices and priorities through mentorship, including to:

- Strengthen Inuit youth capacity;
- Develop Inuit specific values for research;
- Prioritize community-based research needs;
- Embrace Inuit decision making; and, [ultimately]
- Support Inuit self-determination in research (Wilson et al., 2020).

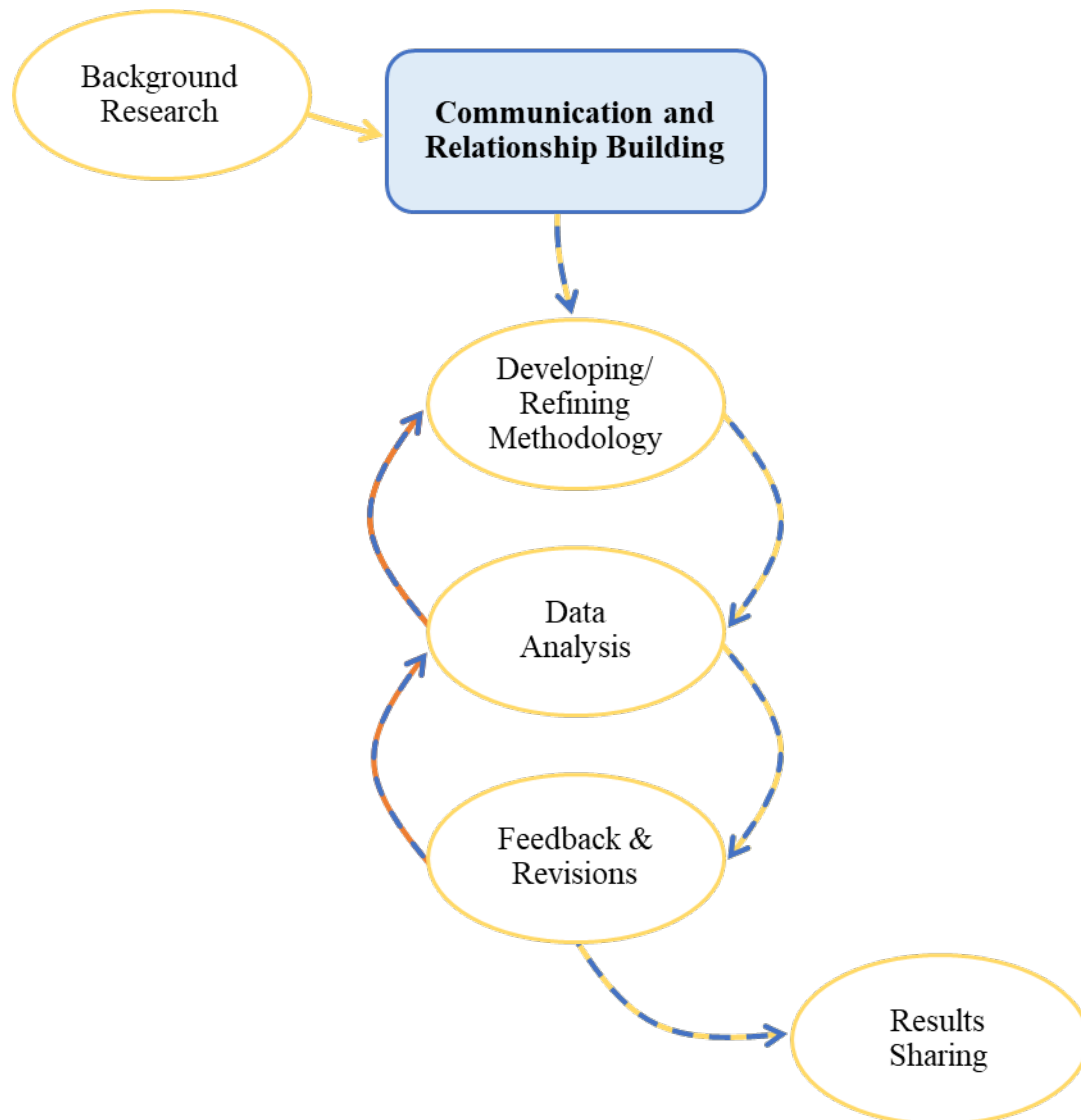
Taking this model to heart, I aimed to contribute to decolonizing research by taking on the role of resource person and facilitator, while tailoring my research objectives to address conservation priorities of the SQSC.

Part of community-engaged research means committing to an iterative approach that acknowledges and responds to community priorities and needs. For this, I also drew on the model developed by Tondu et al. (2014) that emphasizes building trusting research relationships. This involves dedicating time with community partners to build trust and foster genuine collaborative efforts (i.e. through being present, communicating, listening, respecting, and understanding), which are needed for respectful and meaningful knowledge exchange (Tondu et al., 2014). This focus around relationship-building is

echoed in the recommendations by the ITK and NRI (2007) at the outset of initial research project design, as well as through all phases of the research process.

Building on key principles and goals outline by Tondu et al. (2014), Wilson et al. (2020), and ITK and NRI (2007), my research approach was primarily influenced by the AES as well as priorities outlined in the National Inuit Strategy on Research (ITK, 2018). The AES is an Inuit-led organization created specifically to advance meaningful research relationships that involve community members in every stage of the research process (SQSC, 2019a). I developed my own conceptualization of the iterative research approach adopted in working with the AES and SQSC (Figure 3.1). I emphasize communication and research partner engagement and feedback, with the opportunity to adjust and restructure the project to meet evolving community priorities. A flexible research design that is adaptable to community priorities is critical to reduce the likelihood of conflict with project partners (Gearheard & Shirley, 2007). Every phase of my approach included communication with my key research partners (Table 3.1). This reduced the risk of data misinterpretation and allowed the SQSC to decide what data was shared, and how the data was shared.

The background research I reviewed in this chapter, and the community-engaged research methodology used in this project, helped to develop a project that addressed Qikiqta priorities. This reduced the amount of research fatigue experienced by Sanikiluarmit as a result of being approached with ready-made research projects by non-Inuit researchers with no understanding of community interests.



**Figure 3.1:** Iterative research approach used in this project  
*Where:* yellow lines represent project stages, blue dashed lines represent communication with research partners, and orange lines represent feedback and revisions phases in the project

### 3.2.1 COVID-19 Pandemic and Communications

The COVID-19 pandemic (extending from March 2020 – February 2022) created numerous challenges when it came to engaging with my research partners. During the timeframe of this project, I was unable to travel to Sanikiluaq due to travel restrictions

and housing limitations, and the majority of communications with my research partners were conducted remotely. This meant an increased reliance on internet in Sanikiluaq (which can be limited and costly to those in the community) and limited the size of files I could send and received by my research partners through email. Local pandemic restrictions in 2020-2021 also meant that meetings within Sanikiluaq happened less frequently, so fewer project meetings were able to occur during this time. As a researcher with no previous relationships in Sanikiluaq, these restrictions greatly limited opportunities to interact with community partners in an informal setting to facilitate relationship building. It was also important to keep in mind that the community has priorities outside of this project, such as the health and wellbeing of community members. Patience and understanding when working with the Sanikiluaq community are crucial to foster good relationships and good research. Community priorities and events took precedence over the timeframes stipulated by my Master's program, especially during the disruption of the COVID-19 pandemic.

Dr. Heath was a key and ongoing contact during remote communications throughout my thesis project. Lucassie Arragutainaq and Johnny Kudluarok provided key project feedback and direction throughout this thesis research, and Mick Appaqaq provided important feedback during the early stages of this project. Regular emailing and online video conferencing meetings took place starting in December 2020. Video conferencing meetings held in January, May, October, and November 2021, and June and August 2022, focussed on project design and methodology, and meetings in September 2022, and March 2023, discussed draft results and results sharing. Emails facilitated

continuing conversations between meetings. Dr. Heath was the primary contributor of the technical feedback on the data cleaning and analysis methodology during this project and communicated project updates to other research partners in Sanikiluaq. In light of the limitations dictated by the COVID-19 pandemic, I was fortunate to meet in-person with Lucassie Arragutainaq and Johnny Kudluarok during the ArcticNet conference in December of 2022. This meeting was pivotal to building trust and receiving feedback on draft analyses. I also had the opportunity to meet Lisi Kavik-Mickiyuk in person in July of 2023 to discuss Sanikiluarmit terminology for the species in my analysis.

### **3.3 Data Sources and Permissions**

#### **3.3.1 SIKU and the Qikiqtait Project**

This project uses secondary data gathered using SIKU, a “platform to support Indigenous self-determination, ice safety, food security, conservation economies and knowledge transfer” (SIKU & AES, 2020, p. 4). SIKU focuses on promoting Indigenous-led research and supports crowd-sourced data collection directly by Indigenous harvesters.<sup>7</sup> A whole-of-community approach involved Sanikiluarmit in the app design, development and beta testing stages prior to the 2019 launch, and continued app developments rely on this collaborative process (SIKU & AES, 2020). Sanikiluarmit primarily use the SIKU app platform.

---

<sup>7</sup> Although the terms “hunter” and “hunting” are used within SIKU, it is important to acknowledge that not all users of SIKU may identify with these terms. To reflect the diverse hunting and harvesting practices of Sanikiluarmit, this project uses the terms “harvester” and “harvest” instead.

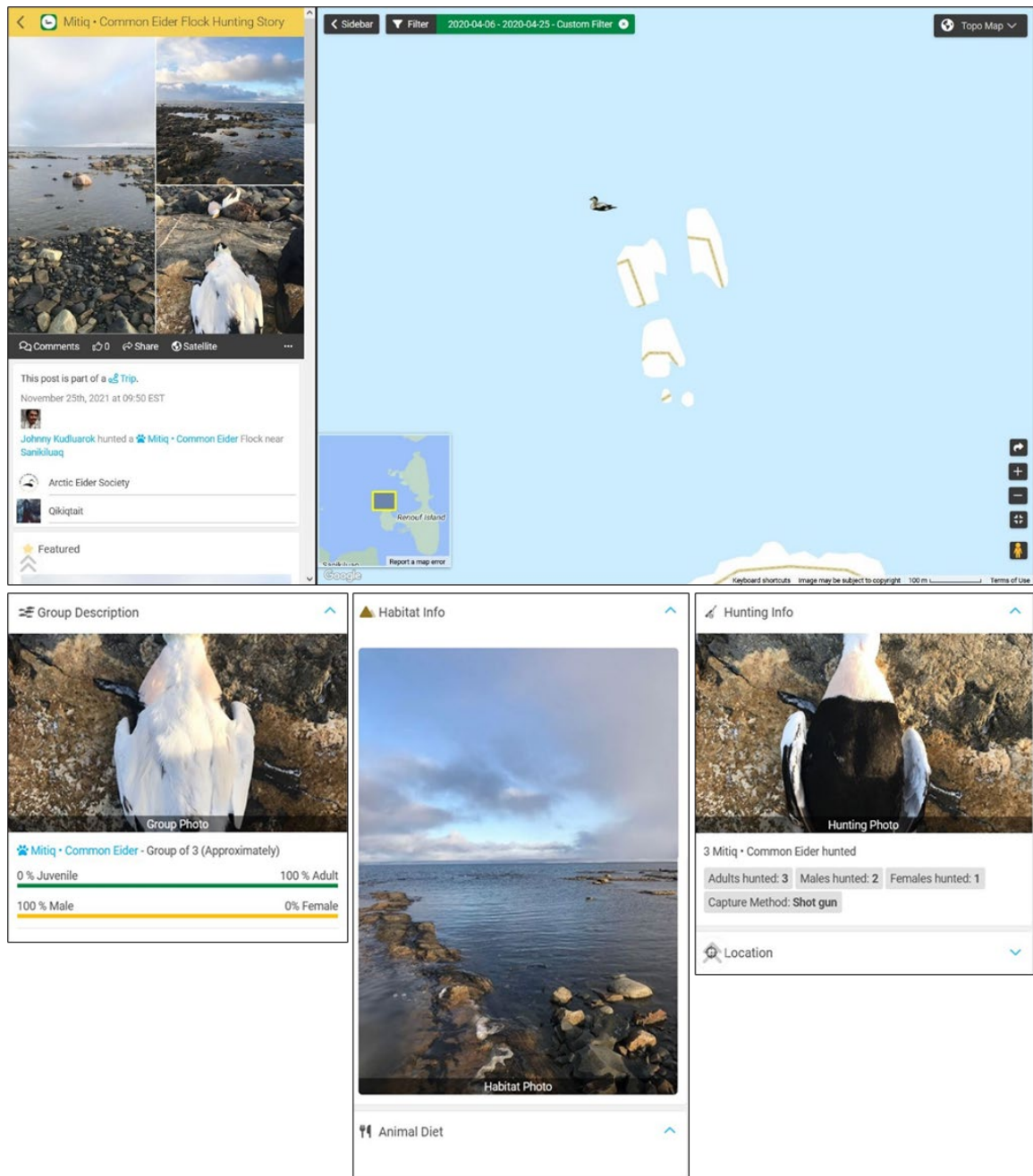
SIKU is structured to record information through “Post” and “Trip” entries (Table 3.2). Posts are unique recordings of instances of wildlife harvesting, wildlife observations, ice observations, social events/practices, monitoring tool use, or reports. A harvesting Post is referred to as a “Wildlife Hunting Story” and identifies one set of coordinates as a harvesting location. Within a Wildlife Hunting Story, users select the species that is harvested, and if the harvest represents one animal or multiple animals. After these selections are made, the user has the option to upload photographs and add information to several fields, including those related to animal measurements, health metrics, habitat description, and harvest method. The wildlife metrics available in a Post are constantly evolving based on user feedback and project needs. An example of a completed Post on the web platform of SIKU is seen in Figure 3.2.

SIKU users use Trips to record and save a GPS (Global Positioning System) track of their travel route. Trips do not contain the same metrics fields as Posts, but Posts can be linked to Trips. An example of a completed Trip on the web platform of SIKU is seen in Figure 3.3.

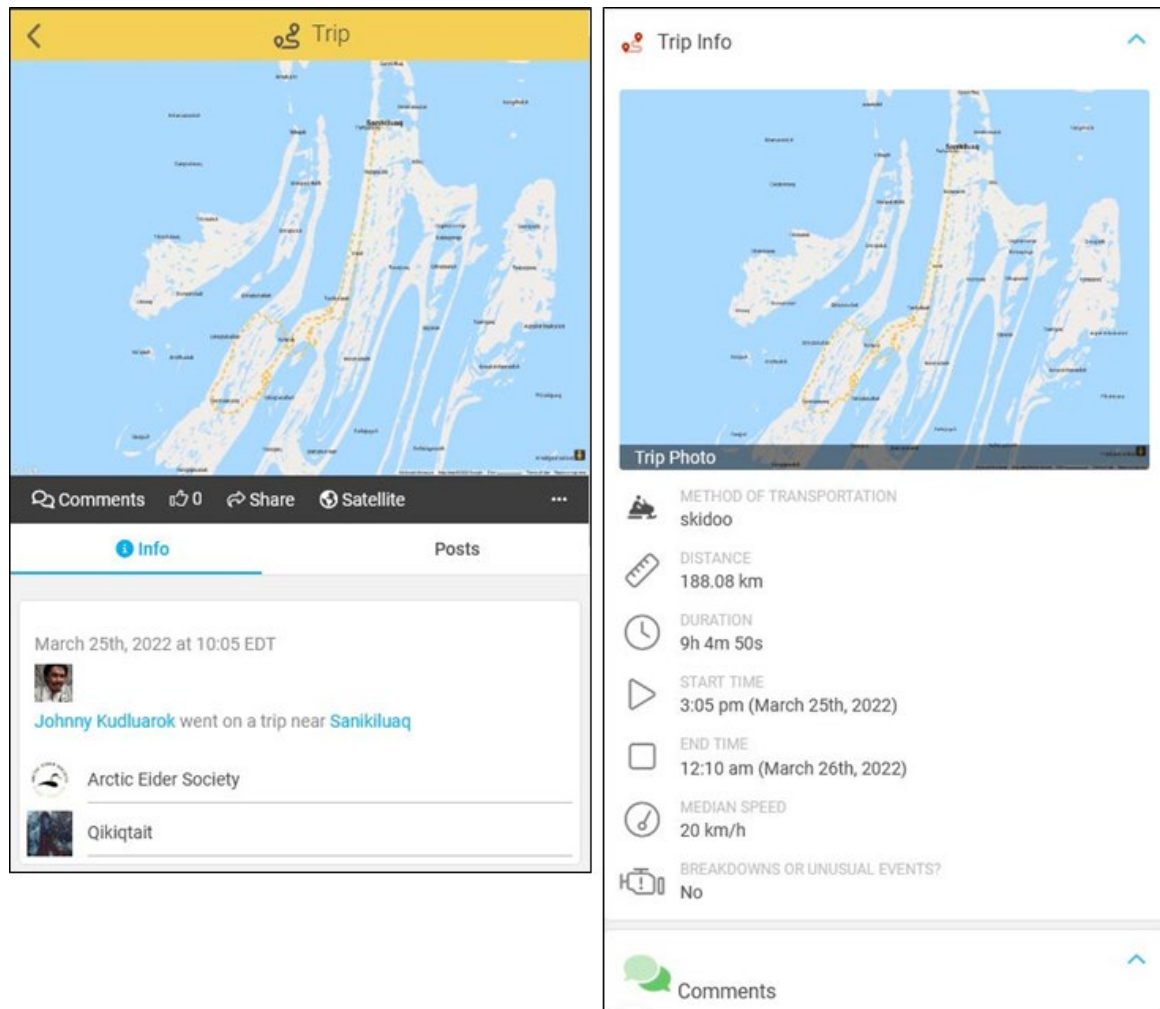
Although Post and Trips have diverse structures, they are both used in different aspects of this project. Posts and Trips are used in the temporal analysis of this project, while only Posts are used in the spatial analysis. Unless otherwise specified, all Post and Trip records will be referred to as “posts” in this project going forward.

**Table 3.2:** Description of the methods of recording data available on the SIKU platform

<b>Method of Recording Data on SIKU</b>	<b>Description</b>
Post	A Wildlife Hunting Story, Wildlife Observation, Social Post, Ice and Snow Observation, Tool, or Ship Observation with one set of corresponding spatial coordinates
Trip	Record of travel with linear spatial coordinates
Wildlife Hunting Story	Post type designed to record harvest instances
Wildlife Observation	Post type designed to record flora or fauna observations when no harvesting occurs
Social Post	Post type designed to record information that does not fit into the other Post types (e.g., meat preparation, group gatherings)
Ice and Snow Observation	Post type designed to record ice conditions
Tool	Post type designed to record the deployment of devices used in environmental monitoring
Ship Observation	Post type designed to record large commercial or transport ships



**Figure 3.2:** Completed SIKU Wildlife Hunting Story Post Retrieved February 23, 2023, from <https://www.siku.org/>. Used with permission from the AES.



**Figure 3.3: Completed SIKU Trip**  
Retrieved February 23, 2023, from <https://www.siku.org/>. Used with permission from the AES.

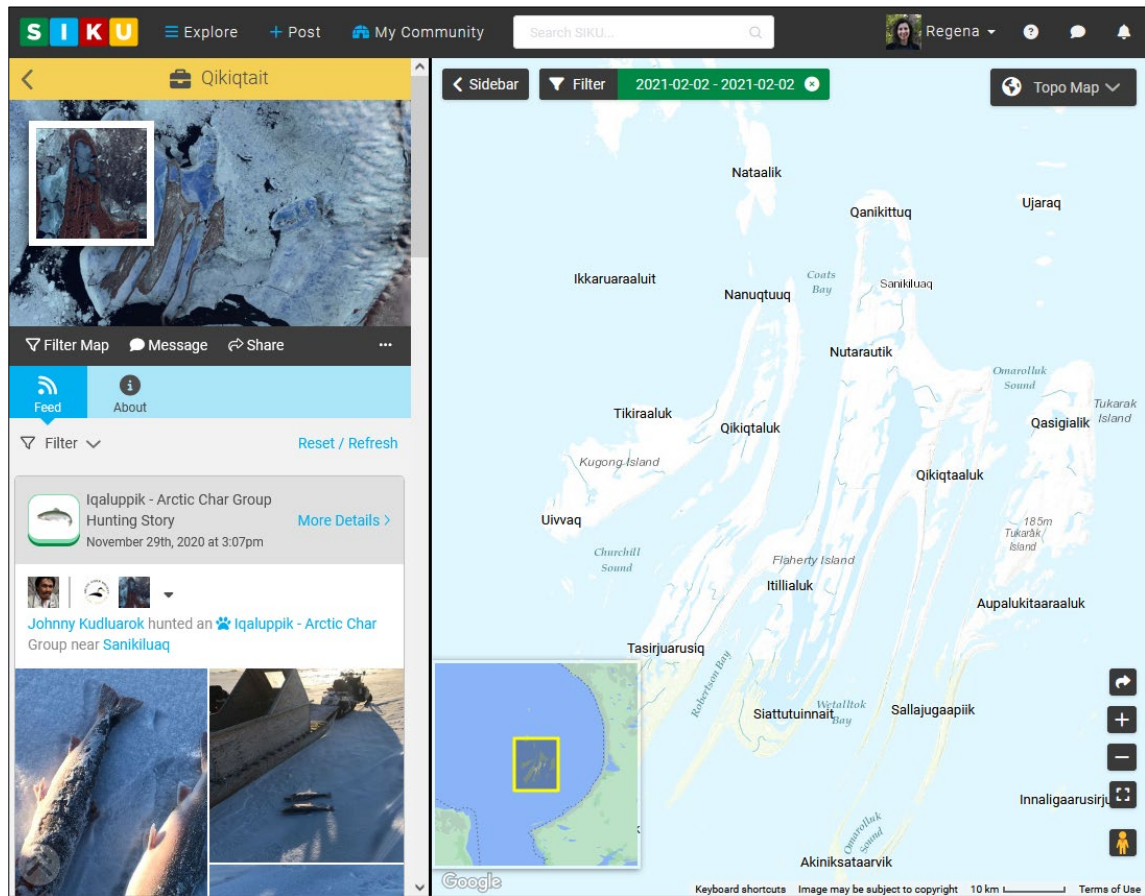
SIKU has developed the option to allow the stewardship of certain posts through the framework of a “Project”. Users can become members of a Project and “tag” their posts to the Project, and in doing so give permission for Project administrators to edit and steward tagged posts for the goals specifically outlined by the Project. Project structure and stewardship is further defined in the documents in Appendix 1. The research data

used in this project was tagged to the Qikiqtait Project, which is governed by the SQSC. Users in the Project have provided the SQSC a non-exclusive license to use the information in their posts for the purposes of the Qikiqtait Project. Community harvesters shared their data regarding hunting trips to the Qikiqtait Project from (Figure 3.4) (SQSC, 2021). Approximately 18.8% of the Sanikiluaq community contributed to the Qikiqtait Project by the end of the study period.



**Figure 3.4:** SIKU Qikiqtait Project approach  
Copyright 2023 by SIKU. Used with permission from the AES.

The Qikiqtait Project web platform (which is primarily intended for the use of Project managers and what I exclusively used in this project) user homepage includes a map view showing post type, species and location, and on the left side there is post feed showing the most recent posts made to the Project (Figure 3.5). My research was done collaboratively with the SQSC, and the rights of the data remain with the Qikiqtait Project.



**Figure 3.5:** Qikiqtait Project user homepage  
Retrieved August 12, 2023, from <https://www.siku.org/>. Used with permission from the AES.

Inuit access, ownership, and control over the knowledge shared in research is a key priority when research involves Inuit data (ITK, 2018). Data collected on SIKU is stored on the SIKU server, which is owned and managed by the AES. While the server stores the data, users hold ownership and control of their posts and data (AES, 2022; Arragutainaq et al., 2020; Pedersen et al., 2020a; SIKU & AES, 2020; SQSC, 2021). SIKU upholds data sovereignty and follows objectives similar to First Nations principles of ownership, control, access, and possession (OCAP)<sup>®</sup>: respect, self-determination, intellectual

property ownership, and data integrity (The First Nations Information Governance Centre, 2023). SIKU users choose how their knowledge is shown to other users, Project administrators, or the public, and how it is shared in Projects or beyond the platform while retaining rights to their knowledge (SIKU & AES, 2020). For example, users can choose to hide or show their post's location, as well as other post details.

After the development and signing of a Research Agreement between the AES, the SQSC and McMaster University, the AES assigned me administrator privilege for the Qikiqtait Project on SIKU. This allowed me to view, edit and download posts in the “Manage Posts” view. Data collected in the Qikiqtait Project was downloaded from SIKU in CSV format for the periods of January 1, 2019, to March 31, 2023, for the selected species (Section 3.4.1; 3.4.2).

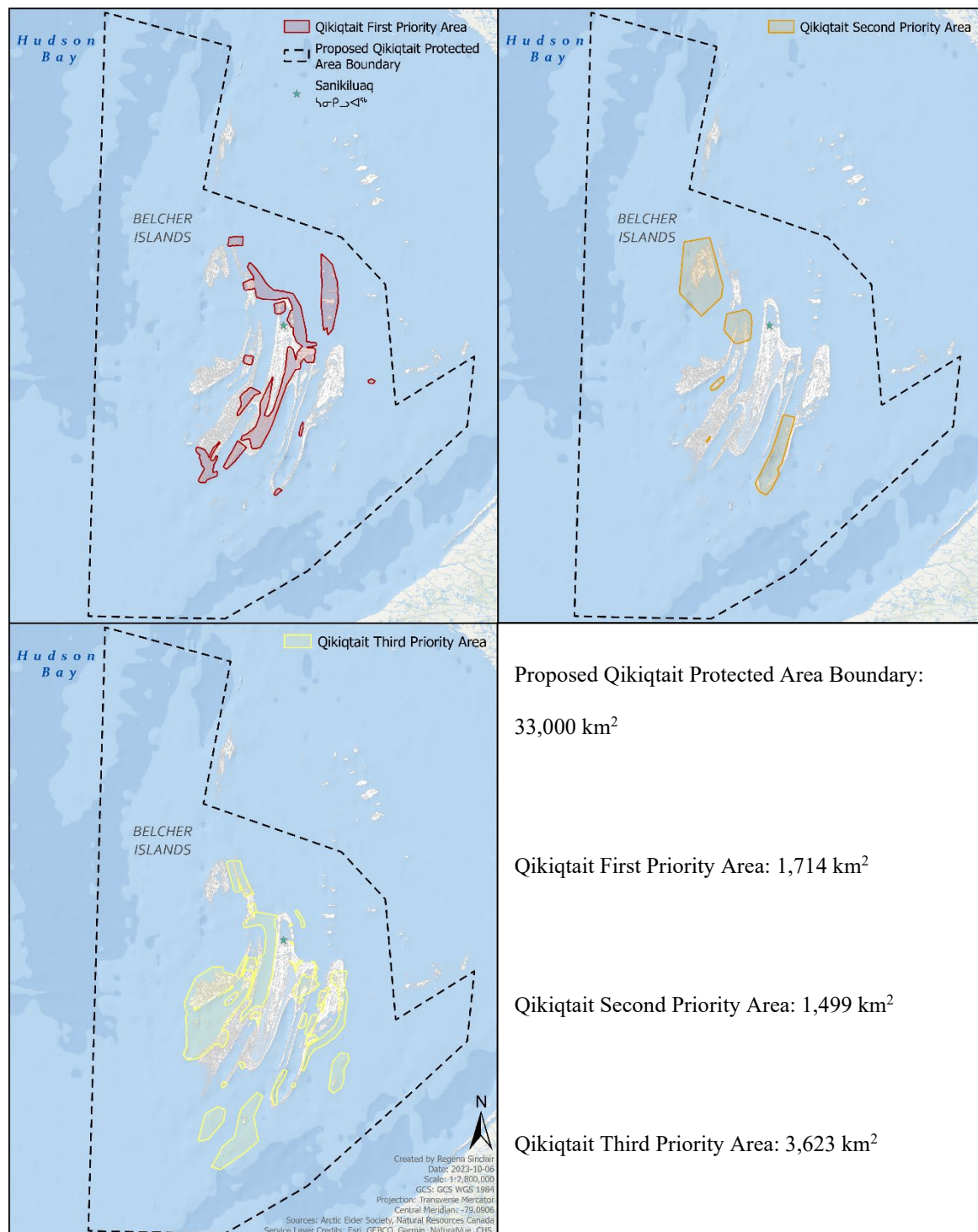
### 3.3.2 Community-identified Priority Areas for Qikiqtait

In 2019, a meeting involving Sanikiluarmit and the local, regional, and federal Qikiqtait partners was held in Sanikiluaq to discuss the next steps of the project (SQSC, 2019b). At this time, the boundaries of Qikiqtait were determined to include the entire marine and terrestrial region of the Belcher Islands (Appaqaq et al., 2020; SQSC, 2019b). This meeting also resulted in the identification of four levels of priority areas, to inform Qikiqtait management decisions (Appaqaq et al., 2020; SQSC, 2019b). Community members unanimously agreed that the entire Belcher Islands region was the primary priority area for protection (Haycock-Chavez, 2021; SQSC, 2019b). Within this primary priority area, further regions were identified as second, third, and fourth priority areas (SQSC, 2019b). These areas were identified by several community members based on

knowledge of “environmental factors, but also included complex community needs such as ecosystem services or areas of particular importance for a specific species” (Haycock-Chavez, 2021, p. 20). These included: “specific areas that represented heightened environmental importance to the community, such as areas used by belugas during the spring and summer months or areas used by the community for harvesting mussels and urchins” and “summer and winter habitat for eider, such as nesting grounds and polynyas” (Haycock-Chavez, 2021, p. 61). These priority areas did not include zones within the Sanikiluaq municipal boundaries. With permission from the AES, the spatial files of this data were provided to me by Natasha Haycock-Chavez on November 8, 2022, and are used in this research to address Objective 2. Following the methodology used by Haycock-Chavez (2021), the priority areas within the primary Belcher Islands-wide priority area were categorized as 1 (first priority), 2 (second priority) and 3 (third priority) (Figure 3.6).

### 3.3.3 Ethics and Project Approvals

This project sought several approvals prior to data collection and analysis. A Research Agreement between AES, the SQSC and McMaster University was signed in October 2021. Research agreements such as this can help to circumvent potential misunderstandings or conflicts between communities and researchers regarding research results sharing and data ownership (Castleden et al., 2012). I received McMaster Research Ethics Board approval for this project on October 25, 2021 (protocol # 5233).



**Figure 3.6:** Community-identified priority areas for Qikiqtait Protected Area

To fulfil part of the ethics process requirements, a project Letter of Information and Project Summary were added to the project webpage (<https://www.straightupnorth.ca/qikiqtait-protected-area-development/>) on the StraightUpNorth research website (<https://www.straightupnorth.ca/>) in February 2022 (Appendix 3). Under the Nunavut Scientists Act, all research in Nunavut requires a license administered by the NRI (NRI, 2021). The analysis conducted in this project was added to an existing NRI license (number 01 007 21R-M) held by AES on October 28, 2021.

#### 3.3.4 Handling of Sensitive Information

Data exported from the Qikiqtait Project on SIKU contains some identifying information of harvesters who contributed to the Qikiqtait Project. For each post, the user's name is identified both in the online SIKU database, and in the downloaded CSV file. User's names were used to help identify duplicate posts (discussed further in Section 3.4.4). User's names (outside of those of my research partners) were not included in this project beyond the purpose of a QC/QA analysis process (Section 3.4.4), were not publicly identified, and were not shared outside the circle of my research partners.

Harvesting frequency, methods, locations, and amounts vary between users, and it was not an objective of this project to examine individual harvesting habits or comment on Sanikiluarmit harvesting practices. Instead, a focus of this discussion is the ability of harvester-collected data to document the seasonality of wildlife resources and harvesting, identify areas of concentrated harvest, and present data representation approaches for Qikiqtait Project data to support Qikiqtait management priorities. In an effort to respect

the sensitive nature of this data regarding harvesting quantities and locations, the daily harvest totals per species and exact harvest locations have not been included in the following results. This data can be obtained with permission from the SQSC.

### **3.4 Data Preparation**

#### **3.4.1 Temporal Scope**

Posts and trips collected from the Qikiqtait Project were downloaded from SIKU for the period of January 1, 2019, to March 31, 2022. While the QC/QA process was completed for all data within this time frame, my analysis focussed on data between April 1, 2020, and March 31, 2022. This time window was chosen for several reasons. SIKU was officially launched on January 1, 2019, and as a result, there was a period of growth during the initial year of the platform where limited or sporadic data was collected. The Qikiqtait Project was initiated in the winter of 2019, thus the data collection for Qikiqtait was started during this time (SQSC, 2021). As a result, the decision to exclude dates prior to April 2020 was made in consultation with the SQSC in order to focus on years with more robust community engagement with the SIKU app, and more accurately recorded data in order to be more representative of Sanikiluarmit harvest patterns. The March 31, 2022, cut-off was determined to include two full harvest years of data. Throughout this thesis (unless otherwise stated) “Year 1” refers to the first full year of data analysis, from April 1, 2020, to March 31, 2021, and “Year 2” is the second full year of data analysis, from April 1, 2021, to March 31, 2022.

### 3.4.2 Species Selection

SIKU is a growing platform that is continually increasing its capacity for community environmental monitoring across Canada, Alaska, and Greenland (Heath & Rosengard, 2022) with new species post options being added to the platform on an ongoing basis, as needed by communities and research programs. All the of the species identified by the SQSC to include in monitoring for the Qikiqtait Project were included from the start of the Project. For this research, it was first necessary to determine the Qikiqtait Project species to undergo the QC/QA process. Through several discussions with my project partners, 18 important harvesting species were identified in relation to Qikiqtait. In addition to these key species, I identified an additional six species that were frequently harvested in the Qikiqtait project. After further examination of the data in the Qikiqtait Project, a further 15 species were included to ensure that the key and more frequently harvested species were captured in the analysis. This inclusion attempted to address two common instances with posts: 1) the incorrect species was listed in the post (e.g., an Arctic char harvest posted as a whitefish harvest post type), and 2) several species were sometime harvested together but only recorded in a single species post (e.g., several species of berries were harvested together in the same location, or several species of invertebrates were collected in the same bucket). Data for a total of 34 species were downloaded from the Qikiqtait Project on SIKU. The 34 species that were put through the QC/QA process were further refined to the key species for my thesis analysis (Table 3.3). Long neck and short next Canada goose, as well as cackling goose were later combined

(Section 3.4.4) and this thesis refers to 14 analysis species going forward. Several factors influenced the final species selection and are listed below:

1. Priority was given to species identified by the SQSC as important harvest species.
2. Due to the restrictive and sensitive considerations around the harvest of managed species, it was decided that polar bear, beluga, and reindeer would not be analyzed in this thesis.
3. Effort was made to include species across the mammal, bird, fish, invertebrate and plant categories.
4. Some species are ecologically important to key species identified by the SQSC and were included in the analysis. For example, green urchin is both harvested for consumption (Wein et al., 1996) and is the primary food source for eider duck, a culturally significant species to Sanikiluarmit (Heath & Community of Sanikiluaq, 2011; Nakashima, 1991; SQSC, 2021). Additionally, Arctic fox was included in the analysis due to its harvest for pelts (AES, 2022; Quigley & McBride, 1987), often used in local clothing.
5. Analysis was limited to the recorded harvest of juvenile and adult animals.  
  
Although waterbird (eider duck and goose) eggs and down are regularly harvested by Sanikiluarmit, this data required additional considerations for analysis and were excluded at this time (see Section 3.4.4 for additional discussion).

### 3.4.3 Qikiqtait Project Users

The Qikiqtait Project had 114 users in Year 1, and 190 users in Year 2. Given that the population of Sanikiluaq is 1,010 (Statistics Canada, 2023), the Qikiqtait Project

**Table 3.3:** List of analysis species

Species English Common Name	Species Latin Name	Inuktitut Name <sup>8</sup>	Details
Blueberry <sup>9</sup>	<i>Vaccinium uliginosum</i>	Tungujuq (ᑦᑦᑭᑦ)	Ripe berries, or when there are ripe and unripe berries together
Cloudberry	<i>Rubus chamaemorus</i>	Arpik (ᐱᑦᑭ)	
Crowberry	<i>Empetrum nigrum</i>	Paunngaq (<ᑦᑭᑦ)	Sanikiluarmiut refer to this berry as “blackberry” in English
Lingonberry	<i>Vaccinium vitis-idaea</i>	Kimminaq (ᑭᑭᑭᑦ)	Also referred to as “red partridge berry” or “cranberry”
Arctic scallop	<i>Chlamys islandica</i>	Tallurunnaq (ᑦᑦᑭᑦ)	
Blue mussel	<i>Mytilus edulis</i>	Uviluq (ᑦᑦᑭᑦ)	
Green urchin	<i>Strongylocentrotus droebachiensis</i>	Mirquliq (ᑭᑭᑦᑭᑦ)	
Arctic fox	<i>Vulpes lagopus</i>	Tiriganiaq qakuqtaapik (ᑭᑭᑦᑭᑦ ᑦᑦᑭᑦ)	“White fox”
Bearded seal	<i>Erignathus barbatus</i>	Utjuq (ᑦᑦᑭᑦ)	
Ringed seal	<i>Pusa hispida</i>	Natsiq (ᑦᑦᑭᑦ)	
Cackling goose	<i>Branta hutchinsii</i>	Nirlinaq (ᑦᑦᑭᑦ)	
Canada goose (long neck)	<i>Branta canadensis</i>	Isatsaq (ᑦᑦᑭᑦ)	
Canada goose (short neck)	<i>Branta canadensis</i>	Nirlik (ᑦᑦᑭᑦ)	
Common eider	<i>Somateria Mollissima</i>	Mitiq (ᑭᑭᑦ)	
Arctic char	<i>Salvelinus alpinus</i>	Iqaluppik (ᑦᑦᑭᑦ) / Tasiqsiutik (ᑦᑦᑭᑦ)	Sea-run / landlocked
Whitefish	<i>Coregonus</i> spp.	Kapisilik (ᑦᑦᑭᑦ)	

involved roughly 18.8% of the Sanikiluaq community in Year 2. This also shows an increase in the number of users involved in the Qikiqtait Project over time. It is important to note that not all users recorded harvest posts equally (e.g., some Sanikiluarmit harvest year-round, when others harvest seasonally), and I did not examine this factor in my thesis. In Year 1, 96 Qikiqtait Project users posted at least one Wildlife Hunting Story. Within the 96 users, 62 (64.6%) posted 20 or less Wildlife Hunting Stories (Figure 3.7). In Year 2, 172 Qikiqtait Project users posted at least one Wildlife Hunting Story. Within the 172 users, 110 (64.0%) posted 20 or less Wildlife Hunting Stories (Figure 3.7).

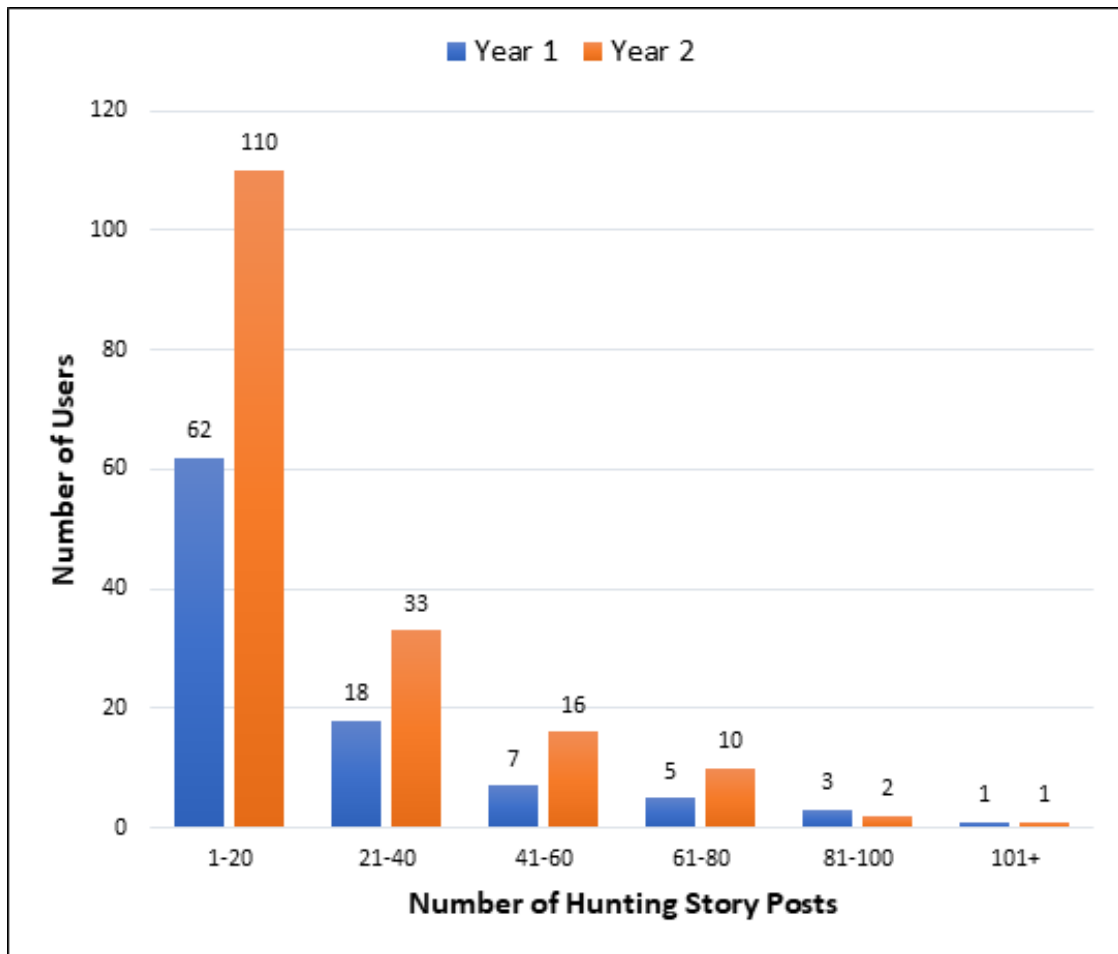
#### 3.4.4 Quality Control/Quality Assurance Process and Results

One of the necessities of preparing this data was to ensure (to the best of my ability) that the data used in this analysis was as accurate as possible, in order to best represent Sanikiluarmit monitoring data. During the COVID-19 pandemic, there was no access to training workshops regarding how to record monitoring data in the Qikiqtait Project in 2020 and limited in-person training in 2021 and 2022. This resulted in some errors and missing information within some of the posts as users learned to navigate the app

---

<sup>8</sup> All Sanikiluaq-specific names and details were provided by Lisi Kavik-Mickiyuk (I. Nicoll, personal communication, April 2023).

<sup>9</sup>The term “blueberry” can refer to several species, some of which — such as the northern highbush blueberry (*Vaccinium corymbosum*) — are not endemic to the Belcher Islands (iNaturalist, n.d.-b). There are four berry plants commonly referred to as “blueberry” on the Belcher Islands (I. Nicoll, personal communication, April 2023). One species is the bog bilberry (*Vaccinium uliginosum*), a plant that produces a fruit similar in appearance to a blueberry (iNaturalist, n.d.-a). Since the term “blueberry” is predominately used in Sanikiluaq, the plant profile on SIKU also uses “Blueberry” to refer to bog bilberry. To carry through this local terminology, this paper also uses the term “blueberry”.



**Figure 3.7:** User posting frequency in the Qikiqtait Project  
*Where: blue represents Year 1 totals and orange represents Year 2 totals*

independently. After initial discussions with my research partners and upon review of the data, it was deemed necessary to complete some QC/QA on the SIKU data in preparation of analysis. Below is an overview of key steps in the QC/QA process (for a detailed outline of the QC/QA steps, see Appendix 4). The main goals of this QC/QA process were to review each post to:

1. Confirm the occurrence of a harvest,
2. Confirm species,
3. Confirm the number of animals harvested, and
4. Identify posts documenting the same harvest (duplicates).

To find all posts (including Wildlife Hunting Stories, Wildlife Observations, Trips, Social, Ice, and Tool Posts) relating to the 34 species to undergo the QC/QA process, keywords for each species were used to filter the data in the Qikiqtait Project Manage Posts view (Appendix 5). This was to ensure that any harvesting posts that were recorded using the incorrect post or species type could be corrected in the QC/QA process and included in analysis. All posts that were identified as representing a harvest were included in my analysis. All downloaded CSV files were transformed into Excel spreadsheets and each entry was reviewed individually. In the “Manage Posts” view in SIKU, each post in the spreadsheet was opened and the photographs and details analyzed for the four objectives above. If the post was a Wildlife Observation type but contained a harvest (either indicated in text somewhere in the post, or a post photograph contained a picture of a harvested species), I included the post in the spreadsheet as a Wildlife Hunting Story. Similarly, if a post was a Wildlife Hunting Story type but there was no clear indication of a harvest (i.e., the post did not contain any metrics or notes, there was no photograph, or the photograph showed the species at a distance), I included the post in the spreadsheet as a Wildlife Observation.

The exception to this process was for berry and invertebrate species. Berry and invertebrate species were a key focus for this research, as my research partners expressed

interest in knowing how many people are harvesting these species, when they are harvesting them, and where they are being harvested. All berry and invertebrate posts (i.e., Wildlife Observations and Hunting Stories) that indicated a harvest for my 14 analysis species (Section 3.4.2) either through post text or photographs were considered harvest posts and included in my analysis. It was unlikely that users were creating posts about berry species without eating or harvesting them at the same time, so it was deemed a reasonable assumption that all the berry species posts could be considered harvest posts. Similarly, it was unlikely that users did not harvest invertebrate species in posts that included photographs of the species when they were out of the water. As a result, all posts that indicated harvest through either text or photographs of invertebrates out of the water were considered harvest posts. For the purposes of this project, the berry and invertebrate species harvest was measured by the presence of the species in the post (i.e., harvest = 1). This method was chosen because the only way to currently record harvest amount on SIKU is to indicate the number of animals hunted, a method that does not translate well for species that are harvested in volume. As harvesters are unlikely to count every berry they pick, or every mussel they catch, it was not deemed appropriate to base harvest totals on individual berries or invertebrate animals. If the species was present in the photograph (and the photograph was not a long-distance landscape photograph), or otherwise indicated in the text, harvest for that post was set as equal to one. These situations are important to highlight as they affected the data included in the analysis, and therefore, the results presented here.

Wildlife posts can either be Individual (representing one animal or plant) or Group (representing two or more animals or plants), and these had to be treated slightly differently within my analysis, as shown in the QC/QA outline of steps (Appendix 4). For all species other than berry and invertebrates, I updated the “# of animals hunted” in Group posts within the spreadsheet to reflect the total harvest of the post based on post text and photographs. The “# of animals hunted” was not altered if the harvest total already indicated was greater than the harvest total as shown in the post photographs. The reasoning here was that it is likely that the photograph did not include the complete harvest. If a Wildlife Hunting Story Post did not include any photograph or text, the Post was kept as a harvest post, as the harvest was assumed to be either equal to one for Individual posts, or equal to two for Group posts. If an Individual harvest post contained more than one animal, the number of animals harvested was recorded in my spreadsheet. Issues or items of note concerning Trips were recorded in the spreadsheets.

Eider duck posts that related to nesting surveys were removed from my analysis. To remove these posts, the word “survey” was searched in the eider duck spreadsheets, and if the word appeared in the post’s “Title” or “Name” fields, or the post was created using the official eider duck survey user accounts, the post was removed from analysis. Additionally, while some Sanikiluarmit differentiate some sub-species of Canada geese, this project was interested in Canada geese generally. As such, short neck and long neck Canada goose, as well as cackling goose (referred to as “Canada/cackling goose” hereafter) were combined for the analysis. Finally, waterbird posts containing either egg or down harvest were not included in this analysis because it was deemed out of scope;

the focus of this research project was of the harvesting of juvenile and adult animals (and berries) only.

The last stage of QC/QA was to identify and remove posts showing the same harvest. Duplicate harvest records occurred for a number of reasons, but the foremost reason was liking due to the lack of available SIKU training during the COVID-19 pandemic. For example, two users fishing together might each make a post of the combined total harvest of the day (6 fish) instead of each posting their individual harvest for the day (3 fish each). Additionally, some users frequently posted the same harvest in various stages of processing (e.g., when the harvest was collected and then again when while the harvest was being prepared), which resulted in the same harvest represented several times within the Qikiqtait Project. For some species, the number of posts recording the same harvest had a large impact on the final tally of harvested animals. Therefore, removing instances of duplicated harvests was necessary to develop a more accurate representation of the number of animals harvested. To identify posts with duplicated harvest, I went through each species' spreadsheet day by day. If there were multiple harvest posts recorded on the same day, I filtered the map view of the Qikiqtait Project on SIKU to only show posts for that day, and visually assessed if the posts were made in close proximity to each other. Posts did not have to have the exact same coordinates to be considered in close proximity to account for differences in where people made the post (e.g., standing separately), along with potential cell phone GPS error. I then opened each of the posts that were in a similar location, and reviewed the post photographs to determine if the same animals were captured in more than one post.

Harvest was considered duplicated if users' photos were exactly the same, or if the harvested animals in the photos were in the same position and were clearly distinguishable as the same animals. I added a new field to each of my species' spreadsheets titled "Duplicate". If the same harvest was represented in several posts, it was recorded in the "Duplicate" field, and the identification numbers of the posts were recorded in the spreadsheet notes. I then had to decide which posts would be used in my analysis. I strived to include as many unique post locations, and post authors, as possible and did not remove post or harvest numbers from my analysis unless I was reasonably confident the harvest was in fact duplicated. This means that even after the QC/QA process, the harvest totals may be slightly higher than the actual harvest made by the Sanikiluarmitut who recorded their harvest using SIKU. The following actions were taken to address duplicate harvest instances:

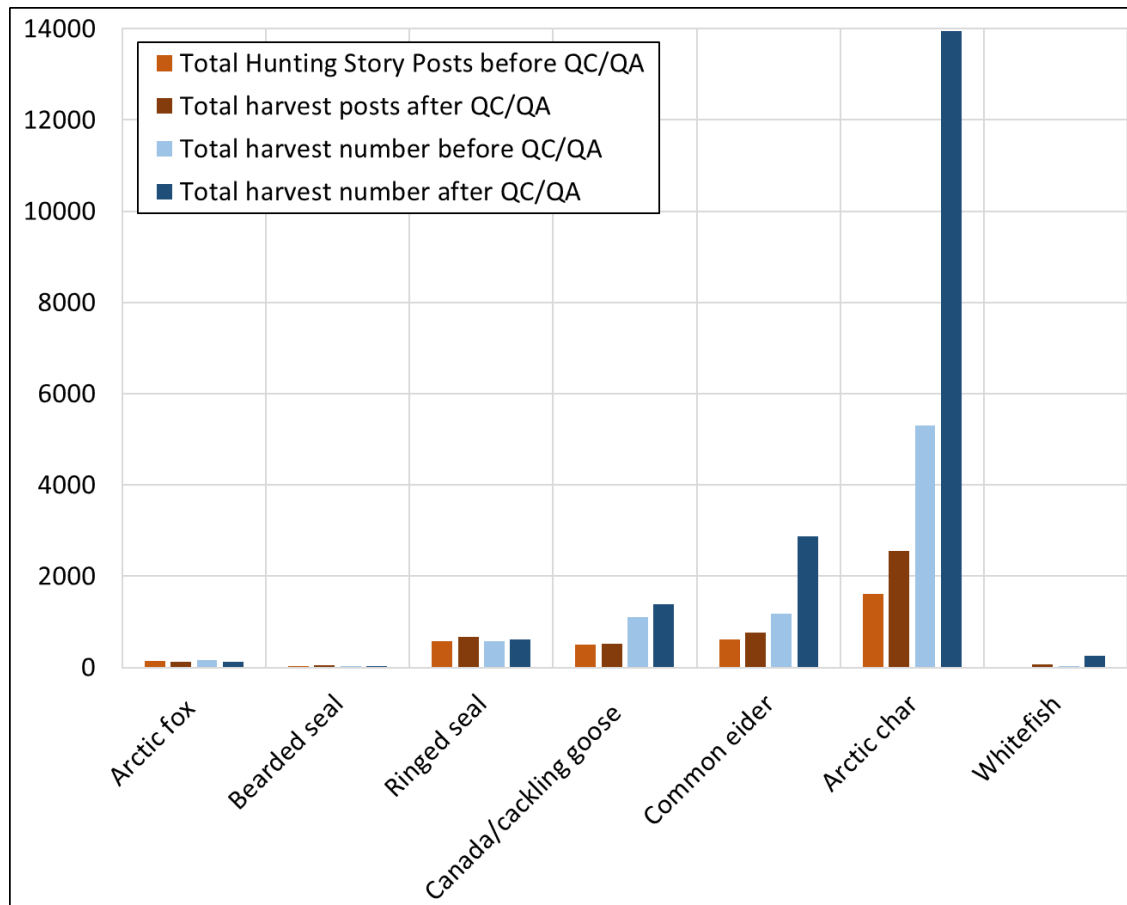
1. If posts were made by the same user, only the first temporal instance was included in the analysis;
2. If posts were made by different users, the harvest total was spread between posts; and,
3. If posts did not include any photographs, the posts were not removed from the analysis.

Each species Excel spreadsheet that I created contained updated fields of harvest numbers, notes on issues or changes with the post, as well as feedback I had received from project partners. After the duplicate posts were addressed, the harvest posts for each species were combined in their own spreadsheet. This involved copying posts that

involved several species (or were made under the incorrect species) to their respective species spreadsheets. A detailed step-by-step methodology of this process was created to support a reproducible workflow for AES to continue this type of analysis in future years (Appendix 4).

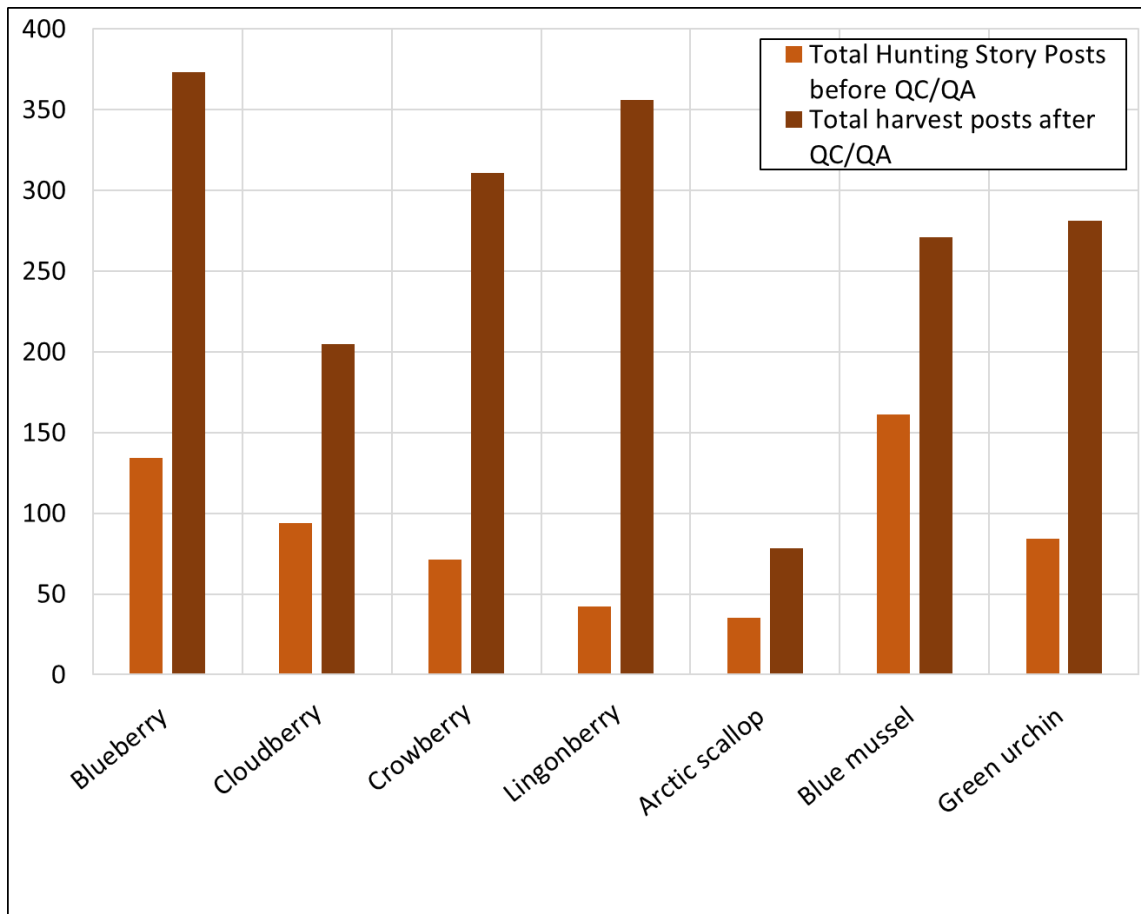
After the QC/QA process, Year 1 had a total of 4,150 harvest posts, and Year 2 had a total of 7,276 harvest posts. The QC/QA process had a substantial impact on the final harvest post and harvest quantity totals. These changes can be seen in Figure 3.8 for the species where the harvest amount was counted, and in Figure 3.9 for species examined by presence/absence. The variations between berry and invertebrate harvest totals before and after the QC/QA process were also influenced by situations where several harvested species were recorded in one post. The QC/QA process recorded all the species harvested in each post, which increased the total number of harvest posts for each species present in a post. There was a large increase in the total harvest amount for Canada/cackling goose, common eider, and Arctic char after the QC/QA process, likely due to the number of instances where several animals were harvested but the SIKU post was either an Individual type, or the post did not record how many animals were harvested.

The difference between the harvest post and harvest quantity totals prior to, and after the QC/QA process are further illustrated in Figure 3.10. For species located above the x-axis, there was an increase in the harvest quantities after the QC/QA process, and for species located below the x-axis, there was a decrease in the harvest quantities after the QC/QA process. Species located to the right of the y-axis had an increase in the harvest posts after the QC/QA process, and species to the left of the y-axis had a decrease



**Figure 3.8:** Harvest post and harvest totals in the Qikiqtaik Project for the two-year analysis period prior to, and after the QC/QA process

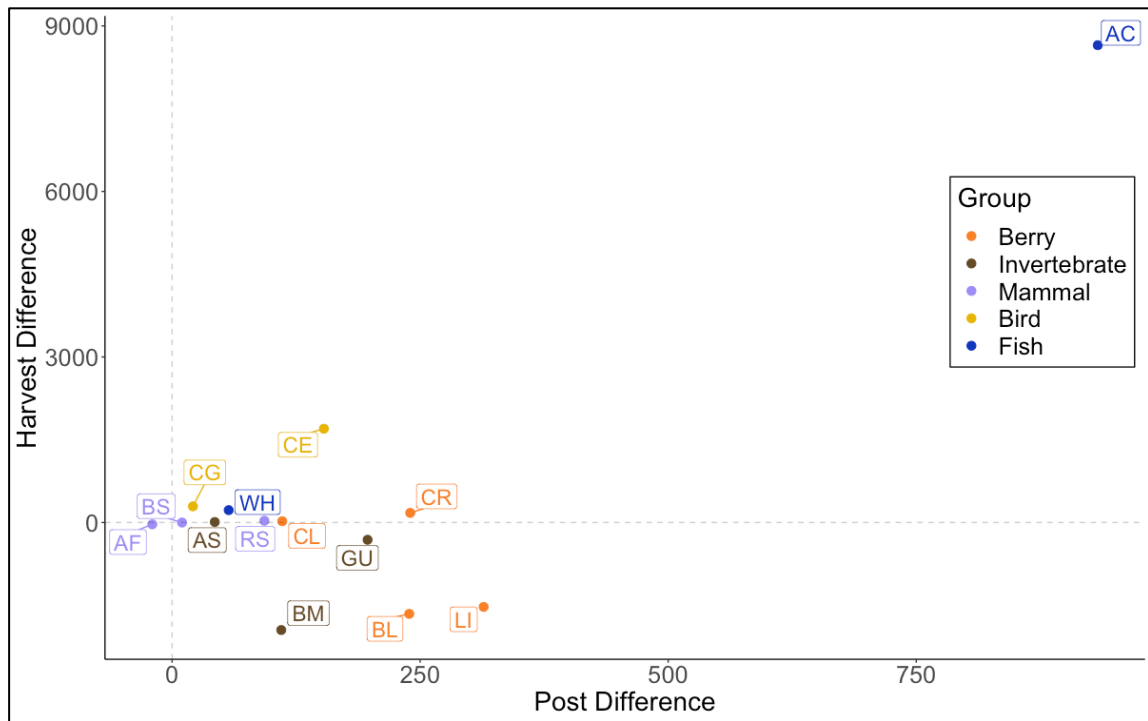
in the harvest posts after the QC/QA process. Mammals had the least variation of harvest quantities in the QC/QA process and had some of the lowest harvest post variation. quantities in the QC/QA process and had some of the lowest harvest post variation. Berries and invertebrates had some of the greatest harvest post variation after the QC/QA process, and some of the largest decreases in harvest quantities. Arctic char was the most affected species by the QC/QA process, both in harvest post totals and in harvest



**Figure 3.9:** Harvest post totals in the Qikiqtait Project for the two-year analysis period prior to, and after the QC/QA process

quantities<sup>10</sup>. Species that are more often harvested two or more animals at a time (such as Arctic char and common eider) might have had a greater chance of being recorded incorrectly than species that are more often harvested one at a time (such as ringed seal).

<sup>10</sup> Prior to the start of my analysis, it was identified that many whitefish species posts actually represented Arctic char harvest. To help resolve this issue, in November 2021, under AES direction, the SIKU development team migrated all whitefish posts to Arctic



**Figure 3.10:** Harvest post and harvest total difference in the Qikiqtaik Project for the two-year analysis period prior to, and after, the QC/QA process

Where: blueberry – BL, cloudberry – CL, crowberry – CR, lingonberry – LI, Arctic scallop – AS, blue mussel – BM, green urchin – GU, Arctic fox – AF, bearded seal – BS, ringed seal – RS, Arctic char – AC, whitefish – WH

### 3.5 Data Analysis and Visualization

#### 3.5.1 Temporal Visualization

The temporal visualization for this project was conducted in Microsoft Excel and RStudio (version 2022.02.3+492). The purpose of this process was address Objective 1 and visualize the harvest data in four different ways to show how harvester data collected

---

char posts (J. Heath, personal communication, November 23, 2023) in order to simplify the QC/QC process, as there were fewer whitefish recording in the Project than Arctic char. As a result, the post and harvest totals recorded here prior to QC/QA are not representative of what was actually recorded on SIKU for the whitefish and Arctic char species until November 2021.

using SIKU could be represented, to view annual seasonal trends, and to eventually identify interannual patterns once a longer-term dataset is established. This was a priority of this project for the SQSC and the AES.

#### *3.5.1.1 Harvest Posts and Harvest Totals per Day*

The first stage of visualization included producing graphs of total daily harvest events (e.g., posts) over the analysis period to show harvest post frequency and distribution over time. Graphs were created of the total number of posts per day for the data of all 14 analysis species combined, and for Arctic char, by summing the number of harvest posts (Posts and Trips) made each day over the two-year analysis window. Trips that included unique harvests were included in this analysis to represent the number of harvesting instances per day as accurately as possible.

The second stage of data visualization involved running a similar process as above to produce graphs of the total amount of harvest (total number of each species that were harvested) each day over the analysis period. The total harvest amount per day was created for all 14 analysis species combined, and for Arctic char. The total harvest that was recorded in posts made each day were summed and then graphed to represent the total amount of daily harvest that occurred over the two-year time frame.

#### *3.5.1.2 Three-Day Moving Window Average of Total Annual Harvest*

The second method of data visualization that was implemented was to produce graphs of a three-day rolling average of total daily harvest. The purpose of these averaged graphs was to better visually identify harvest trends. The total daily harvest data

calculated in Section 3.5.1.1 was used in the “rollmean()” function in RStudio with the rolling average period set to three. This meant that for each day  $n$  the total daily harvest for the two previous days was added to the total daily harvest for  $n$ , and that sum was then divided by three to produce a three-day average total harvest for  $n$ . These graphs were made for all 14 analysis species combined, and for each species individually. Results for species not discussed in Chapter 4 are found in Appendix 6.

#### *3.5.1.3 Percentage of Total Annual Harvest per Day*

The third visualization method utilized to show the Qikiqtait Project harvest data over time was a set of graphs of the daily percentage of the total annual harvest. To account for the difference in total harvest between years, the total harvest of each species for each day  $n$  was divided by the total harvest of that species for the year. The same process was done for Year 2. Following this calculation, each day  $n$  represents the percentage of the total harvest of the year that was collected on that day. This visualization was completed for all 14 analysis species combined, and for each species individually. This approach allows for a standardized comparison of harvest seasonality between years, given that there was often a difference in the number of users and total quantity of harvest between Year 1 and Year 2. By standardizing the data across a scale of 0 – 100% of total annual harvest per day, the graphs allow for a direct comparison of recorded harvest and harvest timing across years. Results for species not discussed in Chapter 4 are found in Appendix 7.

#### *3.5.1.4 Harvest Seasonality*

The fourth and final visualization method involved showing the seasonality of harvest. The harvest data for all 14 analysis species was examined to determine seasonal harvest windows for each species. These harvest windows were then presented together in a figure in order to compare harvest windows between species.

Data from the four berry species (blueberry, cloudberry, crowberry and lingonberry) was also used to produce harvest seasonality curves. This analysis was only completed for berry species due to their definite harvest season (Section 4.7.1). The purpose of this visualization method was to produce a curve of harvest seasonality. For each year, the daily percentage of the total harvest of the year (calculated in Section 3.5.1.3) was multiplied by 100 and a cubic smoothing spline curve fitting technique was applied to the data for each species using the R function “smooth.spline()” and a smoothing parameter of 0.35. A cubic smoothing spline algorithm was used due to its ability to curve fit closely to time series data, handle noisy datasets, and easily change the smoothing parameter (Clark, 2021). The smoothing parameter was chosen because it produces a curve that fit the data well. The resulting seasonality curves for all four berry species were plotted on the same graph.

#### *3.5.2 Spatial Analysis*

The primary analysis focus of this project was a spatial analysis of harvest recorded in the Qikiqtaik Project on SIKU to support Objective 1. The spatial analysis was completed using the ESRI ArcGIS Pro 3.1.0 GIS platform. All the Traditional Inuit Place

Names included on the maps in this thesis are from the Inuit Heritage Trust data shown on the SIKU map interface (SIKU & AES, 2020).

Three situations influenced the data that could be included in the spatial analysis. Firstly, the spatial analysis processes only include harvest Post data. Trips containing harvest, although they were included in the temporal analysis, were not included in this spatial analysis because Trips are recorded using linear features (lines of travel routes). Unlike Posts that are recorded as points, there are no exact coordinates for where the harvest occurred during the Trip. Therefore, linear Trip records in the Qikiqtait Project are not very accurate about where harvest is occurring. The linear features of Trips are more suited to a travel analysis, which was beyond the scope of this thesis. A total of 100 Trips were removed from this part of the analysis.

Secondly, all harvest posts that were geolocated within the Hamlet of Sanikiluaq were not included in the spatial analysis. A key feature of SIKU is that a post can be created on a user's device when they are outside of Internet and cellular coverage. The post is stored on the device until the user again has cellular or Internet access, at which time the user can upload the post to the SIKU platform. This is a very important feature because cellular data and Internet coverage are not often available where harvesting occurs. Posts automatically take the GPS coordinates of the user's device at the time of creating the post, which is often where the harvest was made. However, sometimes users make harvest posts while in the Hamlet. This may be because; a) during the early stages of the Project, users who did not have training were unaware that they could create posts where they made a harvest and upload the post after returning to the Hamlet, b) the

weather was too inclement to be use the app while harvesting; c) because the user did not have a device with them to record the harvest; or d) the user forgot to make a harvest post until they returned home. In these situations, and with the app versions available during the data collection period for this analysis, users had the option to manually enter coordinates within their posts to indicate where their harvest was made.

It was necessary to define the boundaries of the Hamlet for this project in order to exclude post locations within the community. In discussion with Dr. Heath (J. Heath, personal communication, September 20, 2023), we decided that the official municipal boundaries of Sanikiluaq<sup>11</sup> were too large to use as an analysis mask, because they would eliminate nearby areas of regular harvesting from the analysis. Since harvesting does not generally occur within a built-up area, a 200-meter buffer was applied to the built-up area of Sanikiluaq and the Sanikiluaq airport (Figure 3.11). A total of 322 harvest posts within the dataset for this thesis (representing 2.8% of the analysis dataset) were geolocated within the Hamlet or within users' homes. Since harvesting does not occur inside of buildings, and is unlikely to occur within the Hamlet, these posts were removed from the spatial analysis.

---

<sup>11</sup> The area within the municipal boundaries of Sanikiluaq will not be included in Qikiqtait.



**Figure 3.11:** Built up areas around the Hamlet of Sanikiluaq and the Sanikiluaq airport that were excluded from analysis

Thirdly, there were a handful of posts that contained errors in the recorded location coordinates, likely occurring during the manual entry of post coordinates, and these had to be fixed prior to mapping. In six posts, the latitude and longitude values either had to be switched or the “-” sign had to be added to the longitudinal value. Five more posts had issues that could not be fixed, including missing location coordinates or longitude and latitude values that did not contain enough decimal places to be accurately mapped. These posts (representing 0.096% of the total dataset) had to be removed from the spatial analysis data set and were not mapped.

There were no land or aquatic barriers used in the Kernel Density tool for the combined species maps (Appendix 8), even though aquatic and land specific species' data was included in the analysis. It was not possible to apply such barriers to a subset of a larger dataset within the tool.

#### *3.5.2.1 Harvest Post Location Density*

The first stage in the spatial analysis process was to represent the spatial density of where people were making harvest posts. A kernel density estimation (KDE) was chosen for this analysis due to its recognition and use in the fields of biology and ecology relating to situations involving species range (Fieberg, 2007; Peron, 2019; Tracey et al., 2014), and movement (Fleming et al., 2015; Peron, 2019), as well as ecological corridors (Biondi et al., 2012; Harris et al., 2018). KDE is used in studies of species over large areas, and in geographic landscapes that contain barriers and restrictions to species' movement (e.g., water bodies) (Harris et al., 2018).

The harvest posts were imported into ArcGIS Pro as a feature class, and then the Kernel Density tool was used to calculate the density of harvest post locations and produce a density raster. The Kernel Density tool utilizes a search radius to examine the neighbouring cells around each input feature to calculate density (ArcGIS Pro, 2023). I used the Kernel Density tool's default search radius as the tool uses an algorithm that is ideal for smaller datasets, and is not influenced by spatial outliers, to calculate the best search radius for each input dataset (ArcGIS Pro, 2023). The analysis extent for the tool was limited to the Qikiqtait boundaries, excluding the Hamlet area which was masked out of the analysis (Section 3.5.2). Maps of harvest post location density for the two-year

analysis period were completed for the map of all 14 analysis species combined, and for Arctic char. For Arctic char, the Select By Location tool was used to first select posts in aquatic areas, and the land was used as a barrier within the Kernel Density tool. Although Arctic char and other species that are limited to aquatic or terrestrial environments were included in the map of all 14 analysis species combined, aquatic and land extents were not used as barriers in the map. A complete list of the Kernel Density tool parameters used for these two maps can be found in Appendix 8.

#### *3.5.2.2 Harvest Location Density*

A similar process as described in Section 3.5.2.1 was conducted to map the harvest location density. The Kernel Density tool was again used with the same parameters as the harvest post location KDE except that the “Population Field” used in the Kernel Density tool algorithm was set to the harvest total for each post (Appendix 8). Harvest density maps were created for all 14 analysis species combined and for each species individually for Year 1, Year 2, and for both years together. For ringed seal, bearded seal, fish and invertebrates, the Select By Location tool was used to first select posts in aquatic areas, and the land was used as a barrier within the Kernel Density tool. For the berry species, the Select By Location tool was used to first select posts in on land, and the aquatic extent was used as a barrier within the Kernel Density tool.

#### *3.5.2.3 Inter-annual Harvest Density Change*

To examine the changes to harvest density over time, the harvest density results for Year 2 were subtracted from the harvest density results for Year 1 to create harvest density difference maps of all 14 analysis species, and for each species individually. The

purpose of this analysis was to show where harvest density has stayed the same, increased, and decreased between years.

#### *3.5.2.4 Harvest Density Comparison to Community-Identified Priority Areas*

To support Objective 2, the SQSC wanted to know if the data that was collected on SIKU aligned with, and could augment, the previously created community-identified priority areas for Qikiqtait (Section 3.3.2). The community-identified priority areas have previously been compared to World Wildlife Fund (WWF) Canada's Priority Areas for Conservation (PACs), WWF's Marxan Selection Frequency Maps, and the species distribution maps created by the Nunavut Coastal Resource Inventory (NCRI) (Haycock-Chavez, 2021). Spatial analysis in this thesis expands on the previous comparative analyses. In order to compare the two datasets, it was necessary to identify the top harvesting intensity regions from the harvesting data of juvenile and adult animals, as well as berries, from the Qikiqtait Project data. The Locate Regions tool was utilized to identify these regions from the two-year harvest density maps of all 14 analysis species combined, and the top four harvested species (Arctic char, common eider, Canada/cackling goose, and ringed seal). The parameters used for this tool can be found in Appendix 8. The top harvest regions were first visually compared to the Qikiqtait community-identified priority areas and then an overlay analysis was conducted to determine the amount of overlap between the two datasets. This was completed by using the Pairwise Intersect tool to highlight areas of overlap, followed by the Pairwise Dissolve tool to calculate the total area of the key harvest regions that overlapped with the first, second, and third community-identified priority areas (Figure 3.8; Section 3.3.2).

## **4 RESULTS AND DISCUSSION**

To understand the role harvester data can play in supporting Qikiqtait, this chapter will present and discuss the Qikiqtait Project data analysis results for: all 14 analysis species combined, as well as species-specific analysis for Arctic char, common eider, ringed seal, Canada/cackling goose, and berries.

### **4.1 Data Interpretation Considerations**

It is important to note that an overall goal of my analysis is to present Sanikiluarmit data in formats that will aid Qikiqtait development discussions. I do not make any interpretations of the biological data. I am focussed on the capabilities of crowd-sourced harvester data, collected with the SIKU platform, to be used as a baseline harvest resource inventory to support protected area development and management. As Cochran et al. (2008) notes, knowledge is connected to the values of the knowledge producers, and these values determine how conclusions regarding that knowledge are formed. Therefore, it is important that the harvester-collected data is interpreted by Inuit. I do not have the cultural or experiential background to interpret the maps, graphs, and figures here regarding species health or abundance, Sanikiluarmit harvesting practices, or Qikiqtait management decisions. It is for the SQSC, Sanikiluarmit, and their research partners to evaluate the usefulness of the harvester-collected data in relation to biological and demographic aspects of the recorded species. My results and discussion will remain focused on key temporal and spatial considerations in representing harvester-collected data for select species from the Qikiqtait Project, as these are important factors in making informed decisions.

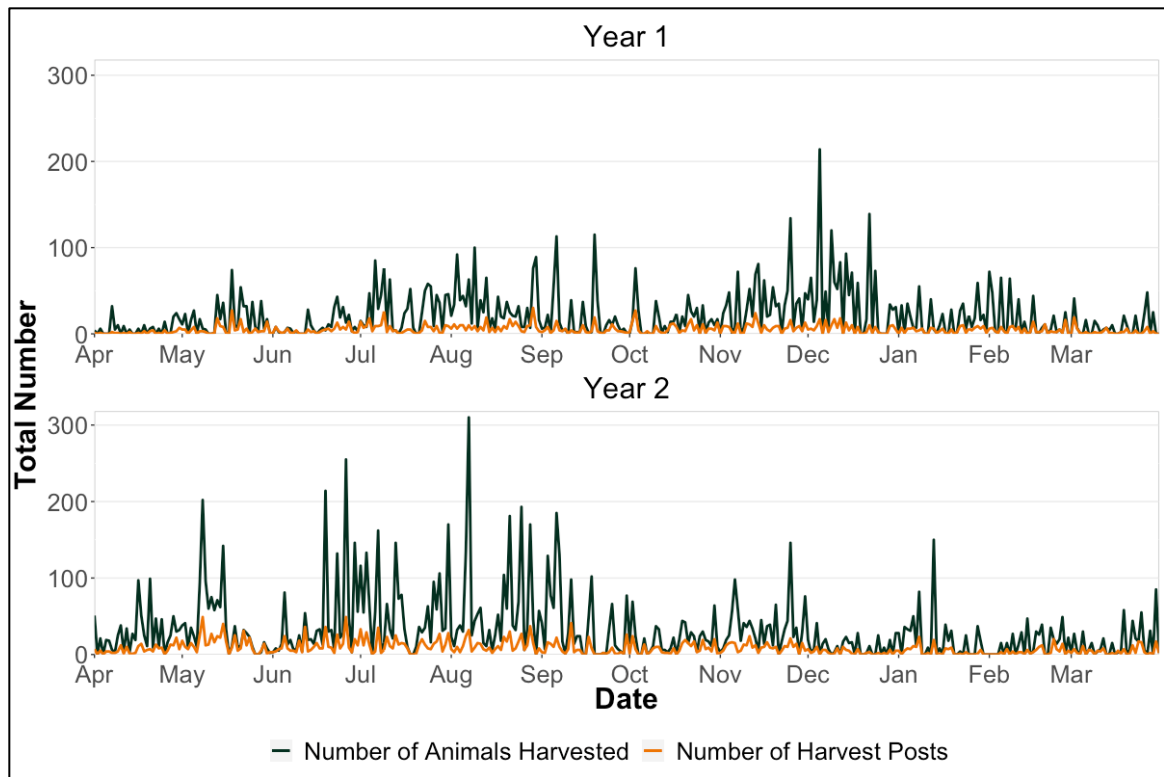
## 4.2 Harvesting Overview

The seasonal availability of country food is a critical component to Inuit diet (McDonald et al., 1997). As a result, the timing of harvesting is important to document. Seasonality visualizations have been a key Inuit approach to this documentation since *Voices from the Bay* (1997), and the following results aim to add to the seasonal harvesting research begun in that seminal work. Results for the species not discussed below are found in Appendixes 6, 7, 9, and 10.

### 4.2.1 Harvest Posts and Harvest Totals per Day

To examine how posting and harvesting fluctuated over time, the harvest data was graphed to identify patterns across seasons and years. The analysis period of this project includes two years of data, which is not extensive enough to make meaningful predictions regarding interannual harvesting trends or interpretations of species populations changes. As more years of data are collected, patterns may emerge from these graphs that show an increase or decline in species availability, indicate a change in the timing of migration or breeding, and record changes in the harvest priorities of Sanikiluarmit.

The total number of harvest posts and the amount harvest recorded per day within the Qikiqtait Project for bird, fish, and mammal species were graphed together (Figure 4.1) to highlight seasonal harvesting trends. This graph clearly shows that Sanikiluarmit are on the land and making posts on SIKU throughout the year on a consistent basis. The graph also shows that more posting occurred between the months of May through November. The graph also shows that the quantity of animals harvested in Year 1 peaked in November through December and peaked in Year 2 between May through September.



**Figure 4.1:** Bird, fish, and mammal species daily harvest post and daily recorded harvest totals

When the total number of harvest posts and the total number of harvested animals per day are compared, there is some overlap between periods of high posting and periods of increased harvest quantities. For example, in Year 2 the number of harvest posts per day and the largest amount of harvest per day are both found from May through September. However, there are times when the number of harvest posts per day are relatively low and the amount of harvest per day is quite high. For example, in Year 1 between November through December the proportion of harvest quantity to the number of harvest posts is quite large, which may indicate that during this time users were harvesting groups of animals at a time (i.e., several animals recorded within one harvest

post) as opposed to harvesting individual animals (i.e., one animal recorded within one harvest post). This could be a result of the species that were most harvested during this time. For example, Arctic char are frequently harvested during these months and were usually harvested several at a time (Figure 4.10). Similarly, periods where there is less discrepancy between the number of harvest posts per day and the harvest quantity per day may indicate that most of the harvest posts during this time recorded individual harvests. Perhaps the species most often harvested during these periods are those that are not harvested frequently in bulk, such as seal (Figure 4.23, Figure A6.10) and Arctic fox (Figure A6.9).

There was an increase in the number of harvest posts and the quantity of harvest recorded from Year 1 to Year 2 (Figure 4.1). This increase could be due to a number of factors, including an increased contribution to the Qikiqtait Project, species' population health and the number of animals and berries available to harvest, the opportunities that Sanikiluarmit had to go harvesting. Examining the relationship between harvest numbers and harvesting effort could be useful future research.

#### 4.2.2 Percentage of Total Annual Posts and Harvest

The percentage of the total number of harvest posts made per species for each year, and for both analysis years combined, is shown in Table 4.1. Harvest posts were most often made for Arctic char, which represented 38.5% of the total harvest posts made for the analysis period. Harvest posts of common eider made up 11.6% of the total harvest posts made over the analysis period. Harvest posts of ringed seal were the third most common species post in Year 1, while Canada/cackling goose harvest posts were the third

most common species post in Year 2. Over the total analysis period, harvest posts of ringed seal were the third most common post species.

**Table 4.1:** Percentage of annual posts by species recorded in the Qikiqtait Project

Year 1		Year 2		Analysis Period Total	
Arctic char	35.6%	Arctic char	40.2%	Arctic char	38.5%
Common eider	14.4%	Common eider	10.0%	Common eider	11.6%
Ringed seal	12.8%	Canada/cackling goose	9.0%	Ringed seal	10.0%
Blueberry	6.0%	Ringed seal	8.4%	Canada/cackling goose	7.9%
Canada/cackling goose	5.9%	Blueberry	5.5%	Blueberry	5.6%
Lingonberry	5.5%	Lingonberry	5.3%	Lingonberry	5.4%
Crowberry	4.1%	Crowberry	5.1%	Crowberry	4.7%
Arctic fox	3.9%	Green urchin	5.0%	Green urchin	4.3%
Blue mussel	3.6%	Blue mussel	4.4%	Blue mussel	4.1%
Green urchin	2.9%	Cloudberry	3.3%	Cloudberry	3.1%
Cloudberry	2.8%	Arctic scallop	1.5%	Arctic fox	1.9%
Whitefish	1.3%	Whitefish	0.9%	Arctic scallop	1.2%
Bearded seal	0.7%	Arctic fox	0.7%	Whitefish	1.1%
Arctic scallop	0.6%	Bearded seal	0.7%	Bearded seal	0.7%

There was some variation in harvest post totals between years. The increase in the number of harvest posts from Year 1 to Year 2 occurred for almost all species except Arctic fox, which decreased by 67.0% (Table 4.2). Harvest posts of Arctic scallop increased the most between years, with 320.0% more Arctic scallop harvest posts made in

Year 2. Green urchin followed with an increase of 201.4%, and the number of Canada/cackling goose harvest posts increased by 171.4%. The number of harvest posts stayed relatively stable between years for ringed seal, common eider and whitefish, each with a harvest post difference of  $\leq 25.0\%$ .

**Table 4.2:** Harvest post and harvest total difference per species between years

Species	Harvest Post Difference Between Years	Harvest Total Difference Between Years
Blueberry	60.8%	n/a
Cloudberry	106.0%	n/a
Crowberry	120.6%	n/a
Lingonberry	71.8%	n/a
Blue mussel	118.8%	n/a
Green urchin	201.4%	n/a
Arctic scallop	320.0%	n/a
Arctic fox	-67.0%	-66.3%
Bearded seal	81.3%	61.5%
Ringed seal	15.3%	20.0%
Canada/cackling goose	171.4%	322.9%
Common eider	22.4%	-10.5%
Arctic char	99.2%	70.5%
Whitefish	25.0%	-64.4%

The percentage of the annual harvest for each species identifies the most intensely harvested species for Year 1, Year 2, and for both analysis years together (Table 4.3).

Arctic char was by far the most harvested species in both years, representing 66.2% of the total harvest during the analysis period. Common eider was the second most harvested species in both years, making up 13.7% of the total annual harvest during the analysis

period. The third most harvested species was different in Year 1 (ringed seal) and Year 2 (Canada/cackling goose) but over the two-year period combined, Canada/cackling goose was the next most harvested species, representing 6.6% of the total annual harvest.

**Table 4.3:** Percentage of annual harvest by species recorded in the Qikiqtait Project

Year 1		Year 2		Analysis Period Total	
Arctic char	63.6%	Arctic char	67.9%	Arctic char	66.2%
Common eider	18.7%	Common eider	10.5%	Common eider	13.7%
Ringed seal	3.5%	Canada/cackling goose	8.7%	Canada/cackling goose	6.6%
Canada/cackling goose	3.3%	Ringed seal	2.6%	Ringed seal	2.9%
Whitefish	2.4%	Lingonberry	1.7%	Blueberry	1.7%
Blueberry	1.7%	Blueberry	1.7%	Lingonberry	1.7%
Lingonberry	1.6%	Crowberry	1.6%	Crowberry	1.4%
Arctic fox	1.2%	Green urchin	1.5%	Green urchin	1.2%
Crowberry	1.2%	Blue mussel	1.3%	Whitefish	1.2%
Blue mussel	1.0%	Cloudberry	1.0%	Blue mussel	1.2%
Cloudberry	0.8%	Whitefish	0.5%	Cloudberry	0.9%
Green urchin	0.8%	Arctic scallop	0.5%	Arctic fox	0.6%
Arctic scallop	0.2%	Arctic fox	0.3%	Arctic scallop	0.4%
Bearded seal	0.2%	Bearded seal	0.2%	Bearded seal	0.2%

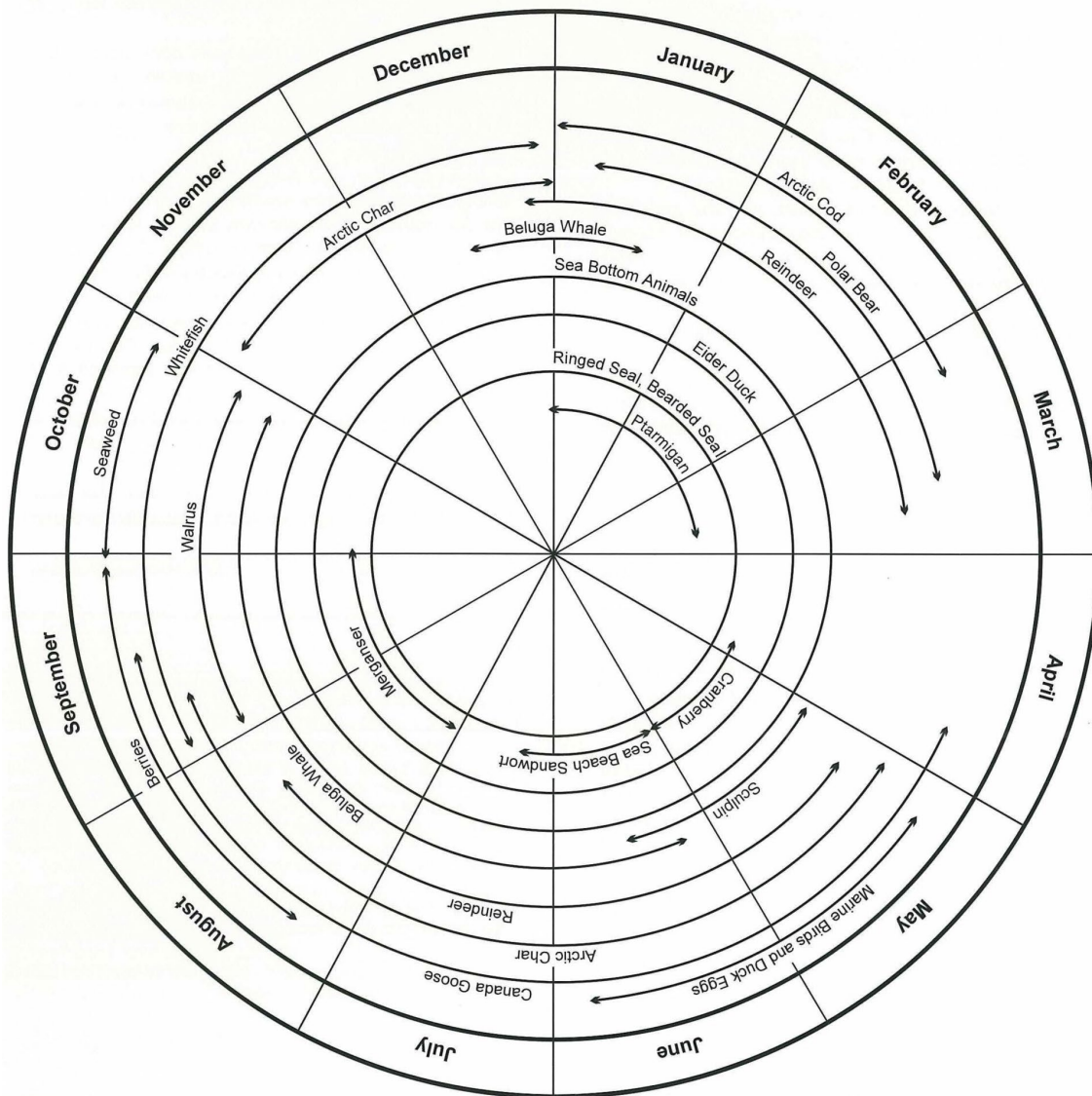
For almost all species there was an increase in the harvest amount recorded in harvest posts within the Qikiqtait Project (based on harvest abundance) from Year 1 to Year 2, with the exception of Arctic fox, whitefish, and common eider, which decreased by 66.3%, 64.4%, and 10.5% respectively (Table 4.2). Canada/cackling goose harvest

increased by 322.9% in Year 2, followed by Arctic char by 70.5% and bearded seal by 61.5%. The total harvest fluctuated the least between years for ringed seal and common eider, each with a harvest post difference of  $\leq 25.0\%$ . The results of Table 4.3 relate to the values represented in Table 4.2. For example, the years for ringed seal and common eider, each with a harvest post difference of  $\leq 25.0\%$ . The results of Table 4.3 relate to the values represented in Table 4.2. For example, the harvest total and the contribution to the total annual harvest of Arctic fox, whitefish, and common eider decreased in Year 2, while the harvest total and the total percentage of total annual harvest of Canada/cackling goose, Arctic char, and bearded seal increased in Year 2.

These shifts may be part of a regular seasonal variation based on weather and annual species abundance (Fleming, 1989), or it could represent the start of a harvest priority transition as a result of changes to species' population abundance, health, and distribution. For instance, the increased harvest of invertebrates may be related to the research the community of Sanikiluaq has been conducting to investigate the potential for a commercial fishery (Hudson Bay Consortium, 2022; Rogers, 2021). Additionally, many ecological factors may influence harvest totals — the increase in harvest of Arctic fox, for example, may be linked to trends between fox abundance and food availability (Verstege, 2016). Some of these trends need to be interpreted by Sanikiluarmitut and may require additional research with harvesters, but it is important to identify the capability of the Qikiqtait Project data to highlight these trends.

#### 4.2.3 Harvest Seasonality

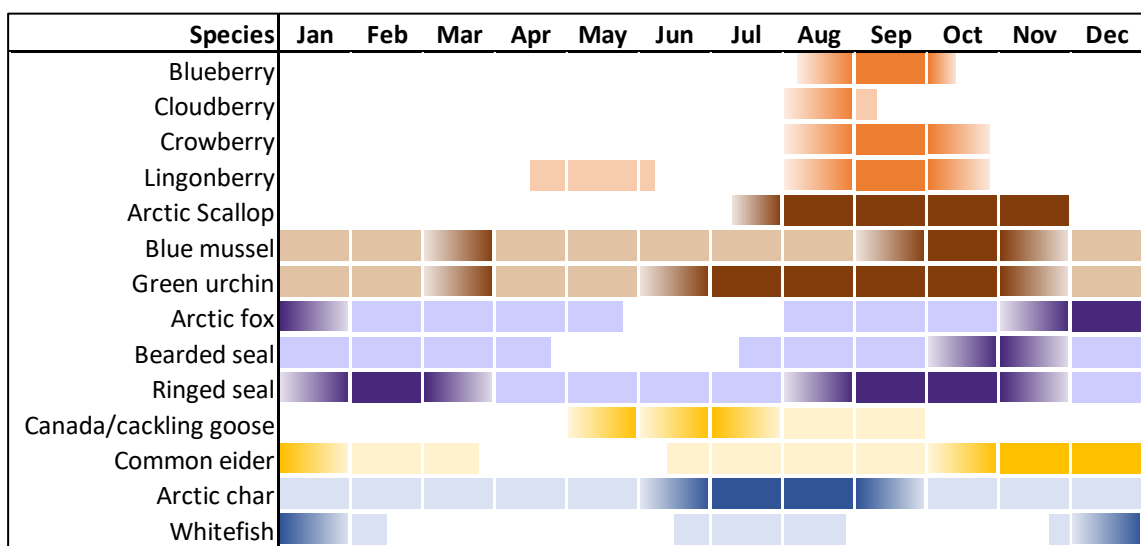
Examining the seasonality of harvest provides important information regarding harvest trends through the year, and over time. This work was started by McDonald et al. (1997) in *Voices from the Bay* with the creation of a seasonal harvest wheel (Figure 4.2). This wheel shows the harvest windows, or timing, of when Sanikiluarmit harvest important species throughout the year, and represents the first time Sanikiluarmit knowledge had been communicated in this manner. Sanikiluarmit recognize six seasons: ukiaksak (early fall) ukiaq (fall), ukiuq (winter), upingasaq (early spring), upingnaq (spring), and aujaq (summer) (McDonald et al., 1997). It can be difficult to define these Inuit seasons, which are related to both weather and animal movements that change from year to year (McDonald et al., 1997). For this reason, the seasonal analysis in this thesis uses months, instead of seasons, and acknowledges that Inuit seasons may break across several months.



**Figure 4.2:** Seasonal harvesting wheel of key species to Sanikiluaarmiut (as presented in McDonald et al., 1997, pg. 21)

The *Voices from the Bay* (1997) harvest wheel is now over 20 years old, and the SQSC expressed interest in seeing if there had been a shift in some of the species harvest windows. In an attempt to address this request, Figure 4.3 was created to show the harvest windows for each of the 14 analysis species for the two analysis years. The harvest

windows were determined by visually examining the three-day moving window average harvest graphs (Section 4.3.1; 4.4.1; 4.5.1; Appendix 6) and identifying the most prolific recorded harvest times. A key takeaway from this figure is that Sanikiluaarmiut harvest year-round, and there is the most overlap of species harvest windows from June through November.



**Figure 4.3:** Average harvest windows for all analysis species  
*Where:* darker colours indicate more intense harvesting

Of the species that appear both in Figure 4.2 and Figure 4.3, there have been some slight changes between harvest windows. The harvest windows for “Berries” and “Cranberry” (lingonberry) from Figure 4.2 relate to the berry species in my analysis. The harvest window for these species in Figure 4.2 is similar to the harvest windows of my analysis; harvest still generally peaks for most berry species in August and September, but the harvest windows for blueberry, crowberry and lingonberry were recorded into

October (Figure 4.3). Ringed seal harvest was recorded year-round Figure 4.3 (the same as Figure 4.2), but bearded seal was not harvested in any appreciable amount in May and June within the Qikiqtait Project. Similarly, the common eider harvest window is year-round in Figure 4.2 but harvest was not recorded frequently in the Qikiqtait Project between April and May in Figure 4.3. Canada goose harvest remained relatively the same between figures. The harvest of “Sea Bottom Animals” in Figure 4.2 was year-round and would include the invertebrates of my analysis. Blue mussels and green urchin harvest was also generally recorded year-round in the Qikiqtait Project (Figure 4.3). A further breakdown of this category would provide the opportunity to record the Arctic scallop harvest window. Arctic char harvest was generally recorded year-round in the Qikiqtait Project during the analysis period (Figure 4.3) and did not have the extended September through October and March through April breaks recorded in Figure 4.2. The whitefish harvest windows are perhaps the most different between figures. Figure 4.2 indicates whitefish harvest occurs between September through December, but the recorded harvest in the Qikiqtait Project now appears to identify harvest windows between late November through early February and mid-June through late August (Figure 4.3). The differences between these two figures could be a result of different figure creation methodologies or could indicate changes to seasonal harvesting patterns. Additionally, several of the species in Figure 4.3, such as whitefish, had smaller sample sizes and the harvest windows were therefore more difficult to identify. Overall, the harvester-collected data from the Qikiqtait Project aligned with, supported, and updated the seasonality work presented in *Voices from the Bay* (1997).

#### 4.2.4 Harvest Spatial Distribution (Harvest Post and Harvest Density)

A spatial analysis for all 14 analysis species combined, as well as select species, was completed to; a) show harvest density; b) to examine changes to harvest density extent and intensity between years; and c) to identify the top areas of harvest intensity. The purpose of this analysis was to show where SIKU users are making posts containing harvest information. This is key to understanding what areas are important for Sanikiluarmit harvesting, and it also provides insight regarding how far harvesters travel from the Hamlet to harvest, and where these key species are located within Qikiqtait.

This spatial analysis includes maps of harvest post density and harvest number density. These maps represent Sanikiluarmit harvesting data in slightly different ways. For the Kernel Density Estimation (KDE) analysis for harvest post density (Section 3.5.2.1), the value of each post was equal to one and the resulting density maps shows the concentration of post locations. In the harvest KDE analysis (Section 3.5.2.2), the value of each harvest post was represented by the total harvest amount of the post and the resulting density maps show the concentration of harvested animals and plants. For berry and invertebrate species, the harvest amount for each post was based on a species presence or absence measure and each post for these species was equal to a total harvest of one. Therefore, post density and harvest number density are interchangeable for berry and invertebrate species in this analysis, but not for other species.

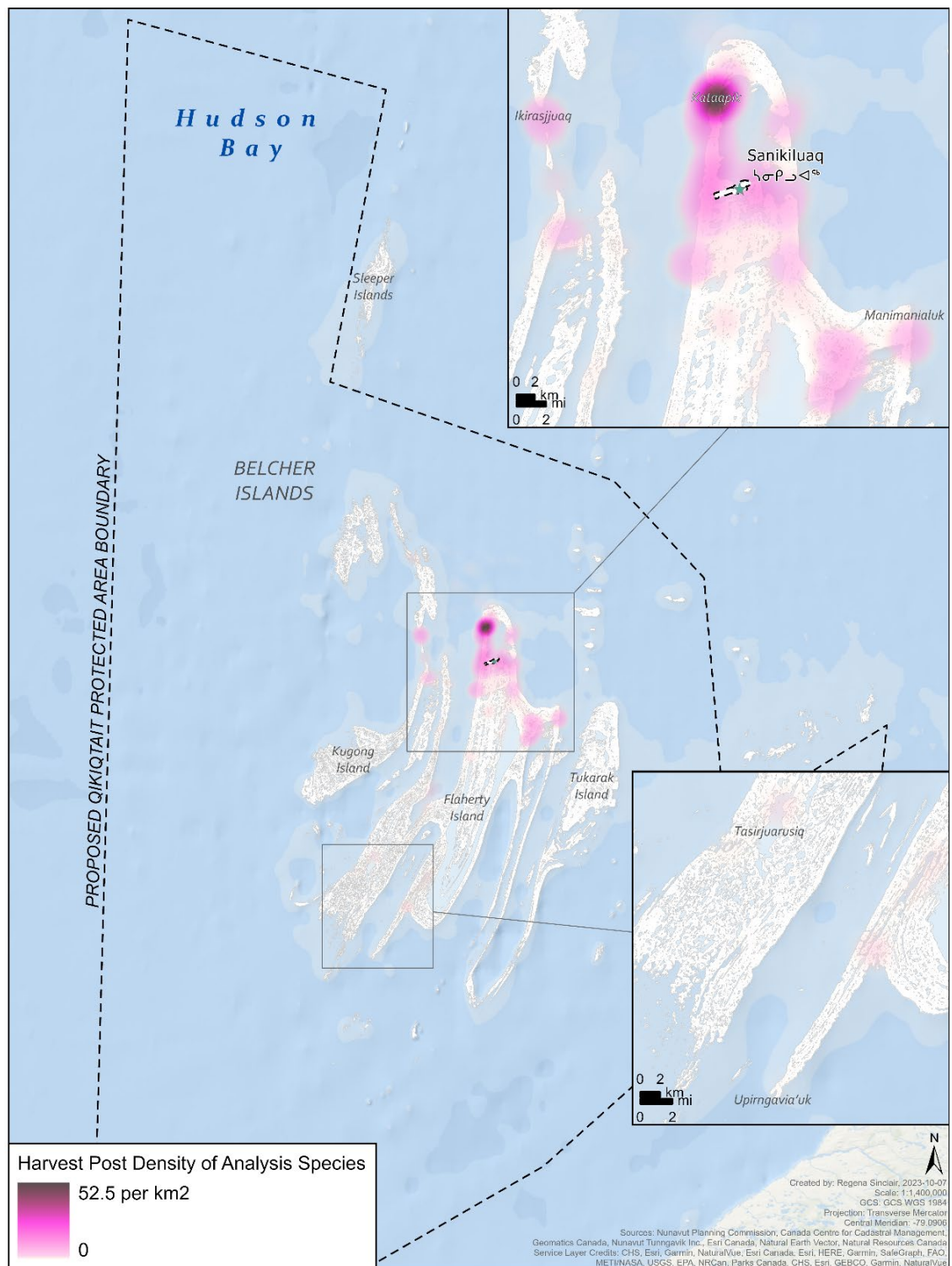
Figure 4.4 shows that the highest concentration of harvest posts for all 14 analysis species was made north of Sanikiluaq, within 13 km of the Hamlet. Harvesting was present around the Hamlet, and an additional area of frequent harvest posting occurs

southeast of Sanikiluaq, near Manimanialuk. A key area for posting harvest is located near Kataapik, where the posting density peaks at 52.5 harvest posts per km<sup>2</sup>.

The harvest post density displayed in Figure 4.4 shows that, although harvesting occurs to some degree across much of the islands, many of the harvesting locations used by Sanikiluarmitut are close to the Hamlet. This is not to say that all harvesting needs can be met at these locations, within close proximity of the Hamlet, because some species may not be present in those areas at all, or during all periods of the year (see Section 4.3.4).

The harvest post density maps here and in Section 4.3.4 provide insights into harvesting locations that are important to Sanikiluarmitut. However, harvest post density does not represent the quantity of harvest (number of animals) that occurs at each location, and understanding of the distribution of harvest amount is an important indicator for key areas of harvesting. This part of the analysis maps the harvest density to further examine the distribution of successful harvesting. Mapping harvest amount distribution can help identify priority areas for harvesting and monitoring. As additional years of data are collected, long-term changes in harvesting intensity and location can be evaluated.

The harvest density for all 14 species combined shows harvesting occurs in many areas throughout the Belcher Islands region (Figure 4.5). A large area around the Hamlet of Sanikiluaq was identified as a high harvest area, with the most concentrated harvest occurring around Kataapik, which peaks at a harvest density of 111.6 harvested animals and plants per km<sup>2</sup>. Additional areas of frequent harvesting occur southwest of



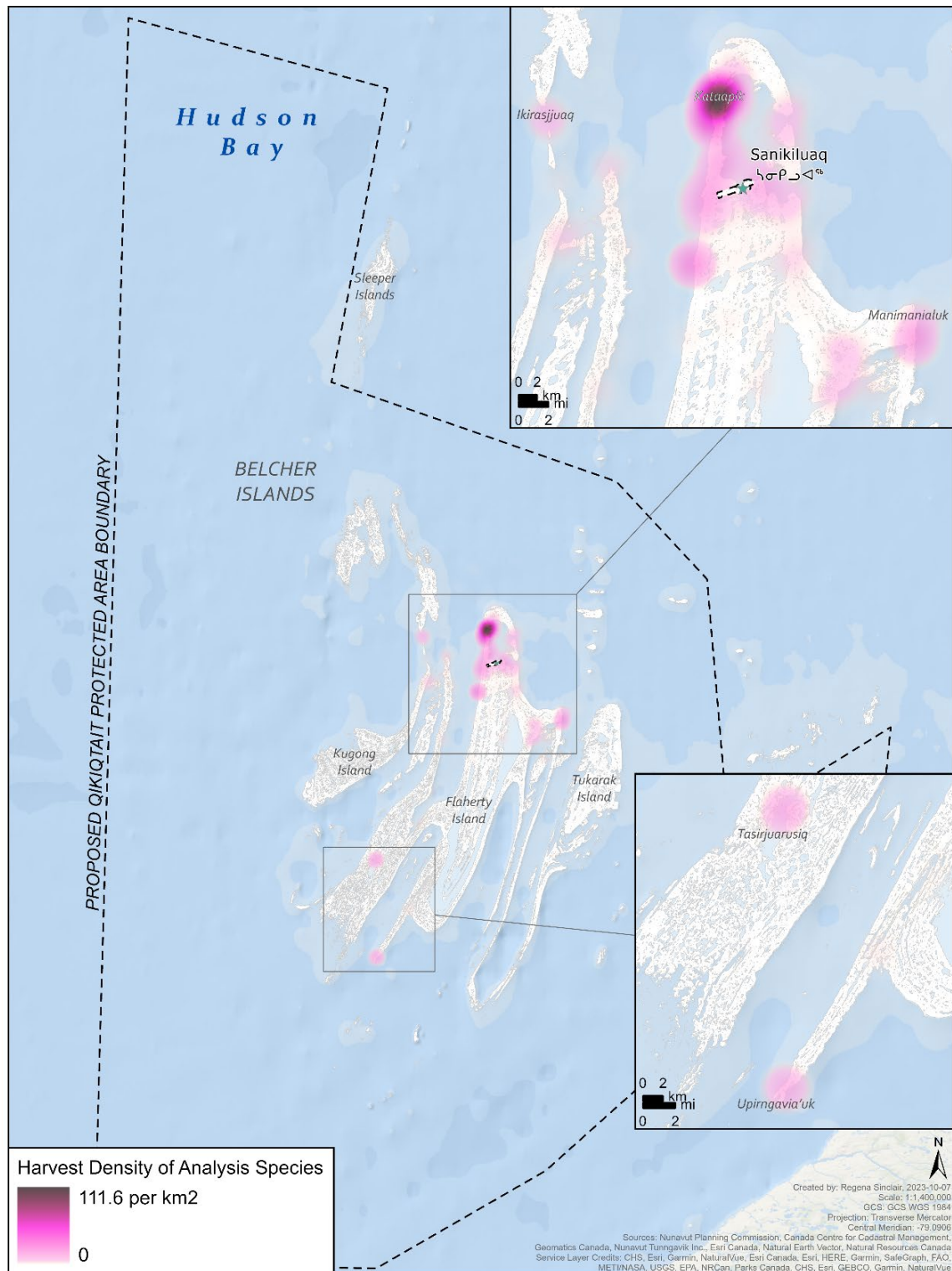
**Figure 4.4:** Density of Qikiqtait Project harvest posts for all 14 analysis species for both analysis years  
*Where:* areas of darker pink represent a larger post density

Sanikiluaq, near Upirngavia'uk and Tasirjuarusiq, west of Sanikiluaq near Ikirasjjuaq, and southeast of Sanikiluaq near Manimaniakuk. This Kataapik area, extending southwards to surround the Hamlet, is then a key location that could be included in Qikiqtait management decisions due to the amount of food and materials that are found in this area.

The spatial distribution of the density in Figures 4.4 and 4.5 are quite similar, as harvesting occurred where harvest posts were made. The density areas around Upirngavia'uk, Tasirjuarusiq, and Manimaniakuk are slightly larger in Figure 4.5, while the density area around Ikirasjjuaq is larger in Figure 4.4. Additionally, the density values differ considerably between the maps (a maximum of 52.5 harvest posts per km<sup>2</sup> in Figure 4.4 compared to a maximum of 111.6 harvested animals and berries per km<sup>2</sup> in Figure 4.5) which means that the two maps show different information.

#### 4.2.1 Inter-annual Harvest Density Change

Lucassie Arragutainaq (personal communication, September 17, 2021) has observed changes in key Sanikiluarmit harvest species over time. Changes to species populations and distributions in the Belcher Islands region are particularly affected by climate change and hydro-electric dams (Chapter 1; Section 2.4). As these situations continue to impact wildlife health and habitats, ecological and biological monitoring data recorded in the Qikiqtait Project could provide an avenue to model wildlife patterns and changes over time.



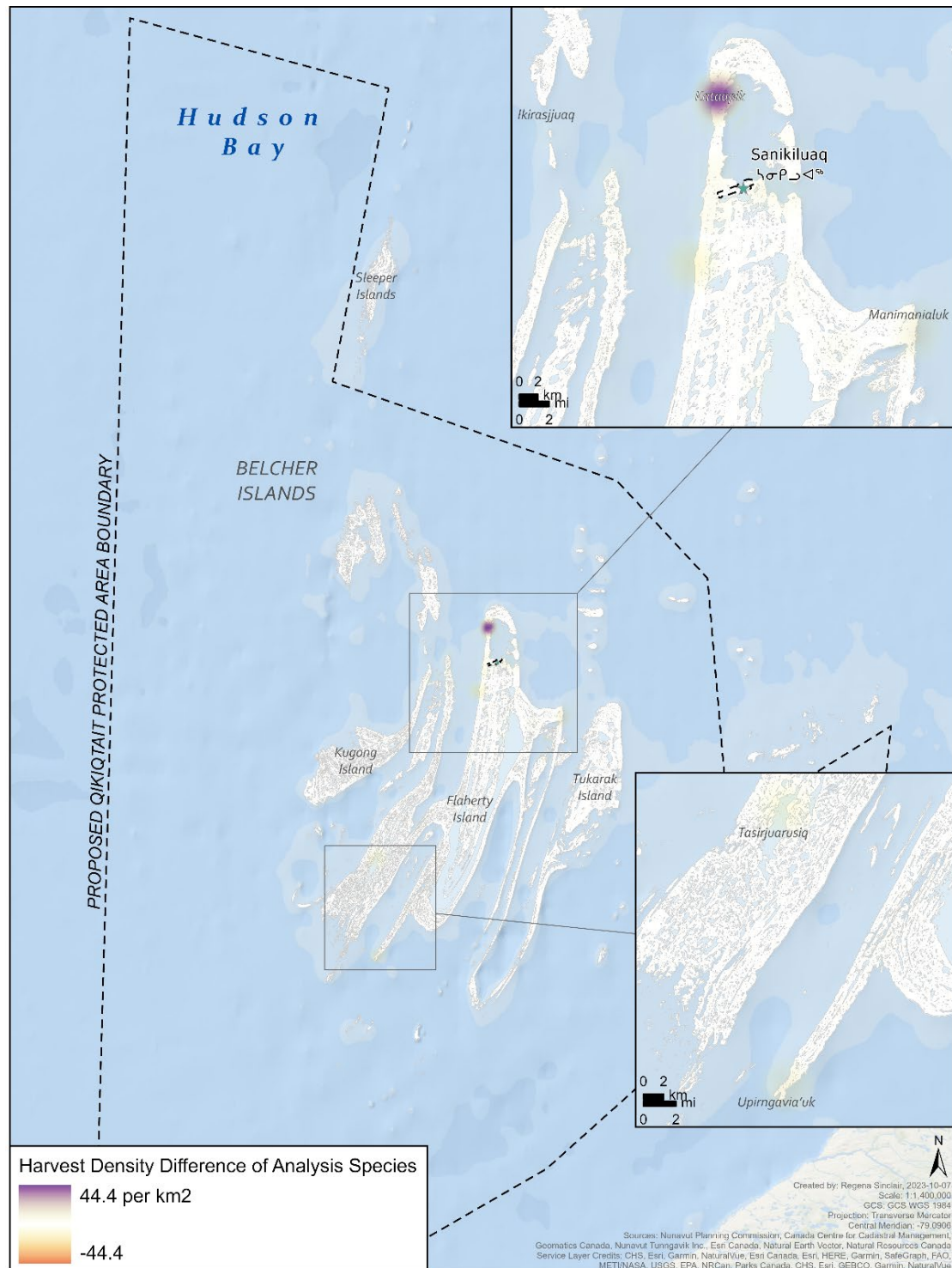
**Figure 4.5:** Harvest density of all 14 analysis species for both analysis years  
*Where: areas of darker pink represent a greater harvest density*

To demonstrate how this inventory process could start and how changes and trends in the data could be identified over time, the harvest difference between Year 1 and Year 2 was calculated for all 14 analysis species combined, and for select species individually. Total harvest density of all species combined showed that density increased near Kataapik, within 10 km of Sanikiluaq (Figure 4.6). This change was quite large, with an increase of 44.4 harvest per km<sup>2</sup> (Figure 4.6). This again highlights the area of Kataapik as a key harvesting location to Sanikiluarmit (as seen in Figure 4.5) and might indicate an increased use of the area in Year 2.

It is important to acknowledge that the data for this project only spanned two years. This work contributes to preliminary analysis of initial baseline data recorded in the Qikiqtait Project, and a continuation of this analysis with additional years of data will yield more representative and robust results. Recording the changes to species harvests over time is valuable to support management decisions regarding harvesting practices (Heward & Black, 2004; Naves, 2018), and as more years of harvest data are recorded, patterns of change may emerge in harvest density and harvest location of species that could help to assess the impacts of climate change or changing hydro-electric regimes, as well as inform potential refinement of community-identified priority areas for Qikiqtait.

#### 4.2.1 Harvest Density Comparison to Community-Identified Priority Areas

The SQSC expressed interest in comparing the harvest density data to their community-identified priority areas to evaluate how data collected on SIKU could augment their previous participatory mapping approach. To achieve this, I compared the



**Figure 4.6:** Harvest density difference over time for all 14 analysis species  
*Where:* dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest

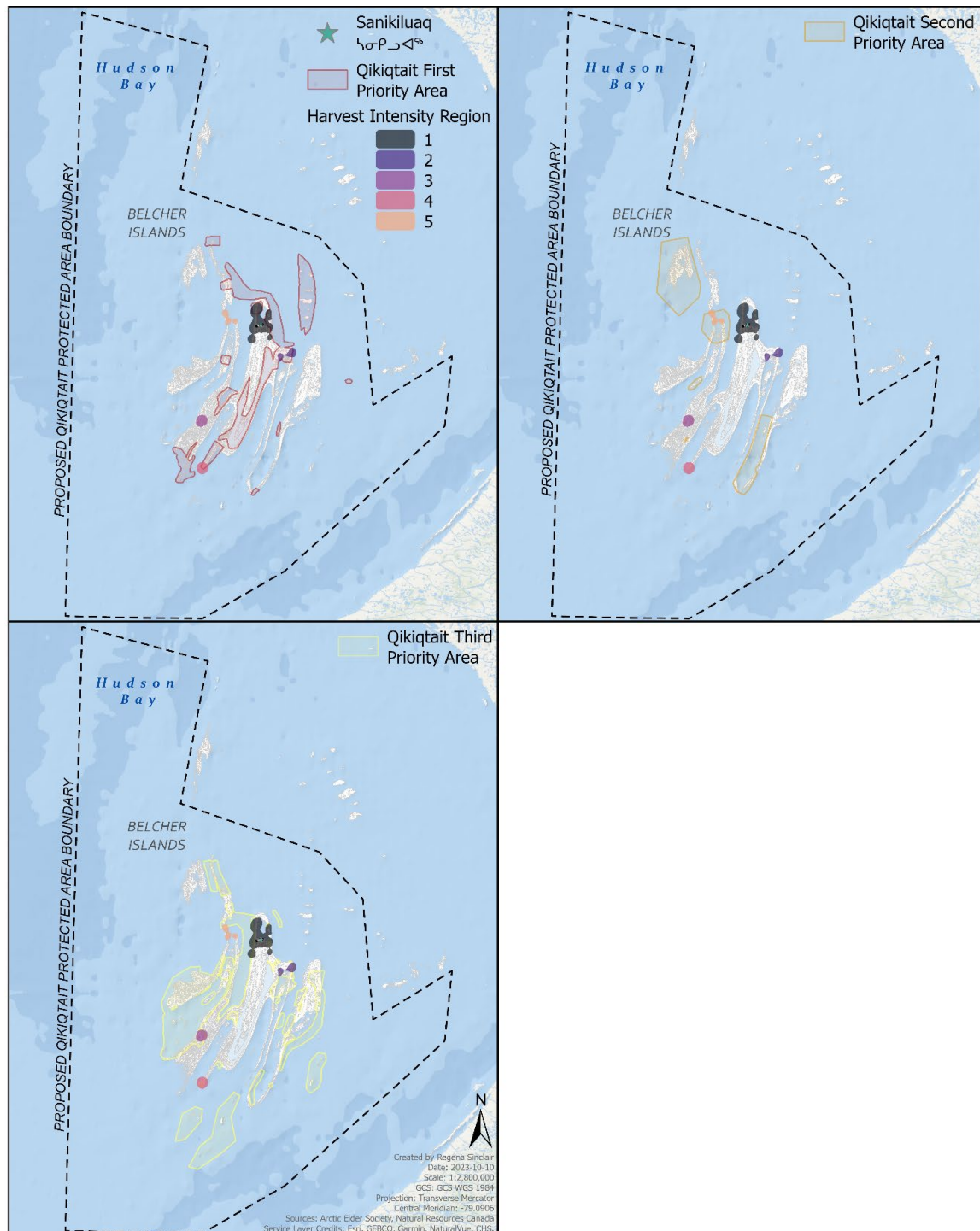
high-level maps of priority areas (Figure 3.6) generated through the participatory mapping workshop in 2019 (Section 3.3.2; Haycock-Chavez, 2021; SQSC, 2019b) to the daily harvesting activities represented in the Qikiqtait Project harvester data. The top harvest intensity regions for all 14 analysis species, among other select species, were identified and mapped over the analysis period along with the community-identified priority areas.

Five regions of intense harvesting were identified for all 14 analysis species, representing a total of 349.9 km<sup>2</sup> (Figure 4.7). The harvest intensity regions were created from Qikiqtait Project harvesting data used in this thesis (i.e. only juvenile and adult animals, as well as berries), while the community-identified priority areas were created based on knowledge of travel routes, culturally important areas, and important habitats for key species to better encapsulate areas of conservation priority (Section 3.3.2; Haycock-Chavez, 2021; SQSC, 2019b). The harvest intensity regions were based on the Qikiqtait harvest data for the 14 species in my analysis, and while there is some overlap in the data represented in both datasets (e.g., blue mussel and green urchin harvesting areas), the harvest intensity regions did not include the data for some species (e.g., beluga whale habitat and eider duck nesting areas) that informed the community-identified priority areas. This data was collected in the Qikiqtait Project and would be useful for future analysis, as discussed in Section 5.3.2.1; 5.3.2.2; 5.3.2.5. As a result, it is not possible to directly compare the datasets for content, but instead this analysis focussed on how Qikiqtait Project harvester data can: i) identify key harvesting intensity regions; and ii) provide valuable baseline harvest data for ongoing consideration in Qikiqtait priority area

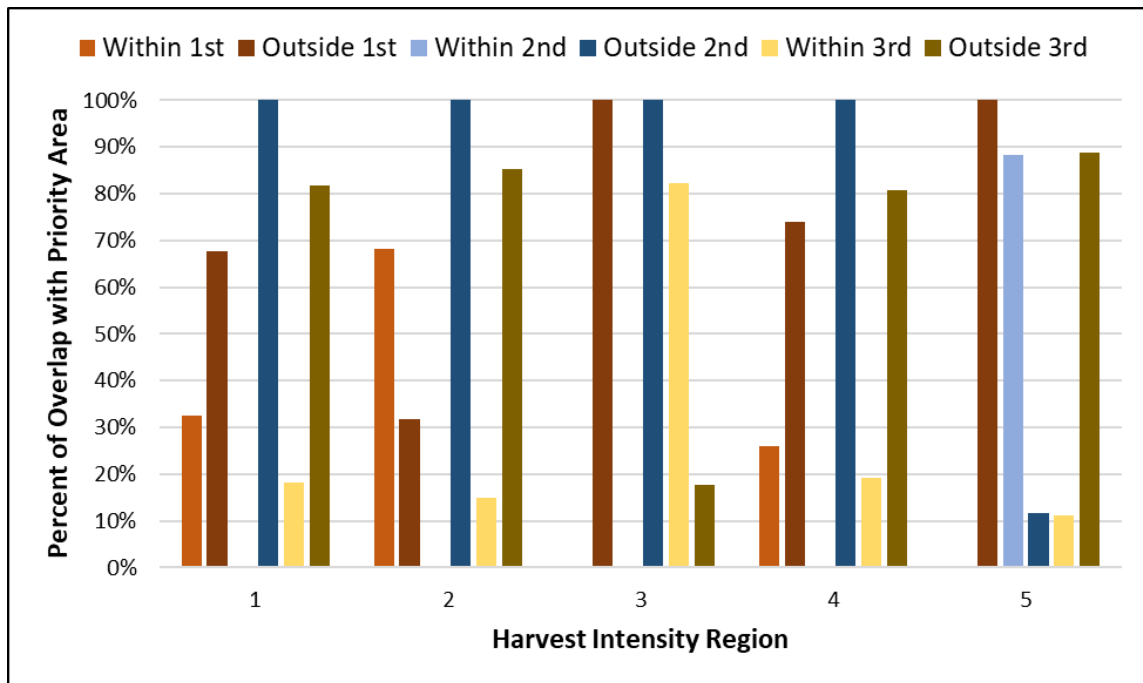
definitions and management practices. Since the key harvest intensity regions and the community-identified priority areas were created using different data, and with different methodologies and goals, there were several community-identified priority areas that did not overlap with any harvest intensity regions. Both datasets have limitations in that they are not comprehensive of all species, habitat considerations, and harvesting practices; however, they can complement each other to provide a more complete dataset that the SQSC can draw on to inform future management decisions. The key harvest intensity regions support current delineations of community-identified priority areas, and could potentially be used to inform future delineations.

In general, the harvest intensity regions identified much smaller key priority harvesting areas. There was some overlap between the harvest intensity regions and the community-identified priority areas (Figure 4.7). Harvest intensity region 1 was within 32.4% of the first priority area, and 18.3% of the third priority area (Figure 4.8). The place where the harvest intensity region and first priority area intersected the most was approximately 7 km north of Sanikiluaq (Figure 4.7). Harvest intensity region 2 overlapped 68.2% with the first priority area (Figure 4.8). The greatest overlap with the second priority area occurred west of Sanikiluaq, in harvest intensity region 5 at 88.4%. All of the harvest intensity regions overlapped with the third priority area, but harvest intensity region 3 had the greatest overlap (82.4%). All of the harvest intensity regions overlapped to some degree with the community-identified priority areas.

The primary harvest intensity regions for all 14 analysis species combined (Figure 4.7), as well as common eider (Figure 4.19) and ringed seal (Figure 4.27), all occur



**Figure 4.7:** Top five harvest intensity regions for all 14 analysis species compared to community-identified priority areas



**Figure 4.8:** Overlap between the harvest intensity regions for all 14 analysis species combined and the community-identified priority areas

Where: “Within 1/2/3” represents the percentage of the harvest intensity region that falls within the corresponding priority area, and “Outside 1/2/3” represents the percentage of the harvest intensity region that falls outside of the corresponding priority area

around – or just north of – the community of Sanikiluaq. Since the community-identified priority areas did not include the area within the municipal boundaries (Section 3.3.2; 3.5.2), it is expected that the harvest intensity regions will have little to no overlap with the community-identified priority areas within the municipality.

The identification of harvest intensity regions and this comparative spatial analysis highlights potentially important harvesting areas that may not have been covered in the initial delineation of community-identified priority areas. The harvest intensity regions that are partially outside of the community-identified priority areas, such as harvest intensity region 4 (Figure 4.7; 4.8), represent important areas for SQSC consideration in

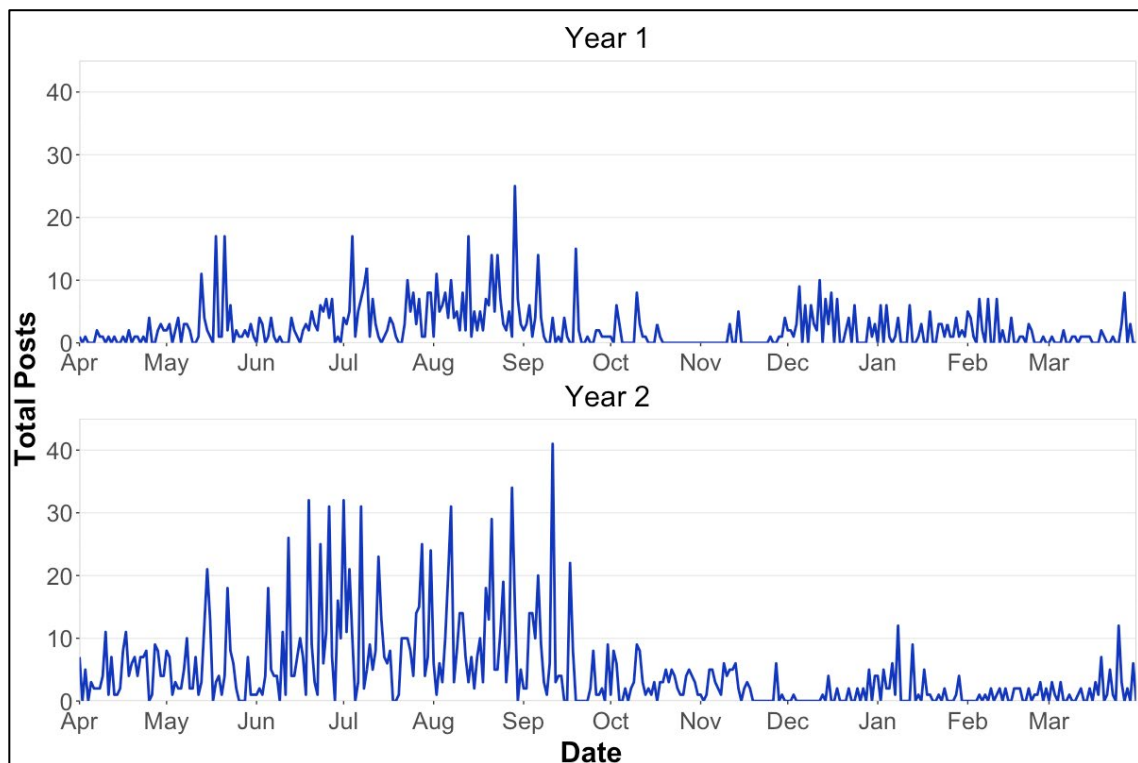
future discussions relating to Qikiqtaaluk management areas. Including the analysis of some commonly harvested species (which were not a focus in initial discussions of community-identified priority areas) highlight areas that can expand the documented knowledge base of key areas for Sanikiluaq harvesting. This information complements the wildlife data for key species (e.g., beluga whale) that were included in the creation of the community-identified priority areas but were not included in my analysis of harvest intensity regions.

### **4.3 Arctic Char Harvest**

#### **4.3.1 Harvest Post Totals**

When the total harvest posts per day is examined for one species, it is possible to identify species-specific harvesting trends. The graph for Arctic char clearly shows that users made Arctic char harvest posts year-round (Figure 4.9). For both Year 1 and Year 2, the most concentrated period of harvest posts was between mid-May through mid-September, which correlate with open water and ice periods (Andrews et al., 2018; Lukovich et al., 2021). There was a short period of less frequent posting in Year 1 (mid-October to late November) and Year 2 (late November to mid-December) that might represent the timing of ice freeze-up, when travel becomes unsafe on sea ice and lakes (Laidler et al., 2011; Laidler & Elee, 2008; McDonald et al., 1997), limiting opportunities to fish. The slight variation between Year 1 and Year 2 could indicate that the weather and ice formation windows differed between the years. Sanikiluaq have been linking this important climatic information to wildlife observations for a long time (Nakashima, 1991). Connecting harvest data collected from the Qikiqtaaluk Project to local ice

monitoring data, harvester knowledge from interviews, and further analysis separating freshwater and sea-run Arctic char is an extension of this established process with the additional of technology. These same type of multifaceted environmental connections and understandings could be completed with the eider duck harvest data as well, as they are associated polynya activity (Nakashima, 1991). Future research could examine relationships between harvester-collected species data and climatic data.



**Figure 4.9:** Arctic char daily harvest post totals

The Qikiqtait Project harvester-collected data has contributed to baseline data on fishing in the Belcher Islands (Appaqaq et al., 2020). Figure 4.9 can provide insight into how Sanikiluaarmiut are involved with Arctic char harvesting. Understanding changes that

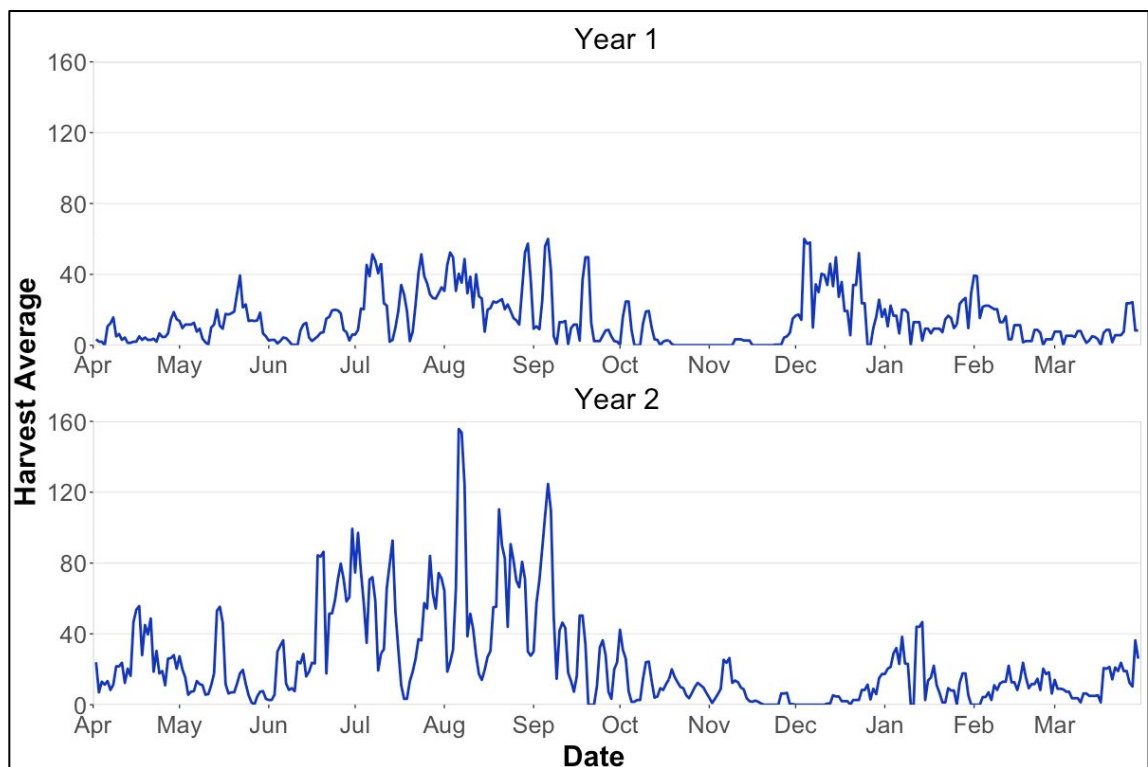
may occur to the number and demographics of Qikiqtait users may be important to know when interpreting community-collected harvest data, and making protected area management decisions, as they might impact priority harvesting areas, and influence species monitoring decisions. Further research linking this harvest data to user engagement and demographic information could be beneficial to identifying harvesting trends.

#### 4.3.2 Daily Average of Annual Harvest Totals

Identifying seasonal trends in the harvest data can be important to species monitoring and management decision-making (Naves, 2018). To start this process with the Qikiqtait project data, the total harvest per day was graphed for each species. A three-day moving average was applied to the daily harvest total for three reasons: a) to produce a smoother harvest line that supported easier interpretation and pattern identification, b) to address some of the noise in the data (outlying extreme values and no harvest days), and, c) to address periods of no harvest that may be a result of extreme weather events (such as storms or high winds), holidays, and Sundays.

Arctic char had the most user engagement (155 users), the largest quantity of annual harvest posts (Table 4.1), and the largest quantity of animals harvested in the two-year analysis period (Table 4.3). These results speak to how important Arctic char are to Sanikiluaarmiut. Inuit harvest Arctic char year-round (Dubos et al., 2023), and the Qikiqtait Project harvest data also shows year-round harvesting (Figure 4.10). In Year 1, the greatest amount of Arctic char harvest was collected from July through September with another peak in harvest from December through February (Figure 4.10). In Year 2,

the greatest amount of Arctic char was harvested from June through September. Overall, more fish were harvested in Year 2 than in Year 1, with the highest total harvest average occurred in August of Year 2. The high average harvests shown in the graph indicates that several fish are harvested at a time.

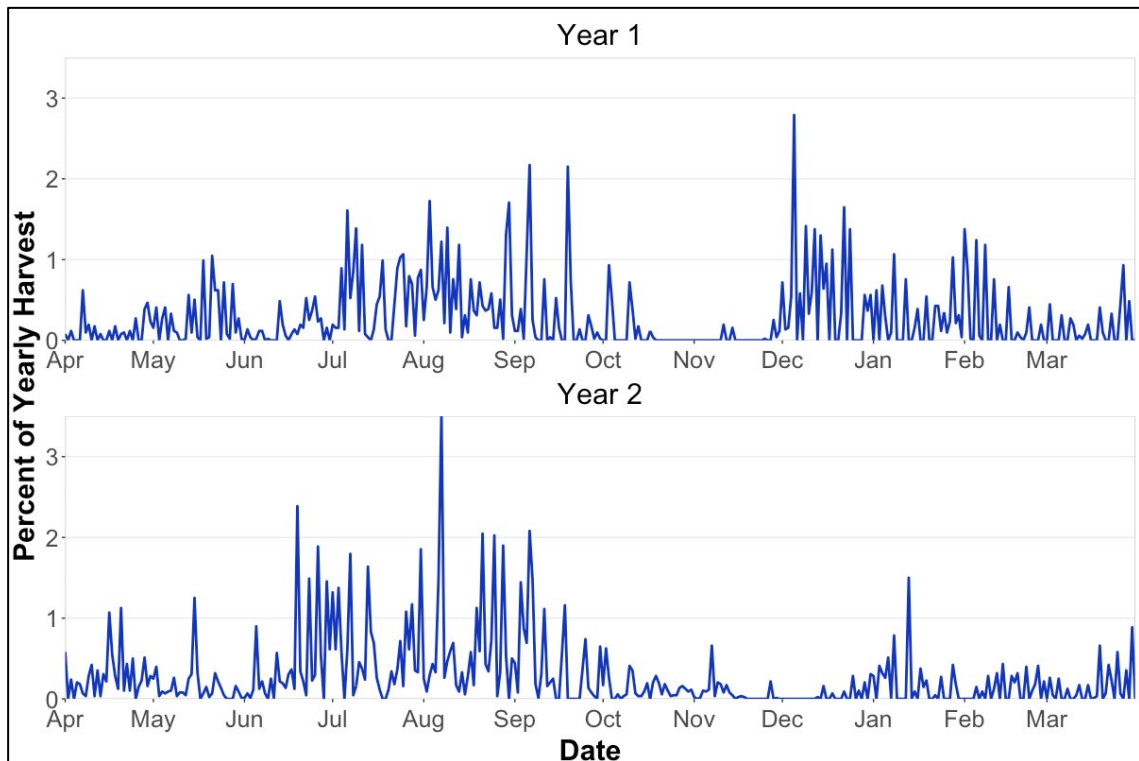


**Figure 4.10:** Three-day moving average of daily Arctic char harvest

#### 4.3.3 Percentage of Total Annual Harvest per Day

The graph for Arctic char shows that the day in which the most fish were harvested represents 3.5 % of the total Arctic char harvest for Year 2 (Figure 4.11). Generally, the daily harvest represents 2% or less of the total annual Arctic char harvest in both years.

This indicates that Arctic char are harvested quite evenly throughout the year, as opposed to harvested all at once at certain time.



**Figure 4.11:** Daily percentage of the total annual harvest for Arctic char

#### 4.3.4 Harvest Spatial Distribution (Post and Harvest Density)

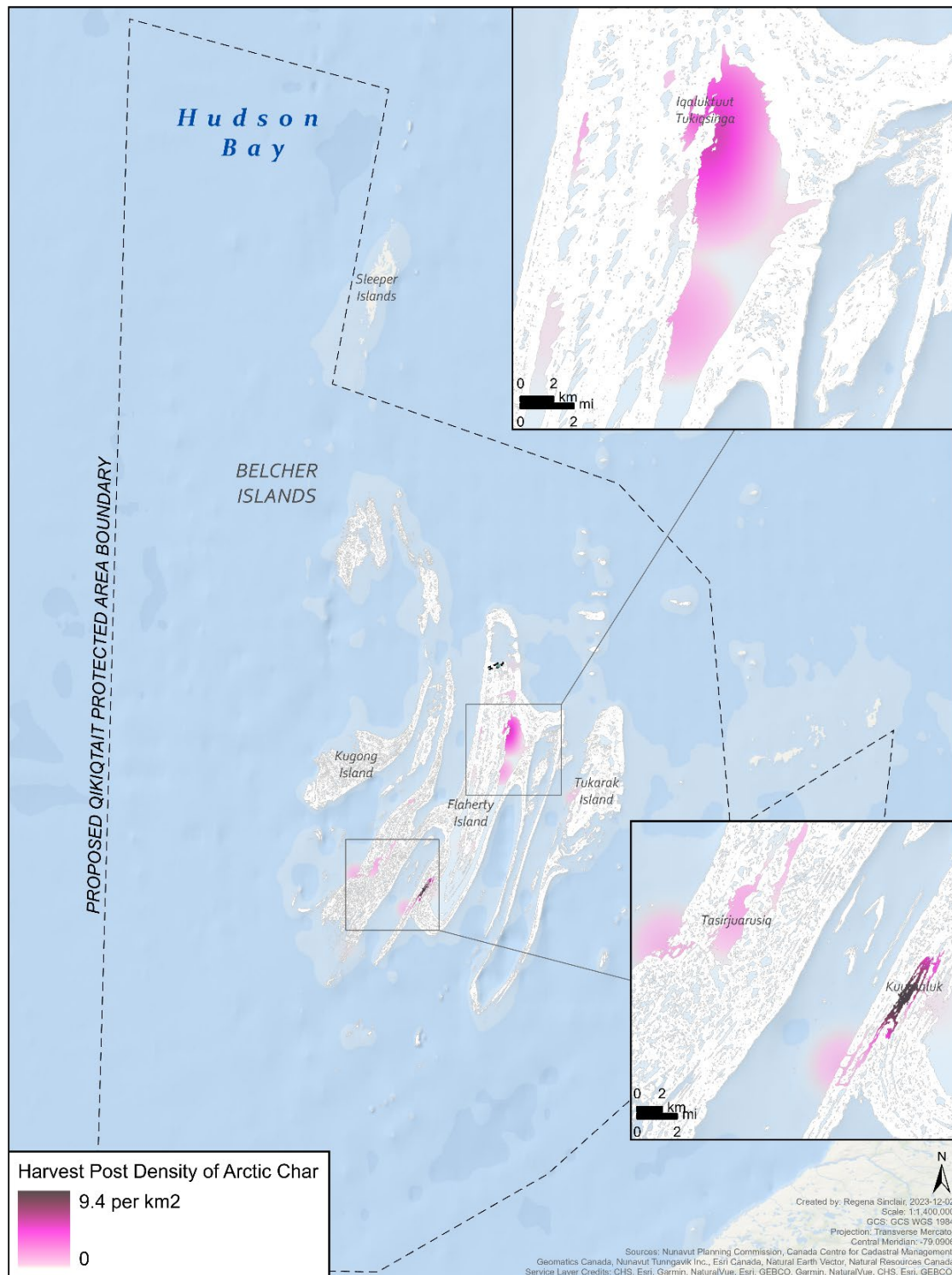
The harvest post and harvest density for Arctic char was limited to aquatic environments and was primarily located in three areas: south of Sanikiluaq near Iqaluktuut Tukiqsinga, and southwest of Sanikiluaq near Kuuraaluk and Tasirjuarusiq (Figure 4.12; 4.13). The most intense area of harvest collection occurred near Kuuraaluk, located 70km from the Hamlet, indicated by peak fishing harvest post density of 9.4 harvest posts per km<sup>2</sup> (Figure 4.12) and with a density harvest peak of 144.6 harvested

fish per km<sup>2</sup> (Figure 4.13). It is important to note that this analysis did not separate landlocked and sea-run char data (further discussed in Section 5.3.2.9) so each of these areas may represent the harvest of only landlocked or sea-run Arctic char, or both ecotypes of fish. The area of dense harvest near Iqaluktuut Tukiqsinga is located within the land-locked lake Tasirjuaq, so it could be assumed that only landlocked Arctic char were harvested in this area. Therefore, the area near Kuuraaluk and the area near Iqaluktuut Tukiqsinga could be considered key locations to be included in Qikiqtaut management decisions to best represent priority areas of Arctic char harvest across ecotypes.

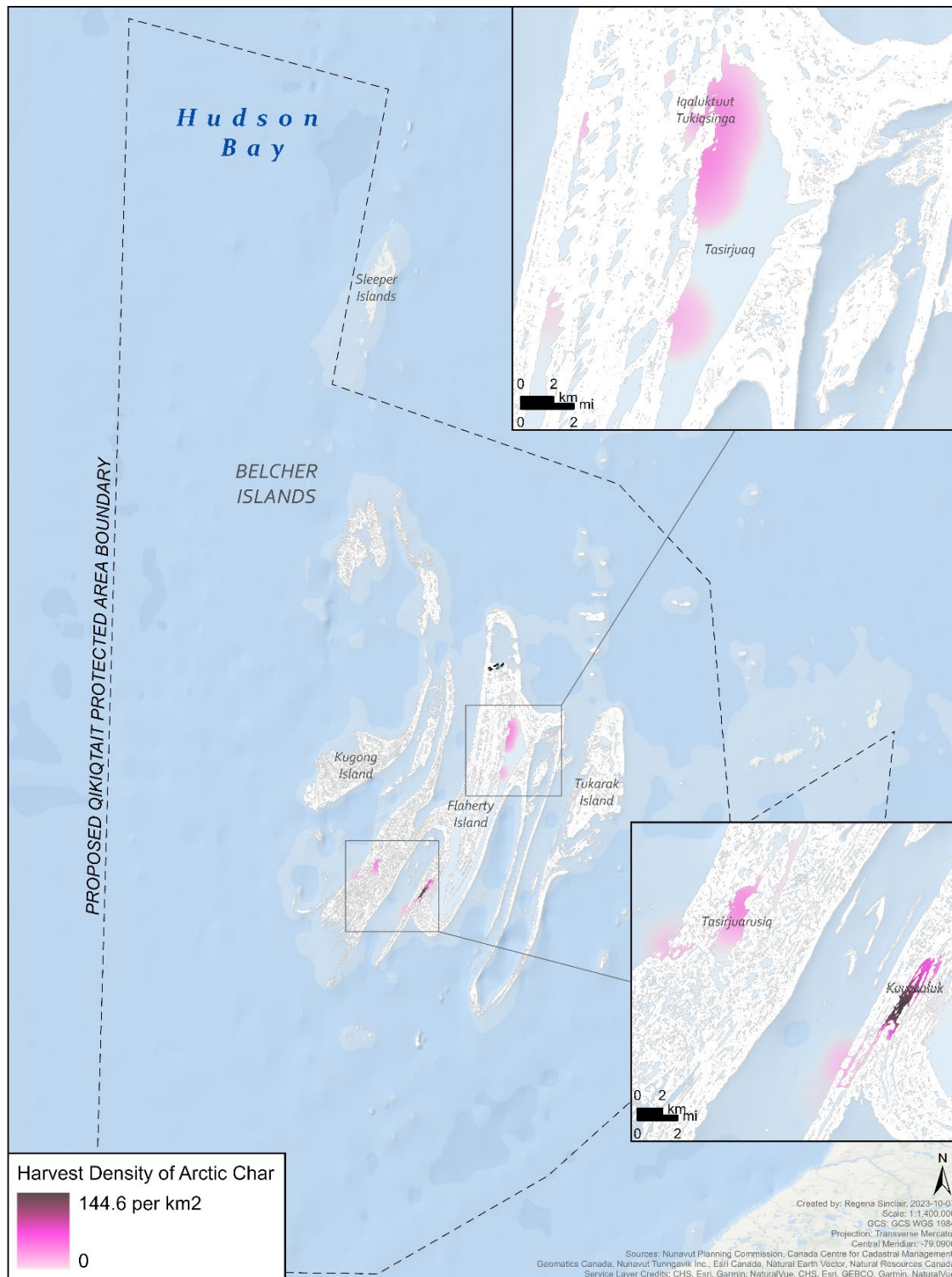
Akin to the combined species maps in Section 4.2.4, the spatial distribution of the density data in Figures 4.12 and 4.13 are similar. The density areas around Iqaluktuut Tukiqsinga and Tasirjuarusiq were larger in Figure 4.12 than they were in Figure 4.13, but the harvest density maximum value in Figure 4.13 (144.6 fish per km<sup>2</sup>) was much larger than the harvest post density maximum value in Figure 4.12 (9.4 posts per km<sup>2</sup>).

#### 4.3.5 Inter-annual Harvest Density Change

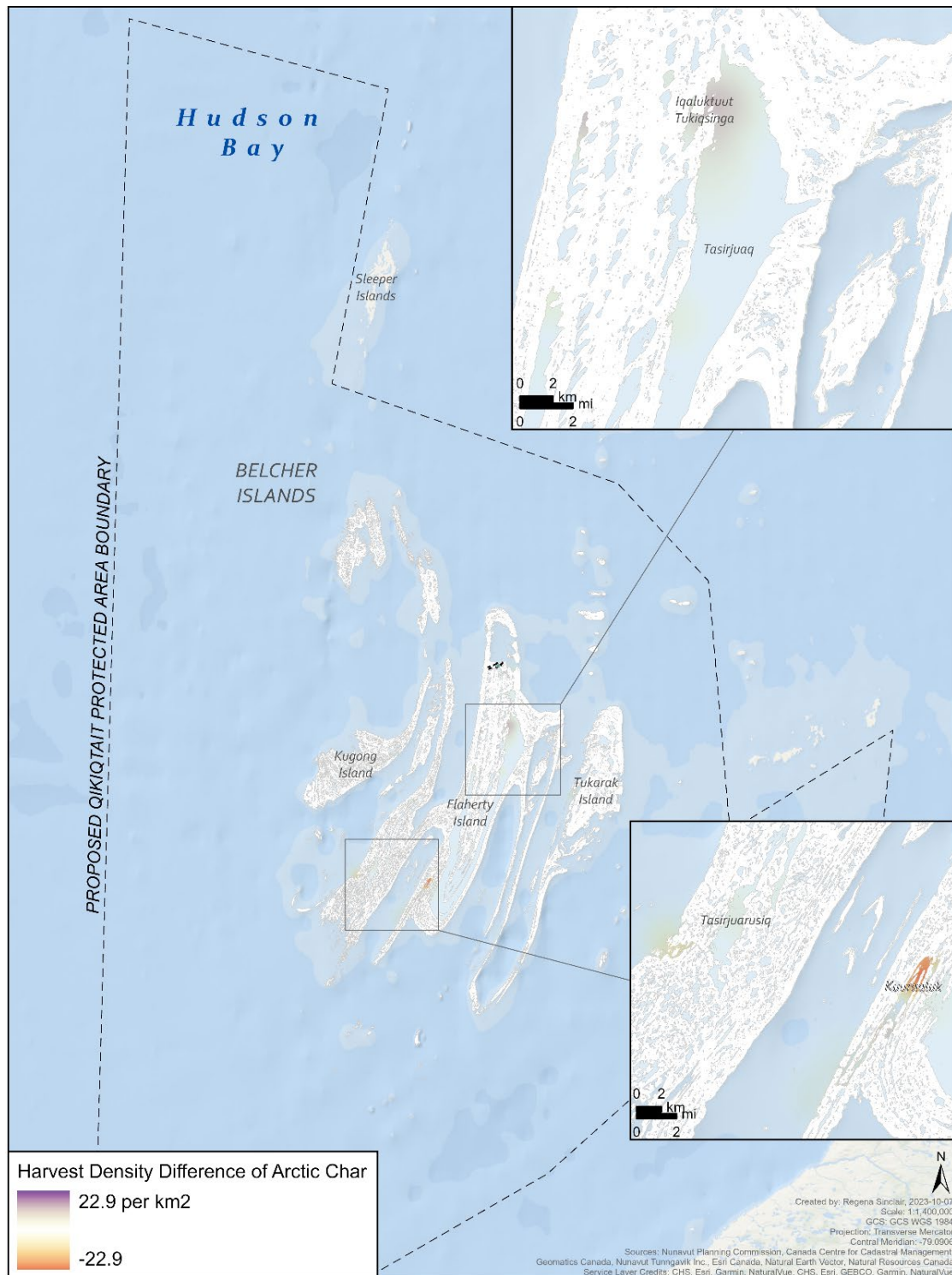
When assessing Arctic char, there was a decrease in harvest density near Kuuraaluk between the analysis years (Figure 4.14), which was identified as a primary fishing location (Figure 4.13). The harvest density in this area decreased by 22.9 fish per km<sup>2</sup> (Figure 4.14). There was an increase in harvest density of Arctic char near Iqaluktuut Tukiqsinga in Year 2, indicating that more fish were harvested within 20 km of Sanikiluaq in Year 2 than in Year 1.



**Figure 4.12:** Density of Qikiqtaik Project harvest posts for Arctic char for both analysis years  
Where: areas of darker pink represent a larger post density



**Figure 4.13:** Arctic char harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*

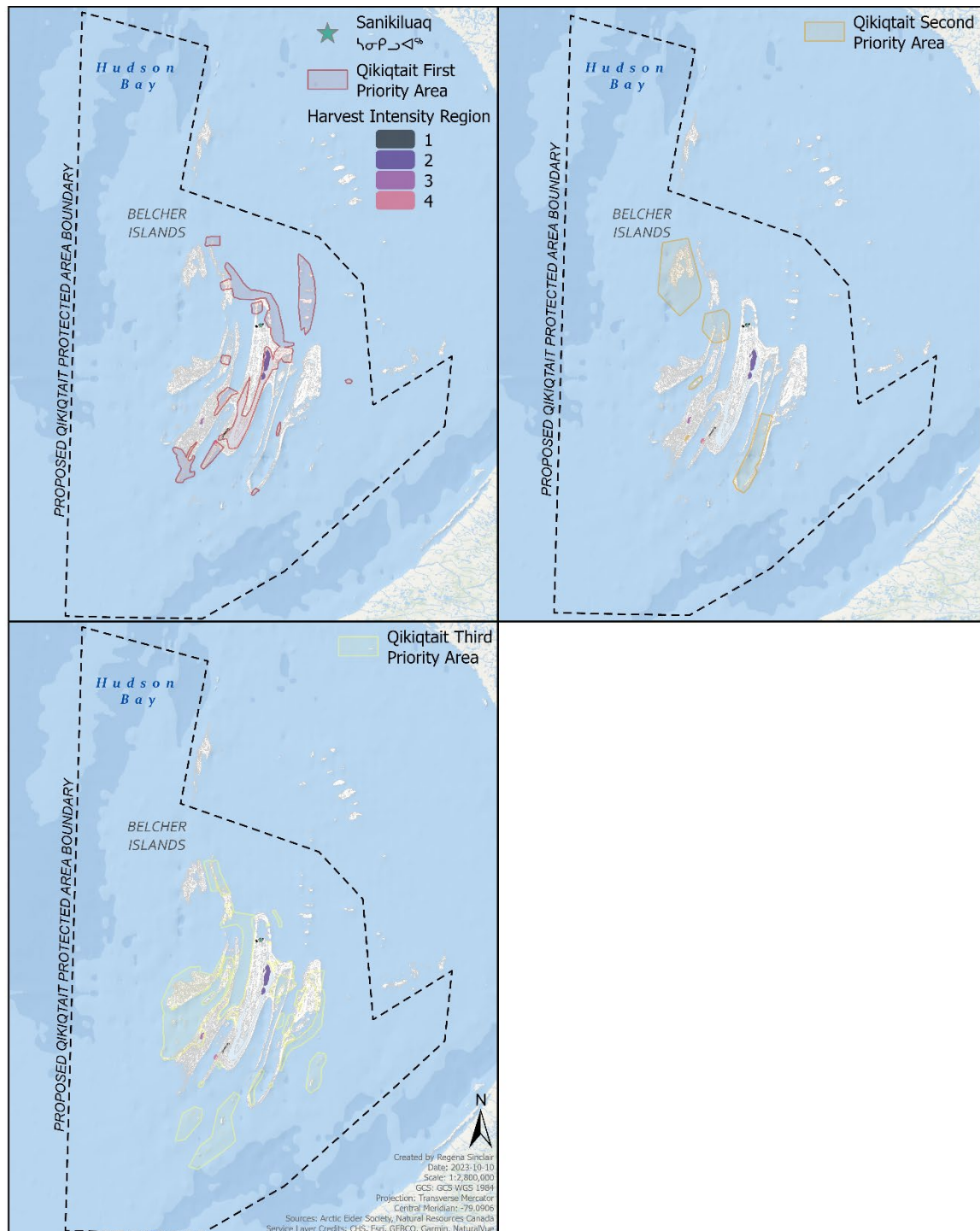


**Figure 4.14:** Harvest density difference over time for Arctic char  
Where: dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest

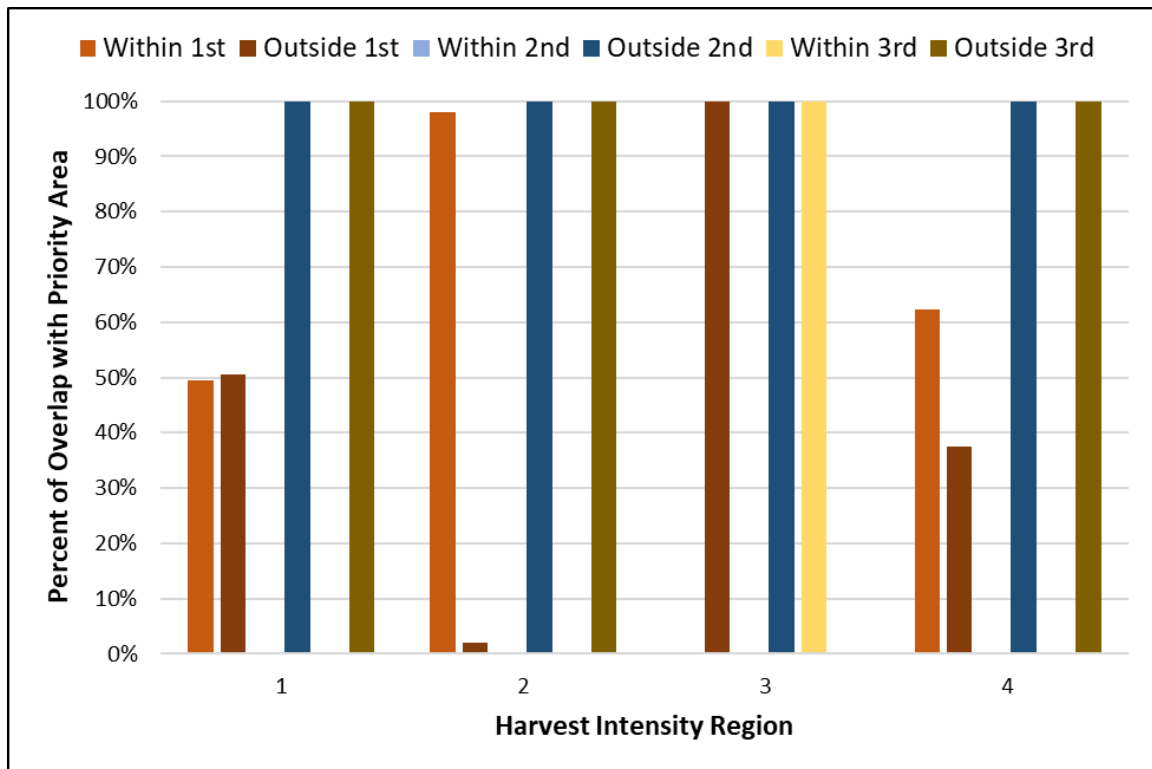
#### 4.3.6 Harvest Density Comparison to Community-Identified Priority Areas

The Arctic char data identified four harvest intensity regions, representing a total of 54.6 km<sup>2</sup>. Overall, there was little overlap between the harvest intensity regions and the community-identified priority areas (Figure 4.15). The greatest amount of overlap with the first priority area was with harvest intensity region 2 with 97.9% and was located approximately 15 km south of Sanikiluaq (Figure 4.16). None of the harvest intensity regions intersected with the second priority area. Harvest intensity region 3 was completely (100%) encompassed within the third priority area. Interestingly, harvest intensity region 1 overlapped 49.4% with the first priority area and had no overlap with the second and third priority areas. As discussed in Section 4.3.4, the area near Kuuraaluk could be considered a key Arctic char harvesting location, and this area only partially overlapped with the first priority area (Figure 4.15; 4.16). It is important to keep in mind that the harvest intensity regions that were created based only on the data of one species may have less overlap with the community-identified priorities areas that represent a much more extensive and holistic knowledge base of several key species.

Arctic char harvest data was not extensively recorded prior to the initiation of the Qikiqtait Project (Appaqaq et al., 2020) and was not a key component in the creation of the community-identified priority areas (Section 3.3.2; 3.5.2.4; Haycock-Chavez, 2021; SQSC, 2019b). The Arctic char harvest intensity regions were also limited to aquatic environments (Figure 4.15), while the community-identified priority areas include aquatic and terrestrial environments (Figure 3.6). Harvest intensity region 1 for Arctic char was not identified in any of the harvest intensity regions for all 14 species combined (Figure



**Figure 4.15:** Top four harvest intensity regions for Arctic char compared to community-identified priority areas



**Figure 4.16:** Overlap between the top four harvest intensity regions for Arctic char and the community-identified priority areas

*Where:* “Within 1/2/3” represents the percentage of the harvest intensity region that falls within the corresponding priority area, and “Outside 1/2/3” represents the percentage of the harvest intensity region that falls outside of the corresponding priority area

4.7), indicating the value of analyzing species-specific harvest intensity regions. Spatial analysis of species-specific harvest intensity can support Qikiqtait conservation management decisions by highlighting unique harvesting areas (e.g. areas of fishing intensity) to complement community-identified priority areas.

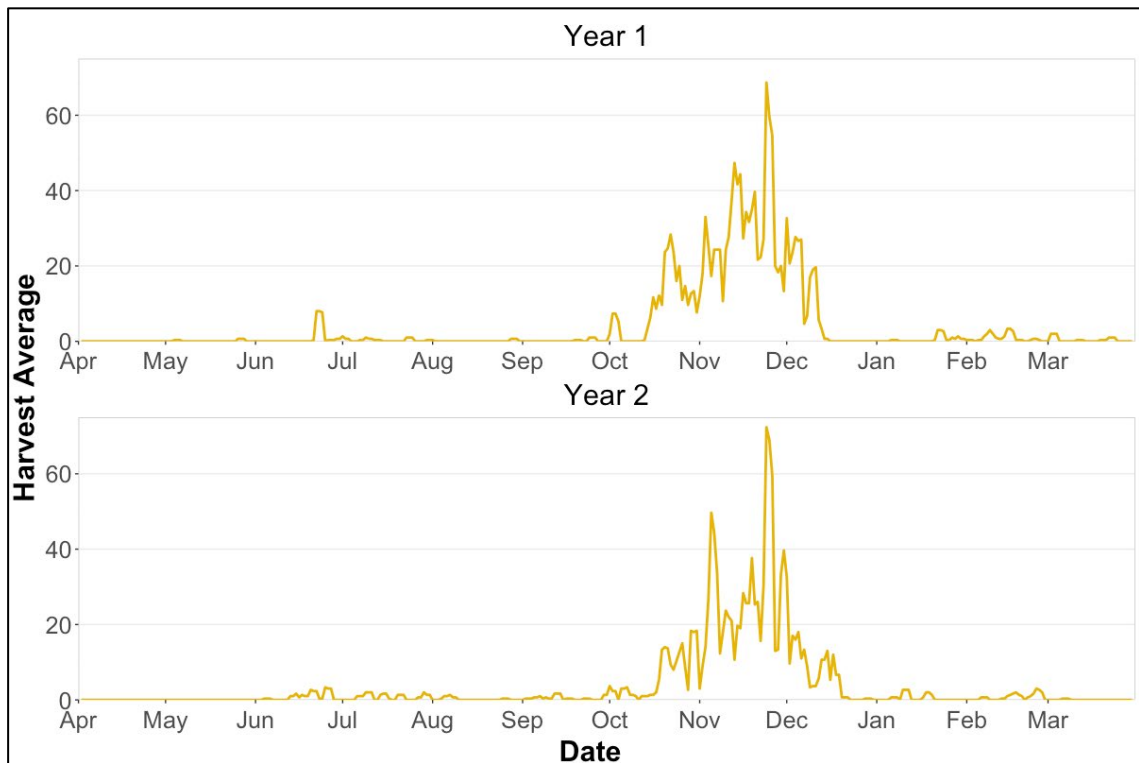
#### **4.4 Common Eider Harvest**

##### **4.4.1 Daily Average of Annual Harvest Totals**

The peak time that common eider was harvest occurred between mid-October and mid-December in both Year 1 and Year 2 (Figure 4.17). During the winter, eiders ducks are harvested in polynyas and near ice flow edges (Gilchrist & Robertson, 2000; Nakashima, 1991). The harvester data shown in Figure 4.17 was able to show this seasonality of eider duck harvesting by identifying a peak in harvesting around December. Few to no juvenile or adult animals were harvested during nesting seasons (when eggs and down are collected), an example of the sustainable management practices of Sanikiluaarmiut that are already in place. More birds were recorded in harvest posts in Year 2 than in Year 1, and the highest total harvest average occurred in November of Year 2. The high average harvests shown in the graph indicates that several birds are generally harvested at a time.

##### **4.4.2 Percentage of Total Annual Harvest per Day**

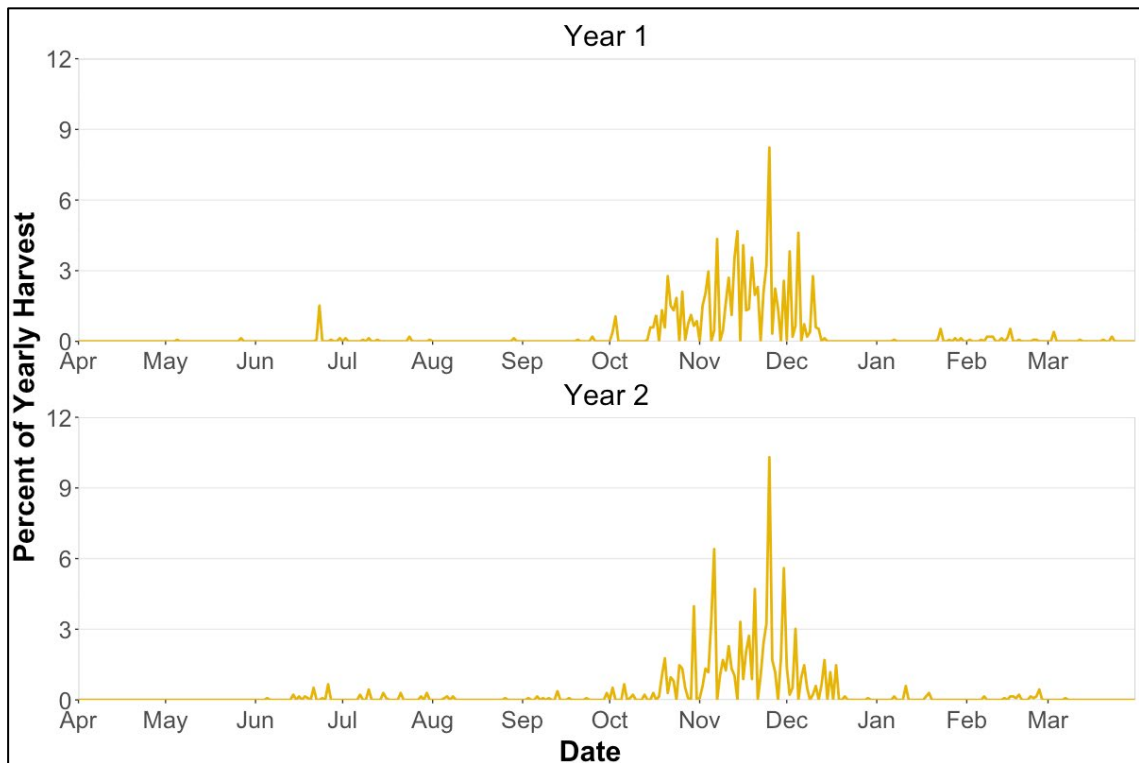
Common eider presents a different harvest narrative. In Figure 4.18, we can see that the day in which the most birds were harvested represents 10.3 % of the total juvenile and adult common eider harvest for Year 2. During periods of harvest, the daily harvest represents 2 – 4% of the total annual common eider harvest for both years, but there are periods of little to no harvest for large parts of the year. The higher daily harvest percentage indicates that juvenile and adult common eider are harvested in greater quantities during a shorter period of the year, as opposed to harvest being spread throughout the year.



**Figure 4.17:** Three-day moving average of daily common eider harvest

#### 4.4.3 Harvest Spatial Distribution (Harvest Density)

Most of the harvest density for common eider was located within 12 km of Sanikiluaq and surrounded the Hamlet (Figure 4.19). The most intense area of harvest collection occurred near Kataapik, with a density harvest peak of 98.2 harvested birds per  $\text{km}^2$  (Figure 4.19). There were also higher levels of harvest density southeast of Sanikiluaq, near Nuitasulik, and west of Sanikiluaq, near Uiguqsik. There was little to no harvesting on the southern half of the Belcher Islands, indicating that key areas for management considerations of adult and juvenile common eider harvesting within Qikiqtait could be located in the northern Belcher Islands region. These key harvest areas do not represent common eider nesting areas (which include egg and down harvesting),

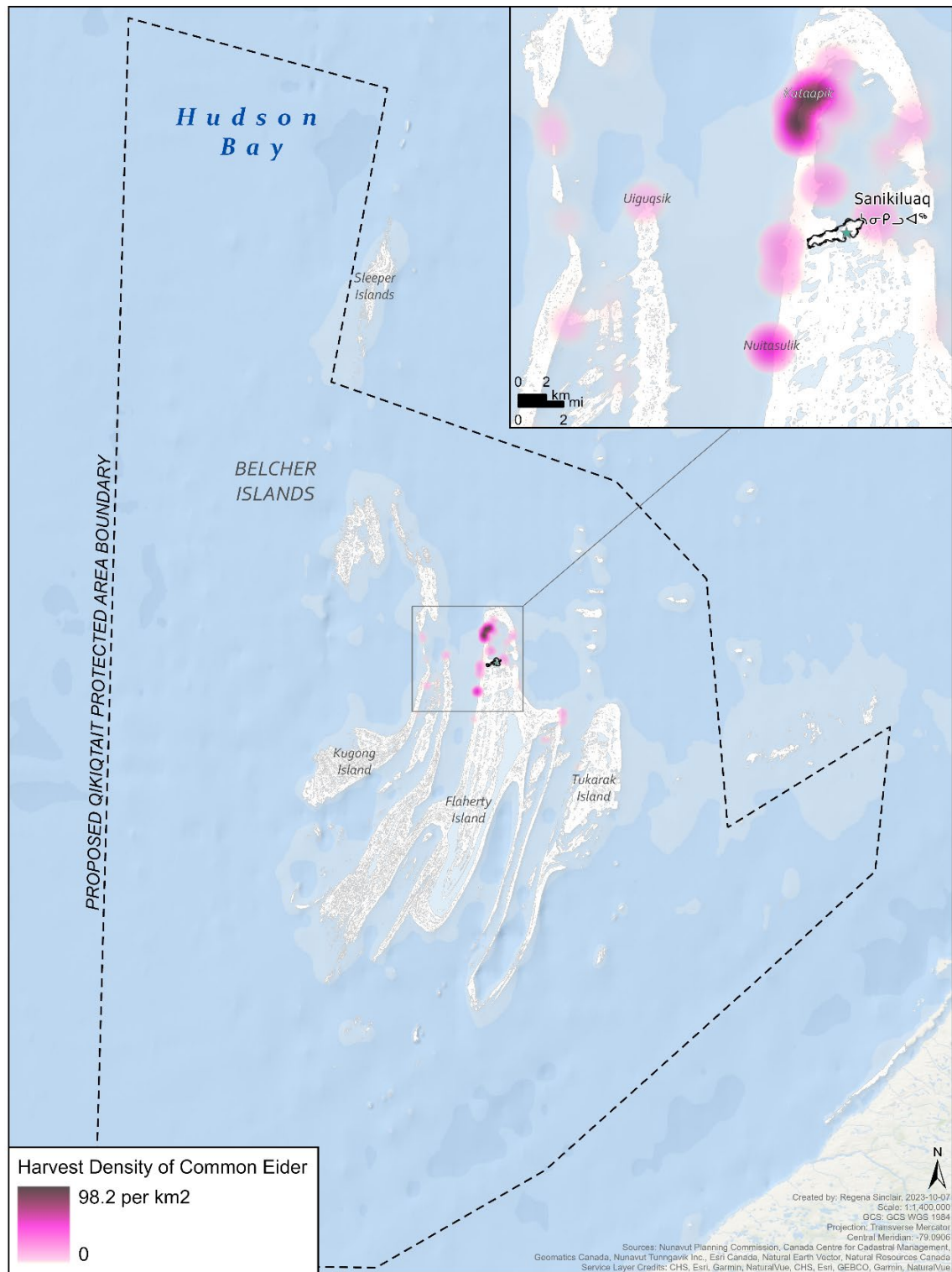


**Figure 4.18:** Daily percentage of the total annual harvest for common eider

thus the SQSC could bring that data into a future analysis to prepare a more complete common eider management plan.

#### 4.4.4 Inter-annual Harvest Density Change

Common eider harvest density increased near Kataapik (Figure 4.20) between Year 1 and Year 2. This area had the highest harvest density in Figure 4.19. The harvest density in this area increased by 33.3 birds per km<sup>2</sup> in Year 2 (Figure 4.20). There was also a decrease in harvest density near Nuitasulik in Year 2, where the number of common eiders harvested per km<sup>2</sup> decreased by 33 birds per km<sup>2</sup>. The results of this map



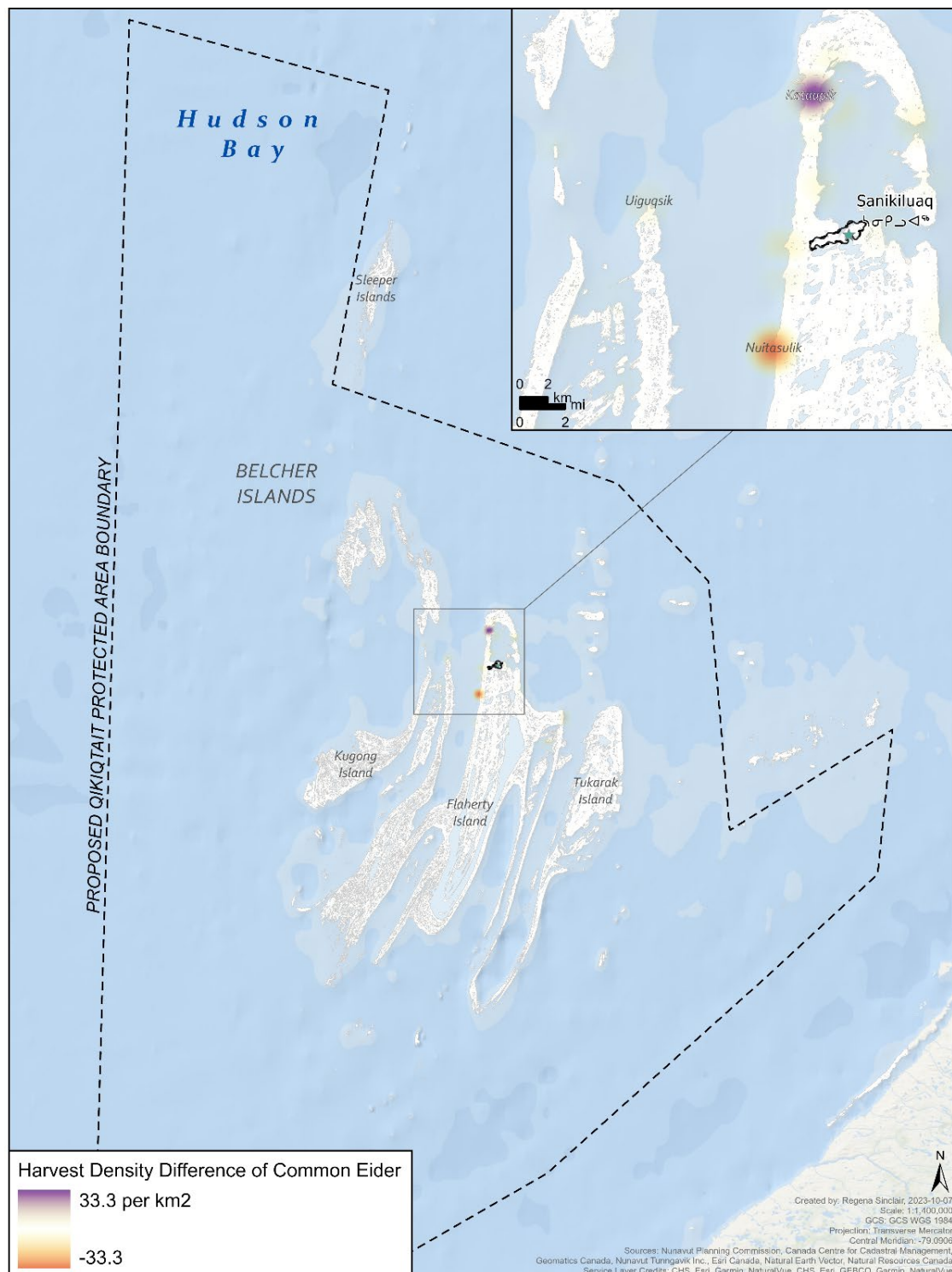
**Figure 4.19:** Common eider harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*

might highlight the importance of the Kataapik area for the SQSC for common eider harvest moving forward.

#### 4.4.5 Harvest Density Comparison to Community-Identified Priority Areas

The common eider harvest data identified six harvest intensity regions, covering a total area of 89.5 km<sup>2</sup>. Harvest intensity region 1 was 64.7% within the first priority area, and was located approximately 7 km north of Sanikiluaq (Figure 4.21). Harvest intensity region 5 was 88.6% within the first priority area (Figure 4.22). Only harvest intensity region 6 intersected with the second priority area with 100% overlap, and harvest intensity region 2 overlapped the most with the third priority area at 59.1%. There was little to no harvesting on the southern half of the Belcher Islands, indicating that key areas for the harvesting management of juvenile and adult common eider within Qikiqtait could be located southwest of Sanikiluaq and encompass harvest intensity region 2 (Figure 4.21).

Given the importance of common eider to the community of Sanikiluaq (Heath & Community of Sanikiluaq, 2011; McDonald et al., 1997; Quigley & McBride, 1987; SQSC, 2021), key areas for harvesting common eider — located mainly in the northern Belcher Islands zone (Figure 4.21) — may be of interest to include in the Qikiqtait management framework. However, it is also important to restate that eider duck nesting areas (which relate to egg and down harvesting) were not included in this analysis (Section 3.4.4) but were a key component in the initial delineation of the community-



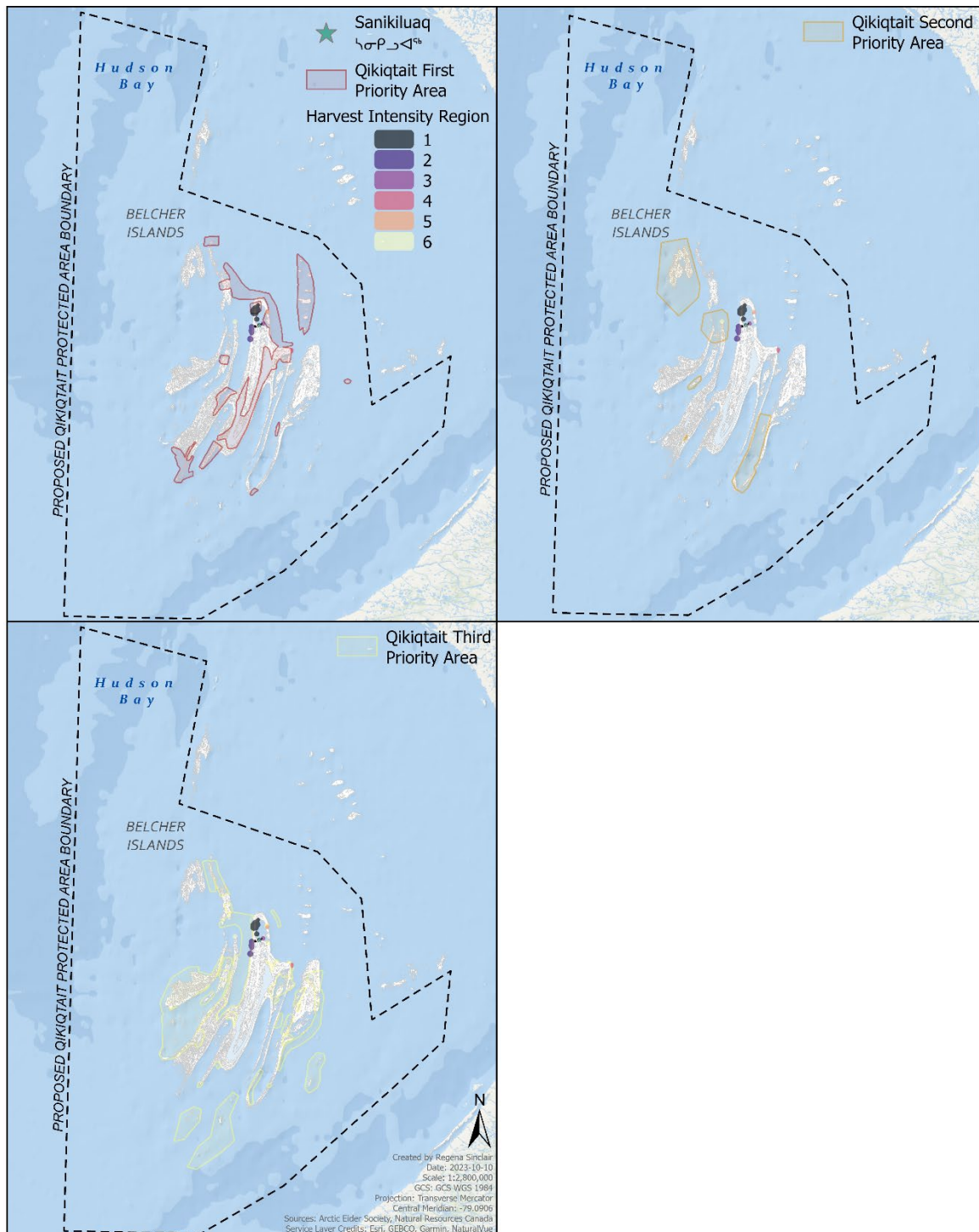
**Figure 4.20:** Harvest density difference over time for common eider  
Where: dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest

identified priority areas. As a result, the top harvest intensity regions for common eider are not fully representative of common eider harvesting by Sanikiluaarmiut, but they do add important information to the harvest resource inventory. Including egg and down harvest data in future research could produce more representative harvest intensity regions for common eider.

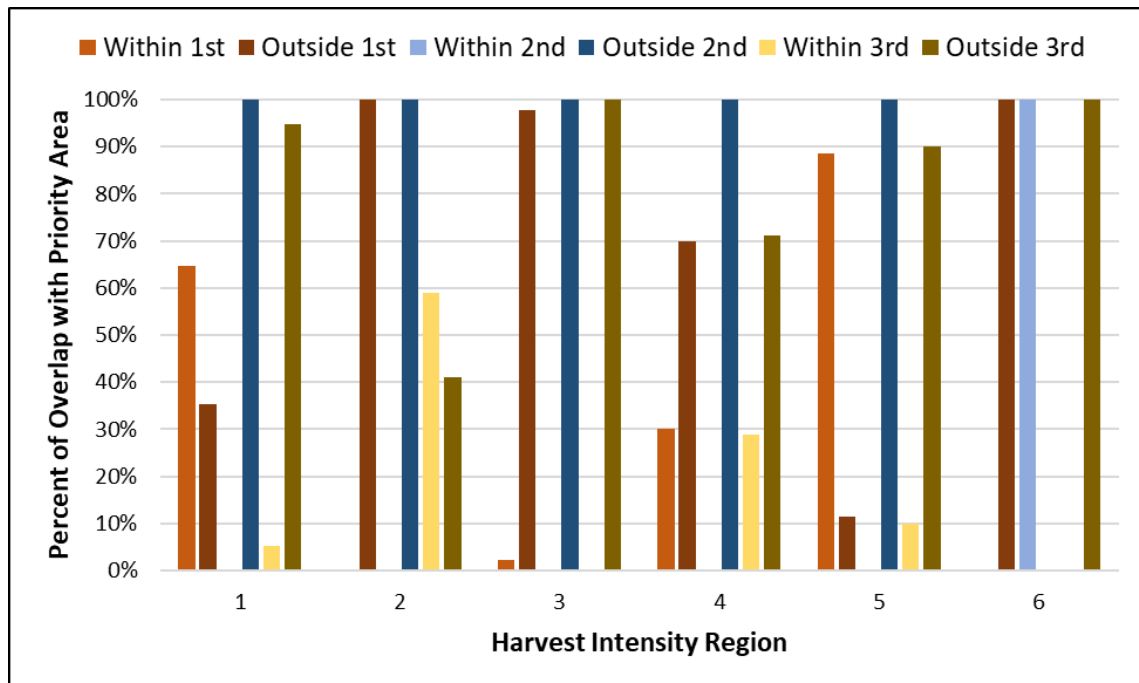
## **4.5 Ringed Seal Harvest**

### **4.5.1 Daily Average of Annual Harvest Totals**

Ringed seal was harvested year-round, with the most frequent harvesting of animals occurring between late September through November, and from January through March (Figure 4.23). Inuit often hunt ringed seal in the winter on the sea ice (Furgal et al., 2002; Gilchrist & Robertson, 2000). The harvester data in Figure 4.23 was also able to represent this increased harvesting of ringed seal during the winter. Ringed seals are a much larger animal that provide more meat and materials than Arctic char and common eider, so not as many animals are harvested at a time. Harvesting only what is necessary to meet needs is required is a fundamental component of Inuit culture (McDonald et al., 1997), thus the amount of caloric value of a harvest can influence the number of animals harvested. Additionally, seals might be more challenging to harvest successfully, as they are generally solitary animals. There were more harvested seals recorded in Year 2 than in Year 1, and the highest total harvest average occurred in March of Year 2.



**Figure 4.21:** Top six harvest intensity regions for juvenile and adult common eider compared to community-identified priority areas

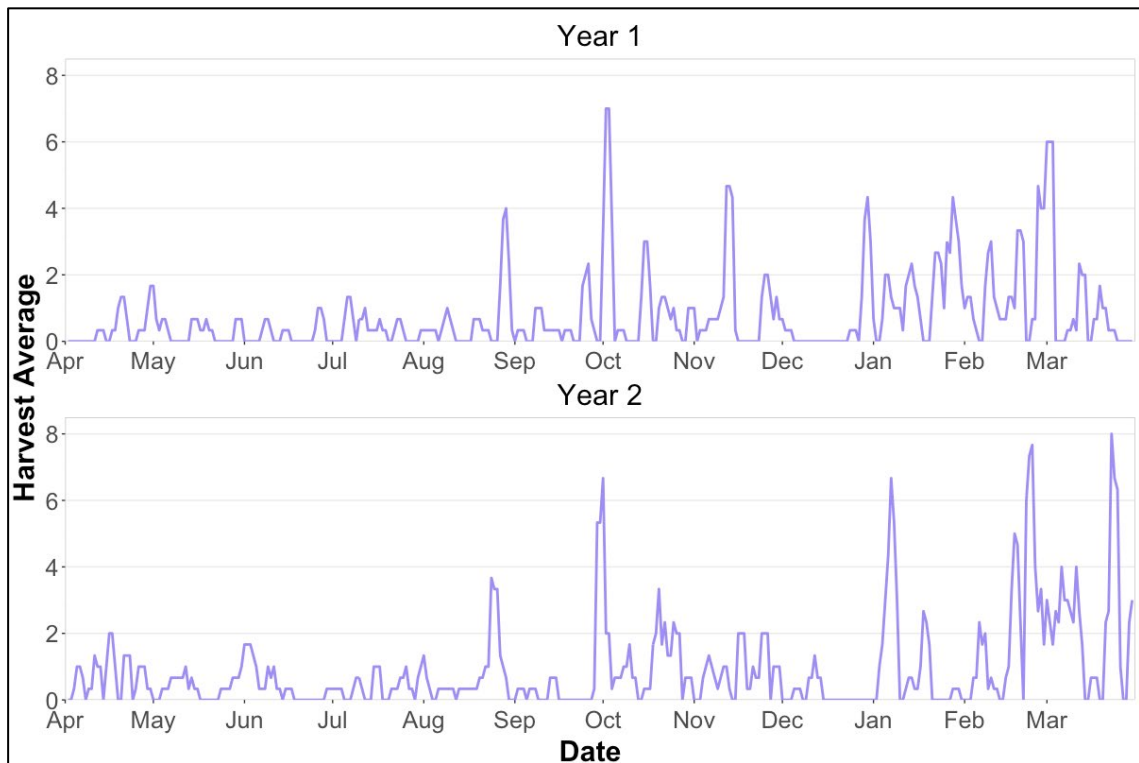


**Figure 4.22:** Overlap between the top six harvest intensity regions for common eider and the community-identified priority areas

Where: “Within 1/2/3” represents the percentage of the harvest intensity region that falls within the corresponding priority area, and “Outside 1/2/3” represents the percentage of the harvest intensity region that falls outside of the corresponding priority area

#### 4.5.2 Percentage of Total Annual Harvest per Day

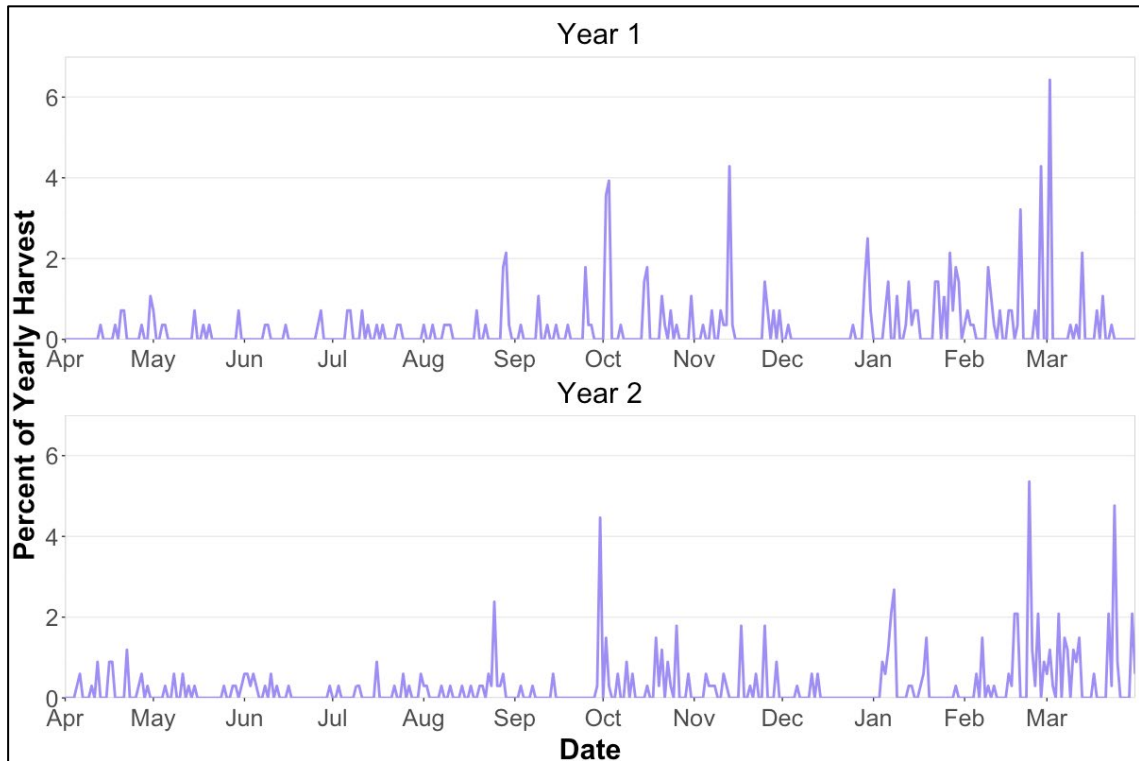
The graph for ringed seal again shows a different harvest pattern. In Figure 4.24, we can see that the day in which the most seals were harvested represents 6.4 % of the total ringed seal harvest for Year 1. However, in both years the daily harvest generally represented less than 2% of the total annual ringed seal harvest. The results of this graph shows that ringed seal are harvested in low, relatively uneven quantities throughout the year.



**Figure 4.23:** Three-day moving average of daily ringed seal harvest

#### 4.5.3 Harvest Spatial Distribution (Harvest Density)

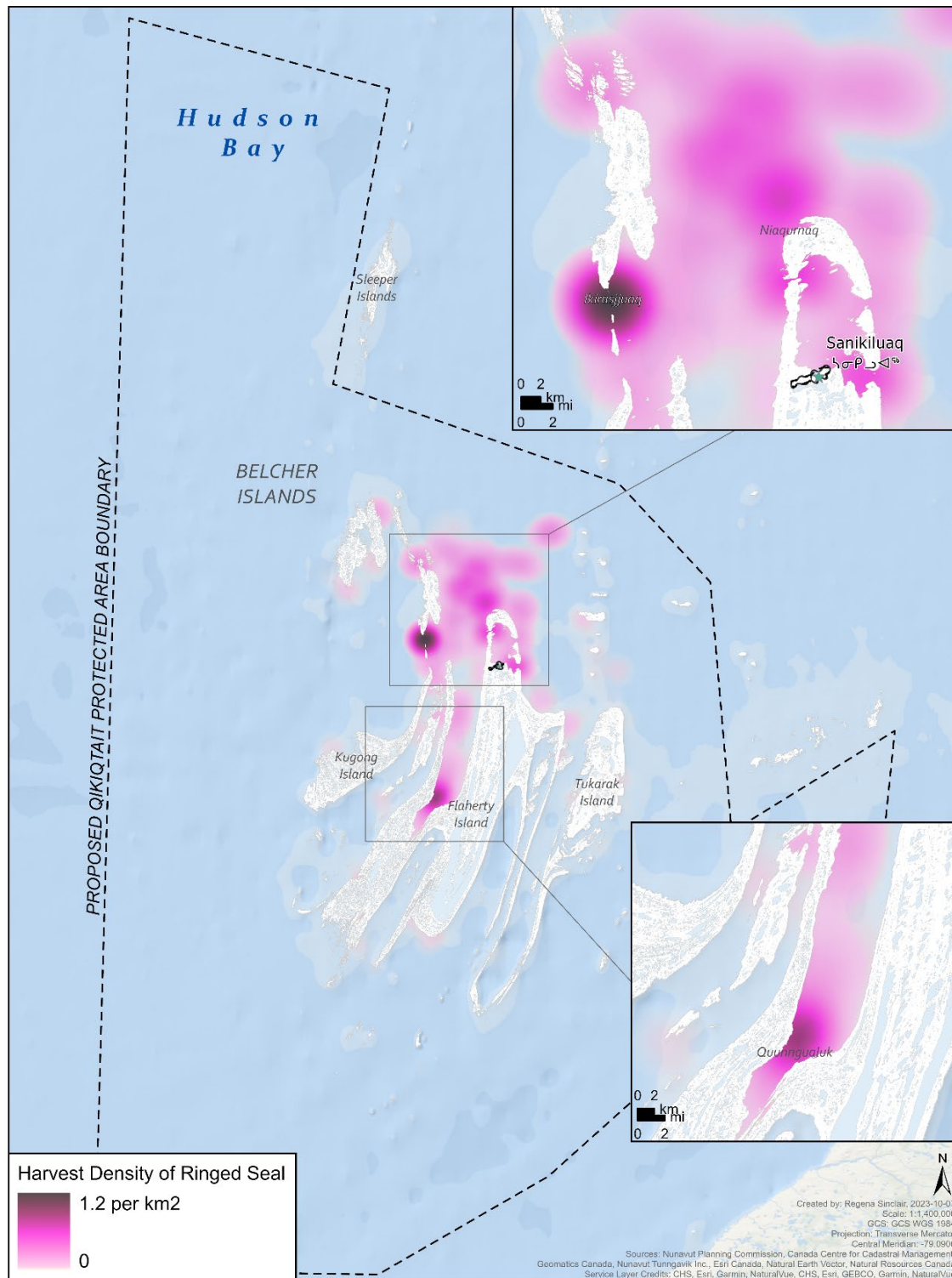
The harvest density for ringed seal was limited to aquatic environments since they are not often harvested on land (McDonald et al., 1997) and was spread throughout the Belcher Islands aquatic region (Figure 4.25). The most intense area of harvest collection occurred west of Sanikiluaq near Ikirasajjuaq and had a harvest density peak of 1.2 harvested seals per km<sup>2</sup> (Figure 4.25). Other areas of high harvest density were located southwest of Sanikiluaq, near Quunngualuk, and north of Sanikiluaq, near Niaqurnaqa.



**Figure 4.24:** Daily percentage of the total annual harvest for ringed seal

#### 4.5.1 Inter-annual Harvest Density Change

The harvest density of ringed seal experienced a great deal of variability between Year 1 and Year 2 (Figure 4.26). Harvest density increased northeast of Niaqurnaᑭ towards Siukkaaluk by 0.4 seals per km<sup>2</sup>, and west of Ikiqtunik by 0.3 seals per km<sup>2</sup> in Year 2 (Figure 4.26). Most of the increase occurred in the offshore region where seals are most often harvested (Figure 4.25), around 14 – 43 km north of Sanikiluaᑭ. There was also a decrease in harvest density near Ikirasajjuaᑭ (which had the highest harvest density in Figure 4.25) by 0.4 seals per km<sup>2</sup>, Quunngualuk by 0.2 seals per km<sup>2</sup>, and north of Niaqurnaᑭ by 0.2 seals per km<sup>2</sup> in Year 2 (Figure 4.26). This analysis shows that the ringed seal harvesting areas can change considerably from year to year. This might



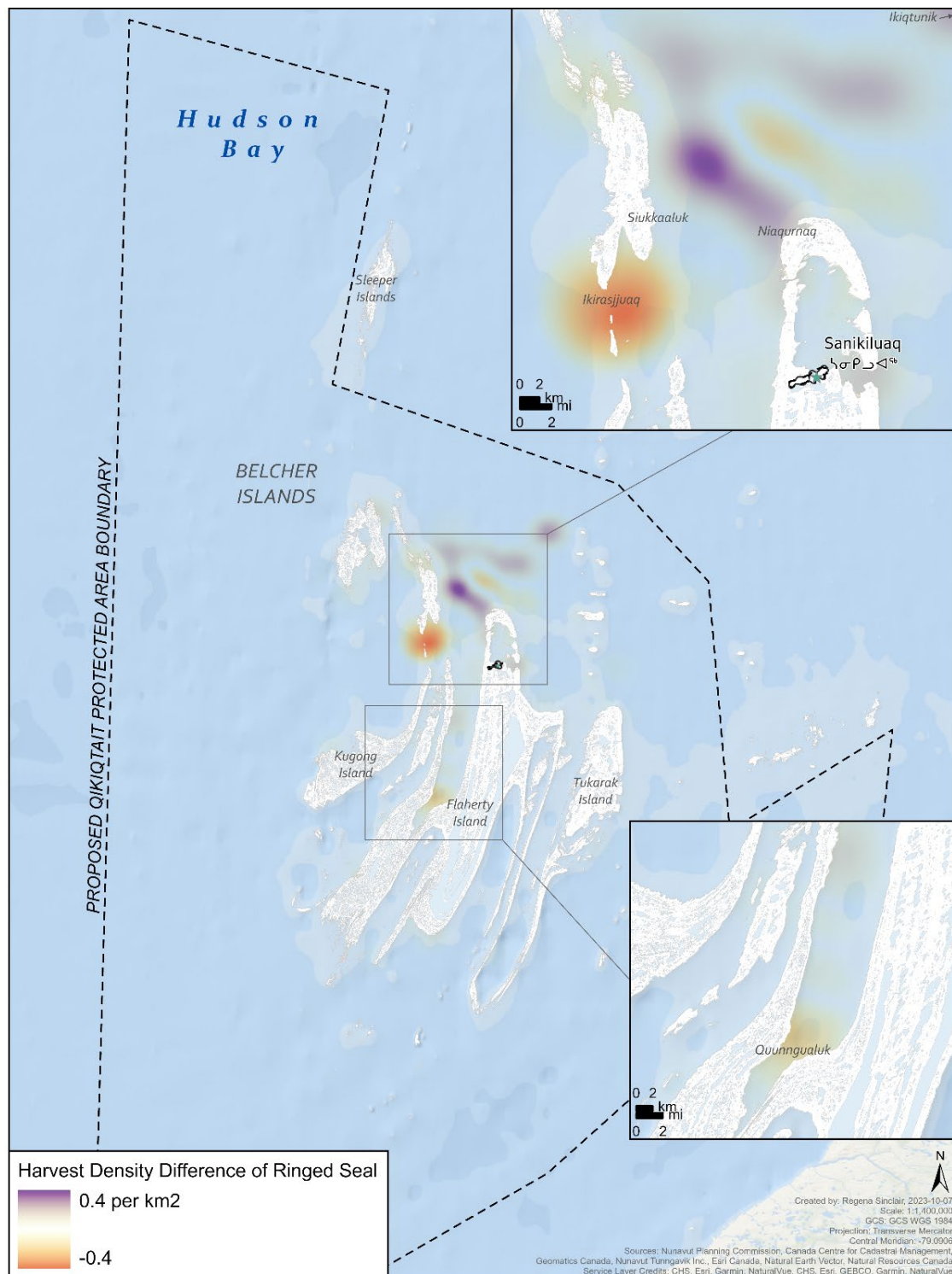
**Figure 4.25:** Ringed seal harvest density for both analysis years  
Where: areas of darker pink represent a greater harvest density

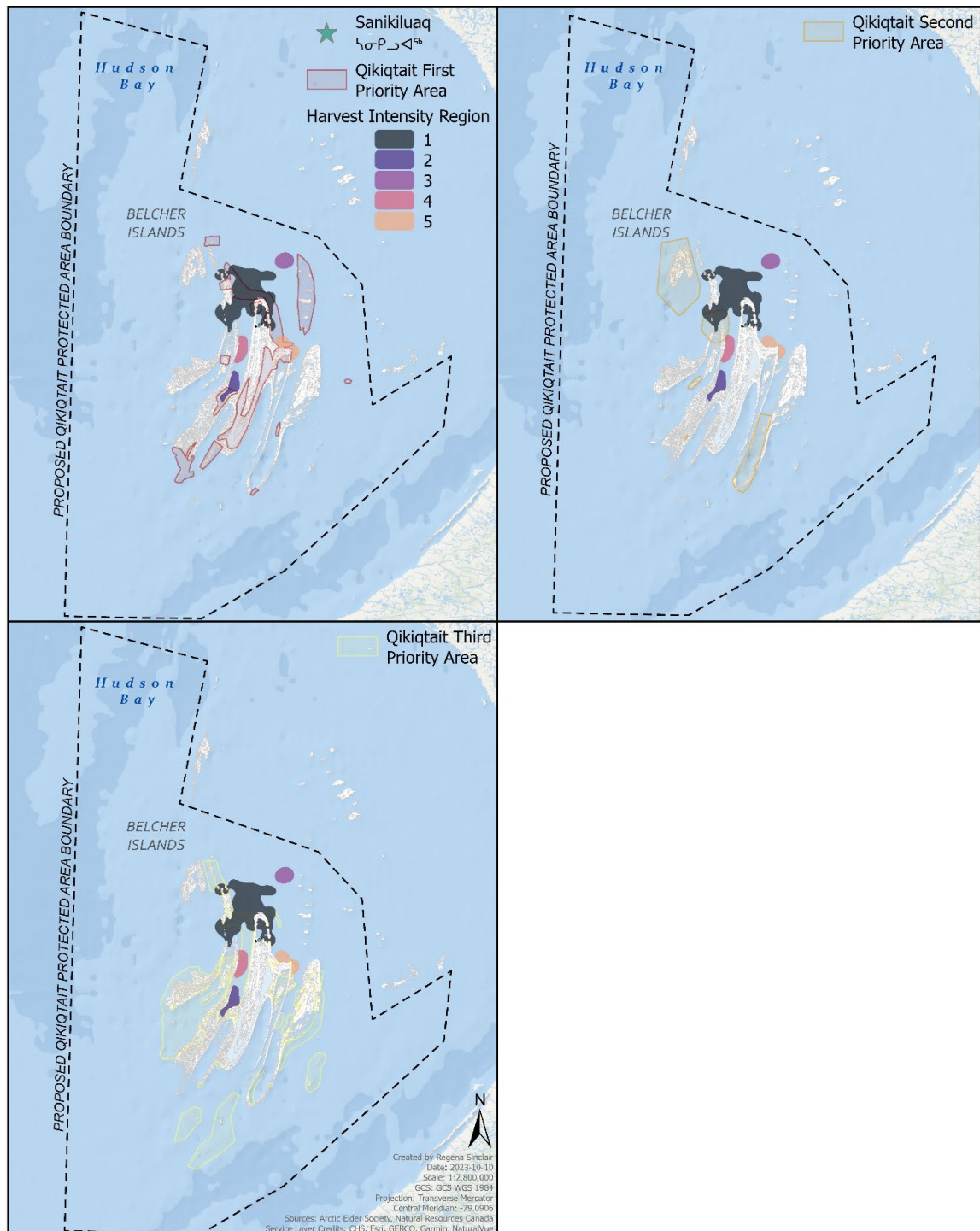
require special consideration when identifying areas for management within Qikiqtait and the ringed seal top harvest intensity regions (Figure 4.27).

#### 4.5.2 Harvest Density Comparison to Community-Identified Priority Areas

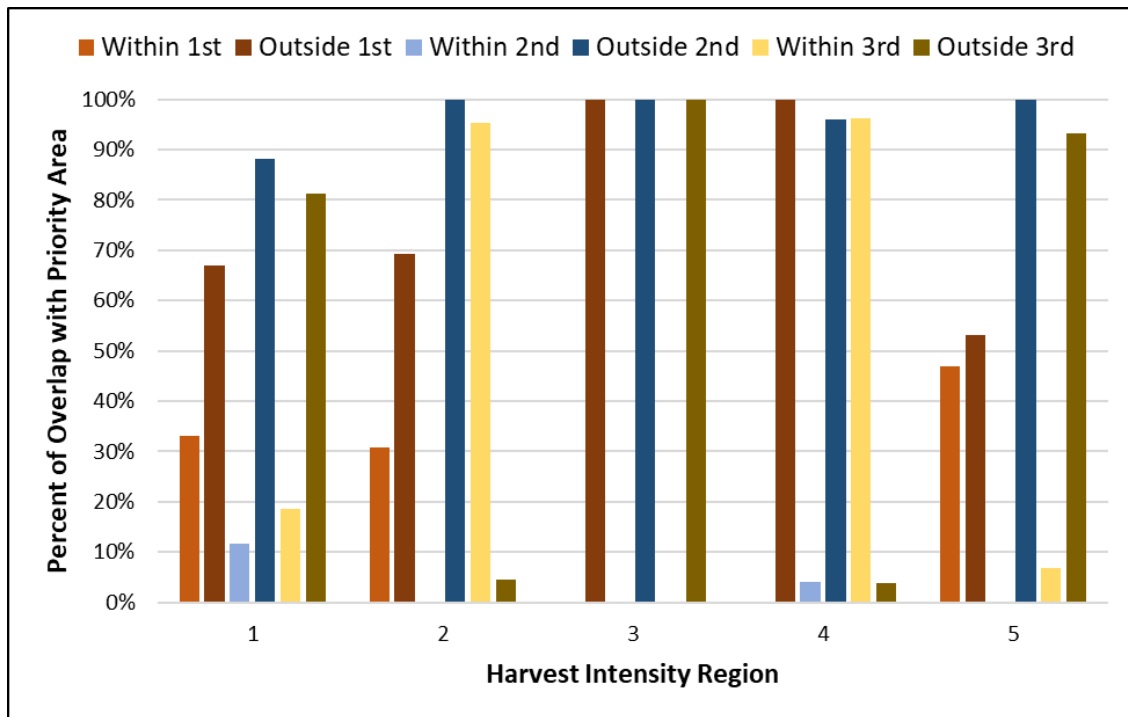
The ringed seal data used in this thesis identified five harvest intensity regions, covering a total area of 1,099.3 km<sup>2</sup> (Figure 4.27). Harvest intensity region 1 had the highest degree of overlap with the first priority area at 33.0% (Figure 4.28), starting from approximately 3 km east of Sanikiluaq (Figure 4.27). Harvest intensity region 2 was 95.3% within the third priority area and harvest intensity region 4 was 96.2% within the third priority area. The most intense area of ringed seal harvest was near Ikirasajjuaq (Figure 4.25) which is captured in a combination of the second and third priority areas (Figure 4.27). Overall, the ringed seal data produced the largest harvest intensity regions and the largest amount of overlap with the community-identified priority areas.

The ringed seal harvest intensity regions were the only harvest intensity regions present exclusively in marine areas (Figure 4.27), and encompassed more of the marine environment than the harvest intensity regions for all 14 species combined (Figure 4.7). Additionally, harvest region 1 was the largest region identified of all the harvest intensity regions within this analysis, likely due to the extensive harvest range for ringed seal recorded in the Qikiqtait Project (Figure 4.25). Sanikiluarmitut have been recording a tremendous amount of information related to ringed seal using the SIKU app (Arragutainaq et al., 2020), and some of this information is represented in the harvest intensity regions. Using this spatial analysis to document ringed seal harvest intensity can





**Figure 4.27:** Top five harvest intensity regions for ringed seal compared to community-identified priority areas



**Figure 4.28:** Overlap between the top five harvest intensity regions for ringed seal and the community-identified priority areas

Where: “Within 1/2/3” represents the percentage of the harvest intensity region that falls within the corresponding priority area, and “Outside 1/2/3” represents the percentage of the harvest intensity region that falls outside of the corresponding priority area

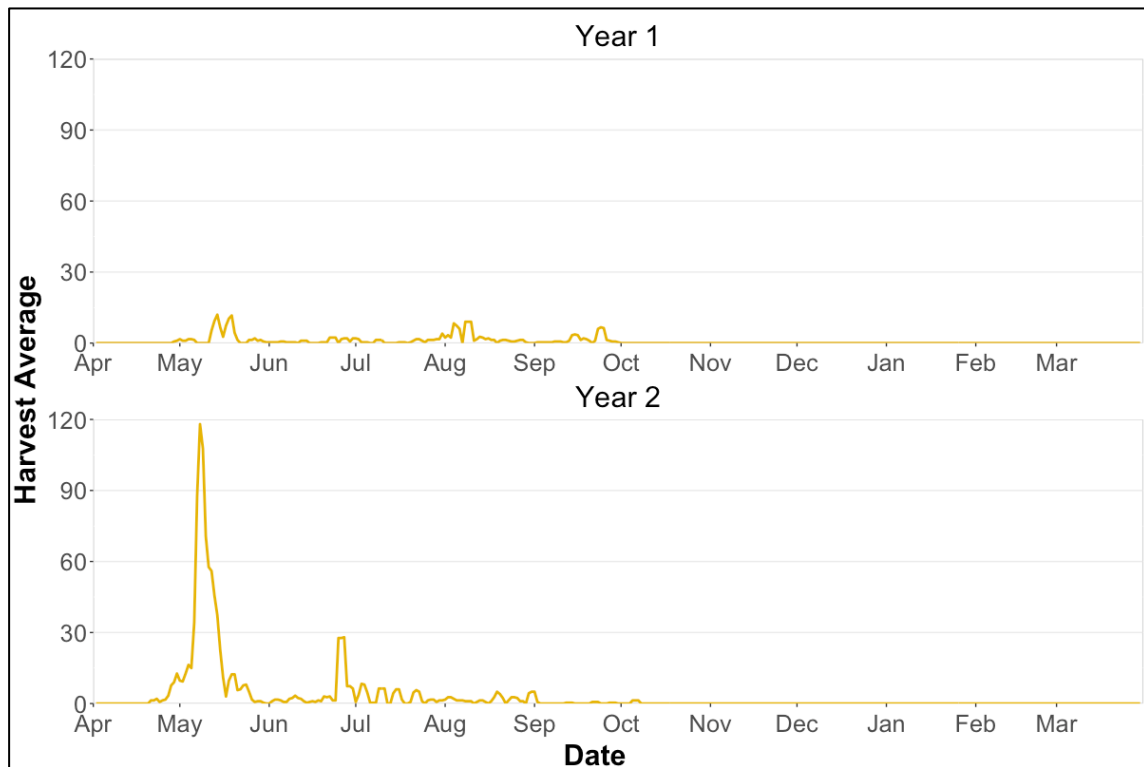
complement the initial delineation of community-identified priority areas that emphasized other key marine species (e.g. beluga whale).

## 4.6 Canada/Cackling Goose Harvest

### 4.6.1 Daily Average of Annual Harvest Totals

Canada and cackling geese are migratory bird species that are harvested when they arrive on the Belcher Islands every spring to nest and/or moult (McDonald et al., 1997; SIKU & AES, 2020). The harvester data shown in Figure 4.29 was able to show this seasonality of Canada/cackling goose harvesting. The temporal distribution of the

Canada/cackling goose harvest is interesting due to the significant increase in the number of birds that were harvested between Year 1 and Year 2 (Figure 4.29), particularly in the month of May.



**Figure 4.29:** Three-day moving average of daily Canada/cackling goose harvest

The annual Goose Watch event was introduced in spring of 2020 by the AES to encourage users to post goose harvests and observations, and to monitor the timing of goose migrations across the Arctic (AES, 2022; Enuaraq-Strauss & Arragutainaq, 2021; Patar, 2020; Pedersen et al., 2020a). Goose Watch offers modest prize incentives for the first three users from each community to post a goose Observation or Hunting Story on SIKU (AES, 2021). Although the Goose Watch event is not a component of the Qikiqtait

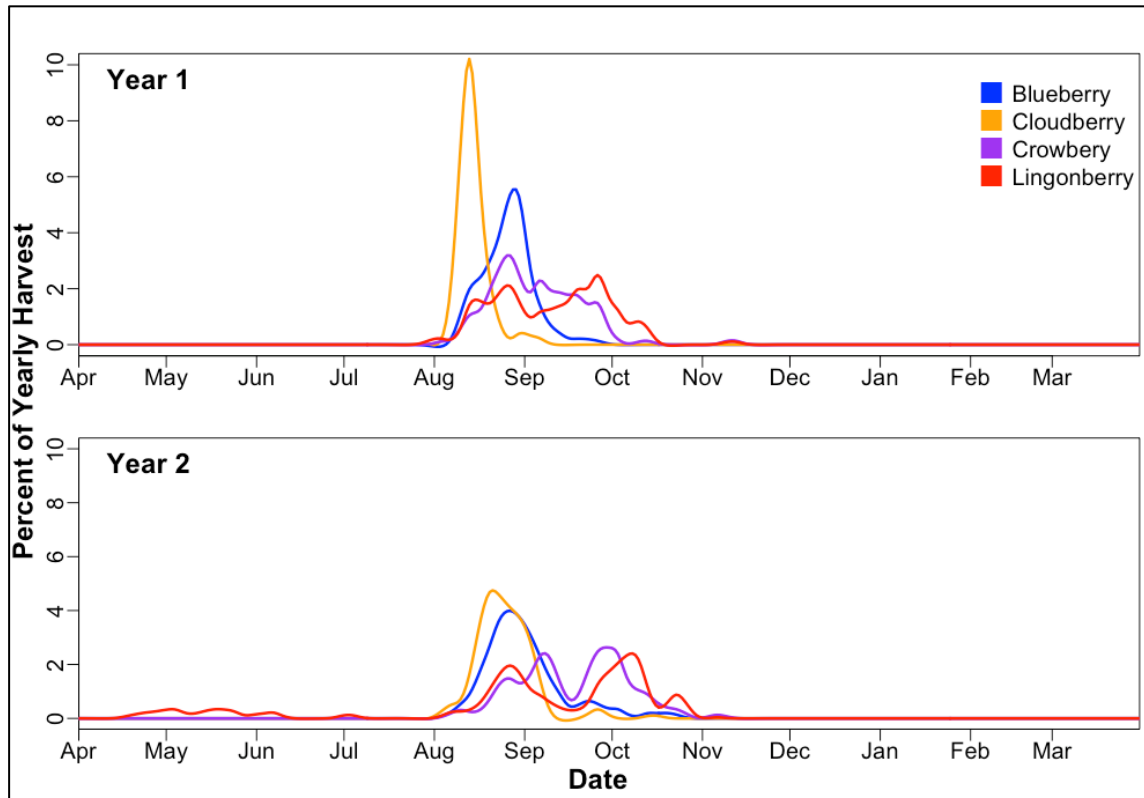
initiative, posts made in the Qikiqtait Project on SIKU are considered in the Goose Watch competition. The Canada/cackling goose harvest experienced the most dramatic increase between years (Table 4.2; Figure 4.29), which could be attributed to an increased number of users recording their harvests in the Qikiqtait Project. The increase at the beginning of the May (the start of the goose migration) could also be related to increased engagement with the Goose Watch competition over time because of the potential to win prizes.

## **4.7 Berry Harvest**

### **4.7.1 Harvest Seasonality**

A closer comparison between the harvest windows of the four berry species recorded in the Qikiqtait Project was completed by graphing the daily percent of annual harvest with a curve of best fit for each species (Figure 4.30). This type of analysis was limited to the berry species due to their definite growing (and therefore harvest) season. The graph shows the broad trends in berry harvesting between the two years, clearly identifying the start of harvesting in August, and the overlap of peak harvesting times between species. This explains why species are often harvested together and recorded in one berry species harvest post in the Qikiqtait Project on SIKU. It is important to note that for the purposes of this thesis, harvest density for these species represents the harvest location and harvest instance, instead of harvest amount, due to the presence/absence treatment of berry harvest data.

The seasonality of harvesting is useful when monitoring species populations (Naves, 2018), and deciding when harvesting could be limited to support future harvesting. This type of data could inform Qikiqtait conservation decision-making related



**Figure 4.30:** Seasonal harvest curves for blueberry, cloudberry, crowberry, and lingonberry

to harvesting and build capacity for Inuit self-governance. Graphs of seasonal harvest curves (like Figure 4.30) might be a way to communicate Inuit management in a “measurable” way that facilitates discussions with non-Inuit scientists (L. Arragutainaq, personal communication, September 17, 2021). The harvester data presented in this thesis was valuable in identifying and comparing seasonal harvest trends.

#### 4.7.2 Harvest Spatial Distribution (Harvest Density)

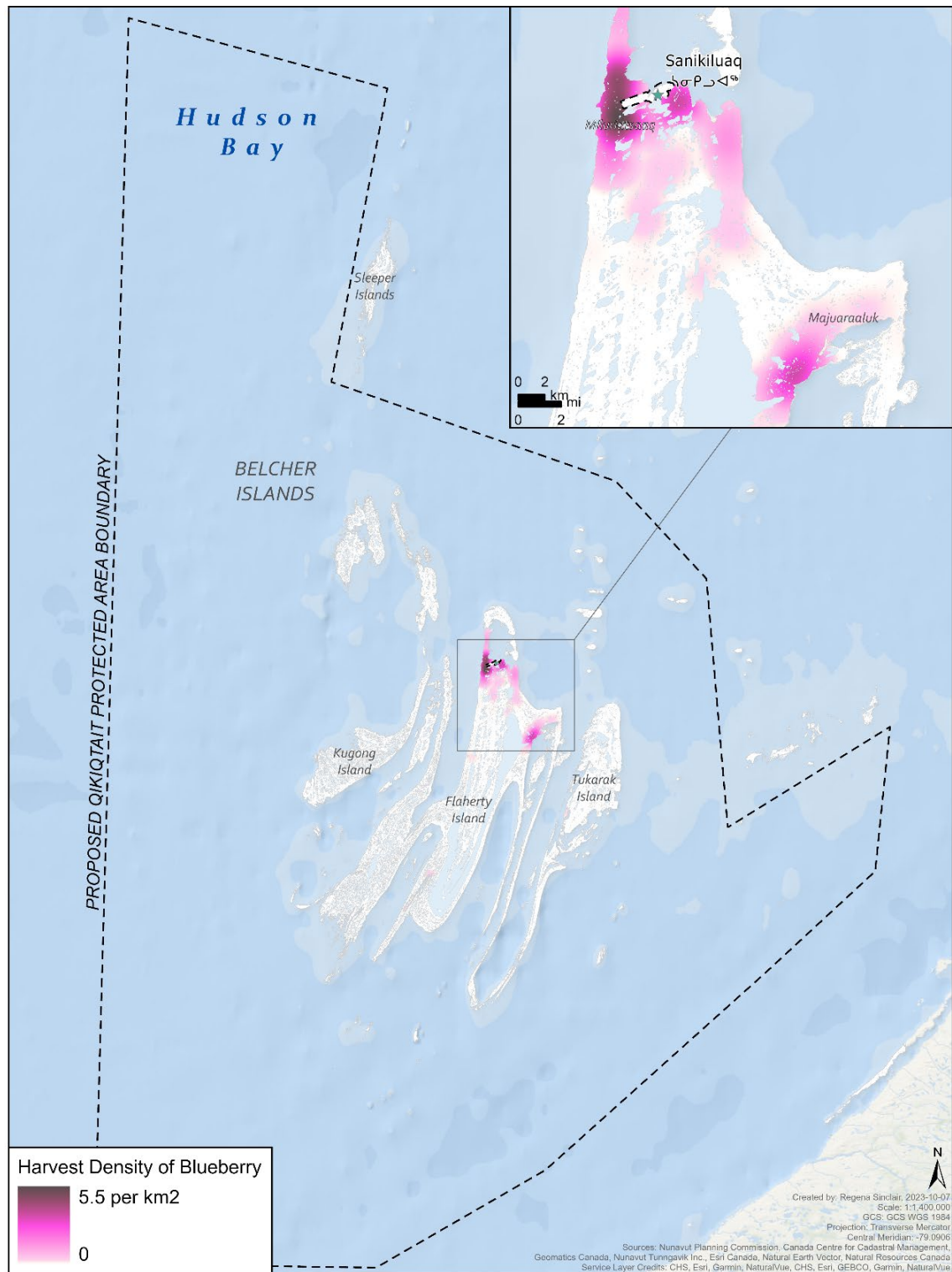
The harvest density (which is equal to harvest post density in this analysis) for blueberry was limited to terrestrial environments, and the most intense areas of harvesting

were located within 5 km of Sanikiluaq and surrounded the Hamlet (Figure 4.31). The most intense area of harvest collection occurred west of Sanikiluaq near Miluriatsaaq and had a harvest density peak of 5.5 harvest instances per km<sup>2</sup> (Figure 4.31). Another area of high harvest density was located southeast of Sanikiluaq, near Majuaraaluk. The proximity to the Hamlet may be indicative of where blueberries are most prolific, or how far Sanikiluarmitut are willing to travel to harvest berries.

#### **4.8 Considerations When Using SIKU and Harvester-collected Data in Qikiqtait and Other Community-Based Conservation Monitoring Projects**

##### **4.8.1 User Contributions to the Qikiqtait Project and SIKU App**

Regardless of how a Project is designed to use SIKU to facilitate community data collection, if the community members do not record data within the Project, it might not be a successful initiative or a productive use of the SIKU app. Community engagement with a Project is fundamental to the presentation of data that can be used to support protected area development and management decisions. A consideration for community engagement is that since SIKU requires a smart phone or computer to use, it requires some familiarity with app interfaces training using technology. This provides an excellent opportunity to engage youth in knowledge co-development (Pedersen et al., 2020b). Indigenous guardian programs have proven to be effective at training monitors for long-term data-collection (Ecoplan International Inc, 2016). Broadly, it must also be considered that depending on the community engagement with the SIKU app could partially speak to the community engagement with the conservation project.



**Figure 4.31:** Blueberry harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*

Additionally, some species may have not been represented in this analysis because they were not harvested as much as others in the Qikiqtait Project, or because they are a species that is not regularly harvested for consumption. These species may have ecological significance and could be considered in future research.

#### 4.8.2 Data Accuracy and Usability

As discussed in Section 3.4.4, the data used in this project had to undergo an extensive and time-consuming QC/QA process. The level of editing needed for the data used in my analysis created an impediment to data analysis that was not ideal. My work has helped produce some key feedback that could reduce the need for data cleaning that may streamline the data use process for Qikiqtait or other conservation initiatives. If the data used in my analysis was used in its raw form, there could be potential to misrepresent Inuit harvest, which could affect decisions made by the SQSC. This is not to say that SIKU is not equipped to support conservation initiatives and community-based monitoring. Instead, the QC/QA process identified that there is room for growth within the platform to support protected area management decisions with even greater robustness. The AES is actively updating and improving the SIKU app, and many of the issues that required initial QC/QA are already being addressed or were addressed in updates in 2022 and 2023 (Section 5.3.1). The openness of the AES to listen to feedback and their continued efforts to make SIKU easier to use will only improve the app's ability to accurately represent Inuit-collected data. New Projects on SIKU will require unique considerations based on the goals of the project, the area, and the community. Early and

frequent discussions about these considerations are necessary to reduce the time needed for a QC/QA process.

The results of the temporal and spatial analysis in this project are useful to inform the conservation management decision-making process as they can help identify when and where certain areas would benefit from greater levels of protection. They could also identify key harvest areas that support the cultural and dietary health of a community, given that harvesting is integral to the well-being of Inuit communities (Fleming, 1989; McDonald et al., 1997; Wein et al., 1996). Decisions about environmental monitoring in conservation management can be applied to the entire protected area or to certain species within the protected area. Most of the literature around the inclusion of IK in environmental monitoring has happened at the species level (Alexander et al., 2019), which identifies a need for more IK involvement in environmental monitoring at the ecosystem level. This thesis shows the difference of each of the 14 analysis species in regard to when and where they are harvested, and how many are harvested. By using the Qikiqtait Project on SIKU to collect data on each species, management decisions can be applied at different ecological scales. This breadth of data is one of the unique aspects of harvester collected data (Sheil et al., 2015) — it is not defined by research conducted by southern-based scientists that are limited by field seasons (ITK & NRI, 2007).

The QC/QA process required for this thesis analysis identified species that are well suited to the recording harvest data quantities using the SIKU app (e.g., mammal and fish species). It also identified species where some components of harvest are not as easily recorded using the platform (e.g., berry and invertebrate species). For example, the

harvest abundance of berry and invertebrate species is challenging to accurately represent on SIKU. Harvest density is similarly hard to display spatially. However, berry species' harvest seasonality was well represented without the inclusion of abundance data (Figure 4.30; A6.2; A6.3; A6.4, A6.5); therefore, harvest abundance data may not always be necessary in order to contribute important seasonality information to a harvest resource inventory. One of the strengths of the SIKU app I identified in response to Objective 3 is its ability to adapt and grow to these kinds of data insights, while addressing community concerns and priorities to improve functionality. Several improvement recommendations are discussed in Section 5.3.1.

#### 4.8.3 Data Sensitivity Considerations

As discussed in Section 3.3.1, it is important to recognize the user data ownership and stewardship rights that are built into the SIKU platform (Appendix 1). These policies affect the accessibility to the data collected within a Project on SIKU by a protected area management committee and affect how the data may or may not be shared with a broader audience. As a vital component to the open, ongoing communication and project collaboration needed in research involving Indigenous peoples and their knowledge (Brunet et al., 2016; Henri et al., 2020a; ITK & NRI, 2006; Ljubicic et al., 2022; Pearce et al., 2009; Tondu et al., 2014), discussions around how the SIKU app will be involved with a conservation initiative are important. Conversations around what data will be used in a Project, and how that data will be analyzed, interpreted, and shared needs to occur at the very start of a project, and involve those who will be collecting the data. The manner in which results are presented and disseminated may influence meetings within and

outside of a community, and thus future policy development, and conservation management decisions. Community voices must be respected when it comes to community data (Wilson et al., 2020), and receiving feedback from local project leadership on what data is appropriate to use and not appropriate to use at the start of a Project is paramount.

#### 4.8.4 Support for Community-based Conservation Projects

The analysis in this thesis is just the first stage of exploring appropriate Sanikiluarmit data representation and must be linked to further local context to interpret data to inform conservation decisions. Although making this connection was not the role of this thesis, this work provides information that the SQSC could use to make more informed data-related decisions. Future conservation initiatives can follow this same model when using the SIKU platform in their projects, by prioritizing the amalgamation of data collected on SIKU with other knowledge sources before presenting data as representative of Inuit priorities.

Utilizing SIKU has provided an avenue for Sanikiluarmit to contribute their knowledge in support of Qikiqtait. By using the platform, Qikiqtait has promoted that fact that Sanikiluarmit knowledge is important, meaningful, and will contribute to the development and management of the protected area program at the onset, setting a critical baseline for ongoing monitoring and assessment. This valuing of community input has the potential to further encourage community members to share their experiences (Johnson et al., 2015; Laidler et al., 2010; Mulrennan et al., 2012). Creating space for Indigenous community engagement within conservation programs is imperative (ICE, 2018), and

SIKU has the potential to greatly expand Inuit leadership in community-based conservation initiatives.

## **5 CONCLUSIONS**

This thesis examined how Qikiqtait Project harvester data recorded using the SIKU app could contribute to the Inuit-led Qikiqtait Protected Area initiative. The results of this thesis provide evidence to support the use of Inuit-collected harvest data in Qikiqtait development and decision-making, helped provide recommendations that improved versions of the app and Project management tools to-date, while also identifying key considerations for opportunities for future SIKU refinement. The temporal and spatial visualizations of the key species in this thesis served to identify trends in harvesting intensity and seasonality, as well as important regions for harvesting by Sanikiluaq (Section 4.2; 4.3; 4.4; 4.5; 4.6; 4.7). Representations of harvest data are formatted in ways to be shared with community members, and research partners, and to be used by the Sanikiluaq Qikiqtait Steering Committee (SQSC) to help inform management decisions. Comparing Qikiqtait Project harvest data to the previous community-identified priority areas for Qikiqtait (Section 4.2.6; 4.3.6; 4.4.5; 4.5.5; Haycock-Chavez, 2021) highlight opportunities for expansion in how important harvesting areas are represented in maps and decision-making. The significance and key results of this thesis, as well as associated recommendations, are presented in this concluding chapter.

### **5.1 Significance of Work**

Broadly, my motivation for this project was to contribute to Qikiqtait, an Inuit-led protected area initiative around the Belcher Islands in Nunavut. The significance of this work includes benefits for a variety of organizations such as the AES, the SQSC, the Hamlet of Sanikiluaq, academic, governmental, and non-governmental organizations

(Table 5.1). This research contributes to my own learning and professional development, as well as provides important methodological insights for academic and government audiences (Table 5.1).

## **5.2 SIKU and Protected Area Decision-making**

### **5.2.1 Qikiqtait Project Data**

Data collected by Sanikiluaq harvesters with the SIKU app was used to create a baseline harvest resource inventory for 14 species of importance to Qikiqtait (Section 4.2; 4.3; 4.4; 4.5; 4.6; 4.7). The temporal and spatial analysis that was applied to this inventory identified harvest seasonality, distribution, and abundance, which aided in the identification of key harvesting regions and time periods. This type of local baseline information can be used in protected area planning and management processes (Cooke et al., 2016; Etiendem et al., 2020), and therefore provides valuable data to support Qikiqtait management decisions now and in the future.

Qikiqtait Project data was visually represented in several different formats using the RStudio and ArcGIS Pro platforms. The resulting maps and graphs represent Sanikiluarmit data in accessible and meaningful ways to aid the interpretations of species-specific and total harvest data, as well as contribute current – and time series – harvesting data to inform protected area development and management. These temporal and spatial representations also provide avenues to communicate harvester-collected data in ways that can be understood by diverse audiences (Williamson et al., 2022), including: the SQSC, the Nunavut and federal government, NGOs, and scientific researcher partners.

**Table 5.1:** Thesis contributions for various audiences

Name	Benefit
AES, SQSC	<ul style="list-style-type: none"> <li>- Contribution to a baseline Qikiqtait harvest resource inventory</li> <li>- Creation of a methodology for future Qikiqtait Project data analysis</li> <li>- Identification of SIKU functionality to be improved in the future</li> <li>- Data cleaning process to support Qikiqtait development</li> <li>- Increased capacity for future Inuit-led research projects using SIKU</li> <li>- Support of Inuit self-determination in research</li> <li>- Support of Inuit harvester knowledge transfer</li> </ul>
Hamlet of Sanikiluaq	<ul style="list-style-type: none"> <li>- Support of Inuit harvester knowledge transfer</li> <li>- Baseline data to support the establishment (and ongoing management) of Qikiqtait</li> <li>- Increased capacity for a conservation economy</li> </ul>
Academia	<ul style="list-style-type: none"> <li>- Creation of a methodology for using SIKU collected data to address research questions</li> <li>- Contribution to the body of work regarding Inuit-led conservation initiatives and Inuit knowledge transmission using technology</li> </ul>
Government	<ul style="list-style-type: none"> <li>- Support for the use of SIKU collected data in protected area management decision-making</li> <li>- Research results may inform conservation policy and support Indigenous-led conservation initiatives</li> </ul>
Non-Government Organizations	<ul style="list-style-type: none"> <li>- Support for the use of SIKU collected data in protected area management decision-making</li> <li>- Introduction of an initial process for Inuit-led conservation initiatives using SIKU</li> </ul>
Regena Sinclair	<ul style="list-style-type: none"> <li>- Opportunity to support an Inuit-led conservation initiative</li> <li>- Experience working with the SIKU platform</li> <li>- Opportunity to build relationships with, and learn from, AES and SQSC research partners</li> <li>- Master of Arts degree</li> </ul>

As discussed in Section 3.4.4, the QC/QA process was essential in order to be able to most accurately represent Sanikiluarmit harvesting data. The framework and use of

SIKU during the period of the data collection in this project would benefit from some important adaptations to the platform in order to more effectively use direct data exports. Many of these adaptations have already been implemented by the AES since March 31, 2022. The improvements recommended in Section 5.3.1 are proposed in order to increase the accuracy of data recorded using SIKU. In so doing, SIKU can become a more robust tool to support Qikiqtait, and a more appealing data collection option for other protected area management decision-makers.

### 5.2.2 Community Engagement

Protected area development and management decisions have not always included IK and harvester data (Ljubicic et al., 2018; Robertson & Ljubicic, 2019; Sandlos, 2014; Secretariat of the CBD, 2009; Stevens, 2014c). When Inuit knowledge and Inuit-collected data is not valued, it undermines efforts to foster engagement between knowledgeable community members and those making management decisions (MacDonald, 2018; Sandlos, 2014; Youdelis et al., 2021). SIKU was developed, in part, to address imbalances in consideration of Inuit knowledge and data in decision-making, as well as to enhance Inuit self-determination in research (Appaqaq et al., 2020; Enuaraq-Strauss & Arragutainaq, 2021; Pedersen et al., 2020a; SIKU & AES, 2020). SIKU creates an avenue for Inuit to document their knowledge and key environmental indicators that can be used to create baseline data that is meaningfully recognized in research and conservation decision-making (Enuaraq-Strauss & Arragutainaq, 2021). The Qikiqtait Project provided an opportunity for Sanikiluarmit to be involved in Qikiqtait by formally recognizing the value of their knowledge, observations, and extensive experience with harvesting key

species. This approach has the potential be a model for other protected area initiatives seeking to engage with Inuit – among other northern Indigenous – communities.

Inuit harvesting practices play an important role in the health of wildlife populations, and Inuit harvesters have observed the detrimental effects of harvesting restrictions on species that can lead to unbalanced species populations (McDonald et al., 1997). Additionally, the cost of harvesting (Section 2.2.4; 5.3.2.1) creates obstacles for Inuit who want to harvest full-time (Kumar et al., 2019). Programs such as Angunasuktit (a full-time hunting and land-based apprenticeship program running in Clyde River, Nunavut) (Ittaq Heritage & Research Centre, 2021) can remove some financial obstacles for harvesters, in turn supporting important community roles (such as related to knowledge transfer and increasing food security (S. Fox, personal communication, March 2, 2023; Ittaq Heritage & Research Centre, 2021). The establishment of territorial or regional funding initiatives to support full-time harvesters could provide opportunities for harvesters to use SIKU regularly as an environmental monitoring and knowledge-sharing tool. A funding approach was modelled in the Qikiqtait Project and showed that it could encourage harvester engagement with Qikiqtait Project data collection using SIKU while offsetting harvesting costs (Section 2.4).

### 5.2.3 Contribution to Long-term Environmental Monitoring

This thesis included a comparison of harvesting patterns between Year 1 (April 1, 2020 – March 31, 2021) and Year 2 (April 1, 2021 – March 31, 2022). Although this analysis showed changes in harvest timing, intensity, and spatial distribution between years (Section 4.2; 4.3; 4.4; 4.5; 4.6; 4.7), the study period was not extensive enough to

identify long-term harvest trends. Using the Qikiqtait Project in ongoing Qikiqtait development provides a unique opportunity to record data from the inception of the protected area establishment. This will provide critical baseline data to support long-term research and identification of harvest trends as subsequent years of data are collected.

The top harvest intensity regions identified from the harvest data collected in the Qikiqtait Project added to the priority areas previously identified by several members of the Sanikiluaq community (Section 4.2.6; 4.3.6; 4.4.5; 4.5.5). Continuous data collection over the long term can support the representation of even more robust harvest intensity regions, which would further compliment the participatory mapping datasets. Ongoing analysis of the top harvest intensity regions for each species could provide annual updates for longer-term species-specific considerations.

#### 5.2.4 SIKU as a Tool to Support Protected Area Projects

The SIKU platform provides an opportunity for Inuit to lead research occurring within and around their communities. This is a key development in the ongoing active process of decolonizing research and enhancing Inuit self-determination (Belaid et al., 2022; Cochran et al., 2008; CB, 2020; ITK, 2018; ITK & NRI, 2006; Wilson et al., 2020a). Entwined with community engagement and community decision-making, SIKU has the capability to support Qikiqtait development without the need for external researchers to travel to Sanikiluaq for data collection (Enuaraq-Strauss & Arragutainaq, 2021), which often involves limited time and great cost (ITK & NRI, 2007) and aligns with the National Inuit Strategy on Research by supporting Inuit self-determination in research (ITK, 2018). Community-based monitoring provides local environmental

monitoring jobs within Sanikiluaq, and financially supports harvesters to continue sustainable harvesting practices (Section 2.4; Pedersen et al., 2020a). With the use of SIKU, Qikiqtaaluk can also encourage growth in one part of a conservation (or blue) economy, which is an important step in supporting Inuit harvesting and economic growth (CBC News, 2023). The building of a conservation economy is a key goal of the SQSC (Chapter 1; Section 2.2.4).

Additionally, incorporating the use of SIKU as a tool in protected area development and management supports some of the calls to action promoting the incorporation of IK within conservation models (CPAWS, 2022; Conservation through Reconciliation Partnership, n.d.; CBD, 2020; ICE, 2018; TRC of Canada, 2015). Conservation models are shifting towards community-inclusive approaches that prioritize the integration of IK (CPAWS, 2022; DFO, 2011; Parks Canada, 2010, 2018a, 2022; Section 2.1.1.1). SIKU is a unique and valuable tool that can help to address the communication and information disconnect that sometimes exists between Inuit and non-Inuit research/decision-making partners (Wong & Murphy, 2016). To realize this goal, the SIKU platform requires the recognition and support of governments, NGOs, and researchers to increase the usage of the app in conservation initiatives. My research project and the results included in this thesis aim to contribute to this effort.

### **5.3 Future Considerations and Recommendations**

#### **5.3.1 For SIKU**

The SIKU app was launched in 2019, with the aim to supporting Indigenous self-determination in research and environmental monitoring (Enuaraq-Strauss &

Arragutainaq, 2021; SIKU & AES, 2020). SIKU was developed not only for Sanikiluaq, but to be an app that can be used broadly to support other Inuit communities to document and share their observations and lead their own research (AES, 2022; Enuaraq-Strauss & Arragutainaq, 2021; Pedersen et al., 2020a). Creating an app that can support many diverse community goals is a sensitive, challenging, and time-consuming task. Therefore, the recommendations presented here aim to support SIKU's growth and continuing work across cultural, linguistic, environmental, biological, and economic spheres.

The SIKU team is continually working to improve the capabilities of the app to represent the diverse knowledges, needs, and applications of the communities it supports. I worked with SIKU data collected by Sanikiluarmit for the Qikiqtait Project between April 1, 2020, and March 31, 2022. I engaged in an iterative feedback process with AES staff to enable edits and improve functionality until I began data analysis in summer 2022. The SIKU platform has improved since undergoing numerous updates and advancements in 2022 and 2023. SIKU has already made strides to address some of the issues identified in during the QC/QA process of this project (Section 3.4.4). The recommendations provided for SIKU in this section are based only on the versions of the platform I worked with up until March 31, 2022. Some of the main takeaways for improved data collection to support protected area initiatives, include: i) enhanced community engagement in decision-making; ii) additional user training and workshops; iii) a simplified Graphical User Interface (GUI); iv) the addition of bulk harvest reporting parameters; v) the creation of harvest sharing parameters; and vi) language and dialect improvements.

#### *5.3.1.1 Community Engagement in Decision-making*

As the use of SIKU continues to expand within and across communities, additional engagement with community users is vital to the continued use and growth of the SIKU platform. This is especially important given the different cultures, community priorities, and wildlife habitats for which SIKU is currently utilized. Each community must be able to identify their own needs and recommendations regarding the app in order to support community projects. Ongoing community engagement with SIKU development (in large regional meetings such as through the Hudson Bay Consortium, as well as smaller community meetings) can help to continually refine and expand the functionality of SIKU to address monitoring and conservation priorities.

#### *5.3.1.2 User Training and Workshops*

The work I completed for this thesis helped identify areas that are now a key focus in the ongoing, and continually refined, training programs developed for SIKU. Since 2022, the SIKU team has developed a vast curriculum of training material for new users and has engaged with communities through individual training and group workshops (SIKU & AES, 2020). Training workshops help to educate SIKU users to maximize functionality and improve the quality of data collected through SIKU posts. SIKU has many features, and there are some situations that can be confusing when making a post. Additional training to address some of the more common situations that cause posting error (such as several posts recording the same harvest, multiple animals recorded in an Individual post type, or harvest recorded in Wildlife Observation posts) is recommended. For groups initiating a new Project in SIKU, it is recommended that administrators host

their own workshops at the outset to discuss specific Project context and needs. This will help users to know what information is important to include when they are making a post. Without this clarity from the beginning, information may be missing from posts, requiring more post-collection verification (QA/QC) which is time consuming and requires dedicated personnel.

An example of a common posting error that could be improved with training relates to the use of GPS within the app. The SIKU mobile app can record a user's location in two ways: 1) automatic recording of the location of the mobile phone when a post is made; and, 2) users can use the app to manually select a point on the map to identify a post location. This is particularly useful when the harvest occurred in a different location than the mobile phone's location at the time of posting (Section 3.5.2). This second technique is not used as frequently as it could be, and so the mobile phone's location is often automatically saved as the post coordinates. This is especially an issue for marine species, as harvests posts are typically made on land after transporting the harvested animal to shore in months of no sea ice (i.e., the animal was caught from a boat, but the harvest post was made once back on shore). For instances when the harvesting does not occur where the post is made, users should select the GPS coordinates of the harvest location on the SIKU map to record the actual harvest location (Section 3.5.2). Users could also create a post where the harvest is made, and then complete or edit the post at a time – or in a location – that is more convenient. Harvest location may be more important than the post location when discussing harvest density since it captures where the species are present as opposed to where they were taken for butchering and preparation. SIKU

already has this feature of manually selecting/editing map coordinates to document specific harvest location. However, more training and awareness around this feature would mean that harvest density maps would be more accurate, and fewer posts would have to be excluded from spatial analyses.

Another frequent issue is that of posting duplicate harvests that often occur when users are harvesting with a hunting partner, family member or other hunting group. As a result of this project, training initiatives by the SIKU team since 2022 have encouraged users to only make a harvesting post that includes their own harvest. In April of 2023, SIKU implemented an “Activity Summary” section to allow users to easily track their harvesting activity on the app and to further encourage users to only make posts including their own harvest. If users want to post on SIKU during a group harvesting event when they did not harvest anything themselves, it is recommended that they make a Social post to record the event, and in this way the post will not inflate harvest numbers.

#### *5.3.1.3 Simplified Graphic User Interface*

Based on the SIKU platform versions up until March 31, 2022, my QC/QA process identified the need for improvements to the graphic user interface (GUI) for the SIKU app. A simplified GUI could encourage full use of app capabilities to record Inuit harvester experiences and relevant metrics of harvested animals and plants. From extensive review of posts in the QC/QA process, an overview of GUI refinement ideas that could help improve app navigation and use include:

- Highlighting important regional species on the main interface based on the user's current GPS location (or community, based on user profile) or Project could reduce incorrect species selection in posts. All other species on SIKU could still be found through a “See More” option, so users could still access the full suite of SIKU species to tag as needed.
- Adding the ability for each user to “Favourite” the one or few species they harvest most commonly could also reduce the likelihood of selecting an incorrect species profile for a post.
- Adding an option to indicate “Other Species” harvested in a post. For example, a user could choose to make a blueberry harvest post, and within the post a user could indicate that crowberry was also harvested so that two or more species can be accurately represented.

SIKU updates in 2022 and 2023 have already many tremendous improvements to the app, and optimized post creation flow to emphasize important fields for users to populate within a harvest post, such as harvest amount. Spotlighting the recording of harvest quantities in harvest posts could reduce the need for an intensive QC/QA process. Some of the app improvements to date were partly informed by the QA/QA and analysis work that I completed for this thesis.

#### *5.3.1.4 Additional Bulk Harvest Reporting Parameters*

As discussed in Section 3.4.4, SIKU is well suited to recording harvest that can be individually counted (e.g. bird, mammal and fish species), but it is more challenging to accurately record harvest quantities of some species (e.g. berries, invertebrates) when

they cannot be counted individually. For berry and invertebrate species, a volumetric or weight-based metric could be added to more accurately record the amount of each harvested species in a post. For example, there could be several commonly used container sizes to choose from, so that a user could indicate that they harvested  $n$  medium-sized containers of blue mussels.

A common occurrence across most species, but especially with berries and invertebrates, is that several species are harvested together and represented within one post. Currently, the only way to indicate that more than one species is included in a post is either to tag the other species in the post photos (if the post contains photo), or to add this information somewhere in the post text. SIKU could benefit from the development of a post option where the user could add secondary, tertiary, and so forth, species that were also harvested within one Hunting Story. For example, in a berry harvesting post where blueberries, crowberries and cloudberry were harvested, the user could make the post initially about the species that was most harvested. In this example we will use blueberry. Within the blueberry post, under an “Add another species” option, the user could select crowberry and populate the field for amount harvested (as discussed above), and then repeat this process to add cloudberry. The posts would then be recorded in SIKU three times (once for each species), but they would be linked to the same location, time, and user. With this method, when all the cloudberry posts are selected on SIKU, this example post with the tertiary harvested species indicated as cloudberry would be included in the output, and therefore in the ensuing cloudberry analysis. This would remove the need for a great part of the QC/QA process that I completed, which was a manual process of

compiling harvest posts for each species to ensure that all harvest was appropriately recorded.

#### *5.3.1.5 Language/Dialect Improvements*

The AES is currently in the process of completing extensive content translation work and updates within SIKU to support app functionality in every language and dialect of participating communities. Species names for the SIKU wildlife profiles were updated with the Sanikiluaq Inuktitut dialect in November 2022, and the full app has been available in the Sanikiluaq Inuktitut dialect since November 2023. This work greatly advances app accessibility, and will also contribute to improved post accuracy. For example, within the Sanikiluaq dialect of Inuktitut, there are several words that exist to describe the different life stages or health indicators of a species, and these vary subspecies, physical attributes, seasonality, sex, and local vernacular (L. Kavik-Mickiyuk & I. Nicholl, personal communication, April 2023). This makes it difficult to assign one term to represent a SIKU species profile. For example, blueberry is referred to as “kigutingirnaq” when the berries are still green and not yet ripe, and “tungujuq” when the berries are ripe or there is a mix of berries that are ripe and not yet ripe (L. Kavik-Mickiyuk & I. Nicholl, personal communication, April 2023). This makes it difficult to assign just one of these words to represent all blueberry posts. Supporting a species profile search function that contains all the terms that are associated with a species would increase the likelihood of the correct species being chosen for a post.

### 5.3.2 For the Sanikiluaq Qikiqtait Steering Committee

#### 5.3.2.1 *Trip Analysis*

Although I included unique harvest data recorded in Trip posts in my QC/QA process and in the temporal analysis, they were not included in my spatial analysis due to their linear features. SQSC research partners have indicated that conducting Trip analyses are among their priorities for future research to contribute to Qikiqtait management and sustainable harvesting. Based on my experience working with Qikiqtait Project data, a Trip analysis could be valuable to examine travel patterns, identify seasonal changes in travel routes for harvesting, and map land use. Knowing how far Sanikiluarmit are travelling, and over what kind of terrain/water/ice, also provide important perspectives on hazards associated with harvesting (Stewart et al., 2020).

In the future, an analysis of Trips could also include the mode of transportation used for travel, and in relation to specific kinds of harvesting trips. Travel methods used by harvesters may be determined by a number of factors, including: season, target harvest species, terrain, and cost of fuel/equipment. There are valuable directions for future research to contribute to a more comprehensive understanding of the cost-per-unit-effort of harvesting different species.

Harvesting can require significant capital investment (Awan et al., 2023; van Luijk et al., 2022). Harvesting equipment (such as firearms, fishing lines, and nets) and travel equipment (such as all terrain vehicles or ATVs, boats, and snow machines) are often required to make a harvesting trip (Etiendem et al., 2020; Quigley & McBride, 1987). With this in mind, the value of harvested goods collected in a harvesting trip must

outweigh the financial cost of the trip for harvesting to be financially sustainable. A cost per unit effort analysis would be beneficial to examine harvest costs related to timing of harvest and target species.

#### *5.3.2.2 Egg/Down Analysis and Hatching Timing Analysis*

Eider duck and goose species are especially important in Sanikiluaq; eider duck down is used in making parkas that are unique to the Belcher Islands (Heath & Community of Sanikiluaq, 2011; Rustad, 2015). Monitoring the eider duck population is thus important to the cultural practices of Sanikiluarmit. My analysis was focussed on juvenile and adult eider ducks and geese (Section 3.4.4). In the future, SQSC partners are interested in examining the egg and down harvesting data to get a more complete picture of Sanikiluarmit eider harvesting practices and population health. An egg analysis could also be useful to monitor the seasonality of egg hatching over time, in order for harvesters to adapt to the availability of this food source.

#### *5.3.2.3 Age and Sex Metrics in Harvesting Analysis*

Considering animal age and sex metrics within a species population are essential in wildlife management. Within SIKU, users can indicate the age and sex of animals harvested through two ways: 1) by recording the age and sex in related post parameters; or, 2) by “tagging” post photographs with age and sex metrics. Tags are a useful tool when a single harvest post is composed of either several distinct species, or several animals of varying sex and age. With more consistent use of this feature, it could be applied to support a robust analysis of age and sex metrics in harvest posts. A record of how many male or female animals are harvested can provide important insights into the

reproductive viability of a population, which can be used to inform discussions around harvesting allotments (Heward & Black, 2004). Similarly, documenting the ratio of adult and juvenile animals harvested lends understanding to the health of a population, which can contribute to species management decisions (Heward & Black, 2004; Kane & Litvaitis, 1992).

#### *5.3.2.4 Capture Method Analysis Based on Quality Control/Quality Assurance, Seasonality or Photograph*

The SIKU data I worked with did not record the method of harvest (e.g. fishing with nets, casting or jigging lines). However, this feature was added to the app in summer 2022. With this new functionality there is great potential in using SIKU data analyze harvesting method use according to species, seasons, locations, costs, and associated changes over time. For SIKU data collected prior to May 2022, it may be possible to identify the capture/harvest method for some species by examining post photographs, harvest location, and harvest date. For instance, fish are usually caught in the Belcher Islands by jigging through holes in lake ice in the colder months, and by line casting along the coast during period of open water (J. Heath, personal communication, September 20, 2022). Over time, this analysis could show a change in methods of fishing or help to assess cost per unit effort.

#### *5.3.2.5 Observation Analysis*

This thesis focussed on harvesting posts within the Qikiqtait Project; however, there are still vast amounts of data within the Project in the form of Wildlife Observation posts. Recording animal presence is also vital to the monitoring of species health and species'

management/conservation decisions. A future analysis of this observation data would be beneficial to gain more insight into breeding areas, feeding locations, and migration routes that reflect movement patterns, health, and important habitat of each species. Such areas may reflect less harvesting intensity in respect for species' health and life cycles, and thus would not be well represented in my harvest-focused analysis. Including Wildlife Observation posts in future mapping initiatives would result in a more representative view of species abundance and distribution. It is anticipated that the inclusion of Observation data in the calculation of top harvest intensity regions would influence the size and location of the regions identified in this thesis, and thus also reflect different areas of overlap with the community-identified Qikiqtait priority areas.

#### *5.3.2.6 Analysis to Support Harvesting*

Qikiqtait aims to support the economy of Sanikiluaq through sustainable harvesting practices, potentially including future sustainable commercial harvesting of some species. Currently the community is investigating the potential for a commercial fishery of Arctic scallops and sea cucumber (Hudson Bay Consortium, 2022; Rogers, 2021). To support this research, further analysis of the benthic invertebrate posts in the Qikiqtait Project could be beneficial.

#### *5.3.2.7 Include Interviews, Historic Material and Traditional Harvesting*

##### *Area Data in Analysis*

My project relied solely on harvester-collected data using SIKU from app users who were part of the Qikiqtait Project, and represents only a part of the extensive Qikiqtait research project. It is imperative to acknowledge that this data does not

represent the full extent of Sanikiluarmit knowledge regarding their wildlife or harvesting practices, nor should it be viewed as a complete narrative. Further analysis would benefit from the inclusion of additional community knowledge in various forms. The harvest analysis completed in this thesis could be expanded with Sanikiluarmit knowledge that has been passed on through generations of oral history and documented through interviews and workshops – beginning with *Voices from the Bay* (1997) and continuing to today – to produce a more holistic picture of the changes that have occurred in species' populations, migration patterns, and habitats over time. The combination of quantitative and qualitative data could also more comprehensively represent Sanikiluarmit knowledge of changes to key harvesting species, practices, and priorities. For example, Lucassie Arragutainaq (personal communication, May 25, 2021) noted that his father's journal did not mention the harvest of fish, but instead focussed on eider duck, seal and fox species. This might indicate that there has been a shift in the key harvest species on the Belcher Islands, as the most commonly harvested species according to the data presented in this thesis was Arctic char, while Arctic fox were not frequently harvested (Table 4.3). Further analysis with previously recorded narratives could highlight additional harvesting trends.

Culturally important knowledge could (when appropriate) contribute to a further analysis. Mick Appaqaq (personal communication, May 25, 2021) highlighted the relationship between harvester demographics (such as age and gender) and harvest species, seasonality, and abundance. Evolving gender roles, the amount of available leisure time, and changes in key subsistence food species have all influenced

Sanikiluarmiut harvesting practices. These are important social and cultural factors that need to be better considered in discussions around wildlife management, since they are entwined with the ecological and cultural health of the Belcher Islands (Fleming, 1989; McDonald et al., 1997; Wein et al., 1996).

#### *5.3.2.8 Including Biological Parameters*

My research focussed on the use of SIKU data to contribute to the development of a harvest resource inventory for the Qikiqtait Project. My analysis explored the timing and distribution of harvester data, and did not include an analysis of species habitats, ranges, breeding cycles, food sources or population dynamics. Incorporating these factors into a future analysis would greatly improve the scope of species health data needed for more representative use in Qikiqtait conservation initiatives. A comparison of species ranges with harvesting locations could potentially provide additional insight into presence of species in Qikiqtait, and if there are areas of significance to key species that are used less frequently by harvesters. Future research on the interrelationships between Inuit harvester data, biological data and environmental data could be beneficial to ongoing monitoring.

#### *5.3.2.9 Arctic Char Analysis*

The “tagging” feature of SIKU allows users to add tags to their post photographs to identify harvest species, sex, and age, and indicate whether an Arctic char was a sea-run or landlocked fish. Much work has been done by the AES and project Research Assistant Jordan Heppell to tag the species in Arctic char post photographs up until March 31, 2022. However, it was not a priority of the AES to tag fish as sea-run or landlocked at that time, and Jordan Heppell and myself were unable to identify this characteristic from

the harvest photographs alone. Additionally, both ecotypes of Arctic char are present in lakes that connect to Hudson Bay (Fleming, 1989), so it could not be spatially determined if a fish was sea-run or landlocked unless it was caught in a landlocked lake. With an increase in tagging fish photos to indicate Arctic char ecotype, an analysis of this data could be used to graph what percentage of Arctic char harvest is landlocked or sea-run, and where these two populations are harvested most abundantly. This type of data could expand understanding Arctic char harvest distribution and population health around the Belcher Islands.

#### *5.3.2.10 Compare to Other Wildlife Research and Government Sources*

The harvester-collected data in the Qikiqtait Project could be compared to other datasets often used for species management decisions. This comparative process could highlight gaps in knowledge or help to assess long-term changes in species' abundance, migration movements, and breeding patterns within and between other datasets. Comparisons could also serve to demonstrate the utility of the SIKU platform in contributing to environmental monitoring and helping to fill many of the gaps that occur in sporadic, and seasonal, assessments. Sanikiluarmit harvest data in this project was compared to community-identified priority areas for Qikiqtait, highlighting the potential to complement priority areas and account for community harvesting practices (Section 4.2.6; 4.3.6; 4.4.5; 4.5.5). To add to this and previous analyses using the community-identified priority areas (Section 3.5.2.4), I recommend a comparison between the top harvest intensity regions identified in this thesis and datasets from other sources. This would support further discussion regarding the contributions of Inuit community-

collected data to wildlife and conservation management decisions. Examples of datasets for comparison include:

- Government of Nunavut - NCRI Sanikiluaq (Government of Nunavut, 2010);
- NWMB – CBMN (NWMB, n.d.-a);
- NPC – Nunavut Land Use Plan (NPC, 2021);
- DFO – EBSAs (Department of Fisheries and Oceans, 2011a);
- WWF Canada – high conservation value areas (WWF Canada, 2019); and
- KBA Canada – KBAs (KBA Canada, 2023).

#### *5.3.2.11 Compare Harvest Data to Satellite Data of Sea Ice*

Although marine areas are often represented as open water in maps (including those in this dissertation), much of the marine extent around the Belcher Islands is frozen from December partway through June (Andrews et al., 2018; Lukovich et al., 2021). The formation of sea ice expands habitat ranges for some species and restricts ranges for others. Much research has been done examining the relationship between sea ice and animal movements, particularly for species such as seal, caribou, reindeer, polar bear, and eider ducks (Martinez-Levasseur et al., 2021; McDonald et al., 1997; Paquette, 2020; Paquette et al., 2023; York et al., 2016). Comparing harvest locations with satellite imagery of sea ice on the same day as the harvest could add important ecological context as to why harvest occurred in those locations. For instance, harvest locations of eider duck during the sea ice months may overlap with polynyas (areas of open water within landfast ice) locations identified through satellite imagery. Further research could then

explore a potential correlation between Sanikiluarmit harvest data recorded in the Qikiqtait Project and sea ice conditions. Additionally, Sanikiluarmit have been recording ice information in harvesting posts (e.g., if seals were caught at floe edges or breathing holes) (Arragutainaq et al., 2020) that would add invaluable information to this type of analysis.

### 5.3.3 For Government, Non-governmental Organizations, and Researcher Partners

Tensions between Indigenous communities and governmental or regulatory bodies regarding the protection and management of wildlife has been extensively documented (Dowsley & Wenzel, 2008; Kourantidou et al., 2021; McDonald et al., 1997; Nielsen & Meilby, 2013; Snook et al., 2018; Tejsner, 2014; Tyrrell, 2006, 2007). This is often a result of inadequate consultation, disregard for Indigenous knowledge, and insufficient decision-making power by Indigenous communities (Tyrrell, 2006, 2007). SIKU is a key development in the ongoing process of decolonizing research, as Western scientists and Inuit harvesters/environmental monitors aim to work together and “not dominate each other” (L. Arragutainaq, personal communication, September 17, 2021). The emphasis on community engagement, community decision-making, and data sovereignty when using SIKU empowers Sanikiluarmit to lead data collection and decision-making regarding the Qikiqtait Protected Area, among other community conservation initiatives (Appaqaq et al., 2020; Enuaraq-Strauss & Arragutainaq, 2021).

In conventional approaches to wildlife management, governments and regulatory bodies often overlook Inuit knowledge regarding wildlife population dynamics and

habitat (MacDonald, 2018; Sandlos, 2014). As stated by Edward Tapiatic (from Chisasibi, Québec) and Arragutainaq: “...we have very good knowledge and, if we use our knowledge, there would be a lot of scientific knowledge...” (as cited in McDonald et al., 1997, p. 65). The SIKU platform and Qikiqtait Project provide an opportunity for the SQSC to collect data year-round in a format that can be more easily communicated between groups (Enuaraq-Strauss & Arragutainaq, 2021), and may encourage federal organizations to more readily accept the use of Inuit knowledge and community-collected data in co-management. Subsequent visualization of data collected on SIKU (like the berry seasonality graphs completed in this thesis) might also bridge communication gaps between Western scientists and Inuit harvesters by showing how Inuit environmental monitoring data can be measurable according to Western standards (Arragutainag & Heath, 2022). As Lucassie Arragutainag explains:

“I think what we are doing with SIKU, I think it's going to take a lead role for us Inuit to look after our own affairs, manage own system, manage our own wildlife or environment, using our own Inuit knowledge, the Inuit Qaujimaqatunangit - it's not just the technical information - it's the information collected in a way that hopefully, in a way that scientists and our government will understand how we do things.” (Enuaraq-Strauss & Arragutainaq, 2021, 08.16)

The Qikiqtait Project is an opportunity for governments, NGOs, and academic partners to support an Inuit-led protected area and community-collected data initiative. To do this, it is imperative that these groups respect and acknowledge Inuit data validity and sovereignty.

#### **5.4 SIKU Supporting the Vision for Qikiqtait**

The development of SIKU, and the establishment of the Qikiqtait Protected Area, are the most recent in a long history of Sanikiluaqmiut leadership in community-based

monitoring and conservation initiatives around the Belcher Islands (Appaqaq et al., 2020; Enuaraq-Strauss & Arragutainaq, 2021; Haycock-Chavez, 2021; McDonald et al., 1997; Pedersen et al., 2020a), and across Hudson Bay (Hudson Bay Consortium, 2022; McDonald et al., 1997). With each new year of harvester-collected data, the Qikiqtait resource inventory will continue to grow, and with it the ability for the SQSC to make conservation decisions based on the knowledge and practices of Sanikiluarmit. The SIKU app and platform are innovative tools that enhance Inuit self-determination in research and conservation by enabling direct harvester contributions to inform local and regional decision-making (Enuaraq-Strauss & Arragutainaq, 2021; Pedersen et al., 2020a).

Sanikiluarmit harvest data provide a robust resource inventory through year-round recordings of species-specific harvests and observations that reflect community harvesting practices. The lessons learned in analyzing harvester-collected data in this thesis highlight important considerations for the SQSC regarding temporal and spatial representations that can inform decision-making. Accounting for inter-annual variations in SIKU users, differentiating between harvest and post numbers, establishing a consistent QA/QC process, and connecting both temporal and spatial aspects of harvest data, are critical to ensuring meaningful representation of Sanikiluarmit knowledge. The two years of harvest data used in this thesis are an initial contribution to the long-term goals of the AES and SQSC in using SIKU to support the vision and management of Qikiqtait. These years also establish a valuable baseline that can be used for long-term trend analysis in the future. SIKU is a valuable tool that can support the vision, and

ongoing-management processes, of Qikiqtait among other Inuit-led protected area initiatives. SIKU is a tremendous example of Inuit innovation, adaptation, and resourcefulness in dealing with ecological, societal, and political changes.

“It’s time for the harpoon and the computer to work together”

Piita Kattuk (as cited in SIKU & AES, 2020, p. 11)

## 6 REFERENCES

- Aaluk, T., Anaviapik, A., Koonoo, I., Maktar, E., Milton, J., Milton, M., Newman, C., Otokiak, M., Pedersen, A., Pedersen, C., Porter, C., Porter, G., Riffi, M., Scott, A., & Tiriraniaq, B. (2018). SciQ: Science and Inuit Qaujimajatuqangit: Research and meaningful engagement of northern Indigenous communities. In *Recommendations from the Ikaarvik Youth SciQ Summit: Nov 19-23, 2018*. <https://ocean.org/wp-content/uploads/SciQ-Report-and-Recomendations-lores.pdf>
- Arctic Eider Society. (2018). Environmental stewardship planning for the Belcher Islands region of southeast Hudson Bay. In *Sanikiluaq Protected Areas Workshop Report*.
- Arctic Eider Society. (2020). *Qikiqtait: Developing a protected area for the Belcher Islands archipelago 2019-20 year end report*. Arctic Eider Society.
- Arctic Eider Society. (2021, August 6). *2021 SIKU Goose Watch grand prize winners video* [Video]. Vimeo. <https://vimeo.com/583845714>
- Arctic Eider Society. (2022). *Inuit Protected and Conserved Areas: Social return on investment impact analysis*. Arctic Eider Society.
- Arctic Eider Society. (2023a). *Arctic Eider Society: Indigenous-driven solutions for thriving communities*. <https://arcticeider.com/>
- Arctic Eider Society. (2023b). *Community-driven research network*. <https://arcticeider.com/community-driven-research-network/>
- Arctic Eider Society. (2023c). *Environmental stewardship*. <https://arcticeider.com/environmental-stewardship/>
- Ahenakew, C. (2016). Grafting Indigenous ways of knowing onto non-Indigenous ways of being: The (underestimated) challenges of a decolonial imagination. *International Review of Qualitative Research*, 9(3), 323–340. <https://doi.org/https://www.jstor.org/stable/26372211>
- Alexander, S. M., Provencher, J. F., Henri, D. A., Taylor, J. J., Lloren, J. I., Nanayakkara, L., Johnson, J. T., & Cooke, S. J. (2019). Bridging Indigenous and science-based knowledge in coastal and marine research, monitoring, and management in Canada. *Environmental Evidence*, 8(1), 1–24. <https://doi.org/10.1186/s13750-019-0181-3>
- Álvarez Larrain, A., & McCall, M. (2019). Participatory mapping and participatory GIS for historical and archaeological landscape studies: A critical review. *Journal of Archaeological Method and Theory*, 26(2), 643–678. <https://doi.org/10.1007/s10816-018-9385-z>
- Andrews, J., Babb, D., & Barber, D. G. (2018). Climate change and sea ice: Shipping in Hudson Bay, Hudson Strait, and Foxe Basin (1980–2016). *Elementa: Science of the Anthropocene*, 6, 19. <https://doi.org/10.1525/elementa.281>

- Appaqaq, M., Kudluarok, J., Kattuk, E., Kuki, J., Heath, J., & Arragutainaq, L. (2020, December 7-10). *Qikiqtait: Progress on a community-driven protected area for the Belcher Islands archipelago* [Conference presentation]. ArcticNet 2020, online. <https://vimeo.com/488757872>
- ArcGIS Pro. (2023). *How Kernel Density works*. <https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/how-kernel-density-works.htm>
- Arqvilliit Indigenous Protected and Conserved Area Establishment Project. (n.d.). *Arqvilliit Indigenous Protected and Conserved Area*. Retrieved November 18, 2023, from <https://arqvilliit.ca/>
- Arragutainag, L., & Heath, J. (2022, December 4-8). *The impacts of investing in Inuit self-determination in northern research* [Conference presentation]. ArcticNet 2022, Toronto, ON, Canada. <https://vimeo.com/779879328>
- Arragutainaq, L., Appaqaq, M., Kudluarok, J., & Heath, J. (2020, December 7-10). *Incorporating Inuit knowledge and observations of ecosystem trends into Northern Contaminants Research* [Conference presentation]. ArcticNet 2020, online. <https://vimeo.com/488757595>
- Artelle, K. A., Zurba, M., Bhattacharrya, J., Chan, D. E., Brown, K., Housty, J., & Moola, F. (2019). Supporting resurgent Indigenous-led governance: A nascent mechanism for just and effective conservation. *Biological Conservation*, 240. <https://doi.org/10.1016/j.biocon.2019.108284>
- Awan, T., & Twigg, M. (2023). *Conservation economies in Nunavut: Aviqtuuq Case Study*. Smart Prosperity Institute. [https://institute.smartprosperity.ca/sites/default/files/SPI\\_ConservationEconomies\\_Aviqtuuq\\_CaseStudy.pdf](https://institute.smartprosperity.ca/sites/default/files/SPI_ConservationEconomies_Aviqtuuq_CaseStudy.pdf)
- Awan, T., Twigg, M., Sushant, & Desrochers, C. (2023). *Inuit-led economic development: An overview of Nunavut's blue conservation economy*. Smart Prosperity Institute. [https://institute.smartprosperity.ca/sites/default/files/SPI\\_Nunavut\\_BlueConservationEconomy.pdf](https://institute.smartprosperity.ca/sites/default/files/SPI_Nunavut_BlueConservationEconomy.pdf)
- Barr, S. L., Larson, B. M. H., Beechey, T. J., & Scott, D. J. (2021). Assessing climate change adaptation progress in Canada's protected areas. *The Canadian Geographer*, 65(2), 152–165. <https://doi.org/10.1111/cag.12635>
- Belaid, L., Budgell, R., Sauvé, C., & Andersson, N. (2022). Shifting paradigm from biomedical to decolonised methods in Inuit public health research in Canada: A scoping review. *BMJ Global Health*, 7(e008311), 1–25. <https://doi.org/10.1136/bmjgh-2021-008311>
- Bell, J. (2020, February 24). *No more protected areas until after devolution, Nunavut premier tells Ottawa*. Nunatsiaq News. <https://nunatsiaq.com/stories/article/no-more-protected-areas-until-after-devolution-nunavut-premier-tells-ottawa/>

- Benoit, L. E. (2011). *On thin ice: An overview of the governance of Hudson Bay*. International Institute for Sustainable Development. [www.iisd.org](http://www.iisd.org)
- Biondi, E., Casavecchia, S., Pesaresi, S., & Zivkovic, L. (2012). Natura 2000 and the Pan-European Ecological Network: A new methodology for data integration. *Biodiversity and Conservation*, 21(7), 1741–1754. <https://doi.org/10.1007/s10531-012-0273-7>
- Brunet, N. D., Hickey, G. M., & Humphries, M. M. (2016). Local participation and partnership development in Canada’s Arctic research: Challenges and opportunities in an age of empowerment and self-determination. *Polar Record*, 52(3), 345–359. <https://doi.org/10.1017/S003224741500090X>
- Buschman, V. Q., & Sudlovenick, E. (2022). Indigenous-led conservation in the Arctic supports global conservation practices. *Arctic Science*, 719, 714–719. <https://doi.org/10.1139/as-2022-0025>
- Canadian Parks and Wilderness Society. (2022). *Roadmap to 2030: Delivering on Canada’s land and ocean protection targets* (Issue June). Canadian Parks and Wilderness Society. [https://cpaws.org/wp-content/uploads/2022/06/cpaws\\_roadmapto2030\\_digital\\_v2.pdf](https://cpaws.org/wp-content/uploads/2022/06/cpaws_roadmapto2030_digital_v2.pdf)
- Carroll, S. R., Garba, I., Figueroa-Rodríguez, O. L., Holbrook, J., Lovett, R., Materechera, S., Parsons, M., Raseroka, K., Rodriguez-Lonebear, D., Rowe, R., Sara, R., Walker, J. D., Anderson, J., & Hudson, M. (2020). The CARE Principles for Indigenous Data Governance. *Data Science Journal*. <https://doi.org/10.5334/dsj-2020-043>
- Carter, N. A., Dawson, J., Simonee, N., Tagalik, S., & Ljubicic, G. (2019). Lessons learned through research partnership and capacity enhancement in Inuit Nunangat. *Arctic*, 72(4), 381–403. <https://doi.org/10.14430/arctic69507>
- Castleden, H., Morgan, V. S., & Lamb, C. (2012). “I spent the first year drinking tea”: Exploring Canadian university researchers’ perspectives on community-based participatory research involving Indigenous peoples. *Canadian Geographer*, 56(2), 160–179. Blackwell Publishing Inc. <https://doi.org/10.1111/j.1541-0064.2012.00432.x>
- CBC News. (2023, September 25). *Conservation economies present “unprecedented opportunity” for Nunavut communities: Report*. CBC News. <https://www.cbc.ca/news/canada/north/nunavut-conservation-economies-1.6976036>
- Clark, D. (2021, January 27). *Smoothing splines for trend*. Actuarial Review Magazine. <https://ar.casact.org/smoothing-splines-for-trend/>
- Coastal First Nations. (2022). *Coastal Guardian Watchmen*. <https://coastalfirstnations.ca/our-stewardship/coastal-guardian-watchmen/>
- Cochran, P. A. L., Marshall, C. A., Garcia-Downing, C., Kendall, E., Cook, D., McCubbin, L., & Gover, R. M. S. (2008). Indigenous ways of knowing: Implications for participatory research and community. *American Journal of Public Health*, 98(1), 22–27. <https://doi.org/10.2105/AJPH.2006.093641>

- Conservation through Reconciliation Partnership. (n.d.). *About the Conservation through Reconciliation Partnership*. Retrieved November 3, 2023, from <https://conservation-reconciliation.ca/about-us-1>
- Convention on Biological Diversity. (2020). *Aichi Biodiversity Targets*. Secretariat of the Convention on Biological Diversity. <https://www.cbd.int/sp/targets/>
- Cooke, S. J., Rice, J. C., Prior, K. A., Bloom, R., Jensen, O., Browne, D. R., Donaldson, L. A., Bennett, J. R., Vermaire, J. C., & Auld, G. (2016). The Canadian context for evidence-based conservation and environmental management. *Environmental Evidence*, 5(1), 1–9. <https://doi.org/10.1186/s13750-016-0065-8>
- Cotrina-Sanchez, A., García, L., Calle, C., Sari, F., Bandopadhyay, S., Rojas-Briceño, N. B., Meza-Mori, G., Torres Guzmán, C., Auquiñivín-Silva, E., Arellanos, E., & Oliva, M. (2023). Multicriteria analysis in apiculture: A sustainable tool for rural development in communities and conservation areas of northwest Peru. *Land*, 12(10). <https://doi.org/10.3390/land12101900>
- De Freitas, D. M., & Tagliani, P. R. A. (2009). The use of GIS for the integration of traditional and scientific knowledge in supporting artisanal fisheries management in southern Brazil. *Journal of Environmental Management*, 90(6), 2071–2080. <https://doi.org/10.1016/j.jenvman.2007.08.026>
- Dei, G. J. S. (2008). Indigenous knowledge studies and the next generation: Pedagogical possibilities for anti-colonial education. *The Australian Journal of Indigenous Education*, 37(S1), 5–13. <https://doi.org/10.1375/S1326011100000326>
- Dencho First Nations. (2023). *Edézhíe*. <https://dehcho.org/resource-management/edehzhie/>
- Department of Fisheries and Oceans. (2011a). Ecologically and Biologically Significant Areas - lessons learned. In *Department of Fisheries and Oceans Canadian Scientific Advisory Secretariat Science Advisory Report*. <https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/344558.pdf>
- Department of Fisheries and Oceans. (2011b). Identification of Ecologically and Biologically Significant Areas (EBSA) in the Canadian Arctic. In *Canadian Science Advisory Secretariat Science Advisory Report* (Vol. 055). <http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm>
- Devin, S., & Doberstein, B. (2004). Traditional ecological knowledge in parks management: A Canadian perspective. *Environments*, 32(1), 47–70.
- Dowsley, M., & Wenzel, G. (2008). “The Time of the Most Polar Bears”: A co-management conflict in Nunavut. *Arctic*, 61(2), 177–189. <http://doi.org/10.1002/ece3.2030>

- Drakopoulos, L., Nost, E., Hawkins, R., & Silver, J. J. (2022). A shark in your pocket, a bird in your hand(held): The spectacular and charismatic visualisation of nature in conservation apps. In C. Travis, D. P. Dixon, L. Bergmann, R. Legg, & A. Crampsie (Eds.), *Routledge Handbook of the Digital Environmental Humanities* (1st ed., pp. 303–316). Routledge. <https://doi.org/10.4324/9781003082798-26>
- Dubos, V., May, P., Gillis, C.-A., St-Hilaire, A., & Bergeron, N. (2023). Nunavik anadromous Arctic char life histories, behaviour, and habitat use informed by both Inuit knowledge and western science: A year in Ungava Bay. *Arctic Science*, 9(3), 526–544. <https://doi.org/10.1139/as-2022-0019>
- Duerden, F., & Kuhn, R. G. (1996). The application of geographic information systems by First Nations and government in Northern Canada. *Cartographica*, 33(2), 49–62. <https://doi.org/10.3138/7013-6H87-2376-8QJK>
- Duerden, F., & Kuhn, R. G. (1998). Scale, context, and application of traditional knowledge of the Canadian north. *Polar Record*, 34(188), 31–38. <https://doi.org/10.1017/S0032247400014959>
- Eastwood, R. A. (2018). *Physical properties and isotopic characteristics of the winter water column and landfast sea-ice surrounding the Belcher Islands, southeast Hudson Bay* [Master's Thesis, University of Manitoba]. FGS - Electronic Theses and Practica. <http://hdl.handle.net/1993/32997>
- Ecoplan International Inc. (2016). *Valuing Coastal Guardian Watchmen programs: A business case*. <https://coastalfirstnations.ca/wp-content/uploads/2019/03/Valuing-Coastal-Guardian-Watchmen-Programs-A-Business-Case.pdf>
- Eichler, L., & Baumeister, D. (2018). Hunting for Justice: An indigenous critique of the North American Model of Wildlife Conservation. *Environment and Society: Advances in Research*, 9(1), 75–90. <https://doi.org/10.3167/ares.2018.090106>
- Enuaraq-Strauss, K., & Arragutainaq, L. (2021, December 6-10). *SIKU for Inuit governance* [Conference presentation]. ArcticNet 2021, online. <https://vimeo.com/649189789>
- Environment and Climate Change Canada. (2012). *Important Areas for Birds in Nunavut Part 2 of 2* (CW66-302/2012E-PDF). [https://publications.gc.ca/collections/collection\\_2021/eccc/CW66-302-2012-2-eng.pdf](https://publications.gc.ca/collections/collection_2021/eccc/CW66-302-2012-2-eng.pdf)
- Environment and Climate Change Canada. (2021). *Species at Risk in Nunavut 2021* (CW66-775/2021E-PD). [https://publications.gc.ca/collections/collection\\_2022/eccc/cw66/CW66-775-2021-eng.pdf](https://publications.gc.ca/collections/collection_2022/eccc/cw66/CW66-775-2021-eng.pdf)
- Environment and Climate Change Canada. (2023). *Canada invests in Inuit-led climate adaptation and conservation in Nunatsiavut, Newfoundland and Labrador*. Government of Canada. <https://www.canada.ca/en/environment-climate-change/news/2023/08/canada-invests-in-inuit-led-climate-adaptation-and-conservation-in-nunatsiavut-newfoundland-and-labrador.html>

- Etiendem, D. N., Jeppesen, R., Hoffman, J., Ritchie, K., Keats, B., Evans, P., & Quinn, D. E. A. (2020). The Nunavut Wildlife Management Board's Community-Based Monitoring Network: Documenting Inuit harvesting experience using modern technology. *Arctic Science*, 6(3), 307–325. <https://doi.org/10.1139/as-2020-0008>
- Felt, L. F., & Natcher, D. (2011). Ethical foundations and principles for collaborative research with Inuit and their governments. *Études Inuit Studies*, 32(1–2), 107–126. <https://doi.org/https://doi.org/10.7202/1012837ar>
- Ferrazzi, P., Christie, P., Jalovcic, D., Tagalik, S., & Grogan, A. (2018). Reciprocal Inuit and Western research training: Facilitating research capacity and community agency in Arctic research partnerships. *International Journal of Circumpolar Health*, 77(1425581), 1–8. <https://doi.org/10.1080/22423982.2018.1425581>
- Ferrazzi, P., Tagalik, S., Christie, P., Karetak, J., Baker, K., & Angalik, L. (2020). *Describing Aajiqatigiingniq as an Inuit consensus methodology in health reserach*. [https://www.aqqiumavvik.com/\\_files/ugd/1f7032\\_c8d0c2f57e51488f937e5450e16fb0c5.pdf](https://www.aqqiumavvik.com/_files/ugd/1f7032_c8d0c2f57e51488f937e5450e16fb0c5.pdf)
- Fieberg, J. (2007). Kernel density estimators of home range: Smoothing and the autocorrelation red herring. *Ecology*, 88(4), 1059–1066. <https://doi.org/10.1890/06-0930>
- Fisher, J. T., Grey, F., Anderson, N., Sawan, J., Anderson, N., Chai, S. L., Nolan, L., Underwood, A., Maddison, J. A., Fuller, H. W., & Frey, S. (2021). Indigenous-led camera-trap research on traditional territories informs conservation decisions for resource extraction. *Facets*, 6, 1266–1284. <https://doi.org/10.1139/FACETS-2020-0087>
- Fleming, B. (1989). *Working at leisure: Inuit subsistence in an era of animal protection* [Master's Thesis, University of Alberta]. ERA. <https://doi.org/10.7939/R3WP9TB8H>
- Fleming, C. H., Fagan, W. F., Mueller, T., Olson, K. A., Leimgruber, P., & Calabrese, J. M. (2015). Rigorous home range estimation with movement data: A new autocorrelated kernel density estimator. *Ecology*, 96(5), 1182–1188. <https://doi.org/10.1890/14-2010.1>
- Foster, J. (1978). *Working for wildlife: The beginning of preservation in Canada*. University of Toronto Press.
- Furgal, C. M., Innes, S., & Kovacs, K. M. (2002). Inuit spring hunting techniques and local knowledge of the ringed seal in Arctic Bay (Ikpiarjuk), Nunavut. *Polar Research*, 21(1), 1–16.
- Galloway, G. (2018, February 28). Ottawa's conservation plan puts Indigenous people in charge of protecting land; Inuit, Métis and First Nations reportedly eager to accept official role in Liberals' \$1.3-billion nature conservation effort. *The Globe and Mail*. <https://www.theglobeandmail.com/news/politics/conservation-plan-puts-indigenous-people-in-charge-of-protecting-land/article38160267/>

- Gearheard, S., Aipellee, G., & O’Keefe, K. (2010). The Igliniit Project: Combining Inuit Knowledge and geomatics engineering to develop a new observation tool for hunters. In I. Krupnik, Claudio. Aporta, S. Gearheard, G. J. Ljubicic, & L. Kielsen Holm (Eds.), *SIKU: Knowing our ice: Documenting Inuit sea ice knowledge and use* (pp. 181–202). Springer. <https://doi.org/10.1007/978-90-481-8587-0>
- Gearheard, S., & Shirley, J. (2007). Challenges in community-research relationships: Learning from natural science in Nunavut. *Arctic*, 60(1), 62–74. <https://doi.org/10.14430/arctic266>
- George, J. (2013, April 8). *Hydro power plays into Hudson Bay wildlife entrapments: Researcher*. Nunatsiaq News. [https://nunatsiaq.com/stories/article/65674hydro\\_power\\_production\\_plays\\_into\\_hudson\\_bay\\_wildlife\\_entrapm/](https://nunatsiaq.com/stories/article/65674hydro_power_production_plays_into_hudson_bay_wildlife_entrapm/)
- Gilchrist, H. G., & Robertson, G. J. (2000). Observations of marine birds and mammals wintering at polynyas and ice edges in the Belcher Islands, Nunavut, Canada. *Arctic*, 61–68.
- Government of Nunavut. (2010). *Nunavut Coastal Resource Inventory: Sanikiluaq*. [https://www.gov.nu.ca/sites/default/files/documents/2022-07/ncri\\_sanikiluaq\\_en.pdf](https://www.gov.nu.ca/sites/default/files/documents/2022-07/ncri_sanikiluaq_en.pdf)
- Government of Nunavut. (2013). *Sanikiluaq 2013*.
- Gregoire, L. (2014, May 23). *Mining company says impacts of Nunavut mine will be good, bad*. Nunatsiaq News. [https://nunatsiaq.com/stories/article/65674mining\\_company\\_says\\_impacts\\_of\\_nunavut\\_mine\\_will\\_be\\_good\\_bad/](https://nunatsiaq.com/stories/article/65674mining_company_says_impacts_of_nunavut_mine_will_be_good_bad/)
- Grimwood, B. S. R., Doubleday, N. C., Ljubicic, G. J., Donaldson, S. G., & Blangy, S. (2012). Engaged acclimatization: Towards responsible community-based participatory research in Nunavut. *Canadian Geographer*, 56(2), 211–230. <https://doi.org/10.1111/j.1541-0064.2012.00416.x>
- Haddaway, N. R., Cooke, S. J., Lesser, P., Macura, B., Nilsson, A. E., Taylor, J. J., & Raito, K. (2019). Evidence of the impacts of metal mining and the effectiveness of mining mitigation measures on social-ecological systems in Arctic and boreal regions: A systematic map protocol. *Environmental Evidence*, 8(1), 1–11. <https://doi.org/10.1186/s13750-019-0152-8>
- Haklay, M. (Muki), Dörler, D., Heigl, F., Manzoni, M., Hecker, S., & Vohland, K. (2021). What is citizen science? The challenges of definition. In K. Vohland, A. Land-Zandstra, L. Ceccaroni, R. Lemmens, J. Perelló, M. Ponti, R. Samson, & K. Wagenknecht (Eds.), *The Science of Citizen Science* (pp. 13–33). Springer International Publishing. [https://doi.org/10.1007/978-3-030-58278-4\\_2](https://doi.org/10.1007/978-3-030-58278-4_2)

- Harris, L. R., Nel, R., Oosthuizen, H., Meÿer, M., Kotze, D., Anders, D., McCue, S., & Bachoo, S. (2018). Managing conflicts between economic activities and threatened migratory marine species toward creating a multiobjective blue economy. *Conservation Biology*, 32(2), 411–423. <https://doi.org/10.1111/cobi.12992>
- Haycock-Chavez, N. (2021). *Indigenous-driven conservation: Exploring the planning of Qikiqtait protected area in Sanikiluaq, Nunavut* [Master's Thesis, Memorial University of Newfoundland]. Memorial University Research Repository. <https://doi.org/https://doi.org/10.48336/KTC1-AV62>
- Healy, G., & Tagak Sr., A. (2014). Piliriqatigiinniq 'Working in a collaborative way for the common good.' *International Journal of Critical Indigenous Studies*, 7(1), 1–14. <https://doi.org/10.5204/ijcis.v7i1.117>
- Heath, J., & Community of Sanikiluaq (2011). *People of a Feather* [Film]. Sanikiluaq Running Pictures.
- Heath, J., & Rosengard, S. (2022, December 1). SIKU: The Indigenous Knowledge Social Network, and tool for community-driven research. *AGU Fall Meeting Abstracts*. <https://ui.adsabs.harvard.edu/abs/2022AGUFMOS46A..03H>
- Held, M. B. E. (2020). Research ethics in decolonizing research with Inuit communities in Nunavut: The challenge of translating knowledge into action. *International Journal of Qualitative Methods*, 19. <https://doi.org/10.1177/1609406920949803>
- Henri, D. A., Brunet, N. D., Dort, H. E., Odame, H. H., Shirley, J., & Gilchrist, H. G. (2020a). What is effective research communication? Towards cooperative inquiry with Nunavut communities. *Arctic*, 73(1), 81–98. <https://doi.org/10.14430/arctic70000>
- Henri, D., Carter, N., Irkok, A., Nipisar, S., Emiktaut, L., Saviakjuk, B., Ljubicic, G. J., Smith, P. A., & Johnston, V. (2020b). Qanuq Ukua Kanguit Sunialiqpitigu? (what should we do with all of these geese?) Collaborative research to support wildlife co-management and Inuit self-determination. *Arctic Science*, 6(3), 173–207. <https://doi.org/10.1139/as-2019-0015>
- Heward, J. D., & Black, H. L. (2004). Management of black bears in Utah: Harvest strategies and outcomes. In *Black Bears of Utah's East Tavaputs Plateau*. Utah Division of Wildlife Resources Brigham Young University. [https://wildlife.utah.gov/pdf/bears/east\\_tavaputs.pdf](https://wildlife.utah.gov/pdf/bears/east_tavaputs.pdf)
- Hudson Bay Consortium. (2022). *Hudson Bay Summit: Final report*. <https://hudsonbayconsortium.com/wp-content/uploads/2023/04/2022-Hudson-Bay-Summit-Final-Report.pdf>
- Hudson Bay Consortium. (2023). *About*. <https://hudsonbayconsortium.com/background/>
- iNaturalist. (n.d.-a). *Bog Bilberry*. Retrieved October 30, 2023, from <https://www.inaturalist.org/taxa/64714-Vaccinium-uliginosum>

- iNaturalist. (n.d.-b). *Northern Highbush Blueberry*. Retrieved October 30, 2023, from [https://www.inaturalist.org/guide\\_taxa/329010](https://www.inaturalist.org/guide_taxa/329010)
- Indigenous Circle of Experts. (2018). *We Rise Together: Achieving Pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation* (R62-548/2018E-PDF). [https://static1.squarespace.com/static/57e007452e69cf9a7af0a033/t/5ab94aca6d2a7338ecb1d05e/1522092766605/PA234-ICE\\_Report\\_2018\\_Mar\\_22\\_web.pdf](https://static1.squarespace.com/static/57e007452e69cf9a7af0a033/t/5ab94aca6d2a7338ecb1d05e/1522092766605/PA234-ICE_Report_2018_Mar_22_web.pdf)
- Inuit Tapiriit Kanatami. (2018). *National Inuit strategy on research*. [https://www.itk.ca/wp-content/uploads/2018/04/ITK\\_NISR-Report\\_English\\_low\\_res.pdf](https://www.itk.ca/wp-content/uploads/2018/04/ITK_NISR-Report_English_low_res.pdf)
- Inuit Tapiriit Kanatami, & Nunavut Research Institute. (2007). Negotiating Research Relationships with Inuit Communities: A Guide for Researchers. *Scot Nickels, Jamal Shirley, and Gita Laidler. Inuit Tapiriit Kanatami and Nunavut Research Institute: Ottawa and Iqaluit*. <https://www.itk.ca/wp-content/uploads/2016/07/Negotiating-Research-Relationships-Community-Guide.pdf>
- Ittaq Heritage & Research Centre. (2021). *On The Land*. <https://itraq.ca/on-the-land/>
- Johnson, N., Alessa, L., Behe, C., Danielsen, F., Gearheard, S., Gofman-Wallingford, V., Kliskey, A., Krümmel, E. M., Lynch, A., Mustonen, T., Pulsifer, P., & Svoboda, M. (2015). The contributions of Community-Based monitoring and traditional knowledge to Arctic observing networks: Reflections on the state of the field. *Arctic*, 68(5), 1–13. <https://doi.org/10.14430/arctic4447>
- Kane, D. M., & Litvaitis, J. A. (1992). Age and sex composition of live-captured and hunter-killed samples of black bears. *Journal of Mammalogy*, 73(1), 215–217. <https://doi.org/10.2307/1381885>
- Karetak, J., & Tester, F. J. (2017). Introduction: Inuit Qaujimajatuqangit, Truth and Reconciliation. In J. Karetak, F. J. Tester, & S. Tagalik (Eds.), *Inuit Qaujimajatuqangit: what Inuit have always known to be true* (pp. 15–30). Fernwood Publishing.
- Keenan, E., Fanning, L. M., & Milley, C. (2018). Mobilizing Inuit Qaujimajatuqangit in narwhal management through community empowerment: A case study in Naujaat, Nunavut. *Arctic*, 71(1), 27–39. <https://doi.org/10.14430/arctic4699>
- Kendrick, A. (2013). Canadian Inuit sustainable use and management of Arctic species. *International Journal of Environmental Studies*, 70(3), 414–428. <https://doi.org/10.1080/00207233.2013.801176>
- Kenny, T. A., Fillion, M., Simpkin, S., Wesche, S. D., & Chan, H. M. (2018). Caribou (*Rangifer tarandus*) and Inuit nutrition security in Canada. *Ecohealth*, 15(3), 590–607. <https://doi.org/10.1007/s10393-018-1348-z>

- Key Biodiversity Areas Canada. (2023). *Key Biodiversity Areas*. <https://kbacanada.org/>
- Key Biodiversity Areas Standards and Appeals Committee. (2020). Guidelines for using A global standard for the identification of Key Biodiversity Areas. In *Guidelines for using A global standard for the identification of Key Biodiversity Areas: version 1.1* (1.1). KBA Standards and Appeals Committee of the IUCN Species Survival Commission and IUCN World Commission on Protected Areas. <https://doi.org/10.2305/iucn.ch.2020.kba.1.1.en>
- Kikkert, P. (2023). *Geography of Nunavut*. The Canadian Encyclopedia. <https://www.thecanadianencyclopedia.ca/en/article/geography-of-nunavut>
- Kourantidou, M., Hoagland, P., Dale, A., & Bailey, M. (2021). Equitable allocations in northern fisheries: Bridging the divide for Labrador Inuit. *Frontiers in Marine Science*, 8. <https://doi.org/10.3389/fmars.2021.590213>
- Kovach, M. (2009). *Indigenous methodologies. Characteristics, conversations, and context*. University of Toronto Press Inc.
- Kukutai, T., & Taylor, J. (2016). Data sovereignty for Indigenous peoples: Current practice and future needs. In T. Kukutai & J. Taylor (Eds.), *Indigenous Data Sovereignty: Toward an agenda* (Vol. 38, p. 1-22). ANU Press. <https://www.jstor.org/stable/j.ctt1q1crgf.8>
- Kumar, M. B., Furgal, C., Hutchinson, P., Roseborough, W., & Kootoo-Chiarelo, S. (2019). *Aboriginal Peoples Survey - Harvesting activities among First Nations people living off reserve, Métis and Inuit: Time trends, barriers and associated factors*. <https://www150.statcan.gc.ca/n1/pub/89-653-x/89-653-x2019001-eng.htm>
- Kuzyk, Z. Z., & Barber, D. (2018). *From science to policy in the greater Hudson Bay marine region: An integrated regional impact study (IRIS) of climate change and modernization*. ArcticNet. [https://arcticnet.ulaval.ca/wp-content/uploads/2022/06/IRIS\\_3\\_synthesis\\_to\\_print\\_rev1\\_compressed.pdf](https://arcticnet.ulaval.ca/wp-content/uploads/2022/06/IRIS_3_synthesis_to_print_rev1_compressed.pdf)
- Laidler, G. J., & Elee, P. (2008). Human geographies of sea ice: Freeze/thaw processes around Cape Dorset, Nunavut, Canada. *Polar Record*, 44(1), 51–76. <https://doi.org/10.1017/S0032247407007061>
- Laidler, G. J., Elee, P., Ikummaq, T., Joamie, E., & Aporta, C. (2010). Mapping Inuit sea ice knowledge, use, and change in Nunavut, Canada (Cape Dorset, Igloolik, Pangnirtung). In Igor. Krupnik, Claudio. Aporta, Shari. Gearheard, G. J. Ljubicic, & Lene. Kielsen Holm (Eds.), *SIKU: Knowing Our Ice Documenting Inuit Sea Ice Knowledge and Use* (pp. 45–80). Springer Netherlands. <https://doi.org/10.1007/978-90-481-8587-0>
- Laidler, G. J., Hirose, T., Kapfer, M., Ikummaq, T., Joamie, E., & Elee, P. (2011). Evaluating the Floe Edge Service: How well can SAR imagery address Inuit community concerns around sea ice change and travel safety? *Canadian Geographer*, 55(1), 91–107. <https://doi.org/10.1111/j.1541-0064.2010.00347.x>
- Lands Directorate. (1986). *Terrestrial Ecozones of Canada* (Issue 19). <http://parkscanadahistory.com/publications/fact-sheets/eng/ecozones.pdf>

- Langdon, S., Prosper, R., & Gagnon, N. (2010). Two paths one direction: Parks Canada and Aboriginal Peoples working together. *The George Wright Forum*, 27(2), 222–233. <http://www.jstor.org/stable/43598154>
- LaSalle, M. (2022, July 25). *Measuring the environmental effects of a hydroelectric dam in Inukjuak*. UdeMNews. <https://nouvelles.umontreal.ca/article/2022/07/25/mesurer-les-effets-environnementaux-d-un-barrage-hydroelectrique-a-inukjuak/>
- Ljubicic, G. J., Mearns, R., Okpakok, S., & Robertson, S. (2022). Nunami iliharniq (Learning from the land): Reflecting on relational accountability in land-based learning and cross-cultural research in Uqšutuuq (Gjoa Haven, Nunavut). *Arctic Science*, 8(1), 252–291. <https://doi.org/10.1139/as-2020-0059>
- Ljubicic, G., Okpakok, S., Robertson, S., & Mearns, R. (2018). Uqsuqtuurmiut inuita tuktimi qaujimaningit (Inuit knowledge of caribou from Gjoa Haven, Nunavut): Collaborative research contributions to co-management efforts. *Polar Record*, 54(3), 213–233. <https://doi.org/10.1017/S0032247418000372>
- Lukovich, J. V., Shabnam, J., Tefs, A., Myers, P. G., Sydor, K., Wong, K., Stroeve, J. C., Stadnyk, T. A., Babb, D., & Barber, D. G. (2021). A baseline evaluation of oceanographic and sea ice conditions in the Hudson Bay Complex during 2016–2018. *Elementa*, 9(1). <https://doi.org/https://doi.org/10.1525/elementa.2020.00128>
- Lyle, A. (2020, February 11). *New research reveals surprising seasonal changes in Hudson Bay currents*. Folio. <https://www.ualberta.ca/folio/2020/02/new-research-reveals-surprising-seasonal-changes-in-hudson-bay-currents.html>
- MacDonald, J. (2018). Stories and representation: Two centuries of narrating Amittutmiut history. In J. MacDonald & N. Wachowich (Eds.), *The Hands' Measure: Essays honouring Leah Aksaajuq Otak's Contribution to Arctic Science* (pp. 43–80). Nunavut Arctic College Media.
- Mallory, M. L., & Fontaine, A. J. (2004). Key marine habitat sites for migratory birds in Nunavut and the Northwest Territories. In *Occasional Paper of the Canadian Wildlife Service* (CW69-1/109E). Canadian Wildlife Service. [https://publications.gc.ca/collections/collection\\_2011/ec/CW69-1-109-eng.pdf](https://publications.gc.ca/collections/collection_2011/ec/CW69-1-109-eng.pdf)
- Mantyka-Pringle, C. S., Jardine, T. D., Bradford, L., Bharadwaj, L., Kythreotis, A. P., Fresque-Baxter, J., Kelly, E., Somers, G., Doig, L. E., Jones, P. D., Lindenschmidt, K. E., & the Slave River and Delta Partnership. (2017). Bridging science and traditional knowledge to assess cumulative impacts of stressors on ecosystem health. *Environment International*, 102, 125–137. <https://doi.org/10.1016/j.envint.2017.02.008>
- Marley, T. L. (2020). Indigenous Data Sovereignty and the role of universities. In M. Walter, T. Kukutai, S. R. Carroll, & D. Rodriguez-Lonebear (Eds.), *Indigenous Data Sovereignty and Policy* (1st ed., pp. 157–168). Routledge. <https://doi.org/10.4324/9780429273957-11>

- Martinez-Levasseur, L., Furgal, C., Hammill, M., Henri, D., & Burness, G. (2021). New migration and distribution patterns of Atlantic walruses (*Odobenus rosmarus rosmarus*) around Nunavik (Québec, Canada) identified using Inuit Knowledge. *Polar Biology*, 44(9), 1833–1845. <https://doi.org/10.1007/s00300-021-02920-6>
- McCann, H. S., Pulsifer, P. L., & Behe, C. (2016). Sharing and preserving Indigenous Knowledge of the Arctic using information and communications technology. In C. Callison, L. Roy, & G. A. LeCheminant (Eds.), *Indigenous notions of ownership and libraries, archives and museums* (pp. 126–144). De Gruyter Saur. <https://doi.org/https://doi.org/10.1515/9783110363234>
- McDonald, M., Arragutainaq, L., & Novalinga, Z. (1997). *Voices from the Bay: Traditional Ecological Knowledge of Inuit and Cree in the Hudson Bay bioregion*. Canadian Arctic Resources Committee, Environmental Committee of Municipality of Sanikiluaq.
- McGrath, J. (2003). Interview: Janet McGrath on IQ. *Meridian*, 5–9. <https://publications.gc.ca/collections/Collection/R102-4-2003-1E.pdf>
- McGrath, J. T. (2019). The Qaggiq Model. In *The Qaggiq Model: Toward a Theory of Inuktitut Knowledge Renewal* (pp. 292–339). Nunavut Arctic College.
- McGregor, D., Bayha, W., & Simmons, D. (2010). “Our Responsibility to Keep the Land Alive”: Voices of northern Indigenous researchers. *Pimatisiwin: A Journal of Aboriginal and Indigenous Community Health*, 8(1), 101–123. [https://journalindigenousewellbeing.co.nz/media/2018/12/6\\_McGregor.pdf](https://journalindigenousewellbeing.co.nz/media/2018/12/6_McGregor.pdf)
- Mulrennan, M. E., Mark, R., & Scott, C. H. (2012). Revamping community-based conservation through participatory research. *The Canadian Geographer*, 56(2), 243–259. <https://doi.org/10.1111/j.1541-0064.2012.00415.x>
- Nakashima, D. J. (1991). *The Ecological Knowledge of Belcher Island Inuit: A traditional basis for contemporary wildlife co-management* [Doctoral dissertation, McGill University]. eScholarship@McGill. <https://escholarship.mcgill.ca/concern/theses/b8515p16f>
- Nature Canada. (2020). *Investing in nature for job creation and economic prosperity*.
- Naves, L. C. (2018). Geographic and seasonal patterns of seabird subsistence harvest in Alaska. *Polar Biology*, 41(6), 1217–1236. <https://doi.org/10.1007/s00300-018-2279-4>
- Nielsen, M. R., & Meilby, H. (2013). Quotas on narwhal (*Monodon monoceros*) hunting in east Greenland: Trends in narwhal killed per hunter and potential impacts of regulations on Inuit communities. *Human Ecology*, 41(2), 187–203. <https://doi.org/10.1007/s10745-012-9558-4>
- Nirwansyah, A. W., Inez-Pedro, B., Mandili, A., Suwarno, & Sadeli, E. H. (2023). Mapping is caring: Fostering forest preservation through young Orang Rimba initiatives. *Earth*, 4(3), 676–690. <https://doi.org/10.3390/earth4030035>

- Nokmaq, M. I., Marshall, A., Beazley, K. F., Hum, J., Joudry, S., Papadopoulos, A., Pictou, S., Rabesca, J., Young, L., & Zurba, M. (2021). “Awakening the sleeping giant”: Re-Indigenization principles for transforming biodiversity conservation in Canada and beyond. *Facets*, 6(1), 839–869. <https://doi.org/10.1139/facets-2020-0083>
- Nunavut Tunngavik Inc., & Minister of Indian Affairs and Northern Development and Federal Interlocutor for Métis and Non-Status Indians (2010). *Agreement between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada as amended* (R32-134/2010E). [https://www.tunngavik.com/documents/publications/LAND\\_CLAIMS\\_AGREEMENT\\_NUNAVUT.pdf](https://www.tunngavik.com/documents/publications/LAND_CLAIMS_AGREEMENT_NUNAVUT.pdf)
- Nunavut Planning Commission. (2021). *Leading the way through land use planning: Nunavut land use plan*. [https://www.nunavut.ca/sites/default/files/21-001e-2021-07-08-2021\\_draft\\_nunavut\\_land\\_use\\_plan-english\\_0.pdf](https://www.nunavut.ca/sites/default/files/21-001e-2021-07-08-2021_draft_nunavut_land_use_plan-english_0.pdf)
- Nunavut Research Institute. (2021). *Research Licensing in Nunavut*. <https://www.nri.nu.ca/research-licencing-nunavut>
- Nunavut Wildlife Management Board. (n.d.). *Community-Based Wildlife Monitoring Network*. Retrieved November 13, 2023, from <https://www.nwmb.com/en/cbmn>
- Nunavuummi Tasiujarjuamiuguqatigiit Katutjiqatigngit. (2008). A life vest for Hudson Bay’s drifting stewardship. *Arctic*, 61(1), 35–47. [https://link-gale-com.libaccess.lib.mcmaster.ca/apps/doc/A193313351/AONE?u=ocul\\_mcmaster&sid=bookmark-AONE&xid=053fbae4](https://link-gale-com.libaccess.lib.mcmaster.ca/apps/doc/A193313351/AONE?u=ocul_mcmaster&sid=bookmark-AONE&xid=053fbae4)
- Office of the Auditor General of Canada. (2013). *Fall 2013 report of the Commissioner of the Environment and Sustainable Development: Chapter 7 ecological integrity in National Parks* (FA1-2/2013-1-7E-PDF). [https://publications.gc.ca/collections/collection\\_2013/bvg-oag/FA1-2-2013-1-7-eng.pdf](https://publications.gc.ca/collections/collection_2013/bvg-oag/FA1-2-2013-1-7-eng.pdf)
- Olson, R., Hackett, J., & DeRoy, S. (2016). Mapping the digital terrain: Towards Indigenous geographic information and spatial data quality indicators for Indigenous Knowledge and traditional land-use data collection. *Cartographic Journal*, 53(4), 348–355. <https://doi.org/10.1080/00087041.2016.1190146>
- Paquette, E. (2020). *Potential impacts of sea ice and ship traffic change to caribou sea ice crossing areas surrounding King William Island, Nunavut, Canada* [Master’s Thesis, Carleton University]. Carleton University Institutional Repository. <https://doi.org/10.22215/etd/2020-14140>
- Paquette, E., Ljubicic, G., Johnson, C. A., Okpakok, S., Mueller, D., & Montpetit, B. (2023). Seasonal Sea Ice Conditions Affect Caribou Crossing Areas Around Qikiqtaq, Nunavut: Uqsuqturmiut Knowledge Guides Ice Chart Analysis. *Arctic*, 76(1), 83–101. <https://doi.org/10.14430/arctic77149>

- Parks Canada. (2010). *Parks Canada Agency corporate plan (2010–2011/2014–2015)* (R61-12/2015E-PDF). [https://publications.gc.ca/collections/collection\\_2010/pc/R61-12-2015-eng.pdf](https://publications.gc.ca/collections/collection_2010/pc/R61-12-2015-eng.pdf)
- Parks Canada. (2018a). *One with nature: A renewed approach to land and freshwater conservation in Canada: A report of Canada's federal, provincial and territorial departments responsible for parks, protected areas, conservation, wildlife and biodiversity* (R62-552/2018E-PDF). [https://publications.gc.ca/collections/collection\\_2022/pc/R62-552-2018-eng.pdf](https://publications.gc.ca/collections/collection_2022/pc/R62-552-2018-eng.pdf)
- Parks Canada. (2018b, July 18). *Parks Canada announces funding to Qikiqtani Inuit Association for pilot Guardian program in Arctic Bay*. <https://www.canada.ca/en/parks-canada/news/2018/07/parks-canada-announces-funding-to-qikiqtani-inuit-association-for-pilot-guardian-program-in-arctic-bay.html>
- Parks Canada. (2019). *Cooperative management - Gwaii Haanas National Park Reserve, National Marine Conservation Area Reserve, and Haida Heritage Site*. <https://parks.canada.ca/pn-np/bc/gwaiihaanas/info/coop>
- Parks Canada. (2022a). *Parks Canada 2022–23 departmental plan* (R61-108E-PDF). [https://publications.gc.ca/collections/collection\\_2022/pc/R61-103-2022-eng.pdf](https://publications.gc.ca/collections/collection_2022/pc/R61-103-2022-eng.pdf)
- Parks Canada. (2022b). *Stewardship and management - Ivvavik National Park*. <https://parks.canada.ca/pn-np/yt/ivvavik/gestion-management>
- Parks Canada. (2023a). *Stewardship and management - Auyuittuq National Park*. <https://parks.canada.ca/pn-np/nu/ayuittuq/info>
- Parks Canada. (2023b). *Stewardship and management - Quttinirpaaq National Park*. <https://parks.canada.ca/pn-np/nu/quttinirpaaq/info>
- Parks Canada. (2023c). *Stewardship and management - Torngat Mountains National Park*. <https://parks.canada.ca/pn-np/nl/torngats/info/gestion-management>
- Parretti, P., Monteiro, J. G., Gizzi, F., Martínez-Escauriaza, R., Alves, F., Chebaane, S., Almeida, S., Pessanha Pais, M., Almada, F., Fernandez, M., Nogueira, N., Andrade, C., & Canning-Clode, J. (2023). Citizen science and expert judgement: A cost-efficient combination to monitor and assess the invasiveness of non-indigenous fish escapees. *Journal of Marine Science and Engineering*, 11(2). <https://doi.org/10.3390/jmse11020438>
- Patar, D. (2020, May 12). *SIKU launches goose watch competition*. Nunatsiaq News. <https://nunatsiaq.com/stories/article/siku-launches-geese-watch-competition/>
- Pearce, T., Ford, J., Laidler, G., Smit, B., Duerden, F., Allarut, M., Andrachuk, M., Baryluk, S., Diaila, A., Elee, P., Goose, A., Ikummaq, T., Joamie, E., Kataoyak, F., Loring, E., Meakin, S., Nickels, S., Shappa, K., Shirley, J., & Wandel, J. (2009). Community collaboration and climate change research in the Canadian Arctic. *Polar Research*, 28(1), 10–27. <https://doi.org/10.1111/j.1751-8369.2008.00094.x>

- Pearce, T., Ford, J., Willox, A. C., & Smit, B. (2015). Inuit traditional ecological knowledge (TEK), subsistence hunting and adaptation to climate change in the Canadian Arctic. *Arctic*, 68(2), 233–245. <https://doi.org/10.14430/arctic4475>
- Pedersen, C., Appaqaq, M., Kudluarok, J., Nicoll, B., Rosengard, S., Segal, B., Warner, E., & Heath, J. (2020a, December 7-10). *SIKU: A summary of progress a year since launch* [Conference presentation]. ArcticNet 2020, online. <https://vimeo.com/474072537>
- Pedersen, C., Otokiak, M., Koonoo, I., Milton, J., Maktar, E., Anaviapik, A., Milton, M., Porter, G., Scott, A., Newman, C., Porter, C., Aaluk, T., Tiriraniaq, B., Pedersen, A., Riffi, M., Solomon, E., & Elverum, S. (2020b). SciQ: An invitation and recommendations to combine science and Inuit Qaujimagatuqangit for meaningful engagement of Inuit communities in research. *Arctic Science*, 6(3), 326–339. <https://doi.org/10.1139/as-2020-0015>
- Peron, G. (2019). Modified home range kernel density estimators that take environmental interactions into account. *Movement Ecology*, 7(1), 16. <https://doi.org/10.1186/s40462-019-0161-9>
- Pulsifer, P. L., Gearheard, S., Huntington, H. P., Parsons, M. A., McNeave, C., & McCann, H. S. (2012). The role of data management in engaging communities in Arctic research: Overview of the Exchange for Local Observations and Knowledge of the Arctic (ELOKA). *Polar Geography*, 35(3–4), 271–290. <https://doi.org/10.1080/1088937X.2012.708364>
- Pulsifer, P. L., Laidler, G. J., Taylor, D. R. F., & Hayes, A. (2011). Towards an Indigenist data management program: Reflections on experiences developing an atlas of sea ice knowledge and use. *Canadian Geographer*, 55(1), 108–124. <https://doi.org/10.1111/j.1541-0064.2010.00348.x>
- Qikiqtani Inuit Association. (2020). *Sarvarjuaq and Qikiqtait: Inuit stewardship and the blue economy in Nunavut's Qikiqtani region*. [https://www.qia.ca/wp-content/uploads/2021/01/qia-regional-marine-protection-strategy-new\\_web.pdf](https://www.qia.ca/wp-content/uploads/2021/01/qia-regional-marine-protection-strategy-new_web.pdf)
- Quigley, N. C., & McBride, N. J. (1987). The structure of an Arctic microeconomy: The traditional sector in community economic development. *Arctic*, 40(3), 204–210. <https://doi.org/10.14430/arctic1768>
- Ramirez-Gomez, S. O. I., Brown, G., & Fat, A. T. S. (2013). Participatory mapping with Indigenous communities for conservation: Challenges and lessons from Suriname. *The Electronic Journal of Information Systems in Developing Countries*, 58(1), 1–22. <https://doi.org/https://doi.org/10.1002/j.1681-4835.2013.tb00409.x>
- Raschke, A. B., Davis, J., & Quiroz, A. (2022). The Central Arizona Conservation Alliance programs: Use of social media and app-supported community science for landscape-scale habitat restoration, governance support, and community resilience-building. *Land*, 11(1). <https://doi.org/10.3390/land11010137>

- Reuters, T. (2020, September 29). *Canada, Britain, EU pledge to protect 30% of land, sea by 2030 to stop “catastrophic” biodiversity loss*. CBC News. <https://www.cbc.ca/news/science/biodiversity-canada-1.5742040>
- Ridenour, N. A., Hu, X., Sydor, K., Myers, P. G., & Barber, D. G. (2019). Revisiting the circulation of Hudson Bay: Evidence for a seasonal pattern. *Geophysical Research Letters*, 46(7), 3891–3899. <https://doi.org/10.1029/2019GL082344>
- Robertson, J. B. (2012). *From felt tip to technology: The challenges of representing Traditional Knowledge in a GIS platform to create a knowledge surface* [Master’s Thesis, Ryerson University]. Toronto Metropolitan University. <https://doi.org/10.32920/ryerson.14654004.v1>
- Robertson, S., & Ljubicic, G. (2019). Nunamii’luni quvianaqtuq (It is a happy moment to be on the land): Feelings, freedom and the spatial political ontology of well-being in Gjoa Haven and Tikiranajuk, Nunavut. *EPD: Society & Space*, 37(3), 542–560. <https://doi.org/10.1177/0263775818821129>
- Rogers, S. (2021, April 8). Nunavut communities look to local fisheries for economic growth. *Nunatsiaq News*. <https://nunatsiaq.com/stories/article/nunavut-communities-look-to-local-fisheries-for-economic-growth/>
- Rowe, R. K., Bull, J. B., & Walker, J. D. (2020). Indigenous self-determination and data governance in the Canadian policy context. In M. Walter, T. Kukutai, S. R. Carroll, & D. Rodriguez-Lonebear (Eds.), *Indigenous Data Sovereignty and Policy* (1st ed., Vol. 1, pp. 81–98). Routledge. <https://doi.org/10.4324/9780429273957-6>
- Rustad, H. (2015, December 8). *Where the Streets Have No Names*. The Walrus. <https://thewalrus.ca/where-the-streets-have-no-names/>
- Sadowsky, H., Brunet, N. D., Anaviapik, A., Kublu, A., & Henri, D. (2022). Inuit youth-engaged community-based environmental research as supporting local development in Nunavut, Canada. *Polar Geography (1995)*, 45(4), 275–292. <https://doi.org/10.1080/1088937X.2022.2105972>
- Sandlos, J. (2014). *National Parks in the Canadian North: Comanagement or Colonialism Revisited?* (S. Stevens, Ed.; pp. 133–149). University of Arizona Press.
- Santori, C., Keith, R. J., Whittington, C. M., Thompson, M. B., Van Dyke, J. U., & Spencer, R.-J. (2021). Changes in participant behaviour and attitudes are associated with knowledge and skills gained by using a turtle conservation citizen science app. *People and Nature*, 3(1), 66–76. <https://doi.org/https://doi.org/10.1002/pan3.10184>

- Schneider-Vieira, F., Baker, R., & Lawrence, M. (1994). The estuaries of Hudson Bay: A case study of the physical and biological characteristics of selected sites. *Canadian Arctic Resource Committee & the Municipality of Sanikiluaq*.  
[https://siku.org/data/5ee7a35e358a1\\_The%20Estuaries%20of%20Hudson%20Bay%20A%20Case%20Study%20of%20the%20Physical%20and%20Biological%20Characteristic%20of%20Selected%20Sites.pdf](https://siku.org/data/5ee7a35e358a1_The%20Estuaries%20of%20Hudson%20Bay%20A%20Case%20Study%20of%20the%20Physical%20and%20Biological%20Characteristic%20of%20Selected%20Sites.pdf)
- Secretariat of the Convention on Biological Diversity. (2009). *Indigenous Peoples and Traditional Knowledge related to biological diversity and responses to climate change in the Arctic region*. <https://www.cbd.int/doc/publications/tk-cc-arctic-en.pdf>
- Sheil, D., Boissière, M., & Beaudoin, G. (2015). Unseen sentinels: Local monitoring and control in conservation's blind spots. *Ecology and Society*, 20(2).  
<https://doi.org/10.5751/ES-07625-200239>
- SIKU, & Arctic Eider Society. (2020). *2020 project report*. Arctic Eider Society.
- Simonee, N., Aloo, J., Carter, N. A., Ljubicic, G., & Dawson, J. (2021). Sila qanuippa? (How's the weather?): Integrating Inuit Qaujimajatuqangit and environmental forecasting products to support travel safety around Pond Inlet, Nunavut, in a changing climate. *Weather, Climate, and Society*, 13(4), 933–962.  
<https://doi.org/https://doi.org/10.1175/WCAS-D-20-0174.1>
- Singh, I., & Hopton, A. (2022, December 6). *How Indigenous-led conservation could help Canada meet its land and water protection targets*. CBC News.  
<https://www.cbc.ca/news/science/canada-conservation-boreal-nature-biodiversity-1.6675175>
- Smith, C. D., Decouto, T. P., & Carvill, A. (2020). *Balancing worldviews: Climate change solutions in Canada's North*. [https://gordonfoundation.ca/wp-content/uploads/2020/04/JGNF\\_2018-2019\\_Balancing-Worldviews\\_-Climate-Change-Solutions-in-Canada%E2%80%99s-North\\_Final\\_Paper.pdf](https://gordonfoundation.ca/wp-content/uploads/2020/04/JGNF_2018-2019_Balancing-Worldviews_-Climate-Change-Solutions-in-Canada%E2%80%99s-North_Final_Paper.pdf)
- Snipp, C. M. (2016). What does data sovereignty imply: What does it look like? In T. Kukutai & J. Taylor (Eds.), *Indigenous Data Sovereignty: Toward an agenda* (pp. 39–56). ANU Press.
- Snook, J., Cunsolo, A., Borish, D., Furgal, C., Ford, J. D., Shiwak, I., Flowers, C. T. R., & Harper, S. L. (2020). “We’re made criminals just to eat off the land”: Colonial wildlife management and repercussions on Inuit well-being. *Sustainability*, 12(19).  
<https://doi.org/10.3390/su12198177>
- Snook, J., Cunsolo, A., & Morris, R. (2018). A half century in the making: Governing commercial fisheries through Indigenous marine co-management and the Torngat Joint Fisheries Board. In N. Vestergaard, B. A. Kaiser, L. Fernandez, & J. N. Larsen (Eds.), *Arctic Marine Resource Governance and Development* (pp. 53–73). Springer International Publishing. [https://doi.org/10.1007/978-3-319-67365-3\\_4](https://doi.org/10.1007/978-3-319-67365-3_4)

- Sanikiluaq Qikiqtait Steering Committee. (2019a). *Arctic Eider Society submission to Canada Nature Fund*.
- Sanikiluaq Qikiqtait Steering Committee. (2019b). *Sanikiluaq Stewardship Workshop #2 Inuit-led conservation and protection of the Belcher Islands March 12-13*.
- Sanikiluaq Qikiqtait Steering Committee. (2021). *Implementing Sanikiluaq's vision for a Qikiqtait Nautsiquitiit Program: Next steps and progress to date*.
- Statistics Canada. (2023). *Census Profile - Sanikiluaq, Nunavut*. 2021 Census of Population. <https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&DGUIDlist=2021A00056204001&GENDERlist=1,2,3&STATISTIClist=1,4&HEADERlist=0>
- Stevens, S. (2014a). A new protected area paradigm. In S. Stevens (Ed.), *Indigenous Peoples, National Parks, and Protected Areas* (pp. 47–83). University of Arizona Press.
- Stevens, S. (2014b). Indigenous Peoples, biocultural diversity, and protected areas. In S. Stevens (Ed.), *Indigenous Peoples, National Parks, and Protected Areas* (pp. 15–46). University of Arizona Press.
- Stevens, S. (2014c). Introduction. In S. Stevens (Ed.), *Indigenous Peoples, National Parks, and Protected Areas* (p. 3). University of Arizona Press.
- Stewart, E. J., Liggett, D., Lamers, M., Ljubicic, G., Dawson, J., Thoman, R., Haavisto, R., & Carrasco, J. (2020). Characterizing polar mobilities to understand the role of weather, water, ice and climate (WWIC) information. *Polar Geography*, 43(2–3), 95–119. <https://doi.org/10.1080/1088937X.2019.1707319>
- Sumi, L., Thomsen, S., & Rogers, N. (2001). *Mining in remote areas: Issues and impacts*. MiningWatch Canada. [https://miningwatch.ca/sites/default/files/mine\\_impacts\\_kit\\_1.pdf](https://miningwatch.ca/sites/default/files/mine_impacts_kit_1.pdf)
- Tagalik, S., Baker, K., Karetak, J., & Rahm, J. (2023). Rebuilding relations and countering erasure through community-driven and owned science: A key tool to Inuit self-determination and social transformations. *Journal of Research in Science Teaching*. <https://doi.org/10.1002/tea.21881>
- Tauli-Corpuz, V., Alcorn, J., Molnar, A., Healy, C., & Barrow, E. (2020). Cornered by PAs: Adopting rights-based approaches to enable cost-effective conservation and climate action. *World Development*, 130, 104923. <https://doi.org/https://doi.org/10.1016/j.worlddev.2020.104923>
- Tejsner, P. (2014). Quota disputes and subsistence whaling in Qeqertarsuaq, Greenland. *Polar Record*, 50(4), 430–439. <https://doi.org/10.1017/S0032247414000242>
- Tester, F. J., & Irniq, P. (2008). Inuit Qaujimagatuqangit: Social history, politics and the practice of resistance. In *Arctic*, 61(1).

- The First Nations Information Governance Centre. (2023). *The First Nations Principles of OCAP® - The First Nations Information Governance Centre*. <https://fnigc.ca/ocap-training/>
- The Indigenous Leadership Initiative. (2022). *Indigenous-led conservation: The key to sustaining biodiversity in Canada*. <https://static1.squarespace.com/static/5f8367238502ed181766aaf0/t/6385a0f8287ff4075f43774d/1669701885238/Indigenous+Led+Conservation+Report+-+FINAL.pdf>
- The National Advisory Panel. (2018). *Canada's conservation vision: A report of the National Advisory Panel* (R62-549/2018E-PDF). [https://static1.squarespace.com/static/57e007452e69cf9a7af0a033/t/5b23dce1562fa7bac7ea095a/1529076973600/NAP\\_REPORT\\_EN\\_June+5\\_ACC.pdf](https://static1.squarespace.com/static/57e007452e69cf9a7af0a033/t/5b23dce1562fa7bac7ea095a/1529076973600/NAP_REPORT_EN_June+5_ACC.pdf)
- Thomlinson, E., & Crouch, G. (2012). Aboriginal Peoples, Parks Canada, and protected spaces: A case study in co-management at Gwaii Haanas National Park Reserve. *Annals of Leisure Research*, 15(1), 69–86.
- Thumbadoo, R. V., & Taylor, D. R. F. (2022). Editorial commentary on the IJGI special issue “Mapping Indigenous Knowledge in the Digital Age.” In *ISPRS International Journal of Geo-Information*, 11(7). <https://doi.org/10.3390/ijgi11070363>
- Tondu, J. M. E., Balasubramaniam, A. M., Chavarie, L., Gantner, N., Knopp, J. A., Provencher, J. F., Wong, P. B. Y., Simmons, D., & Simmons, D. (2014). Working with northern communities to build collaborative research partnerships: Perspectives from early career researchers. *Arctic*, 67(3), 419–429. <https://doi.org/10.14430/arctic4416>
- Tracey, J., Sheppard, J., Lockwood, G., Chourasia, A., Tatineni, M., Fisher, R., & Sinkovits, R. (2014). Efficient 3D movement-based Kernel Density Estimator and application to wildlife ecology. *ACM International Conference Proceeding Series*, 1–8. <https://doi.org/10.1145/2616498.2616522>
- Truth and Reconciliation Commission of Canada. (2015). *Truth and Reconciliation Commission of Canada: Calls to Action*. [http://trc.ca/assets/pdf/Calls\\_to\\_Action\\_English2.pdf](http://trc.ca/assets/pdf/Calls_to_Action_English2.pdf)
- Tsosie, R. (2020). *The legal and policy dimensions of Indigenous Data Sovereignty (IDS)*. In M. Walter, T. Kukutai, S. R. Carroll, & D. Rodriguez-Lonebear (Eds.), *Indigenous Data Sovereignty and Policy* (1st ed., Vol. 1, pp. 204–225). Routledge. <https://doi.org/10.4324/9780429273957-14>
- Tyrrell, M. (2006). More bears, less bears: Inuit and scientific perceptions of polar bear populations on the west coast of Hudson Bay. *Etudes Inuit Studies*, 30(2), 191–208. <https://doi.org/10.7202/017571ar>
- Tyrrell, M. (2007). Sentient beings and wildlife resources: Inuit, beluga whales and management regimes in the Canadian Arctic. *Human Ecology: An Interdisciplinary Journal*, 35(5), 575–586. <https://doi.org/10.1007/s10745-006-9105-2>

- United Nations. (2023). *United Nations Declaration on the Rights of Indigenous Peoples Act*. [https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP\\_E\\_web.pdf](https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP_E_web.pdf)
- van Luijk, N., Carter, N. A., Dawson, J., Parker, C., Grey, K., Provencher, J., & Cook, A. (2022). Community-identified risks to hunting, fishing, and gathering (harvesting) activities from increased marine shipping activity in Inuit Nunangat, Canada. *Regional Environmental Change*, 22(24). <https://doi.org/10.1007/s10113-022-01894-3>
- Verstege, J. (2016). *Fox and lemming responses to climate and snow conditions at the Arctic's edge* [Master's Thesis, University of Manitoba]. FGS - Electronic Theses and Practica. <http://hdl.handle.net/1993/31976>
- Waithaka, J. (2010). Parks Canada Science: Providing Knowledge for Better Service to Canadians. *The George Wright Forum*, 27(2), 213–221. <https://www.jstor.org/stable/43598153>
- Walter, M. (2018). The voice of Indigenous data: Beyond the markers of disadvantage. *Griffith Review*, 60, [256]–263. <https://search.informit.org/doi/10.3316/ielapa.586241932732209>
- Walter, M., Lovett, R., Maher, B., Williamson, B., Prehn, J., Bodkin-Andrews, G., & Lee, V. (2021). Indigenous Data Sovereignty in the era of Big Data and Open Data. *Australian Journal of Social Issues*, 56(2), 143–156. <https://doi.org/https://doi.org/10.1002/ajs4.141>
- Watt-Cloutier, S. (2015). *The right to be cold: One woman's story of protecting her culture, the Arctic and the whole planet*. Penguin Canada.
- Wein, E. E., Freeman, M. M. R., & Makus, J. C. (1996). Use of and preference for traditional foods among the Belcher Island Inuit. *Arctic*, 49(3), 256–264. <http://www.jstor.org/stable/40512002>
- Wenzel, G. W. (1999). Traditional ecological knowledge and Inuit: Reflections on TEK research and ethics. *Arctic*, 52(2), 113–124. <http://www.jstor.org/stable/40512224>
- Whittington, P. (2013). *The Impacts of diamond mining to peatlands in the James Bay lowlands* [Doctoral Dissertation, University of Waterloo]. UWSpace. <http://hdl.handle.net/10012/7352>
- Wiggins, A., & Crowston, K. (2011). From conservation to crowdsourcing: A typology of citizen science. *2011 44th Hawaii International Conference on System Sciences*, 1–10. <https://doi.org/10.1109/HICSS.2011.207>
- Williamson, B., Provost, S., & Price, C. (2022). Operationalising Indigenous data sovereignty in environmental research and governance. *Environment and Planning F*, 2(1–2), 281–304. <https://doi.org/10.1177/26349825221125496>

- Wilson, K. J., Bell, T., Arreak, A., Koonoo, B., Angnatsiak, D., & Ljubicic, G. J. (2020). Changing the role of non-Indigenous research partners in practice to support Inuit self-determination in research. *Arctic Science*, 6(3), 127–153. <https://doi.org/10.1139/as-2019-0021>
- Wong, P. B. Y., & Murphy, R. W. (2016). Inuit methods of identifying polar bear characteristics: Potential for Inuit inclusion in polar bear surveys. *Arctic*, 69(4), 406–420. <https://doi.org/10.14430/arctic4605>
- Workshop #2: Community updates and priorities. (2022, November 29-December 1). [Conference session]. Hudson Bay Summit, Montréal, QC, Canada.
- World Wildlife Fund Canada. (2019). *Wildlife protection assessment: A national habitat crisis*. <https://doi.org/10.13140/RG.2.2.22764.62089>
- York, J., Dowsley, M., Cornwell, A., Kuc, M., & Taylor, M. (2016). Demographic and traditional knowledge perspectives on the current status of Canadian polar bear subpopulations. *Ecology and Evolution*, 6(9), 2897–2924. <https://doi.org/10.1002/ece3.2030>
- Youdelis, M., Nakoochee, R., O’Neil, C., Lunstrum, E., & Roth, R. (2020). “Wilderness” revisited: Is Canadian park management moving beyond the “wilderness” ethic? *The Canadian Geographer*, 64(2), 232–249. <https://doi.org/10.1111/cag.12600>
- Youdelis, M., Townsend, J., Bhattacharyya, J., Moola, F., & Fobister, J. B. (2021). Decolonial conservation: Establishing Indigenous Protected Areas for future generations in the face of extractive capitalism. *Journal of Political Ecology*, 28(1). <https://doi.org/10.2458/jpe.4716>
- Zurba, M., Beazley, K., English, E., & Buchmann-Duck, J. (2019). Indigenous Protected and Conserved Areas (IPCAs), Aichi Target 11 and Canada’s Pathway to Target 1: Focusing conservation on reconciliation. *Land*, 8(1). <https://doi.org/10.3390/land8010010>

## APPENDIX 1: SIKU POLICIES

### Terms of Use for SIKU Platform

The SIKU platform has been collaboratively developed with Inuit and we are continually seeking consultation and guidance to improve the platform for the benefit of Inuit. Feedback and suggestions on the terms of use and privacy policy are welcome.

These Terms of Use govern your access to and use of, including the content and functionality offered on or through, siku.org (<https://siku.org>) and the SIKU Mobile App (collectively, the "Platform").

All access to and use of the Platform is subject to the terms and conditions in this document (including any other terms, agreements and documents that are linked or referred to below) and in any separate or supplemental terms of use agreement that may be referenced or linked within the Platform (collectively, the "Terms of Use").

SIKU, operated by the Arctic Elder Society, ("SIKU", "we", "us", "our"), respects Indigenous knowledge and strives to protect it from misuse while encouraging its mobilization for the benefit of Indigenous self-determination based on the following guiding principles:

- Respect for Indigenous knowledge and rights holders.
  - Users of the Platform agree to respect Indigenous knowledge, rights holders, other users and the policies and protocols in place. The Platform is intended to be a safe space for sharing Indigenous knowledge and hunting stories, free from bullying, derogatory comments or criticisms.
- Self-Determination in research, education and stewardship.
  - A primary goal of the Platform is to provide tools and services that facilitate Indigenous self-determination in research, education and stewardship through accessible features for documenting and sharing Indigenous knowledge, to design, conduct and steward data in an informed approach, and to provide novel ways to engage in all stages of research projects. Existing governance structures must be respected when using the Platform, including permitting, research licensing, ethics and other policies and procedures in place by communities, regional Indigenous organizations and governance. It is a subtle but important distinction that the Platform is not a citizen science tool (citizens providing data to scientists) but rather is a tool to empower Indigenous self-determination (Indigenous peoples collecting data for Indigenous peoples and maintaining control over data stewardship).
- Intellectual property ownership maintained through an informed data stewardship framework.
  - Ownership and control by users over stewardship and sharing of knowledge and data is a core part of the Platform's framework. In contrast to most platforms, sharing data and content on the Platform does not provide SIKU with a license to otherwise use that content, and SIKU and The Arctic Elder Society are required to acquire permissions for use in the same way as any other individual, project or organization using the Platform. Appropriate permissions must be obtained from rights holders (e.g. users, communities, projects and organizations) before any content shared on the Platform can be used in any other context. Sharing knowledge and hunting stories does not imply legal permission for others to use or replicate that information in any way. Posting a photo, data or other content does not imply others can repost or otherwise use that content, and explicit permission must be obtained from the owner of the content along with any other requirements (permits, ethics, etc.) from the region. Users and projects can easily control the sharing and management of their posts and data in a simple dashboard and download it for their own purposes at any time. Privacy, sharing, stewardship and ownership can be controlled on a post-by-post basis and defaults settings controlled on the users profile.
- Integrity of Information facilitating safe travel, knowledge transfer, language and cultural preservation.
  - Preserving the integrity of Indigenous knowledge and observations is a critical framework for SIKU as this is key for knowledge transfer, safety, language and cultural preservation. Misinformation, mis-representation, "fake news" and other abuse of the Platform will not be tolerated and reporting mechanisms are intended to help facilitate the integrity of the Platform. You are expected to take responsibility for your account and protect the integrity of the Platform by using your real name (not a pseudonym), uploading a profile picture that represents your likeness and by not hiding your identity or acting anonymously. You are expected to ensure the truth and accuracy of your posts, comments and other contributions to the best of your ability. See Section C for more information about the standards applicable to content that you post to the Platform.

Violation of these principals may lead to the removal of your access to the Platform at the sole and absolute discretion of the Platform's administrators.

**BY ACCESSING, VIEWING OR USING ANY PAGE, PART OR COMPONENT OF THE PLATFORM, A USER ("USER", "YOU") AGREES TO BE CONTRACTUALLY BOUND BY THE TERMS OF USE, INCLUDING OUR PRIVACY POLICY (FOUND AT SIKU.ORG/PRIVACY (<https://siku.org/privacy>)) WHICH IS INCORPORATED HEREIN BY REFERENCE. IF YOU DO NOT AGREE TO THESE TERMS OF USE (INCLUDING THE PRIVACY POLICY), YOU MUST NOT ACCESS OR USE THE PLATFORM.**

We reserve the right to make changes to these Terms of Use from time to time and an effort will be made to notify you of these changes. Unless we indicate otherwise, such changes are effective upon posting to the Platform and apply to all access to and continued use of the Platform. Accordingly, the Terms of Use may have changed since your last visit to the Platform and it is your responsibility to review the Terms of Use for any changes. You agree that you access or use of the Platform after any change of these Terms of Use will signify your acceptance of the revised Terms of Use. You agree to regularly review the Terms of Use to be aware of any changes. If you do not agree to any updated version of these Terms of Use, do not continue to access or use the Platform.

While every effort will be made to ensure continuity of services and inform Users of updates, in order to improve and add features and respond to changes in technology, we reserve the right to change, suspend or discontinue any aspect of the Platform, in whole or in part, at any time and without notice or liability to you, and for any reason or no reason, including by: (a) adding, removing or modifying functionality or features; (b) adding, removing, modifying, correcting or refusing any content on the Platform; (c) limiting, suspending or terminating your or any persons access or use of all or parts of the Platform; and (d) discontinuing all or any part of the Platform. The Platform may also be unavailable from time to time due to maintenance or malfunction of computer or network equipment or other reasons.

SIKU, an Inuit driven-charity based in Sanikiluaq, is the developer and provider of the Platform and agrees to follow the Terms of Use and Privacy Policy in the same way as any other User of the Platform is.

**A. License Grant**

A.1 SIKU grants Users a nonexclusive, personal, non-transferable, revocable, limited license to access and use the Platform only in accordance with the Terms of Use. Users' binding obligations under the Terms of Use are in consideration of SIKU's grant of license to use the Platform.

A.2 The Platform include all notes, documents, updates, text, images, html, data, databases, email messages, advertisements and other content, resources, materials, know-how and services or resources produced, published, displayed, distributed or provided by SIKU in, on or through The Platform (excluding User Content, as defined below) and all software and other technology hosted or used by SIKU to provide The Platform (collectively, the "**SIKU Materials**").

**B. User Content (You retain control and ownership of the information you post and it's stewardship)**

B.1 The Platform may enable you to upload, post and transmit content to The Platform and also provide you with access to discussion forums, blogs and other interactive areas in which you or other Users may post or transmit photos, videos, text, messages, information or other content or materials (collectively, the "**User Content**").

B.2 You retain all intellectual property rights in and to any User Content you post, upload or otherwise make available through The Platform, including the copyright in and to any User Content. SIKU does not claim any ownership, right, title or interest in and to your User Content.

B.3 **PROJECT STEWARDSHIP:** "Projects" using SIKU may be granted a licence to use User Content if you tag the project and you are a project member at the time of creation. This licence between you and the project is only valid if both parties agree in writing, the licence adheres to SIKU's Terms of Use and it complies with all relevant governance structures, permitting, licensing and ethics processes. Projects that do not adhere to these conditions are in violation of these Terms of Use. SIKU is not responsible for ensuring that such a licence is granted.

B.4 **INDIGENOUS STEWARDSHIP:** By choosing to assign "Indigenous Stewardship" to User Content, you will share the data/content of that post with community, regional and other affiliated Indigenous organizations and will grant members of those communities a licence to use your User Content on a non-exclusive basis for the benefit of that Indigenous group. Community affiliated organizations, as determined through existing Indigenous governance structures and policies, are also granted a licence to use your User Content where you have the "Indigenous Stewardship" featured turned on and which you have tagged with the relevant affiliated community.

B.5 **CUSTOM STEWARDSHIP** You may choose to give other Users, organizations or projects the ability to download your User Content by using the "Custom Stewardship" posting permission.

B.6 **OPEN ACCESS STEWARDSHIP:** Additionally, you may make your User Content publicly available for use in larger research studies by turning on the "Open Access Stewardship" setting on a post or User level basis. Currently only limited meta-data (e.g. species, location) is being considered for open-access stewardship where it can benefit Indigenous peoples.

B.7 Notwithstanding the foregoing, by uploading and/or posting any User Content to the Platform, you grant SIKU a worldwide, perpetual, irrevocable, nonexclusive, sub-licensable and royalty-free right to use, reproduce, modify, perform, display, distribute, and otherwise disclose to third parties the User Content (and the username that is submitted in connection with such User Content) as is reasonably necessary in order to enable SIKU to provide the Platform, including to display the User Content on the Platform. You waive any moral rights or other rights of authorship as a condition of submitting any User Content. You represent and warrant that (i) you own or otherwise control all of the rights to the User Content that you post or transmit, or you otherwise have the right to post, use, display, distribute and reproduce such User Content and to grant the rights granted herein; (ii) the User Content you supply is accurate and not misleading; and (iii) the use and posting of the User Content you supply does not violate these Terms of Use and will not violate any rights of or cause injury to any person or entity.

**C. Acceptable Use**

C.1 You are solely responsible for the User Content that you post or transmit using the Platform and you agree not to post, transmit or otherwise publish through the Platform any of the following:

- i. User Content that is unlawful, defamatory, hateful, harassing, threatening, invasive of privacy or publicity rights, abusive, inflammatory, fraudulent or otherwise objectionable or harmful;
- ii. User Content that is obscene, pornographic, indecent, lewd, sexually suggestive, including without limitation photos, videos or other User Content containing nudity;
- iii. User Content that would constitute, encourage or provide instructions for a criminal offense, violate the rights of any party, endanger national security, or that would otherwise create liability or violate any local, provincial, territorial, national or international law;
- iv. User Content that may infringe or violate any patent, trademark, copyright or other intellectual or other proprietary right of any party;
- v. User Content that impersonates any person or entity or otherwise misrepresents your affiliation with a person or entity;
- vi. unsolicited messages containing promotions, political campaigning, advertising or solicitations;
- vii. private information of any third party, including, without limitation: addresses, phone numbers, email addresses, and credit card numbers;
- viii. viruses, corrupted data or other harmful, disruptive or destructive files;
- ix. data, information or other content which is untrue, false or otherwise misleading; and
- x. User Content that, in the sole judgment of SIKU, is objectionable, harmful or which restricts or inhibits any other person from using or enjoying the Platform, or which may expose SIKU or its Users to any harm or liability of any nature.

Although we prohibit certain activities in these Terms of Use and will make a concerted effort to enforce them, SIKU does not make any representation or warranty that the User Content you may encounter through your use of the Platform is accurate, complies with these acceptable use provisions, or the Terms of Use. YOUR USE OF THE PLATFORM IS SOLELY AT YOUR OWN RISK. These Terms of Use do not create any private right of action on the part of any third party or any reasonable expectation that the Platform will not contain any inaccuracies or content that is prohibited by these acceptable use provisions.

SIKU reserves the right (but is not obligated) to (i) review or screen any User Content submitted to the Platform or otherwise submitted through the Platform; (ii)

edit any User Content posted on the Platform and/or (iii) remove any User Content from the Platform for any reason, at any time, without prior notice, at our sole discretion. SIKU will have no liability or responsibility to Users of the Platform or any other person or entity for performance or non-performance of such activities. Arctic Eider's enforcement of the acceptable use provisions set forth in these Terms of Use with respect to User Content in some instances does not constitute a waiver of our right to enforce such provisions in other instances involving similar User Content.

**D. Permitted Use of SIKU**

D.1 All Users are permitted to use, in a manner that is not prejudicial to SIKU or any other User, the Platform to:

- i. search and view SIKU Materials and User Content available through the Platform; or
- ii. bookmark or link to any web page within the Platform, provided that no SIKU Materials or User Content (not owned by the acting User) are reproduced or displayed on the web outside of Arctic Eider's original frameset;

D.2 Users shall not under any circumstances by any means or for any purpose whatsoever, except as otherwise expressly permitted by the User who authored/created the User Content or expressly provided in these Terms of Use (e.g. assigned ownership or license for use to other projects, individuals or organizations via data stewardship tools as above):

- i. provide, transmit or distribute printed or electronic copies of any User Content to any other person;
- ii. quote, customize and incorporate User Content, in whole or part, in documents, memoranda, articles and other work product in connection with research or educational activities; or
- iii. modify any such User Content.

D.3 You understand and acknowledge that it is your responsibility to review User Content sharing settings that SIKU provides on a per post basis and as a User level default. These settings determine if limited post data and metadata are publicly available for third party search engines, social networks or other websites to access, download, index, archive, link to and republish User Content. You acknowledge that User Content that you post, upload or otherwise make available via the Platform may be accessed, used and downloaded by other Users of the Platform. You understand and acknowledge that any User Content contained in public areas of the Platform, including any User galleries or other portions of the Platform, is accessible to the public and could be accessed, downloaded, indexed, archived, linked to and republished by others including, without limitation, appearing on other websites and in search engine results. SIKU provides security options and settings for your content available in the settings section of your applicable User account (the "Account Settings"). You can adjust the Account Settings and the setting on individual posts to limit who can see and access your User Content.

**E. Access Restrictions**

E.1 Users shall not access or attempt to access any SIKU Materials or User Content other than through the Platform, or otherwise circumvent or attempt to circumvent any access restrictions or controls through hacking or other means. All use of a SIKU account, be it from the account creator or any other person, is governed under these Terms of Use and the account creator is solely responsible for any misuse. Users shall not disclose their username or password to anyone or allow any other person to use the Platform with their username or password.

E.2 Without limitation to any other available contractual, legal or equitable remedies, SIKU reserves the right to revoke, suspend or terminate, without notice, any User's access to the Platform upon any violation or suspected violation of the Terms of Use.

**F. Proprietary Rights**

F.1 SIKU and its affiliates own and use certain registered and unregistered service marks, trademarks, slogans, logos, symbols, graphics and distinctive trade dress in connection with the Platform (the "SIKU Marks").

F.2 Except for the limited rights granted to Users in the Terms of Use, all rights, title, and interest in the Platform, SIKU Materials and SIKU Marks, in all languages, formats and media throughout the world, including all copyrights, are and will continue to be the exclusive property of SIKU, its affiliates and their licensors. The Terms of Use do not grant Users any right or license with respect to the Platform or SIKU Marks except to the minimum extent necessary to exercise the limited license provided herein in Section A.

**G. Prohibited Activities**

G.1 Without limitation to any other restriction, obligation or condition in the Terms of Use, Users shall not, under any circumstances by any means or for any purpose whatsoever, intentionally or unintentionally do or attempt to do any of the following:

- i. print, reproduce, download, store, modify, disclose, distribute, transmit or publish any SIKU Materials or User Content, in whole or part, except as expressly permitted in writing by the Terms of Use or otherwise authorized by the User who authored the User Content or under data stewardship features;
- ii. remove, alter or obscure any citation or attribution of the author or source, or any notice of copyright, trademark or other proprietary rights on any SIKU Materials or User Content (except when quoted or incorporated in material in the manner expressly permitted by these Terms of Use), or make any use of the SIKU Marks without SIKU or the User who authored the User Content's prior written consent;
- iii. Interfere with any other User's access, use or enjoyment of the Platform;
- iv. use the Platform, SIKU Materials, or User Content in a manner contrary to or in violation of any applicable law, regulation or rule of any jurisdiction, governmental agency or securities exchange;
- v. use the Platform to store, distribute or transmit any material without authority or right to do so or in violation of any contractual or fiduciary duty, or that is otherwise unlawful, harmful, threatening, defamatory, obscene, harassing, disparaging of any person or group on the basis of race, ethnicity, religion, age, gender or sexual orientation;
- vi. reverse compile, disassemble, reverse engineer or otherwise seek to discover the source code form of any Arctic Eider or SIKU software or other technology, except as may be allowed by applicable law which is incapable of exclusion by agreement between the parties;
- vii. introduce any virus, denial of service attack or other potentially harmful or malicious software code or device into the Platform, or use the Platform in any manner that might destroy, damage or degrade performance of any data communications facility, network, server, system, component, software or data used to deliver the Platform;
- viii. use the Platform, or email addresses or other contact information gathered through use of the Platform, in any way to distribute any advertising, solicitations or other commercial messages;

	<p>ix. use any network software, device or manual process to monitor, download or copy the Platform, SIKU Materials, or User Content to extract information concerning usage or individual Users or to collect email addresses for any purpose; or</p> <p>x. transfer, either permanently or temporarily, any rights or obligations under these Terms of Use.</p>
H.	<p>User Information and Privacy Policy</p>
H.1	<p>In providing the Platform, SIKU shall conform to its SIKU Privacy Policy available at <a href="https://siku.org/privacy">siku.org/privacy</a> (<a href="https://siku.org/privacy">https://siku.org/privacy</a>), as such SIKU Privacy Policy may be amended from time to time, with respect to the collection, use, and disclosure of data and personal information that a User transmits or submits to SIKU through the Platform ("<b>User Information</b>").</p>
H.2	<p>Subject to SIKU Privacy Policy, if applicable, User hereby expressly consents to collection, use, reproduction, hosting, transmission and disclosure of any User Information by SIKU, and its affiliates, and their employees and contractors, as SIKU deems reasonably necessary or expedient for the purpose of providing the Platform.</p>
H.3	<p>Subject to SIKU Privacy Policy, Users hereby consent to receive email from SIKU. Users acknowledge that notices posted on the Platform or sent to Users by email satisfy any legal requirement that notices be in writing. Users can set their email preferences in their Account Settings.</p>
I.	<p>Third-Party Materials</p>
I.1	<p>Arctic Eider may make third party content and services available on or through the Platform ("<b>Third Party Services</b>") solely as a convenience to Users (for example, links to third party websites, software and other services). For example, weather forecast from Environment Canada and information about ice conditions from SmartICE may be made available through the Platform.</p>
I.2	<p>When you leave the Platform or access these content of services through the Platform, you should be aware that these Terms of Use and all other Arctic Eider policies no longer govern your use of such websites and services or any content contained thereon. SIKU does not imply affiliation, approval, or control of any Third Party Services by making such Third Party Services available via the Platform. SIKU makes no claim or representation regarding, and accepts no responsibility for, the quality, accuracy, nature, ownership or reliability of Third Party Services. YOUR USE OF ANY SUCH THIRD PARTY SERVICES IS SOLELY AT YOUR OWN RISK AND SUBJECT TO THE APPLICABLE TERMS AND CONDITIONS AND PRIVACY POLICIES APPLICABLE TO SUCH THIRD PARTY SERVICES.</p>
J.	<p>Warranty Disclaimers and Exclusion of Liability</p>
J.1	<p>SIKU PROVIDES THE PLATFORM SOLELY ON AN "AS-IS" AND "AS-AVAILABLE" BASIS. SIKU MAKES NO EXPRESS WARRANTIES, CONDITIONS OR REPRESENTATIONS OF ANY KIND UNDER THESE TERMS OF USE TO ANY USER AND SIKU HEREBY DISCLAIMS ANY AND ALL IMPLIED WARRANTIES AND CONDITIONS, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OR CONDITIONS OF QUALITY, ACCURACY, COMPLETENESS, TIMELINESS, PERFORMANCE, MERCHANTABILITY, MERCHANTABLE QUALITY, FITNESS FOR A PARTICULAR PURPOSE, ABSENCE OF ANY SOFTWARE VIRUS OR OTHER HARMFUL COMPONENT, OR NON-INFRINGEMENT WITH RESPECT TO THE PLATFORM AND SIKU MATERIALS.</p>
J.2	<p>USERS ASSUME THE ENTIRE RISK AS TO THE USE, RESULTS AND PERFORMANCE OF THE PLATFORM. IN NO EVENT WILL SIKU, ITS AFFILIATES OR LICENSORS HAVE ANY LIABILITY TO USERS UNDER THESE TERMS OF USE OR ON THE BASIS OF TORT (INCLUDING NEGLIGENCE) OR ANY OTHER LEGAL THEORY FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, PUNITIVE OR CONSEQUENTIAL DAMAGES IN ANY AMOUNT RESULTING FROM (I) THE PROVISION, USE OR RESULTS OF THE PLATFORM, ANY DELAYS, ERRORS OR OMISSIONS THEREIN OR ANY DEFECT OR LACK THEREIN OF QUALITY, ACCURACY, COMPLETENESS, TIMELINESS, AVAILABILITY OR PERFORMANCE; (II) ANY LOSS OR DESTRUCTION OF USERS' DATA OR INFORMATION, OR THE COST OF RECOVERING SUCH DATA OR INFORMATION; (III) THE COST OF SUBSTITUTE OR REPLACEMENT SERVICES; (IV) LOST BUSINESS OPPORTUNITY, REVENUE OR PROFITS; (V) LIABILITY TO THIRD PARTIES; OR (VI) ANY OTHER CAUSE WHATSOEVER, EVEN IF SIKU OR ITS AFFILIATES OR LICENSORS WERE ADVISED OF THE POSSIBILITY OF ANY SUCH DAMAGES.</p>
J.3	<p>NOTWITHSTANDING ANYTHING TO THE CONTRARY IN THIS AGREEMENT OR ANY STATUTE OR RULE OF LAW TO THE CONTRARY, SUBJECT TO SECTION J.2, SIKU'S CUMULATIVE LIABILITY FOR ALL CLAIMS ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT AND THE PLATFORM AND SIKU MATERIALS, WHETHER DIRECTLY OR INDIRECTLY, INCLUDING WITHOUT LIMITATION, FROM OR IN CONNECTION WITH THE LICENCE, USE OR IMPROPER FUNCTIONING OF PLATFORM AND SIKU MATERIALS, SHALL NOT EXCEED COMPENSATION PAID BY A USER, IF ANY, TO SIKU FOR ACCESS OR USE OF THE PLATFORM.</p>
J.4	<p>IF A USER OBJECTS TO THESE TERMS OF USE, AS AMENDED BY SIKU FROM TIME TO TIME, THE USER'S ONLY RECOURSE IS TO IMMEDIATELY DISCONTINUE USE OF THE PLATFORM.</p>
J.5	<p>SIKU'S PERFORMANCE UNDER THIS AGREEMENT IS SUBJECT TO INTERRUPTION AND DELAY DUE TO CAUSES BEYOND ITS REASONABLE CONTROL, SUCH AS ACTS OF GOD, ACTS OF ANY GOVERNMENT OR GOVERNMENTAL AUTHORITY, WAR OR OTHER HOSTILITY, TERRORISM, CIVIL DISORDER, THE ELEMENTS, FIRE, EXPLOSION, POWER FAILURE, EQUIPMENT FAILURE, INDUSTRIAL OR LABOUR DISPUTE, INABILITY TO OBTAIN NECESSARY SUPPLIES, INABILITY OF ANY COMPUTER SYSTEM OR SOFTWARE TO PROPERLY CALCULATE DATES.</p>
K.	<p>Indemnity</p>
K.1	<p>To the maximum extent permitted by applicable law, you agree to defend, indemnify and hold harmless SIKU and its affiliates and subsidiaries (collectively, the "<b>Indemnified Parties</b>"), and the Indemnified Parties' independent contractors, service providers and consultants, and their respective directors, employees and agents, from and against any claims, damages, costs, liabilities and expenses (including reasonable legal fees and disbursements) arising out of or related to any User Content you post or otherwise transmit on or through the Platform, your use of or inability to use the Platform, the User Content, or the SIKU Materials, including any actual or threatened suit, demand or claim made against any of the Indemnified Parties and/or their independent contractors, service providers, employees, directors or consultants, arising out of or relating to your User Content, your conduct, your violation of these Terms of Use or your violation of the rights of any third party.</p>
L.	<p>Governing Law; Jurisdiction and Venue</p>
L.1	<p>Any claim, action, suit, proceeding or dispute arising out of these Terms of Use shall in all respects be governed by, and interpreted in accordance with, the substantive laws of the Province of Ontario, without regard to the conflicts of laws provisions thereof, and the laws of Canada applicable therein.</p>
M.	<p>Security</p>
M.1	<p>Security is important to us. SIKU takes steps to protect the Platform, and the content transmitted through the Platform. However, SIKU cannot and does not make any representation or warranty concerning security of any communication to or from the Platform or any representation or warranty regarding the interception by third parties of personal information or other information.</p>



**Appendix Figure 1.1:** SIKU platform Terms of Use, as of September 2023  
Retrieved August 13, 2023, from <https://siku.org/terms>

## Privacy Policy for SIKU Platform

SIKU, operated by the Arctic Eider Society ("SIKU", "we", "us", "our"), is committed to maintaining the accuracy, security and privacy of Personal Information in accordance with applicable legislation. This privacy policy (the "Privacy Policy") sets out how SIKU collects, uses and discloses Personal Information in connection with your access to and use of, including the content and functionality offered on or through, siku.org (<https://siku.org>) and the SIKU Mobile Apps (iOS and Android) (collectively, the "Platform").

This Privacy Policy is designed to respect Indigenous knowledge rights holders and ensure privacy, self-determination and stewardship over the information you provide. Our commitment is to only collect, use, and share Personal Information essential to providing the tools and services of the Platform and to allow users informed options for privacy over their posts and information. In order to provide and respect the guiding principles of the Terms of Use, it is of course necessary to store information about users and your posts for basic operation of the Platform. For example, to ensure accountability, users names and profiles are associated with their posts and it is necessary to collect and share this information to operate the Platform. This Privacy Policy outlines how we work to protect your privacy while providing these tools and services and ensuring the integrity of the Platform and its content.

## Consent

BY SUBMITTING PERSONAL INFORMATION TO SIKU OR BY USING THE PLATFORM YOU AGREE THAT SIKU MAY COLLECT, USE AND DISCLOSE SUCH PERSONAL INFORMATION IN ACCORDANCE WITH THIS PRIVACY POLICY AND AS PERMITTED OR REQUIRED BY LAW. Subject to legal and contractual requirements, you may refuse or withdraw your consent to certain identified purposes at any time by contacting the SIKU Privacy Officer at [info@siku.org](mailto:info@siku.org) (mailto:info@siku.org) or using the other contact information provided at the end of the Privacy Policy. If you refuse or withdraw your consent we may not be able to provide you or continue to provide you with certain services or information which may be of value to you.

This Privacy Policy covers the following topics:

1. What personal information do we collect?
2. Why do we collect personal information and how do we use it?
3. To whom do we disclose your Personal Information?
4. Where do we store your Personal Information?
5. How may you obtain access to your Personal Information?
6. How do we protect your Personal Information?
7. Privacy and our Platform
8. Changes to the Privacy Policy
9. Further information

## What Personal Information Do We Collect?

Personal Information means information about an identifiable individual. Not all information we collect identifies you or can be attributed as being identifiable about you. Similarly, we may aggregate your information with other information, or anonymize your information, in a way that it isn't attributable as being identifiable about you. This Privacy Policy does not apply to restrict our collection, use or disclosure of such anonymous or aggregated information, which we refer to in this Privacy Policy as "Aggregated Information".

We collect the following types of Personal Information when you visit or use the Platform:

- **Registration Information.** When you sign up for a user account, we may ask you to provide Personal Information such as your name, location, email address etc.
- **User Support Information.** We may collect Personal Information through your communications with our user support and outreach teams to respond to your inquiries, improve our Platform and offer you the Platform.
- **Platform Use Information.** We automatically collect Personal Information as you visit and use the Platform in our server logs and through the use of cookies. This is described in more detail in the section below entitled "Privacy and our Platform".

## Why Do We Collect Personal Information and How Do We Use It?

We use Personal Information for the following reasons:

- To display your profile, posts and comments on the Platform in accordance with the settings you have selected.
- To ensure that content from the Platform is presented in the most effective manner for you and for your computer or other device.
- To provide you with information or services that you request from us or which we feel may interest you, where you have consented to be contacted for such purposes.
- To notify you about changes to our Platform and provide you with information that may be relevant to your use of the Platform.
- To create Aggregated Information.
- For additional purposes that may be identified at or before the time that the Personal Information is collected, or that you subsequently consent to.

Without limitation, we use Aggregated Information that we produce for the following purposes:

- To better understand how users use the Platform to allow us to continually improve and expand the Platform.

## To Whom Do We Disclose Your Personal Information?

From time to time, we may disclose your Personal Information to:

- vendors and service providers including organizations or individuals retained by SIKU to perform functions on its behalf such as surveying, data processing, document management, and office services;
- any third party or parties, where you consent to such disclosure or where disclosure is required or permitted by law (for example, if you assign stewardship of certain posts to a third party project, organization, or individual through the Platform);
- as permitted by, and to comply with, any foreign and domestic legal or regulatory requirements or provisions; and
- as consented to by you from time to time, including to fulfill any other purposes that are identified when the Personal Information is collected from you.

We do not rent, sell, or share Personal Information about you with other people or companies for any other purposes.

## Where Do We Store Your Personal Information?

We take steps to ensure that your Personal Information is treated securely and in accordance with this Privacy Policy, including implementing reasonable industry standard practices. Unfortunately, the Internet cannot be guaranteed to be 100% secure, and we cannot ensure or warrant the security of any information you provide to us.

Your Personal Information is stored in locations and on servers located in Canada, controlled by SIKU, and located either at our offices or at the offices of our service providers. By submitting Personal Information, you agree to this storage and processing of your Personal Information. You acknowledge and agree that while your Personal Information is in a jurisdiction it may be accessed by the courts, law enforcement and national security authorities of that jurisdiction in accordance with the laws applicable in that jurisdiction.

If you are visiting the Platform from outside of Canada, please note that you are agreeing to the storage and processing of your information in Canada. By providing your information you consent to any transfer, including for storage and processing, in accordance with this Privacy Policy.

## How You May Obtain Access to Your Personal Information

Upon your written request, subject to certain exceptions, SIKU will inform you of the existence, use, and disclosure of your Personal Information and will give you access to that information. Access requests should be sent to our Privacy Officer using the contact information below.

There are a few instances where we may not be able to provide some of the Personal Information we hold, including:

- if it is subject to solicitor-client or litigation privilege;
- if it contains references to other individuals;
- if it cannot be disclosed for legal, security, or commercial proprietary reasons; or
- if it is prohibitively costly to provide.

Your Personal Information will be retained in accordance with SIKU's policies and procedures for storing Personal Information; however you may request in writing to the address below for the earlier deletion of your Personal Information (where reasonably practical).

## How Do We Protect Your Personal Information?

To help protect the confidentiality of your Personal Information, SIKU employs physical, administrative and technological safeguards appropriate to the sensitivity of your Personal Information. Where Personal Information is sent to a third party for processing we require that all Personal Information is kept secure. Please be aware though that, despite these efforts, no security measures are perfect and no systems are impenetrable. Particularly if you are using the password-protected areas of the Platform, your privacy can be enhanced by taking care to use suitably strong passwords that others cannot guess, that are kept safe by you, and that are not re-used on other websites. Taking steps like avoiding dictionary words or proper names and adding extra character and punctuation marks can also help protect you. If you believe your password has been compromised, you should change it immediately.

## Retention and Storage

Your Personal Information is stored on secure servers located in Canada.

Except as otherwise permitted or required by applicable law or regulation, we will only retain your Personal Information for as long as necessary to fulfill the purposes we collected it for, including for the purposes of satisfying any legal, accounting, or reporting requirements.

## Privacy and our Platform

When you browse or use our Platform, you should be aware of the following activities:

- **Cookies** - When you browse the Platform, we may use a browser feature called a 'cookie' to collect information such as the type of Internet browser and operating system the visitor uses, the domain name of the website from which the visitor came, date and duration of the visit, number of visits, average time spent on our Platform, pages viewed and number of cookies accumulated. A cookie is a small text file containing a unique identification number that identifies the visitor's browser, but not necessarily the visitor, to our computers each time our Platform is visited. Unless a visitor specifically informs us (e.g. by registering for an event or sending us correspondence from our Platform), we will not know who the individual visitors are. In addition to the identified purposes described in our Privacy Policy, we may use this Platform information and share it with other organizations with whom we have a commercial relationship to measure the use of our Platform, to improve the functionality and content of our Platform and to facilitate usage by a visitor.

Visitors can reset their browsers either to notify them when they have received a cookie or refuse to accept cookies. However, if a visitor refuses to accept cookies, he or she may not be able to use some of the features available on our Platform.

- **Online Communications** - Visitors may voluntarily submit Personal Information to us for purposes such as asking a question, obtaining information, or reviewing or downloading a publication.
- **Electronic Communications** - Occasionally, in compliance with Canada's Anti-Spam Law (CASL), we may send electronic communications to you with information that may be useful to you, including information about SIKU and other third parties with whom we have a relationship. We will include instructions on how to unsubscribe and inform us of preferences if you decide you do not want to receive any future e-mails from SIKU. Such preferences may also be expressed by e-mailing our Privacy Officer at [info@siku.org](mailto:info@siku.org) (<mailto:info@siku.org>) with your name and the electronic addresses you wish to have removed from our database. Please note, however, that in certain circumstances, SIKU may be required or empowered by law to send you certain important electronic messages notwithstanding an earlier unsubscribe request.
- **Links** - Our Platform may contain links to other websites which are provided as a convenience only. Visitors are advised that other third party websites may have different privacy policies and practices than SIKU, and SIKU has no responsibility for such third party websites.
- **Children's Privacy** - We do not knowingly collect, maintain, or use Personal Information from children under 13 years of age, and no part of our Platform is directed to children under the age of 13. If you learn that your child has provided us with Personal Information without your consent, you may alert us at [info@siku.org](mailto:info@siku.org) (<mailto:info@siku.org>). If we learn that we have collected any Personal Information from children under 13, we will promptly take steps to delete such information and terminate the child's account.

## Changes to this Privacy Policy

SIKU reserves the right to modify or supplement this Privacy Policy at any time. If we make a change to this Privacy Policy, we will post such changes on our Platform and make such revised policy and changes available upon request to SIKU's Privacy Officer. However, SIKU will obtain the necessary consents required under applicable privacy laws if it seeks to collect, use or disclose your Personal Information for purposes other than those to which consent has been obtained unless otherwise required or permitted by law.

## Further Information

SIKU's Privacy Officer oversees compliance with this Privacy Policy and applicable privacy laws. For information on SIKU's privacy practices or to inquire about SIKU's collection, use or disclosure of your Personal Information, please contact the SIKU Privacy Officer at:

[info@siku.org](mailto:info@siku.org) (<mailto:info@siku.org>)

The Arctic Eider Society  
House 408B Box 174  
Sanikiluaq, NU  
X0A 0W0  
Canda



SIKU IS BROUGHT TO YOU BY



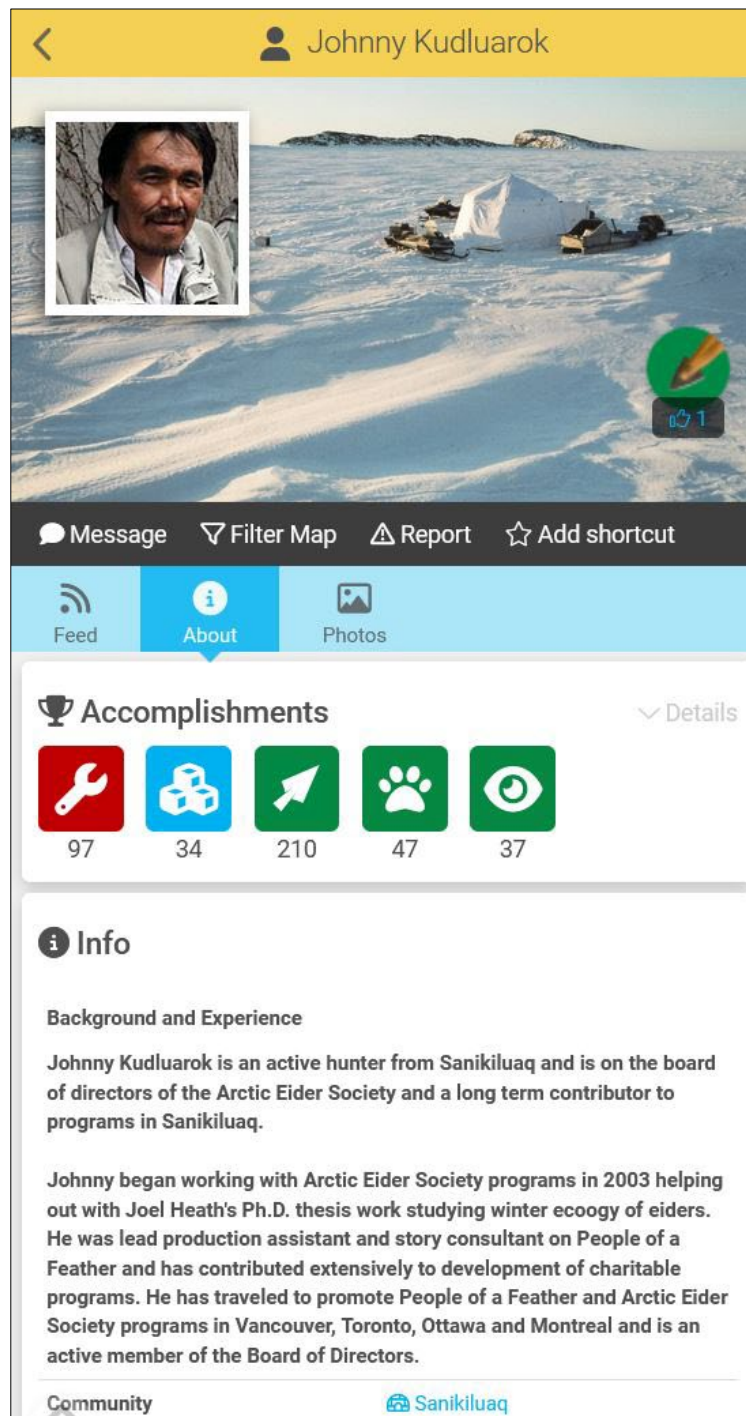
(<https://arcticeider.com>)

**Appendix Figure 1.2:** SIKU Privacy Policy, as of September 2023  
Retrieved August 13, 2023, from <https://siku.org/privacy>

## APPENDIX 2: SIKU INTERFACE



**Appendix Figure 2.1: SIKU promotional image**  
Retrieved August 13, 2023, from <https://www.siku.org/>. Copyright 2023 by <https://www.siku.org/>. Used with permission from AES.



**Appendix Figure 2.2:** Example of a SIKU user profile  
Retrieved February 23, 2023, from <https://www.siku.org/>. Used with permission from AES.

### APPENDIX 3: PROJECT LETTER OF INFORMATION AND PROJECT SUMMARY



#### Master of Arts Research Project, McMaster University

**Project Title:** Mapping Sanikiluarmit Knowledge for Qikiqtait Protected Area Development

**Research Partners:** The [Arctic Eider Society](#), the Qikiqtait Protected Area Committee, [SIKU](#), and the Sanikiluaq Hunters and Trappers Association

**Research Topics:** Inuit-led and managed conservation, linking conservation and technology with Sanikiluarmit knowledge, community-driven research

**Research Goals:** The goal of this project is to assess the capacity of SIKU (the Indigenous Knowledge Social Network) data to support Inuit-led protected area design. This is an important part of understanding the influence of Sanikiluarmit (people of Sanikiluaq) knowledge on shaping protected area design and implementation. This project will also investigate how Sanikiluarmit monitoring data can be used to meet the Qikiqtait Protected Area Committee priorities.

**Project Overview:** Conservation programs have often excluded Indigenous knowledge, management, and priorities. However, the importance of Indigenous protected areas and the incorporation of Indigenous knowledge in management strategies is being increasingly recognized. The Belcher Islands Archipelago in southern Nunavut are culturally, ecologically, and biologically important islands. The Qikiqtait Protected Area project is a conservation program that aims to protect the Belcher Islands and build capacity for a conservation economy in the community of Sanikiluaq, Nunavut. Since 2019, Sanikiluarmit hunters, harvesters, and environmental monitors have been collecting data on important species on the islands through SIKU. The Qikiqtait Protected Area project represents the first time the SIKU mobile app and web platform has been used in protected area development.

This research project will involve mapping and analyzing data from the SIKU app to address Qikiqtait Committee priorities. The primary goal is to assist the planning and implementation of the Qikiqtait Protected Area by developing a baseline Qikiqtait resource inventory. To contribute to this inventory, maps and graphs showing the distribution, abundance, and seasonality of harvesting in the Belcher Islands will be produced. An analysis of trips, including catch per unit effort and travel type, will also be completed using GIS (Geographic Information Systems) and statistical software. This research is important to learn about the advantages and challenges of using community monitoring data to produce conservation management strategies. The results of this analysis will help to create a process for using SIKU data to support the establishment of future Inuit-led conservation initiatives and economies. The analysis will be conducted by [Regena Sinclair](#), a graduate student at McMaster University supervised by [Gita Liubicic](#). The Qikiqtait Protected Area Committee will oversee Regena's research, and all results will be provided to the committee and shared in SIKU. Results will also be included in Regena's Master of Arts thesis and related publications and presentations.

**Proposed Research Objectives:** This project will work under the guidance of the Arctic Eider Society (AES) and QPA Steering Committee to:

1. Contribute to the QPA resource inventory by mapping distribution, abundance, and richness of key species and areas according to hunter and environmental monitor data;
2. Compare how the resource inventory data aligns with, and can support, QPA management priorities;
3. Compare the resource inventory data to other sources such as the Nunavut Coastal Resources Inventory participatory mapping project; and,
4. Assess the capacity of SIKU as a tool to contribute to a community approach to Inuit-led protected area development and ongoing management.

**Research Significance:** This research project will contribute to efforts to improve collaborative and Inuit-driven approaches to developing protected areas by:

- Examining the potential for new technology to support Indigenous governance and conservation initiatives;
- Exploring methods of weaving Inuit and scientific knowledge together in conservation planning following Inuit methodologies; and,
- Supporting Inuit self-determination in conservation projects.

**Privacy and Opt-out:** All SIKU posts tagged to the Qikiqtait Project will be included in this research, according to a research agreement with the Arctic Eider Society, the Qikiqtait Protected Area Committee, and McMaster University. This project will not use or disclose any personal information relating to the SIKU posts. Names will be removed from SIKU posts prior to analysis. Post photos will be examined to verify species information, and photos containing persons will not be downloaded from the SIKU platform. **If you do not wish your SIKU posts to be used for this project, please contact our research team by May 31, 2022, to opt-out of this analysis (see below).**

**Ethics and Licensing:**

McMaster Research Ethics Board  
Phone: (905) 525-9140 ext. 23142  
Email: [ethicsoffice@mcmaster.ca](mailto:ethicsoffice@mcmaster.ca)  
McMaster Research Ethics application number: 5233  
McMaster Research Ethics approval date: October 25, 2021

Nunavut Research Institute  
Phone: (867) 979-7280  
Nunavut Research Institute license number: 01 007 21R-M

**Project Contacts:** For further information, please feel free to contact us!

Dr. Gita Ljubicic  
Associate Professor  
School of Earth, Environment and Society, McMaster University  
Canada Research Chair in Community-Engaged Research for Northern Sustainability  
Phone: (289) 659-2074  
Email: [gita.ljubicic@mcmaster.ca](mailto:gita.ljubicic@mcmaster.ca)  
Facebook: Gita Ljubicic  
Twitter: @straightupnorth  
Website: <https://straightupnorth.ca/gita-ljubicic/>

Regena Sinclair  
Master of Arts Student  
School of Earth, Environment and Society, McMaster University  
Phone: (705) 341-1635  
Email: [sinclr6@mcmaster.ca](mailto:sinclr6@mcmaster.ca)  
Facebook: Regena.Sinclair.GIS  
Twitter: @Regena\_Sinclair  
Website: <https://straightupnorth.ca/regena-sinclair/>

**Appendix Figure 3.1:** Thesis project Letter of Information



### Mapping Sanikiluarmit Knowledge for Qikiqtait Protected Area Development

The Qikiqtait Protected Area project is a conservation program that aims to protect the Belcher Islands and build capacity for a conservation economy in Sanikiluaq. This research project will involve mapping and analysing data from SIKU (the Indigenous Knowledge Social Network) to address Qikiqtait Protected Area priorities.

The primary goal is to assist the planning and implementation of the Qikiqtait Protected Area by developing a baseline resource inventory for the Qikiqtait Protected Area. To contribute to this inventory, maps and graphs showing the distribution, abundance, and seasonality of harvesting in the Belcher Islands will be produced. An analysis of trips will also be completed using GIS (Geographic Information Systems) and statistical software.

This project is interested in how Sanikiluarmit knowledge and monitoring data can support Qikiqtait Protected Area priorities, and how SIKU data can assist Inuit-led conservation programs and economies.

The analysis will be conducted by [Regena Sinclair](#), a graduate student at McMaster University, supervised by [Gita Ljubicic](#). The Arctic Eider Society and the Qikiqtait Protected Area Steering Committee will oversee Regena's research, and all results will be provided to the Committee and shared in SIKU.

If you do not wish your SIKU posts to be used for this project, please contact our research team by May 31, 2022, to opt-out of this analysis. For further information, please see the project page at <https://straightupnorth.ca/qikiqtait-protected-area-development/>.

**Appendix Figure 3.2: Thesis Project Summary**

## **APPENDIX 4: SIKU POST QUALITY CONTROL/QUALITY ASSURANCE AND DATA PREPARATION WORKFLOW**

**BOLDED** tasks occurred within the SIKU database.

**1. Search all spelling options for each species in the SIKU Qikiqtait Project  
Manage Posts view**

**2. Regena QC/QA:**

- a. All berry
- b. All fox
- c. All goose
- d. All seal
- e. Alpine bearberry
- f. Arctic fox
- g. Bearded seal
- h. Beluga whale
- i. Blueberry
- j. Brant goose
- k. Cackling goose
- l. Canada goose (long and short neck)
- m. Cloudberry
- n. Common eider
- o. Common merganser
- p. Cranberry
- q. Crowberry
- r. Harp seal
- s. Hooded seal
- t. King eider
- u. Polar bear
- v. Ptarmigan
- w. Raspberry
- x. Red bearberry

- y. Red fox
- z. Lingonberry
- aa. Red-breasted merganser
- bb. Reindeer
- cc. Ringed seal
- dd. Ross's goose
- ee. Snow goose
- ff. Walrus

3. Jordan QC/QA (reviewed by Regena for issues and duplicates)

- a. All cod
- b. All fish
- c. Arctic char
- d. Arctic cod
- e. Arctic scallop
- f. Blue mussel
- g. Clam
- h. Green urchin
- i. Greenlandic cod
- j. Sculpin
- k. Sea cucumber
- l. Seaweed
- m. Whitefish

**4. Download CSV of posts and trips**

5. Convert CSV to Excel spreadsheet

- a. Add 18 new columns
  - i. "Type EDIT"
  - ii. "Title"
  - iii. "Number of Animals Hunted in Photos"
  - iv. "Total Harvest"
  - v. "Reviewed"
  - vi. "Edited in SIKU"

- vii. “For Analysis”
- viii. “Duplicated Harvest”
- ix. “Notes”
- x. “Requires Change to Observation”
- xi. “Requires Change to Hunting Story”
- xii. “Requires Change to Flock”
- xiii. “Requires Change to Nest”
- xiv. “Requires Change to Social Post”
- xv. “Requires Change to Group Post”
- xvi. “Requires Change to Individual Post”
- xvii. “Requires Change of Species”
- xviii. “Multiple Species in Post”

6. The “Title” field updated for any post that included a title

## 7. Update posts

### a. For wildlife:

- i. **Update the “# of animals hunted” field in the post with the number of animals in the photos, and record that the change was made in the “Quality Assurance Notes” and “Edited in SIKU”**
  - 1. **E.g., “# of animals hunted” field updated to #, DATE RS**
  - 2. Field is not updated for berry or invertebrate species
- ii. If there was a different number of animals hunted already entered in the post, record in “Number of Animals Hunted in Photos” for a case-by-case review and do not edit original post
- b. In the case of Individual Hunting Stories where more than one animal or species was harvested, note in “Requires Change to Group Post” for potential SIKU update to Group (*not possible to edit within SIKU*)
  - i. For bird species, note in “Requires Change to Flock”
    - 1. Note: the Flock post type on SIKU was changed to the Group post type after QC/QA had been completed
- c. In the case of Group Hunting Stories where only one animal or species was harvested, note in “Requires Change to Individual Post” for potential SIKU update to Individual (*not possible to edit within SIKU*)

- d. **In the case of Wildlife Observations that should be Hunting Stories, update post to “Hunting Story” and fill in fields, and record that the change was made in the “Quality Assurance Notes” and “Edited in SIKU”**
  - i. E.g., “Updated from Observation to Hunting Story DATE RS”
  - ii. If a post cannot be changed on SIKU, due to data that could be lost, or restricted posts, note in “Requires Change to Hunting Story”
- e. **In the case of Hunting Stories that should be Observations, copy all information entered in the hunting fields to another more appropriate field, and then change to an Observation and record that the change was made in the “Quality Assurance Notes” and “Edited in SIKU”**
  - i. E.g., “Updated from Hunting Story to Observation DATE RS”
  - ii. If a post cannot be changed on SIKU, due to data that could be lost, or restricted posts, note in “Requires Change to Observation”
- f. In the case of Trips, note the number of animals or species harvested in “Number of Animals Hunted in Photos” (*not possible to edit within SIKU*) unless the harvest has already been captured in a harvesting post associated with the Trip

**8. Check the “Reviewed” box for all examined posts and “Reviewed”**

**9. Check the “Edited” box for a post where fields have been updated/changed**

**10. Record issues/anomalies**

- a. Note posts that are the incorrect species for potential SIKU update (*not possible to edit in SIKU*) in “Requires Change of Species”
  - i. E.g., cranberries > lingonberry (red partridge berry)
- b. Note posts contain Inuktitut for review in “Notes”
- c. In the case of two species harvested or observed in one post (one post for multiple species) note in “Multiple Species in Post” and “Notes”
- d. In the case of posts that are of smoking meat, indicate 0 in “# of animals hunted” field, and note in “Requires Change to Social Post”
- e. In the case of posts that show a bird nest with no bird harvest, note in “Requires Change to Nest”

**11. After review, update “Type EDIT” to reflect any changes**

**12. Remove the following that are non-harvesting instances:**

- a. Observations
  - i. Except for berry and invertebrate species

1. It can be assumed that all Observations included some harvesting
    2. Analysis focusses on species presence
  - b. Social Posts
  - c. Ice Observations
  - d. Tracks
  - e. Dens
  - f. Nests
  - g. Trips with no harvest data, harvest already recorded in an associated post, or with no photo
  - h. Trips that contain harvest photos that have already been captured in a Hunting Post
  - i. Mortalities
  - j. Fetuses
  - k. Survey posts, or posts by “Eider# Survey” that do not contain a harvest
13. Mark remaining harvesting posts in “For Analysis”
14. Update “Total Harvest” field
- a. Use the “# of Animals Hunted”, unless:
    - i. Field is blank, then use the “Number of Animals Hunted in Photos” value
    - ii. “Number of Animals Hunted in Photos” value is larger than the “# of Animals Hunted” value
    - iii. If “Number of Animals Hunted in Photos” value is smaller than the “# of Animals Hunted” value, it can be assumed that the rest of the harvest was just not included in the photographs
    - iv. If post has no photo or other indication of the number of animals hunted, the default values are:
      1. Individual – 1
      2. Group – 2
  - a. Except berry and invertebrate species, will always be assigned 1
  - b. Review for multiple posts of the same harvest (duplicates):
    - i. Filter the map view on SIKU for each day with multiple posts

- ii. If a harvesting post has no photo, it is counted in “Total Harvest” unless the same poster has another post at the same location, date and time
  - 1. For multiple Individual posts of the same harvest on the same day at a similar time at the same location (either as a result of several users of the same harvesting party each making a post of the same harvest, or of one user making multiple posts of the same harvest), the first post in terms of time the post was made will receive a 1 in “Total Harvest”, and all the rest of the posts will receive a 0.
    - a. Unless first post has no photo, then first post with a photo will receive 1 in “Total Harvest”
    - b. If multiple posts are made by the same user, all posts with no photos will be assumed duplicates and receive 0 in “Total Harvest”
    - c. If all posts by the same user do not contain photos, they are assumed duplicates and receive the first post will be assigned 1 in “Total Harvest” and the rest will receive a 0
    - d. For berry and invertebrate species, only posts showing the exact same harvest photo are removed as duplicates
  - 2. For multiple Group posts of the same harvest (the result of each user of harvesting party making a post of the same harvest), the totals will be spread evenly in “Total Harvest” among the posts in order of post time. This means it is possible for some posts to receive a 0 in “Total Harvest”.
    - a. Unless first post has no photo, then first post with a photo will receive value in “Total Harvest”
    - b. If multiple posts are made by the same user, all posts with no photos will be assumed duplicates and receive 0 in “Total Harvest”
    - c. If all posts by the same user do not contain photos, they are assumed duplicates and receive the first post will be assigned a value in “Total Harvest” and the rest will receive a 0
    - d. For berry and invertebrate species, only posts showing the exact same harvest photo are removed as duplicates

3. For a mix of Individual and Group posts, (the result of each user of a harvesting party making a post of the same animals), the Individual posts will receive 1 in “Total Harvest” in order of post time, and the remaining harvest will be spread among the Group posts in order of time. This means it is possible for some posts to receive a 0 in “Total Harvest”.
  - a. Unless first post has no photo, then first post with a photo will receive value in “Total Harvest”
  - b. If multiple posts are made by the same user, all posts with no photos will be assumed duplicates and receive 0 in “Total Harvest”
  - c. If all posts by the same user do not contain photos, they are assumed duplicates and receive the first post will be assigned a value in “Total Harvest” and the rest will receive a 0
  - d. For berry and invertebrate species, only posts showing the exact same harvest photo are removed as duplicates
4. If duplicate posts are in different locations, each post will receive 0.5 in “Total Harvest”.
5. If the first duplicate post is a Social post, the second harvesting post is counted in “Total Harvest”
- iii. If a Hunting Story has no location, it is counted in “Total Harvest” unless the user has another post at the same date and time
15. Note any other issues as they arise in “Notes”
16. Send posts in need of review to QPA Steering Committee for feedback
17. Compile all species harvest instances into species-specific spreadsheets for analysis
  - a. Remove duplicate posts that might have come from different spreadsheets
18. Remove dates outside of analysis period

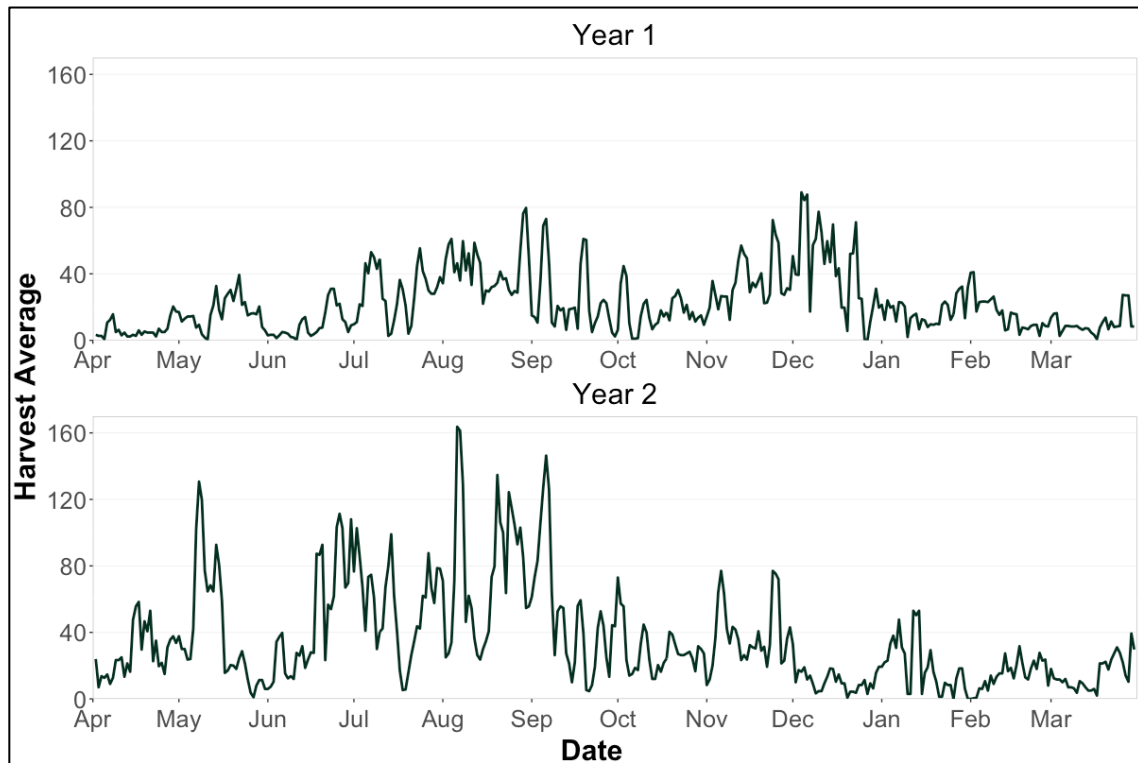
## APPENDIX 5: SIKU POST SPECIES KEYWORDS

**Appendix Table 5.1:** Species search keywords used in the Qikiqtaik Project

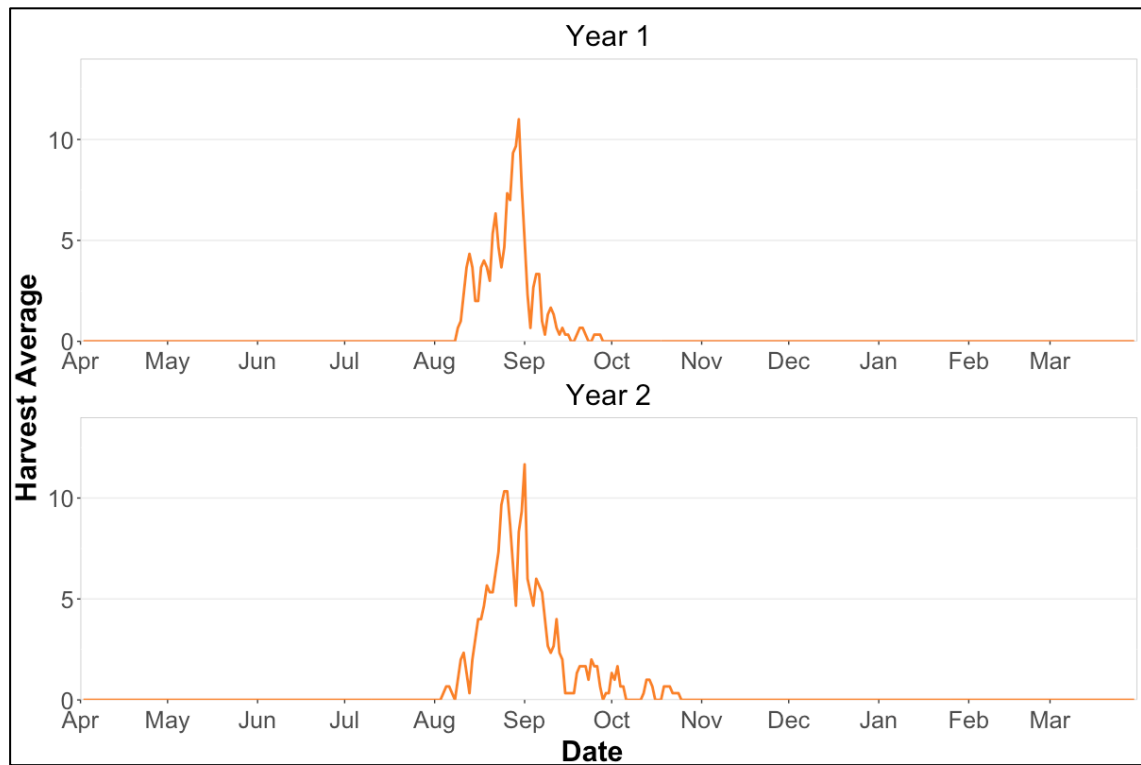
Species	SIKU Post Search Keywords
All berries	berry, berries
All cod	cod
All fish	fish, net
All fox	fox
All goose	goose, geese
All seal	seal
Alpine bearberry	kallat, alpine bearberry, alpine, kallak, kallait
Arctic char	Arctic char, iqaluppik, char (posts made by users with names containing “char” were removed)
Arctic cod	Arctic cod, uugaq
Arctic fox	Arctic fox, tiriganiarjuk
Arctic scallop	scallop, tallurunnaq
Bearded seal	bearded seal, bearded, utjuk
Beluga whale	beluga, whale, qilalugaq
Blue mussel	blue mussel, uviluq, uviluk, mussel
Blueberry	blueberry, blue, kigutangirnaq, tungujuit, tungujuk, tungujuq, kigutigarnaq
Brant goose	Brant goose, nirlinnait
Cackling goose	cackling goose, nirlinak
Canada goose (long and short neck)	Canada, short neck, long neck, nirlik
Clam	clam, ammuumajuq, ammuumajuk
Cloudberry	arpik, cloudberry, cloud, arpiks, aqpatuk, arpiit, aqpiit
Common eider	common eider, mitiq, eider
Common merganser	common merganser, merganser, appangiuu
Cranberry	cranberry, kipningat
Crowberry	crowberry, crow, black, paurngaq
Green Urchin	sea urchin, urchin, mirqulik, green urchin
Greenlandic cod	Greenlandic cod
Harp seal	harp seal, harp, qaigulik
Hooded seal	hooded seal, hooded, natsivak
King eider	king eider, qingalik
Polar bear	polar bear, bear, polar, nanuq
Ptarmigan	ptarmigan, aqiggiq
Raspberry	raspberry
Red bearberry	red, red bearberry, bear, kublak
Red fox	red fox

Lingonberry (formally red partridge berry on SIKU)	kimminaq, red (partridge) berry, kimmernaq, kimminait
Red-breasted merganser	red-breasted merganser
Reindeer	caribou, tuktu, reindeer
Ringed seal	ringed seal, ringed, natsik
Ross's goose	Ross's goose, qaaraarjuk
Sculpin	scuplin, kanajuq
Sea cucumber	sea cucumber, cucumber, quksurjuk
Seaweed	seaweed, aqajaq
Snow goose	snow goose, kangutva
Walrus	walrus, aiviq
Whitefish	whitefish, kapihilik

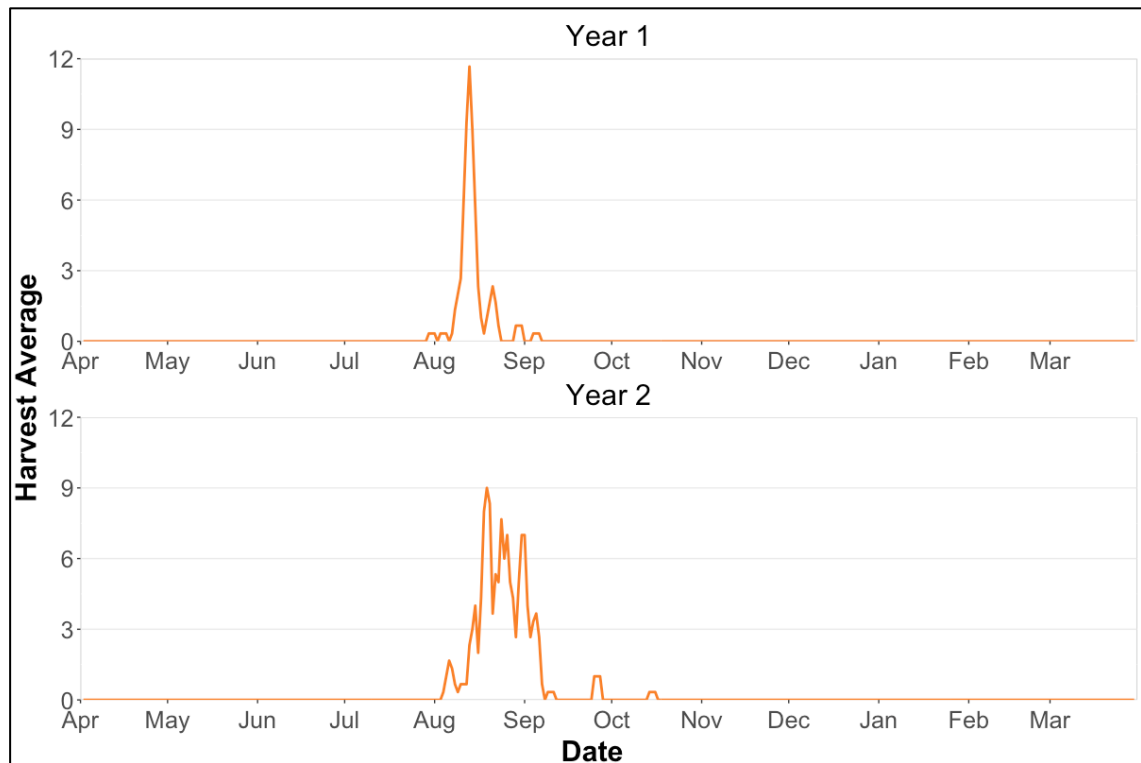
**APPENDIX 6: THREE-DAY MOVING WINDOW AVERAGE OF TOTAL  
ANNUAL HARVEST GRAPHS**



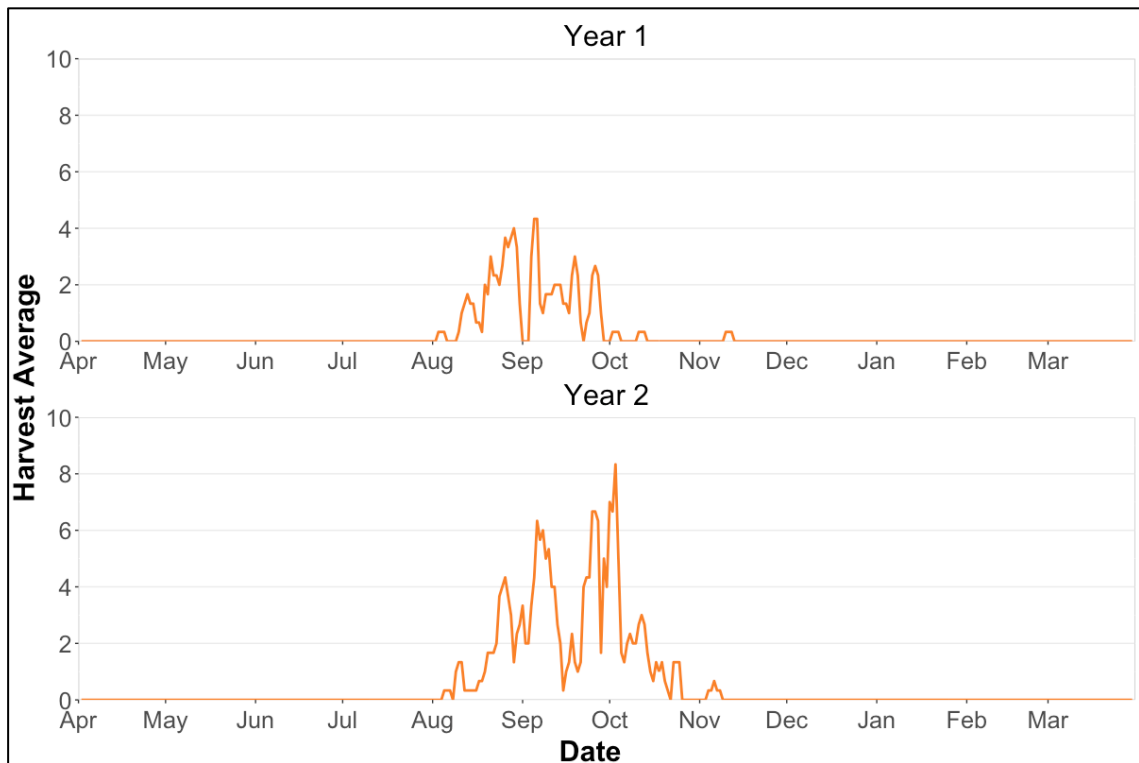
**Appendix Figure 6.1:** Three-day moving average of daily harvest for all 14 analysis species



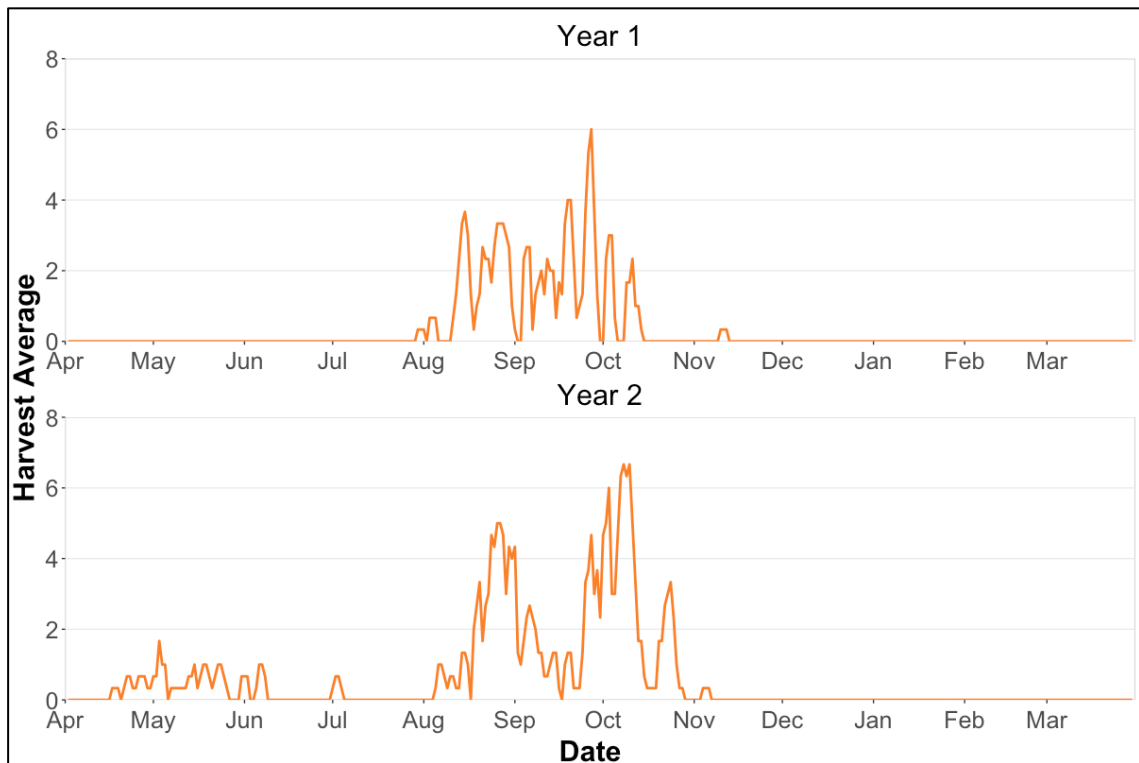
**Appendix Figure 6.2:** Three-day moving average of daily harvest for blueberry



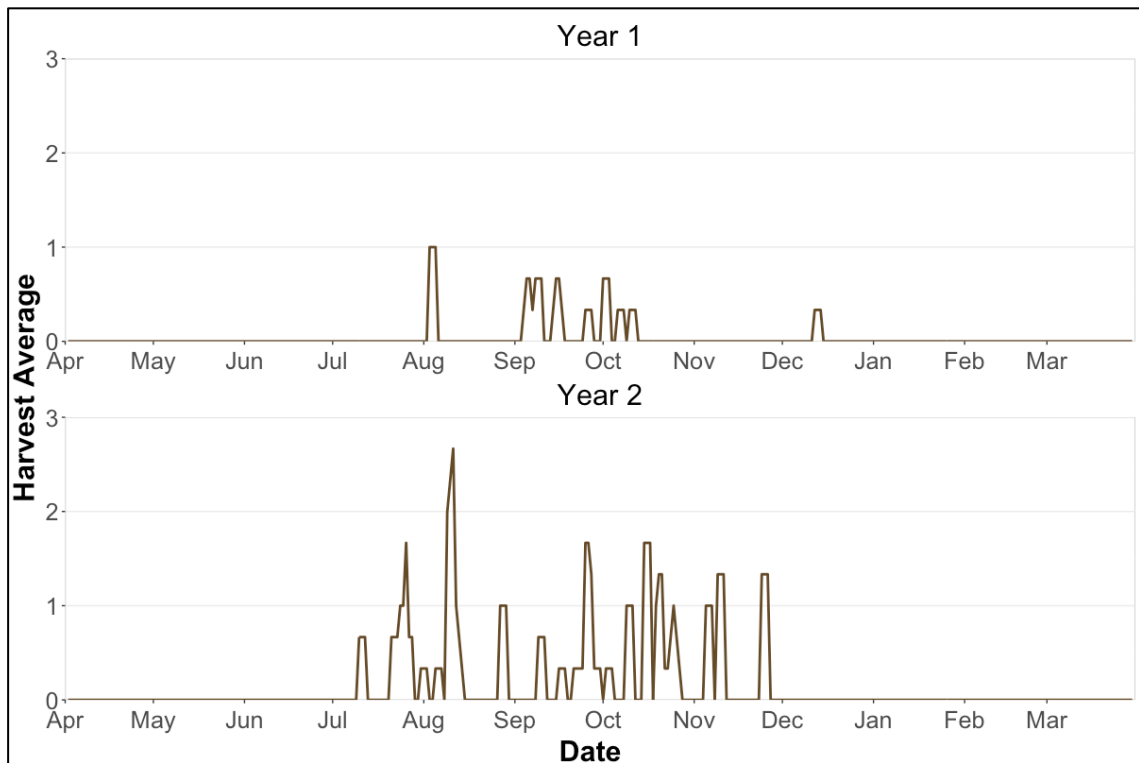
**Appendix Figure 6.3:** Three-day moving average of daily harvest for cloudberry



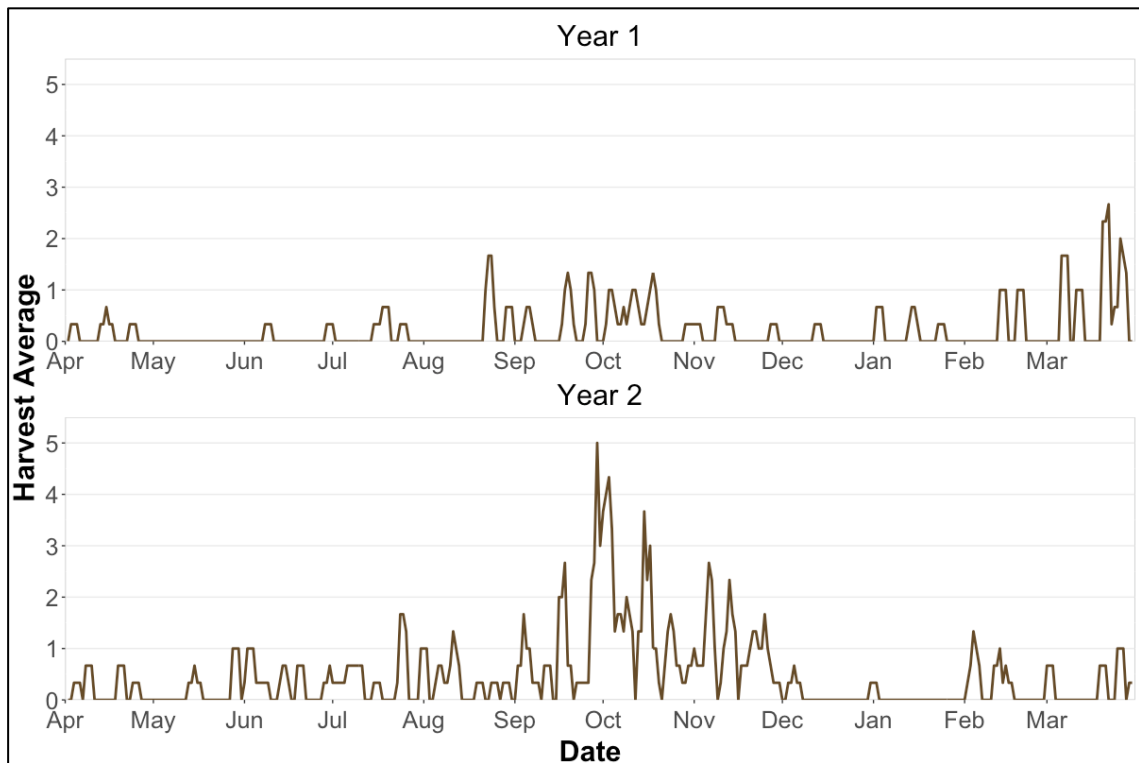
**Appendix Figure 6.4:** Three-day moving average of daily harvest for crowberry



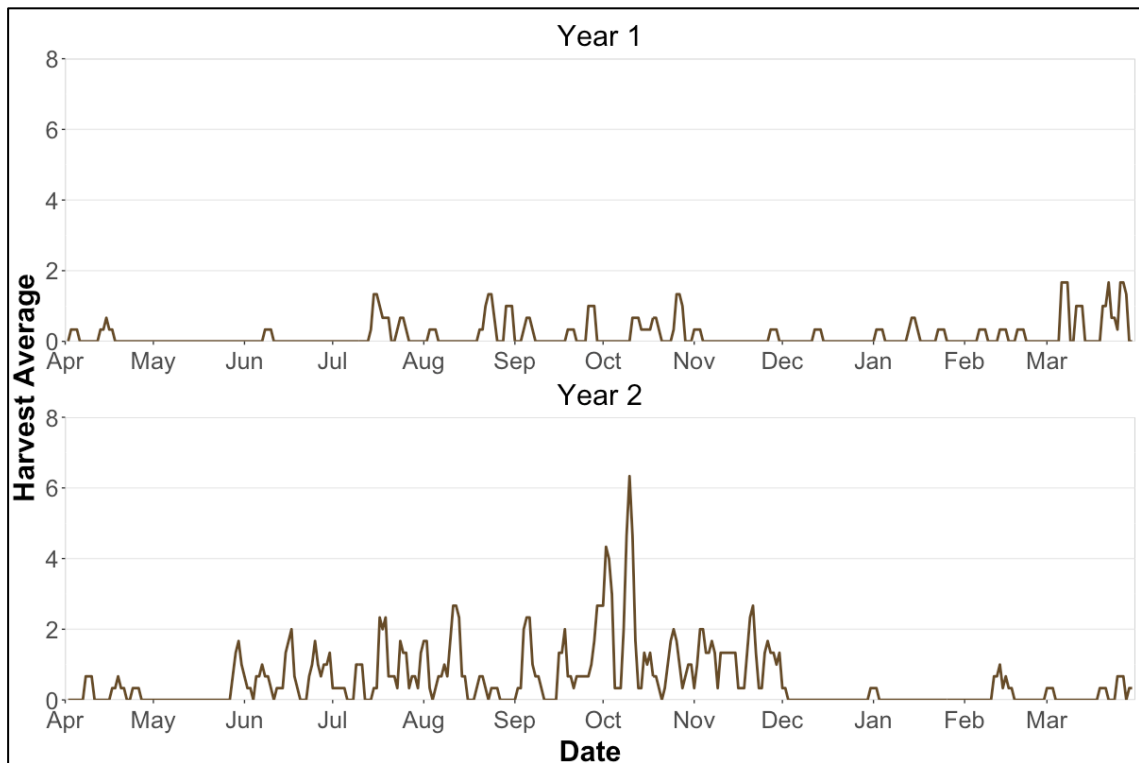
**Appendix Figure 6.5:** Three-day moving average of daily harvest for lingonberry



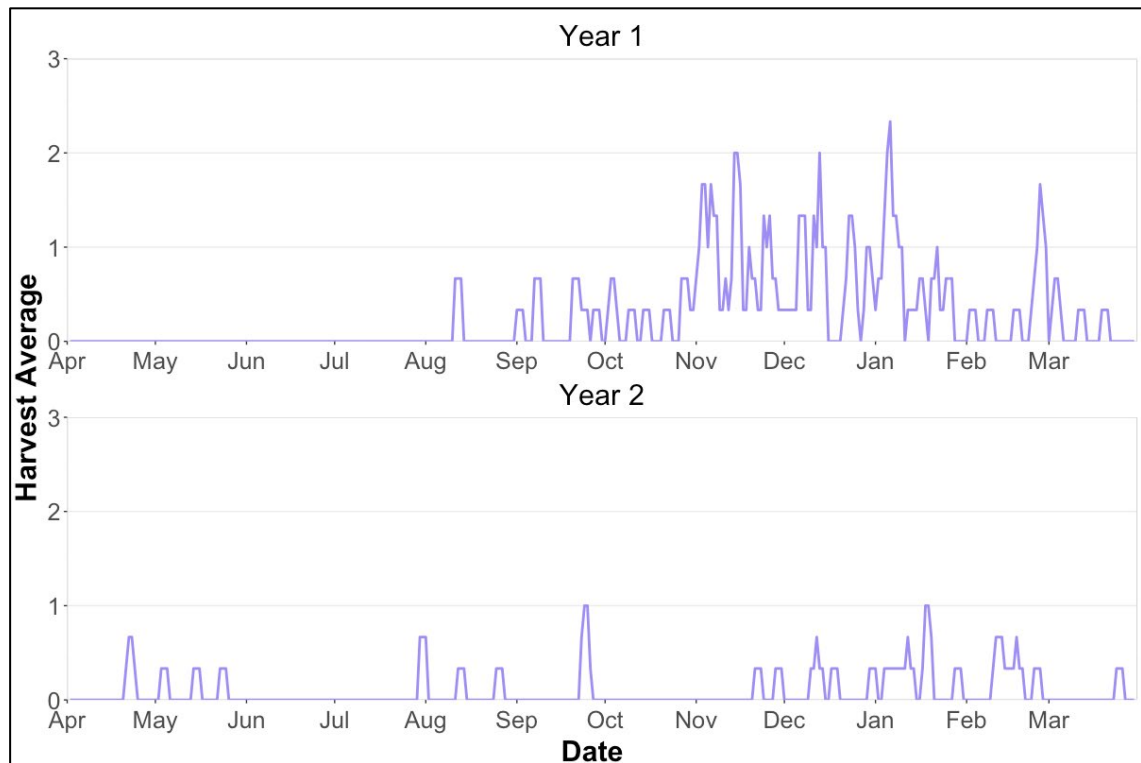
**Appendix Figure 6.6:** Three-day moving average of daily harvest for Arctic scallop



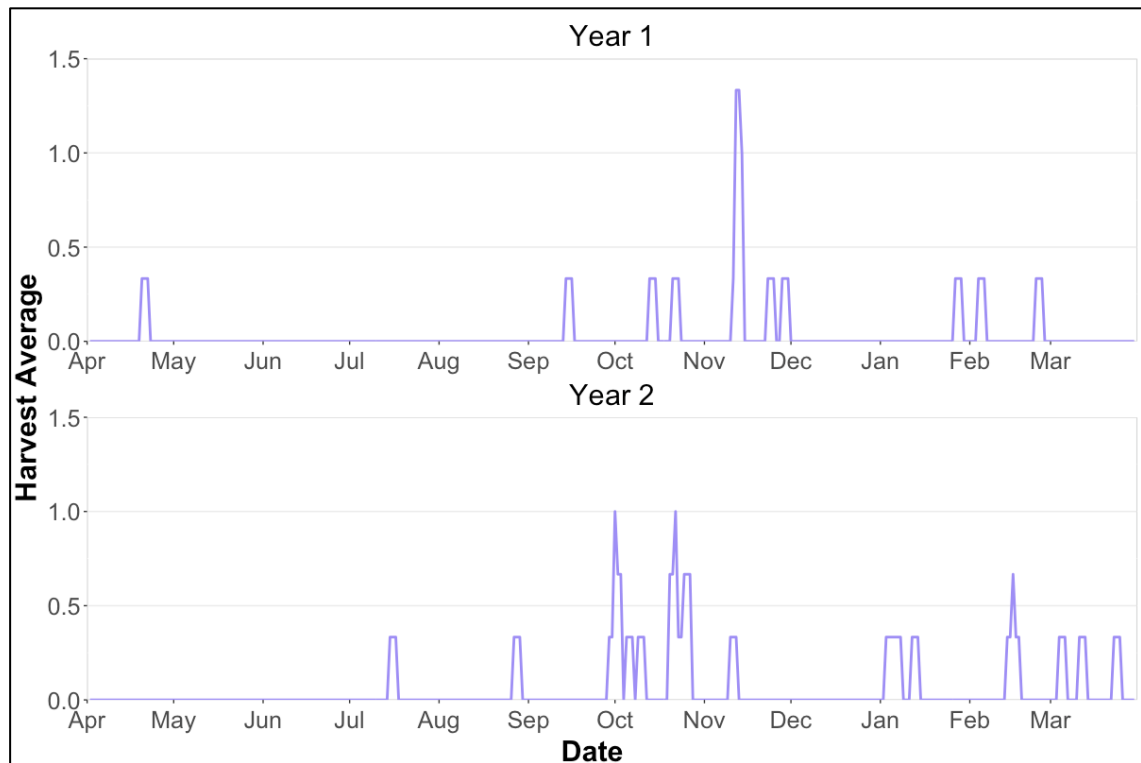
**Appendix Figure 6.7:** Three-day moving average of daily harvest for blue mussel



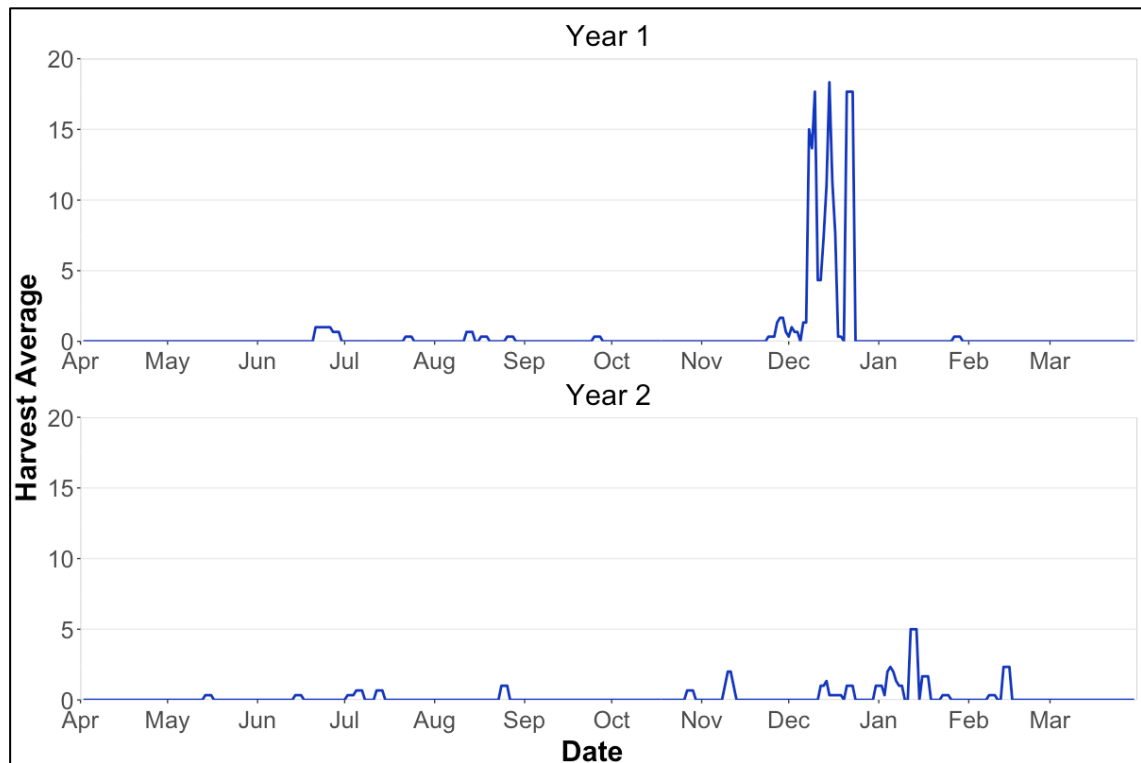
**Appendix Figure 6.8:** Three-day moving average of daily harvest for green urchin



**Appendix Figure 6.9:** Three-day moving average of daily harvest for Arctic fox



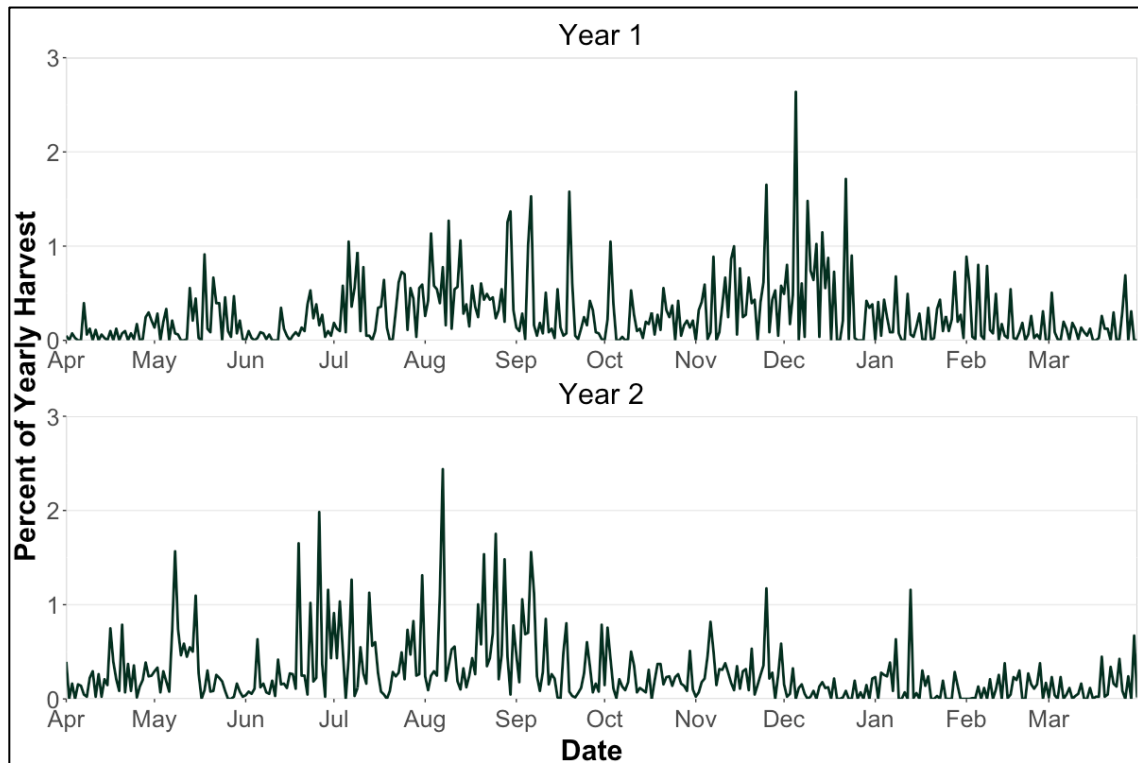
**Appendix Figure 6.10:** Three-day moving average of daily harvest for bearded seal



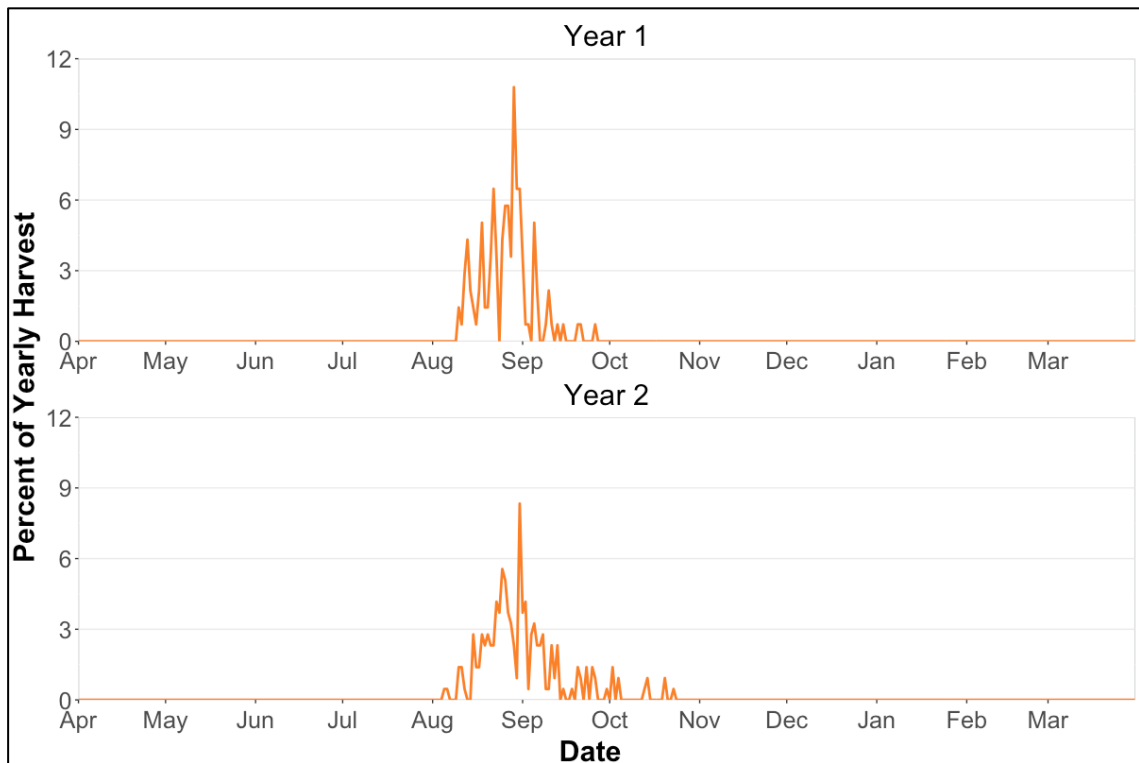
**Appendix Figure 6.11:** Three-day moving average of daily harvest for whitefish

## APPENDIX 7: PERCENTAGE OF TOTAL ANNUAL HARVEST PER DAY

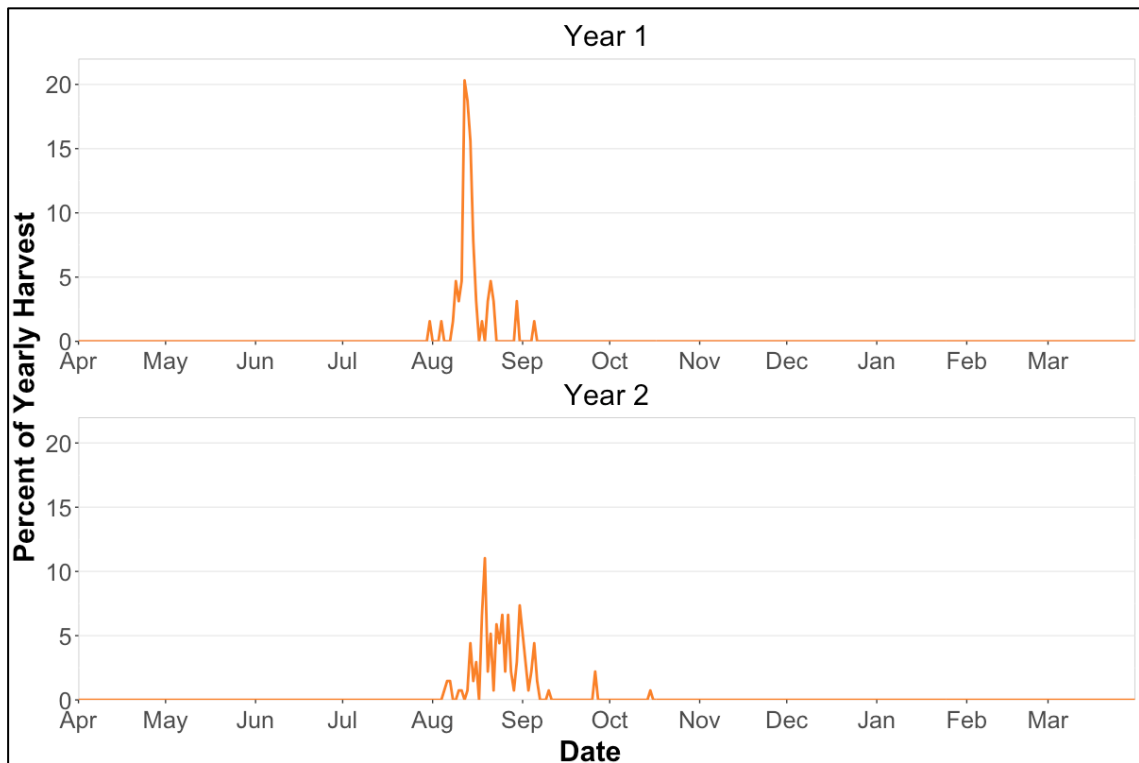
### GRAPHS



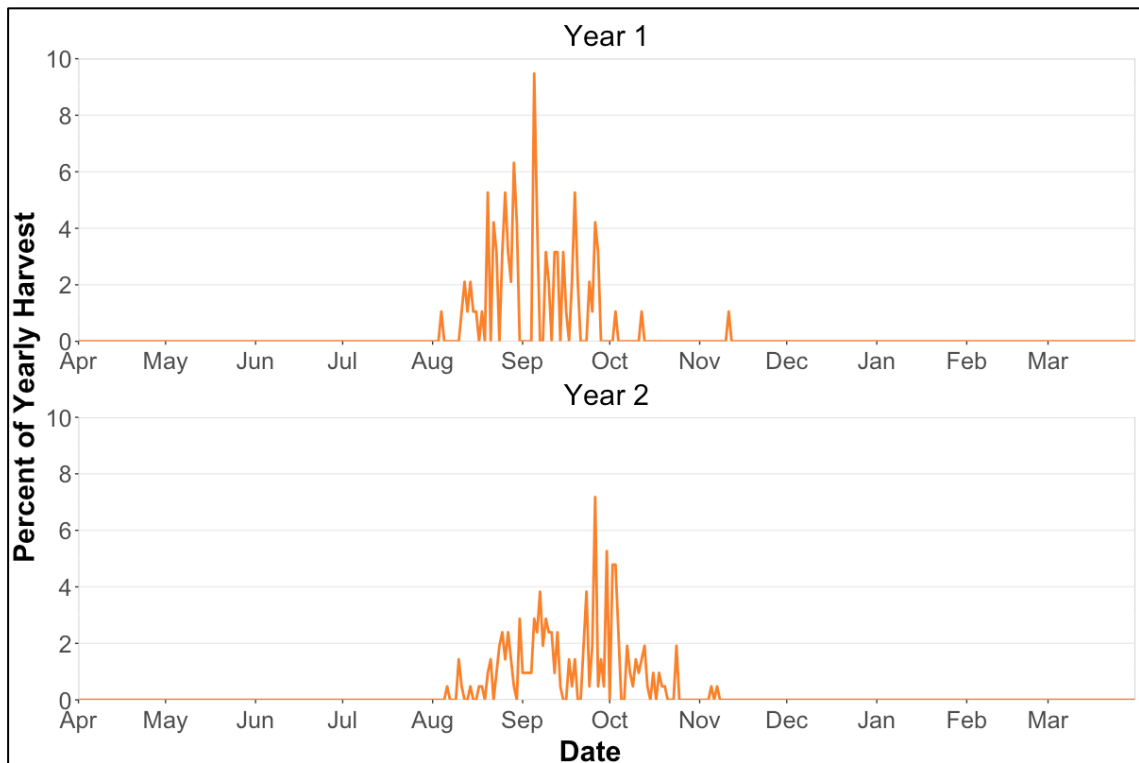
**Appendix Figure 7.1:** Daily percentage of the total annual harvest for all 14 analysis species



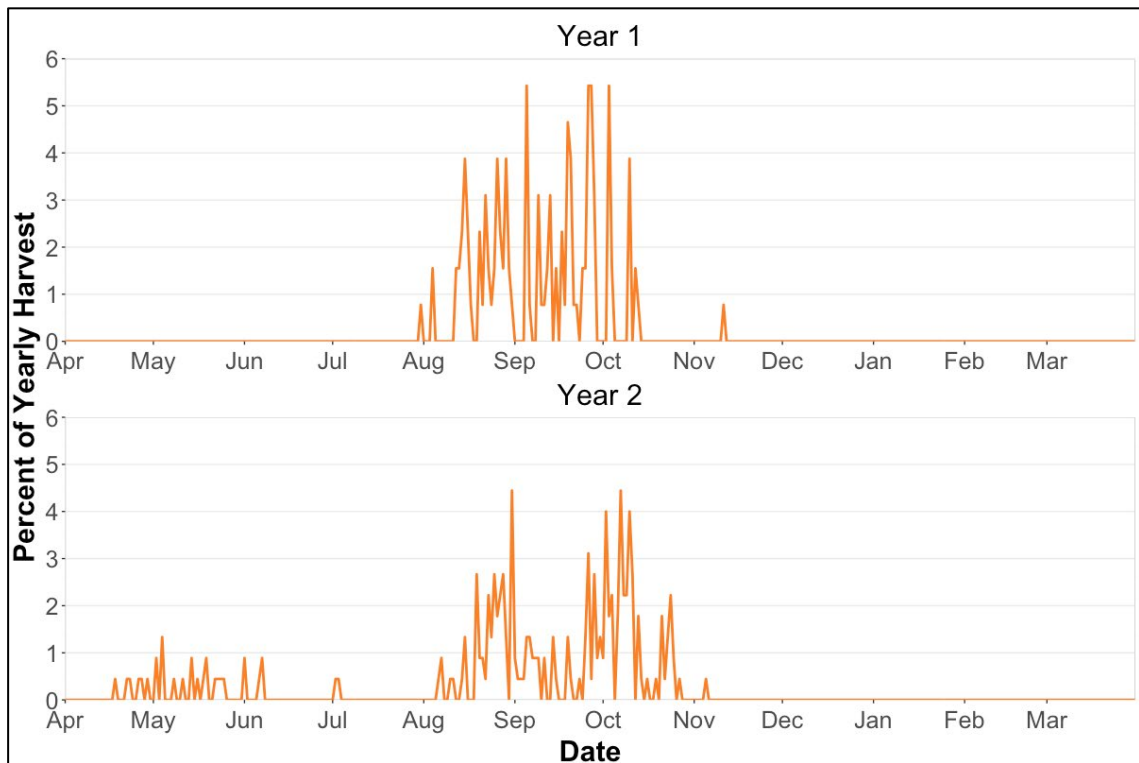
**Appendix Figure 7.2:** Daily percentage of the total annual harvest for blueberry



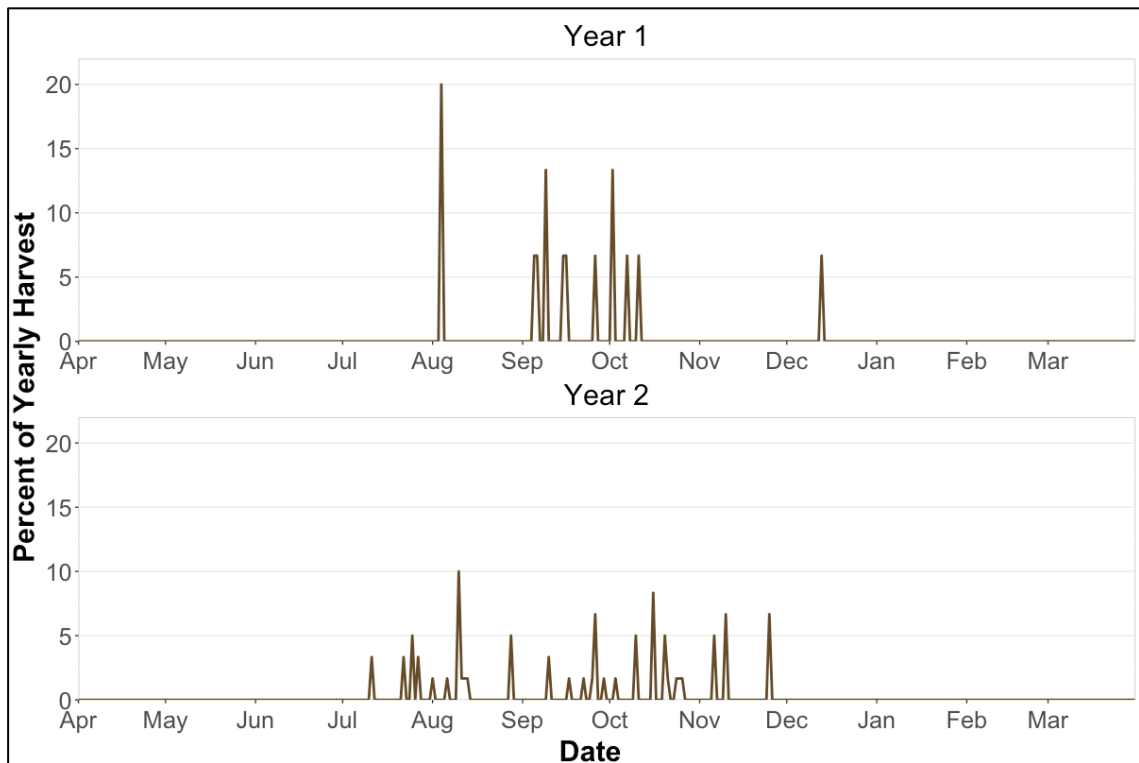
**Appendix Figure 7.3:** Daily percentage of the total annual harvest for cloudberry



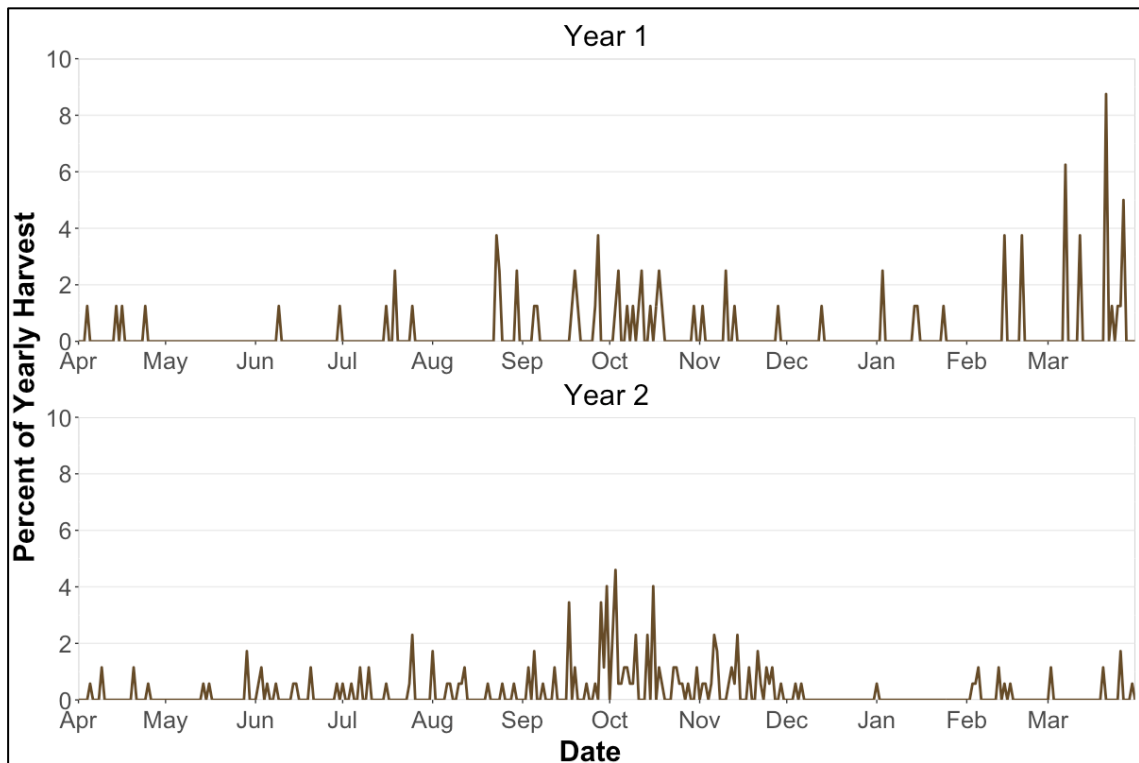
**Appendix Figure 7.4:** Daily percentage of the total annual harvest for crowberry



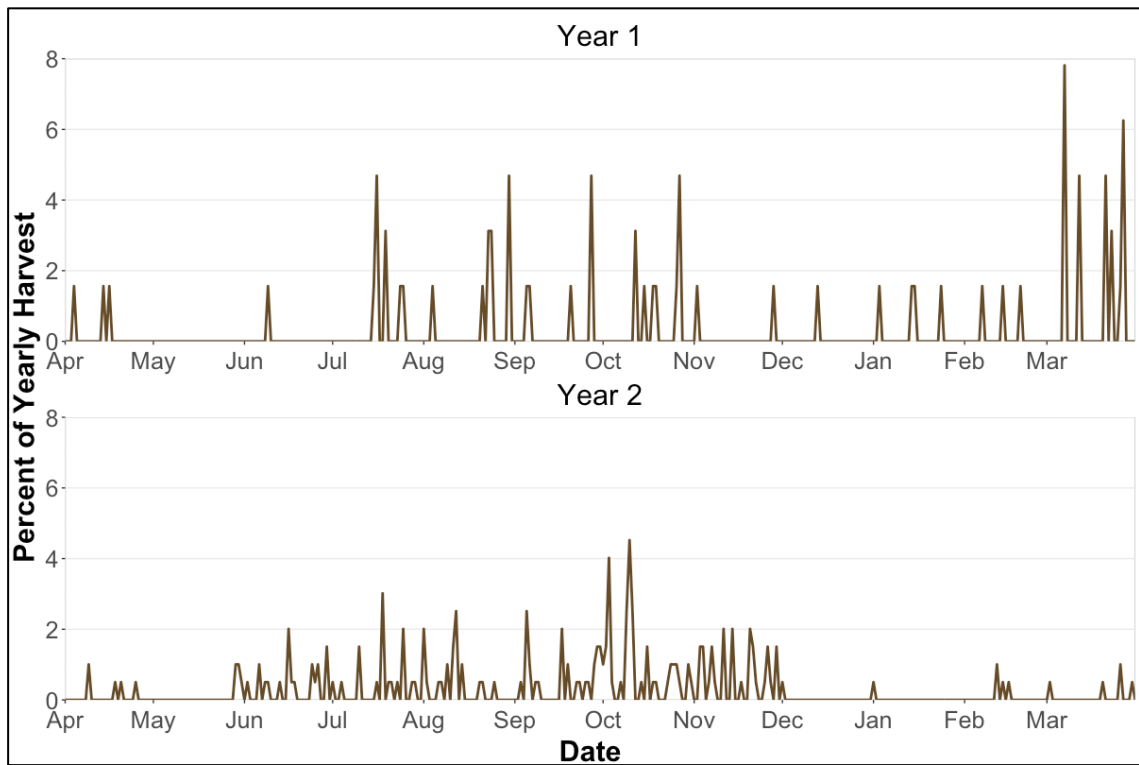
**Appendix Figure 7.5:** Daily percentage of the total annual harvest for lingonberry



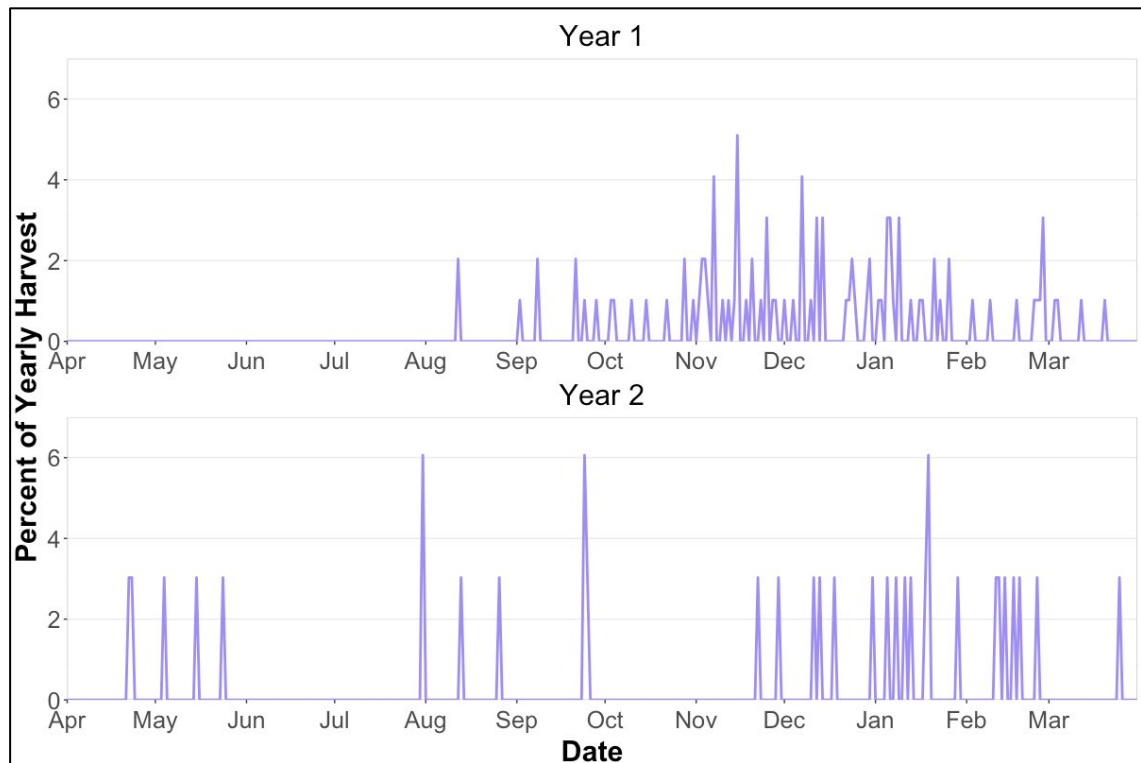
**Appendix Figure 7.6:** Daily percentage of the total annual harvest for Arctic scallop



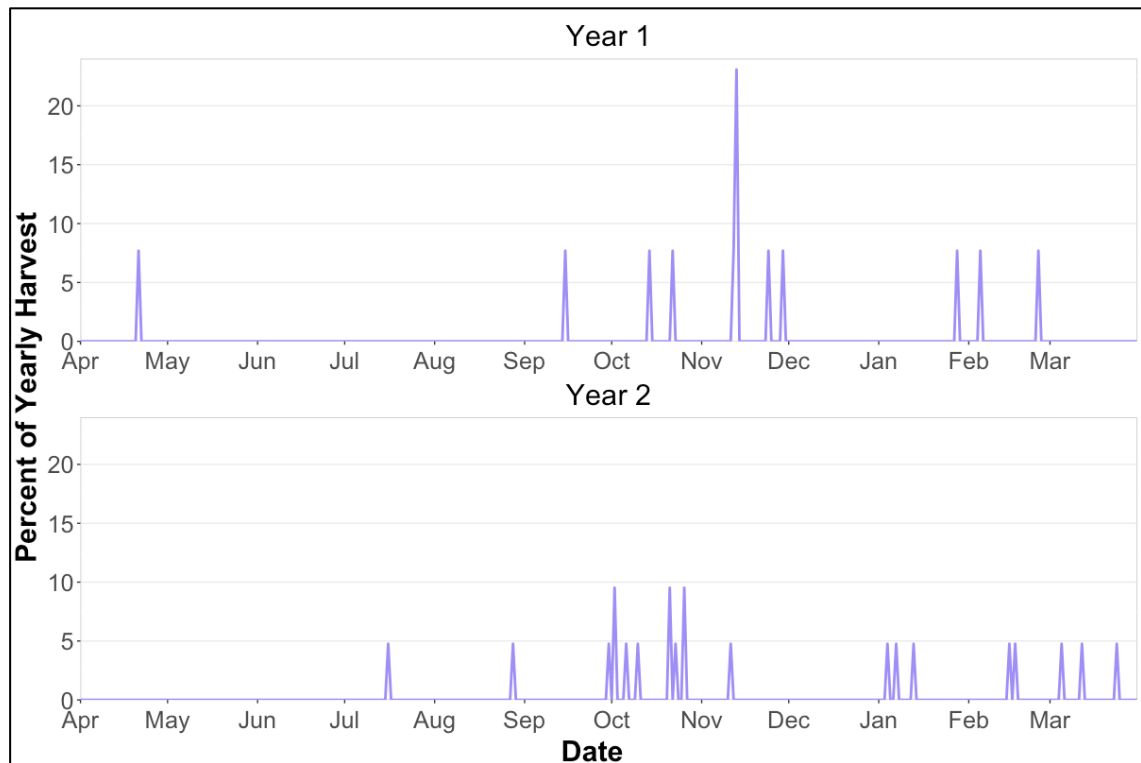
**Appendix Figure 7.7:** Daily percentage of the total annual harvest for blue mussel



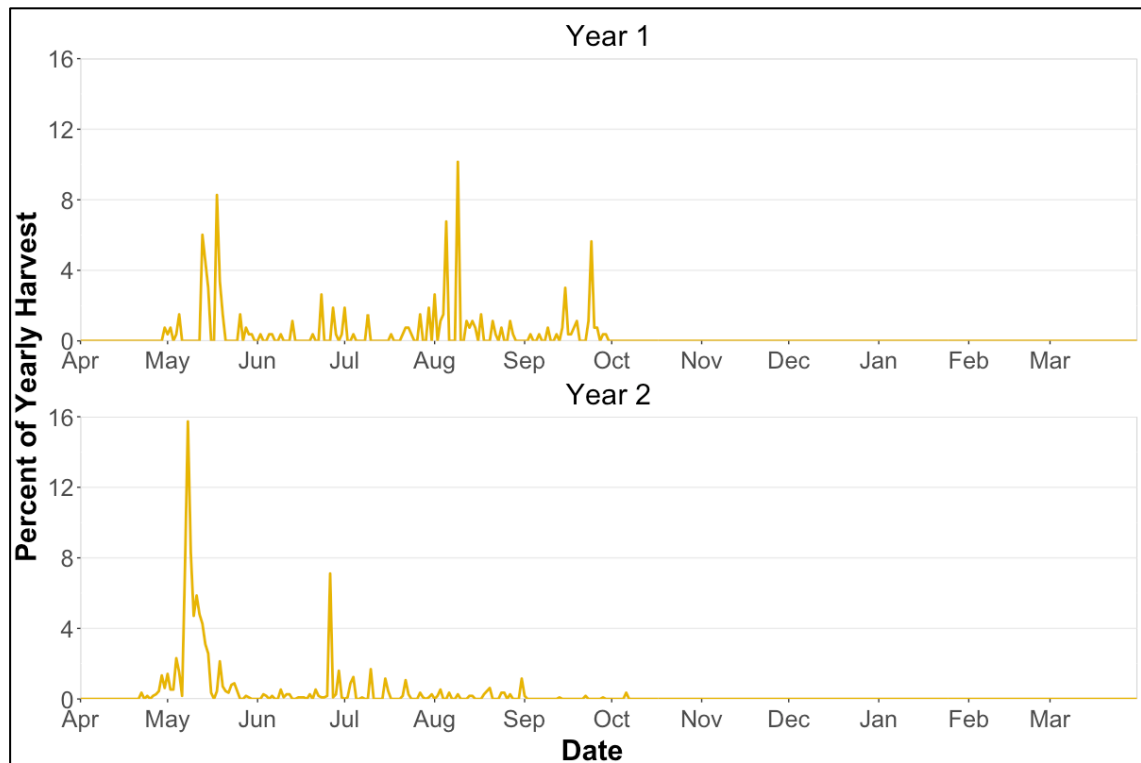
**Appendix Figure 7.8:** Daily percentage of the total annual harvest for green urchin



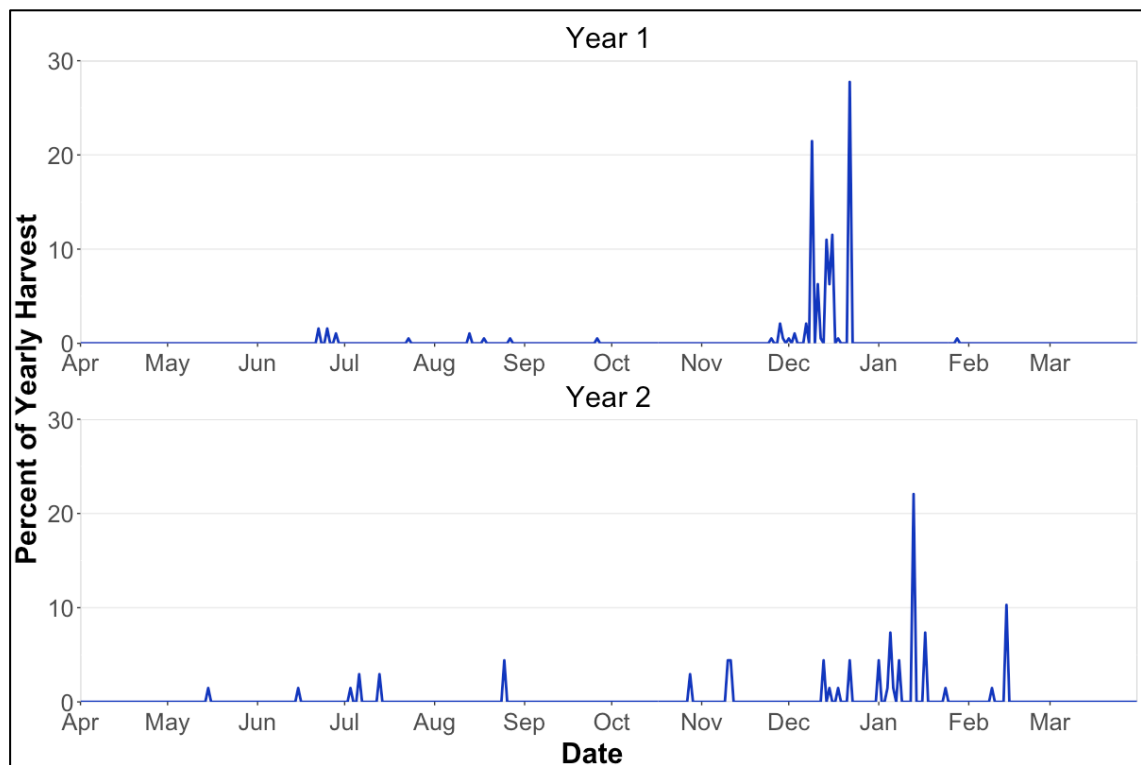
**Appendix Figure 7.9:** Daily percentage of the total annual harvest for Arctic fox



**Appendix Figure 7.10:** Daily percentage of the total annual harvest for bearded seal



**Appendix Figure 7.11:** Daily percentage of the total annual harvest for Canada/cackling goose



**Appendix Figure 7.12:** Daily percentage of the total annual harvest for whitefish

## APPENDIX 8: MAPPING PARAMETERS

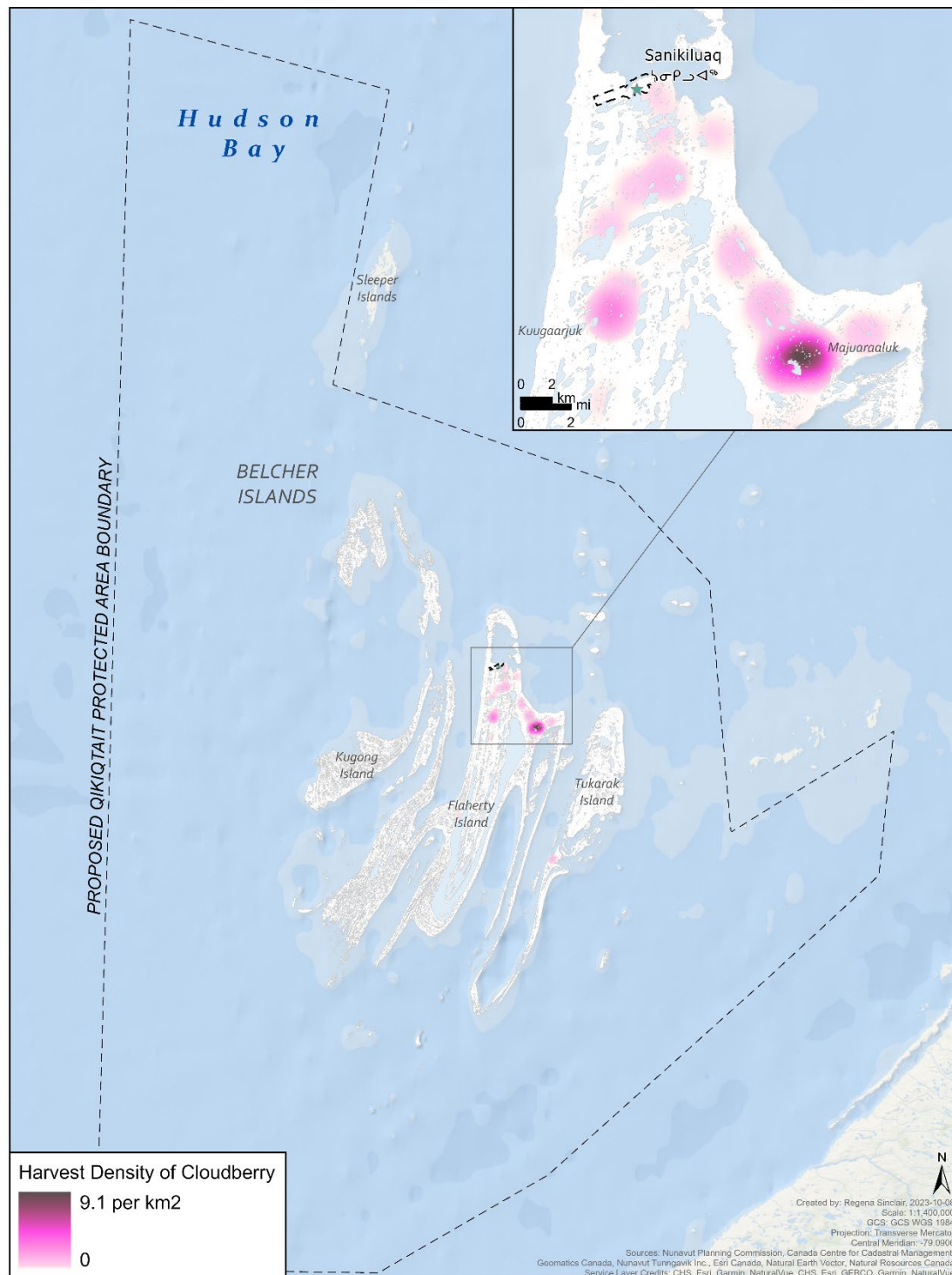
**Appendix Table 8.1:** Kernel Density tool parameters – Post and Harvest Density

Species	Population Field	Output Cell Size	Default Search Radius - All Years (m)	Total Posts	Selected Posts	Default Search Radius - Year 1 (m)	Total Posts	Selected Posts	Default Search Radius - Year 2 (m)	Total Posts	Selected Posts	Area Units	Output Value	Method	Input Barrier Features	Mask
All species	NONE	50	3336.53	3777	3444	---	---	---	---	---	---	KM <sup>2</sup>	Densities	Geodesic	Qlikqatit_No_Town	Qlikqatit_No_Town
Arctic char	NONE	50	5195.14	2365	2174	---	---	---	---	---	---	KM <sup>2</sup>	Densities	Geodesic	Qlikqatit_No_Town	Marine_No_Town
Harvest Density																
All species	Harvest_Total	50	3253.62	3777	3444	4010.03	1412	1238	3493.90	2365	2206	KM <sup>2</sup>	Densities	Geodesic	Qlikqatit_No_Town	Qlikqatit_No_Town
Blueberry	Harvest_Total	50	2754.83	267	272	4172.80	122	92	2467.31	213	180	KM <sup>2</sup>	Densities	Geodesic	Marine	Land_No_Town
Cloudberry	Harvest_Total	50	2164.42	189	160	3701.27	57	42	2236.39	132	118	KM <sup>2</sup>	Densities	Geodesic	Marine	Land_No_Town
Crowberry	Harvest_Total	50	4353.68	290	244	6196.65	88	64	3612.23	202	180	KM <sup>2</sup>	Densities	Geodesic	Marine	Land_No_Town
Lingonberry	Harvest_Total	50	4433.28	335	276	6581.14	117	89	4441.24	218	187	KM <sup>2</sup>	Densities	Geodesic	Marine	Land_No_Town
Blue mussel	Harvest_Total	50	513.53	234	227	1094.11	73	68	402.73	161	159	KM <sup>2</sup>	Densities	Geodesic	Land	Marine_No_Town
Green urchin	Harvest_Total	50	947.57	260	246	2239.52	63	58	801.73	197	188	KM <sup>2</sup>	Densities	Geodesic	Land	Marine_No_Town
Arctic scallop	Harvest_Total	50	4803.14	74	73	6827.67	15	15	4974.16	59	58	KM <sup>2</sup>	Densities	Geodesic	Land	Marine_No_Town
Arctic fox	Harvest_Total	50	3488.54	121	111	3803.05	90	80	6266.49	31	31	KM <sup>2</sup>	Densities	Geodesic	Qlikqatit_No_Town	Qlikqatit_No_Town
Bearded seal	Harvest_Total	50	15234.09	34	31	11338.91	13	10	117249.16	21	21	KM <sup>2</sup>	Densities	Geodesic	Land	Marine_No_Town
Ringed seal	Harvest_Total	50	6290.80	605	583	7960.04	275	264	6755.54	330	319	KM <sup>2</sup>	Densities	Geodesic	Land	Marine_No_Town
Canada/cackling goose	Harvest_Total	50	6803.16	514	485	9728.45	137	125	7023.59	377	360	KM <sup>2</sup>	Densities	Geodesic	Qlikqatit_No_Town	Qlikqatit_No_Town
Common eider	Harvest_Total	50	2081.45	746	698	2281.06	334	304	2293.20	412	394	KM <sup>2</sup>	Densities	Geodesic	Qlikqatit_No_Town	Qlikqatit_No_Town
Arctic char	Harvest_Total	50	3663.97	2365	2174	3778.17	778	697	4030.93	1587	1477	KM <sup>2</sup>	Densities	Geodesic	Land	Marine_No_Town
Whitefish	Harvest_Total	50	4229.52	70	67	2342.81	32	30	10791.81	38	37	KM <sup>2</sup>	Densities	Geodesic	Land	Marine_No_Town

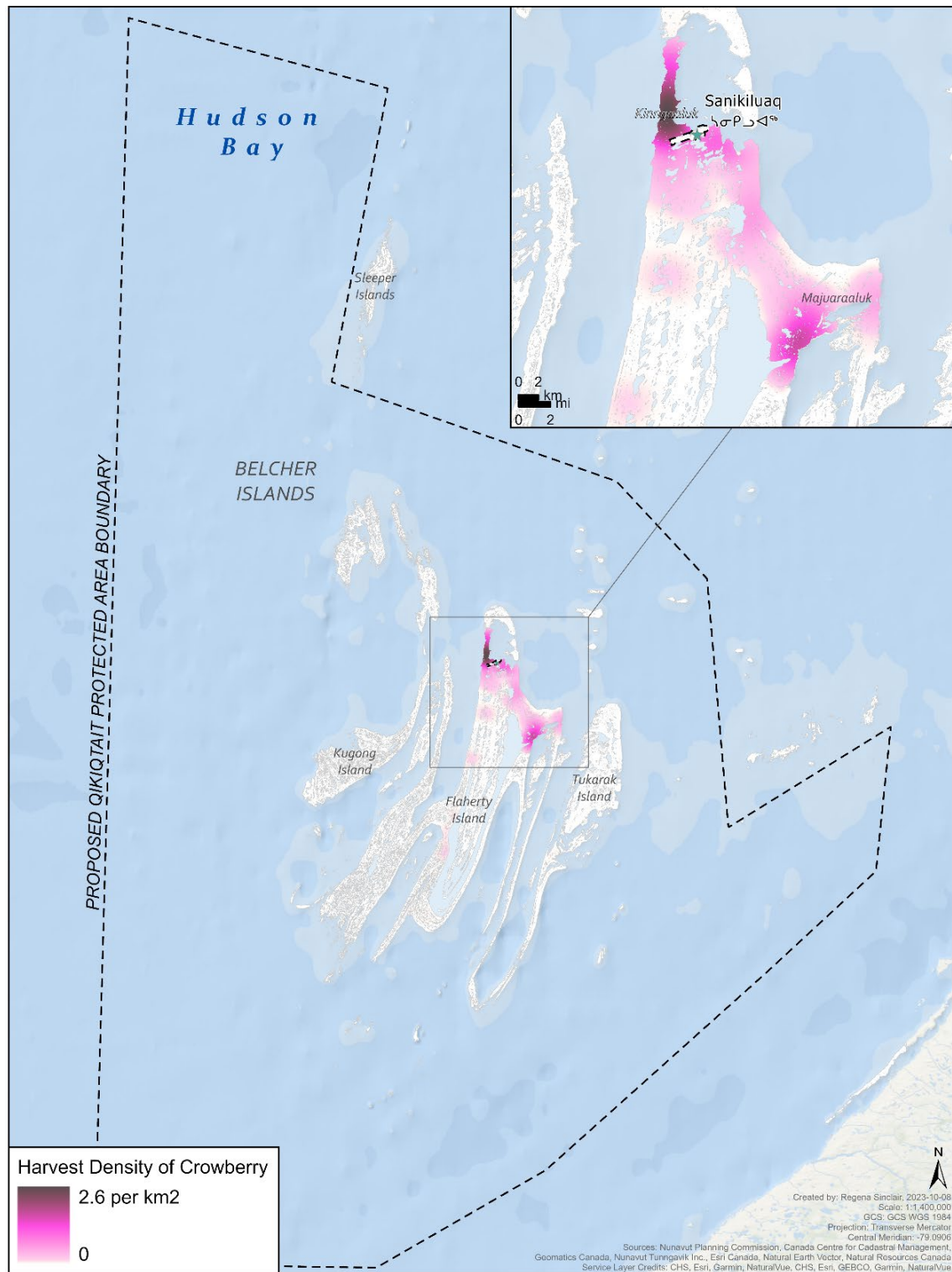
**Appendix Table 8.2:** Locate Regions tool parameters

Map	Total area	Number of regions	Region shape	Shape/Utility trade-off	Evaluation method	Region minimum area	Region maximum area	Minimum distance between regions	Distance units	Number of neighbours to use in growth	Number of seeds to grow from	Resolution of growth	Region selection method
All 14 analysis species	350	5	circle	10%	highest value	10	200	1	km	8	based on input	based on input	sequential
Arctic char	55	3	circle	10%	highest value	3	40	1	km	8	based on input	based on input	sequential
Common eider	90	5	circle	10%	highest value	5	50	1	km	8	based on input	based on input	sequential
Ringed seal	1100	5	circle	10%	highest value	10	760	1	km	8	based on input	based on input	sequential

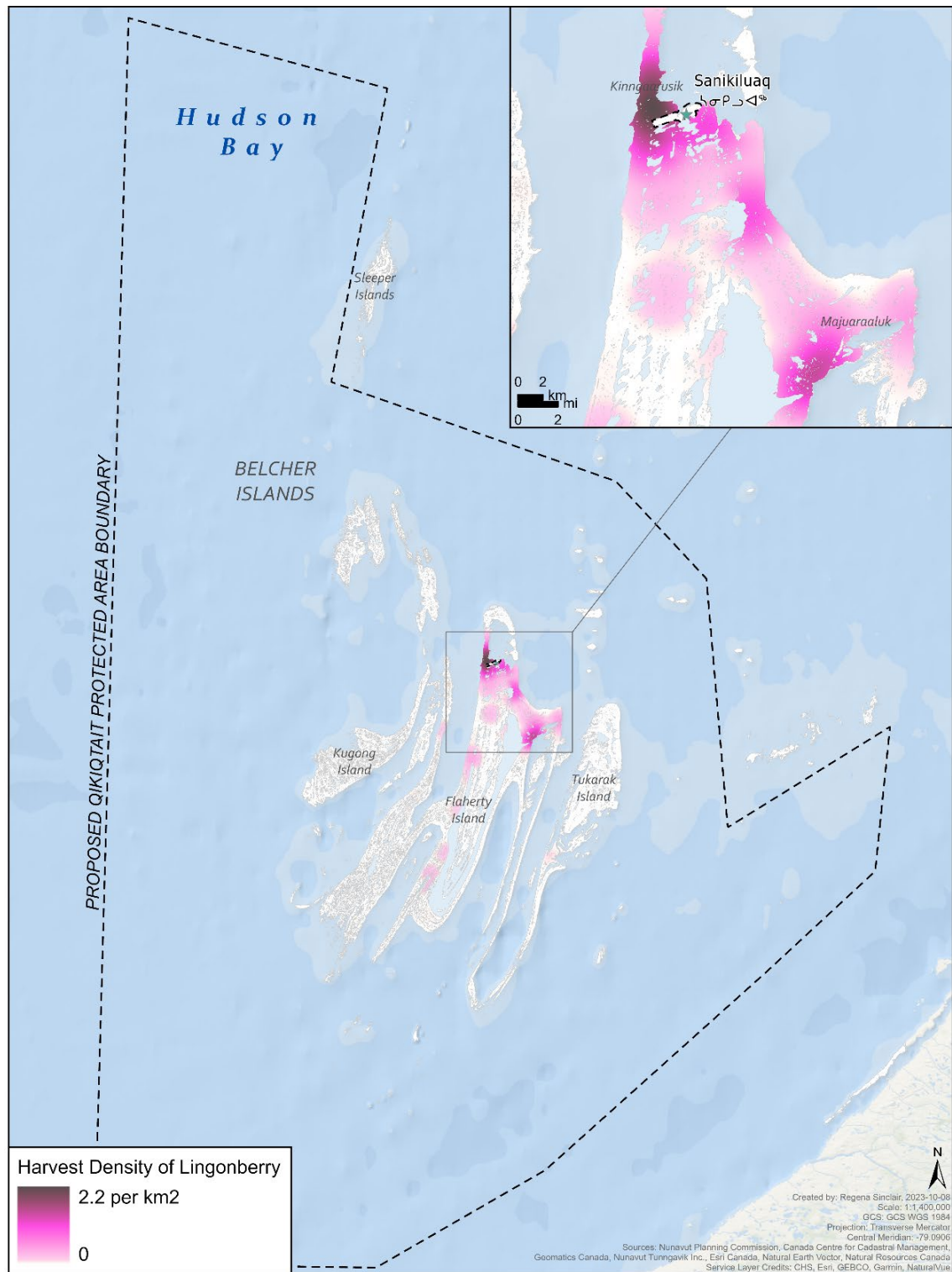
## APPENDIX 9: HARVEST LOCATION DENSITY MAPS



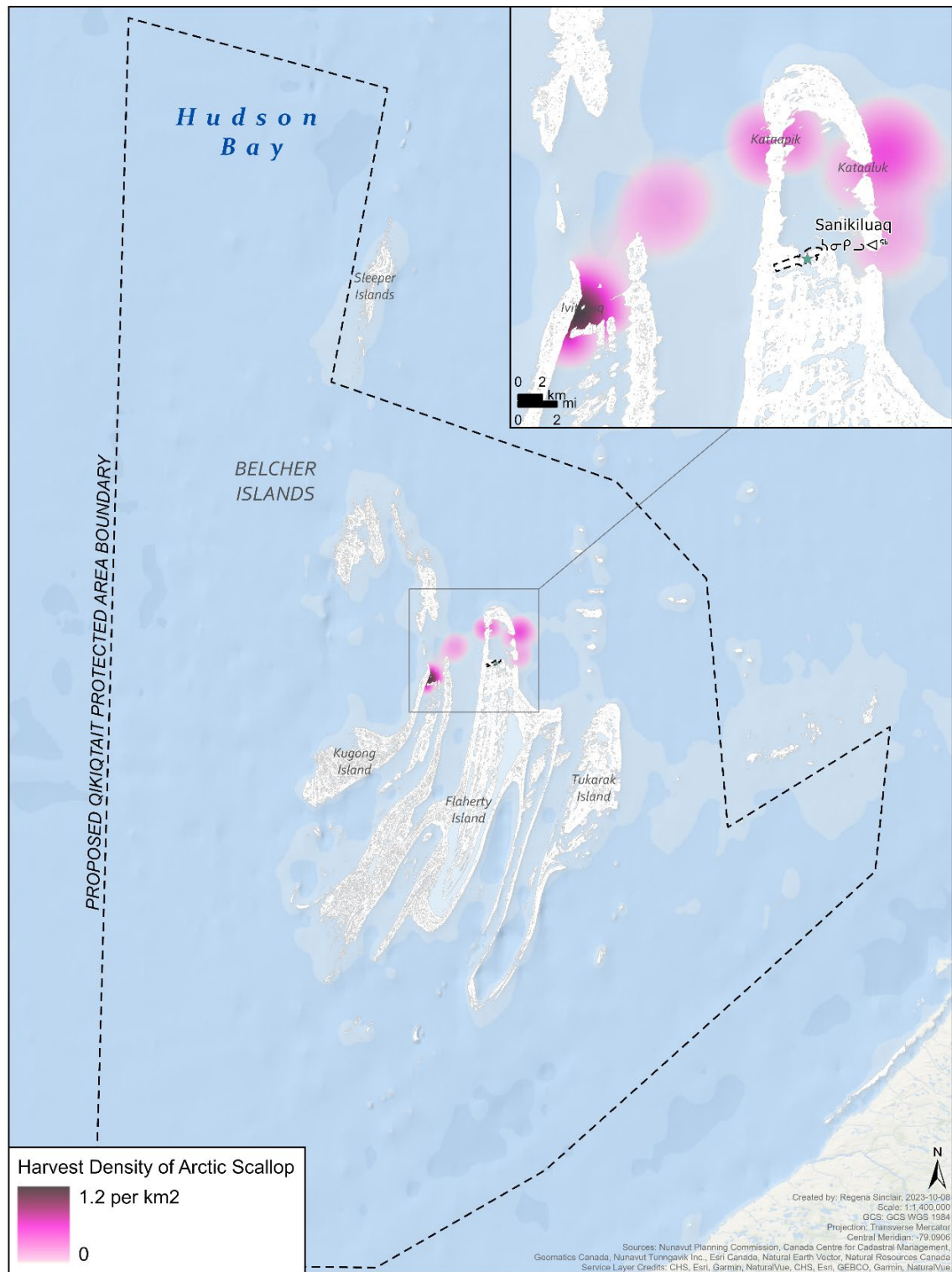
**Appendix Figure 9.1:** Cloudberry harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*



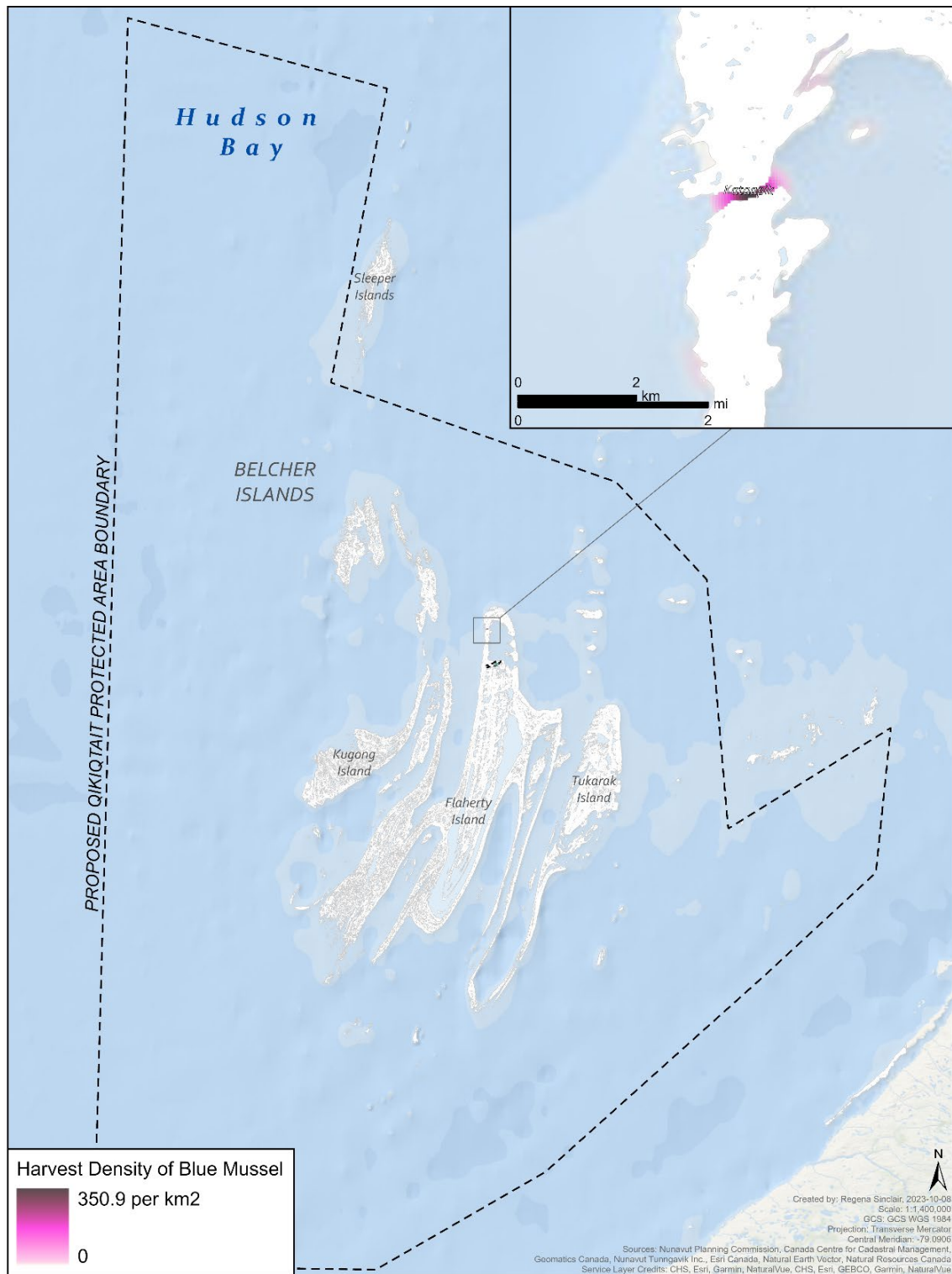
**Appendix Figure 9.2:** Crowberry harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*



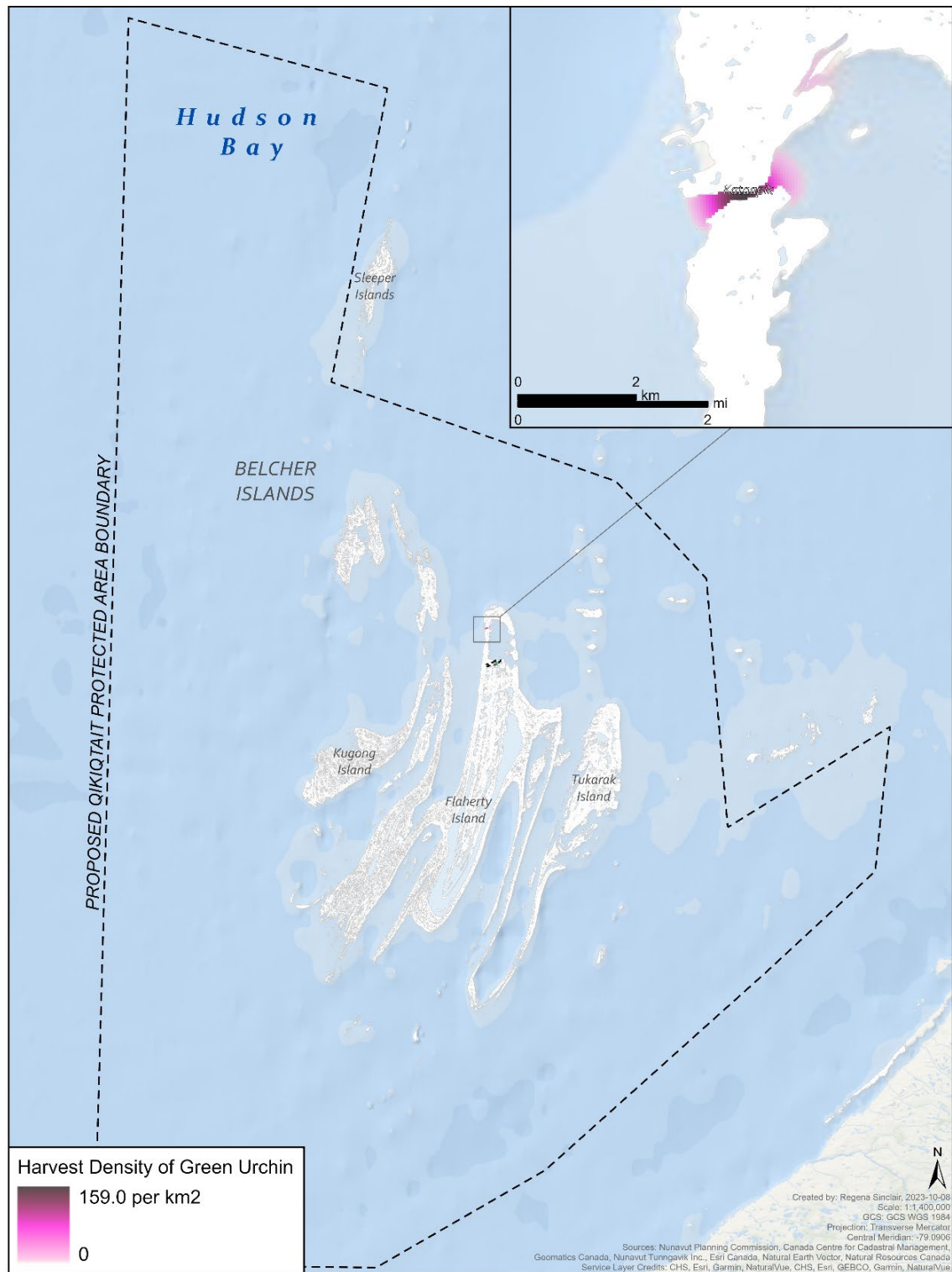
**Appendix Figure 9.3: Lingonberry harvest density for both analysis years**  
*Where: areas of darker pink represent a greater harvest density*



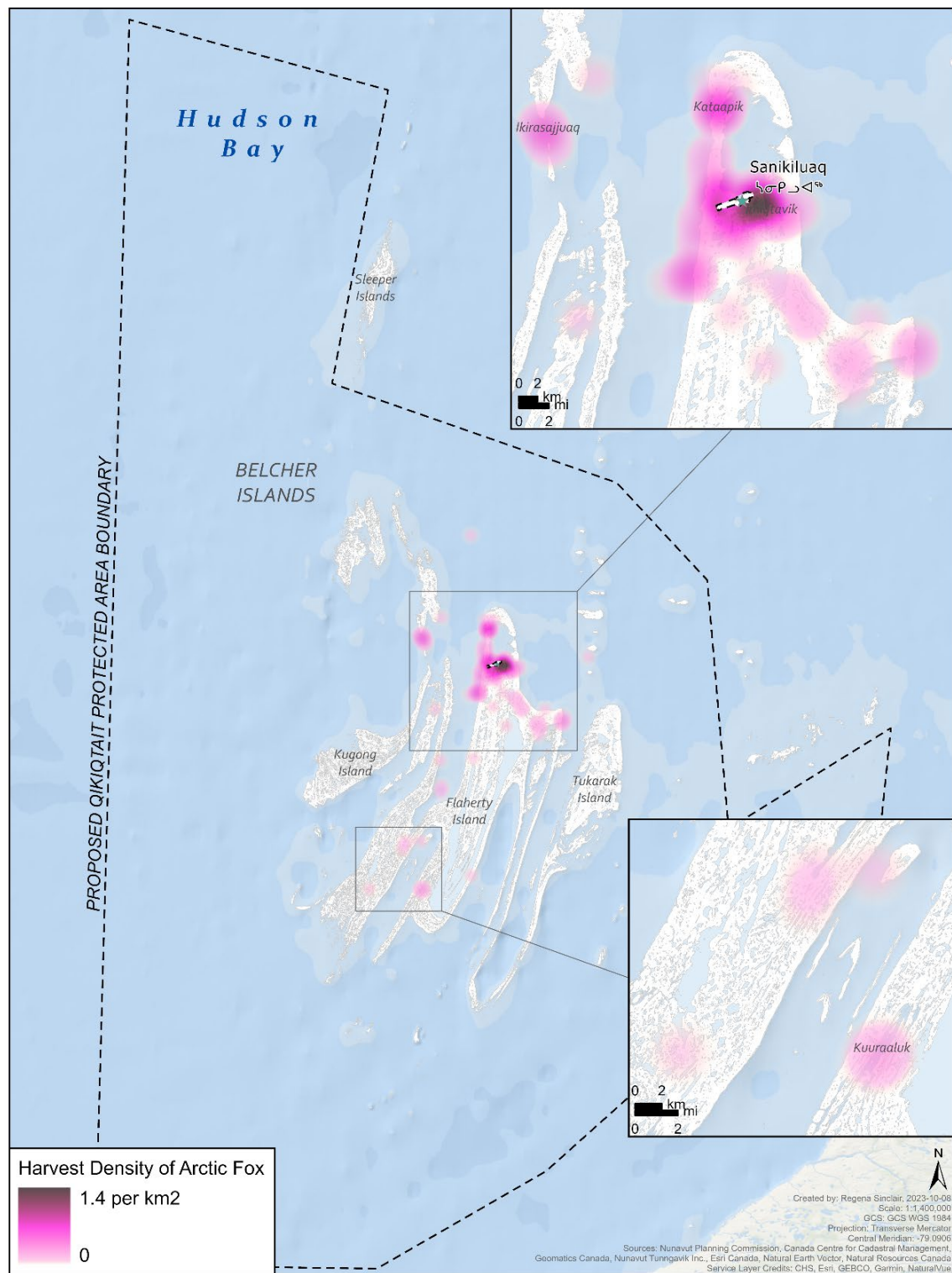
**Appendix Figure 9.4:** Arctic scallop harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*



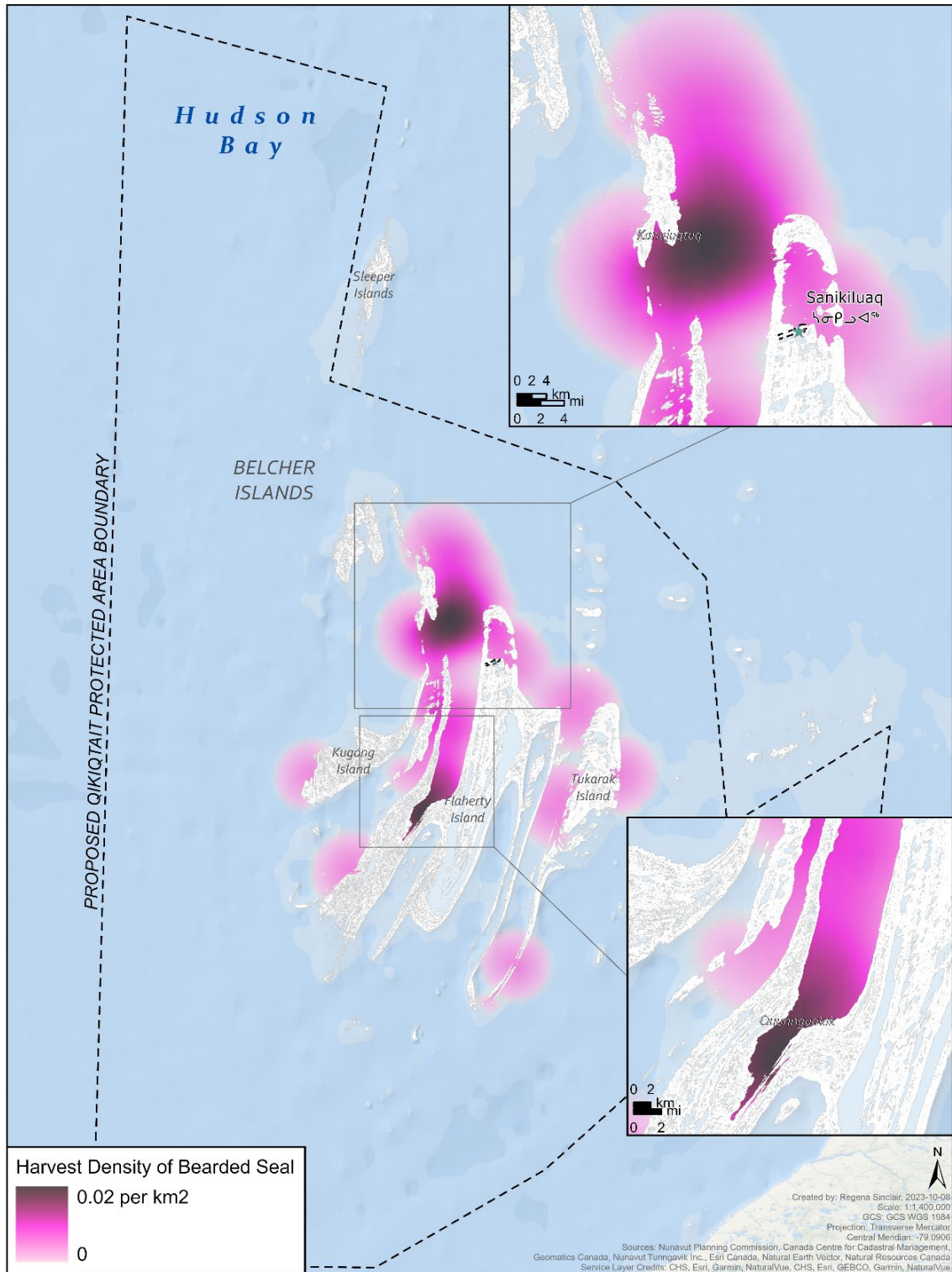
**Appendix Figure 9.5:** Blue mussel harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*



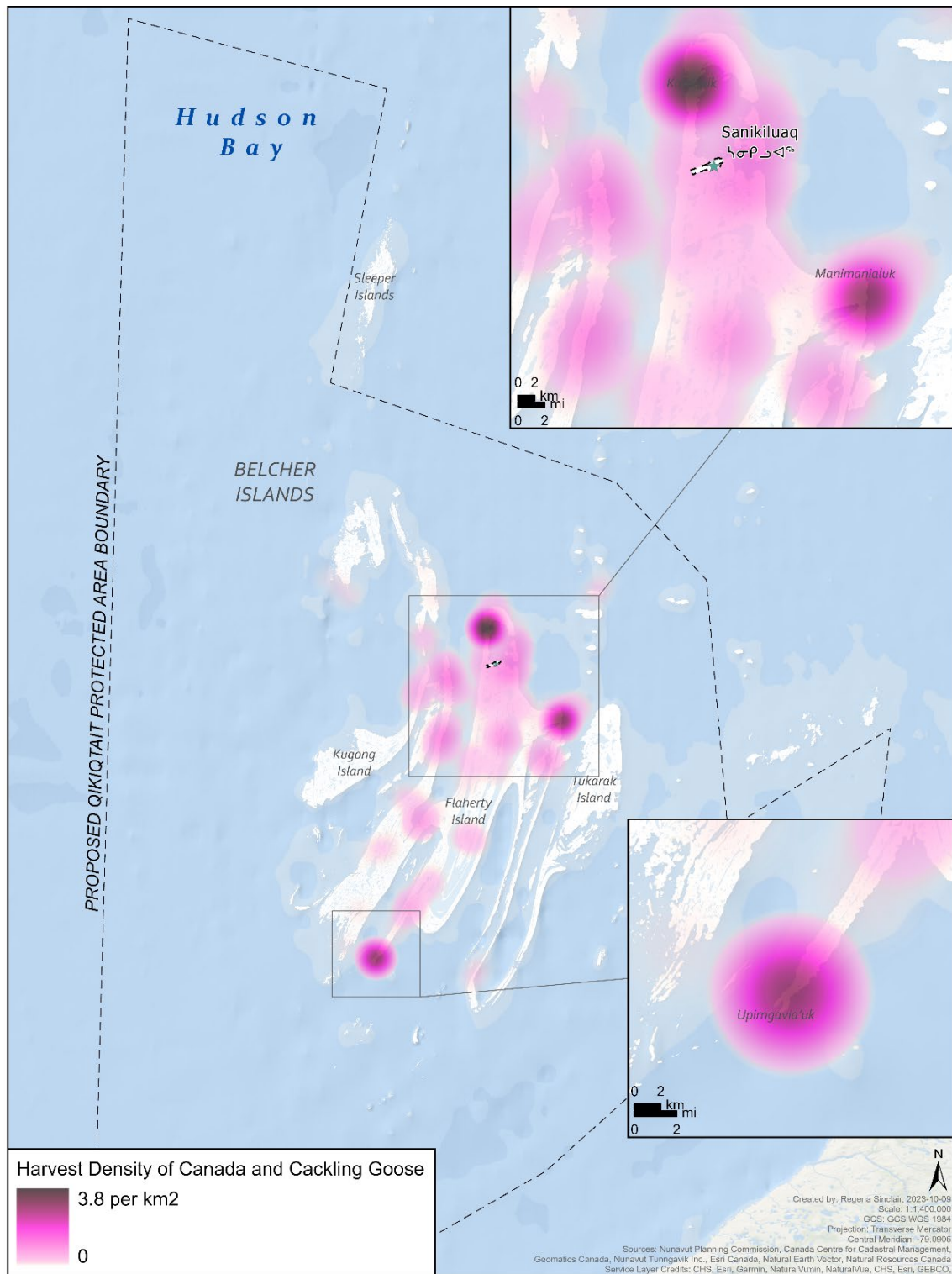
**Appendix Figure 9.6:** Green urchin harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*



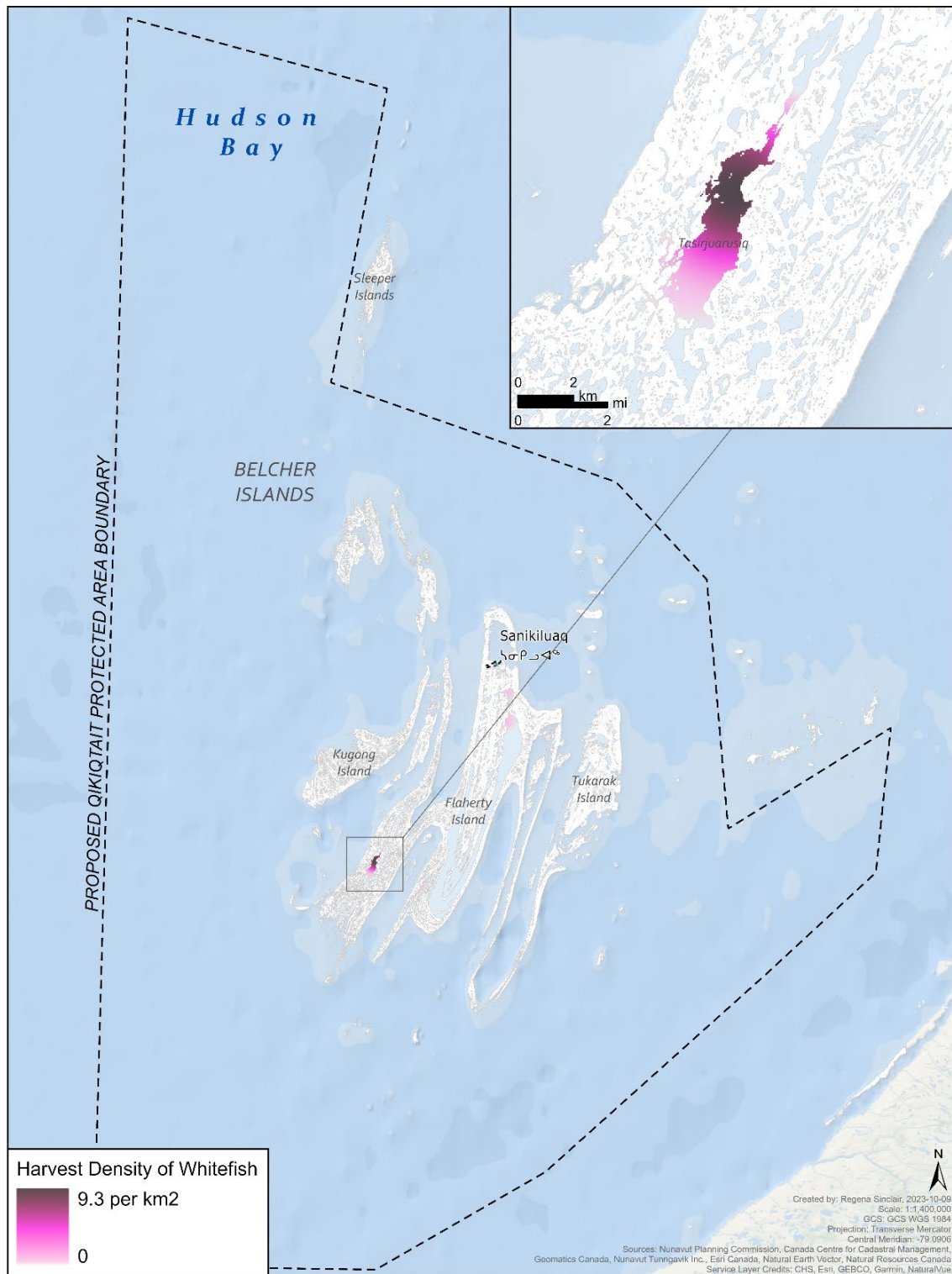
**Appendix Figure 9.7:** Arctic fox harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*



**Appendix Figure 9.8:** Bearded seal harvest density for both analysis years  
Where: areas of darker pink represent a greater harvest density

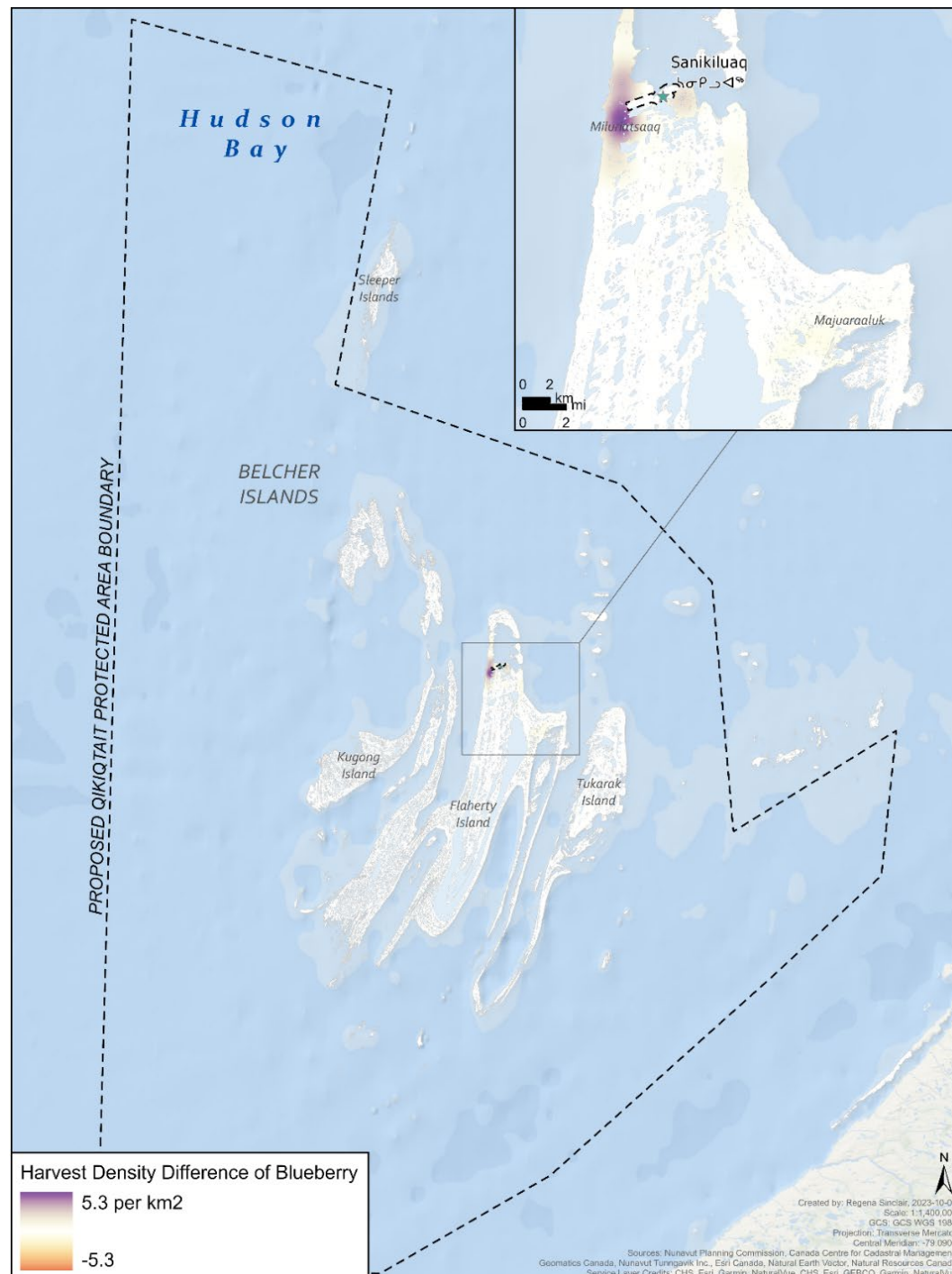


**Appendix Figure 9.9:** Canada/cackling goose harvest density for both analysis years  
Where: areas of darker pink represent a greater harvest density



**Appendix Figure 9.10:** Whitefish harvest density for both analysis years  
*Where: areas of darker pink represent a greater harvest density*

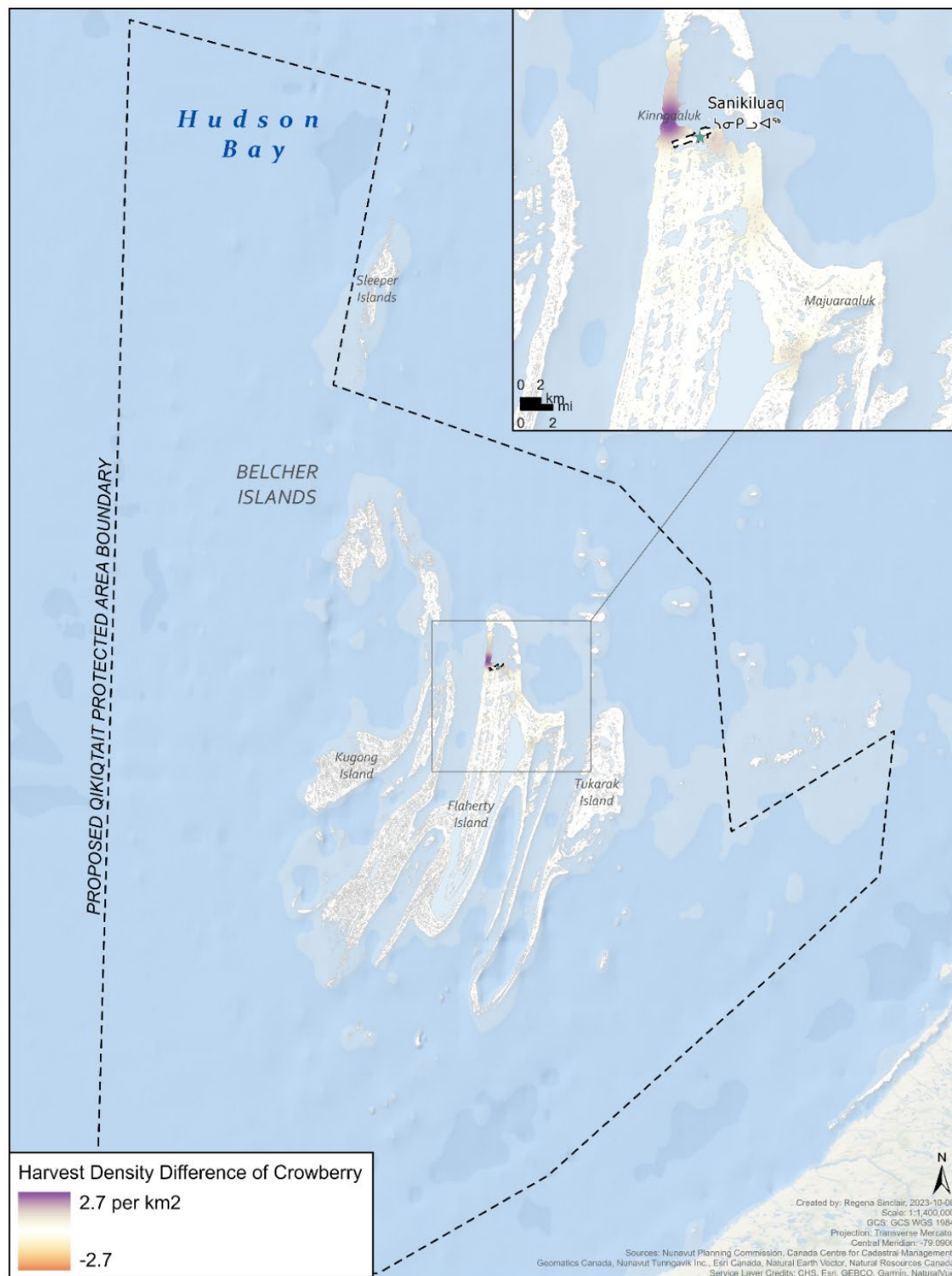
## APPENDIX 10: INTER-ANNUAL HARVEST DENSITY CHANGE MAPS



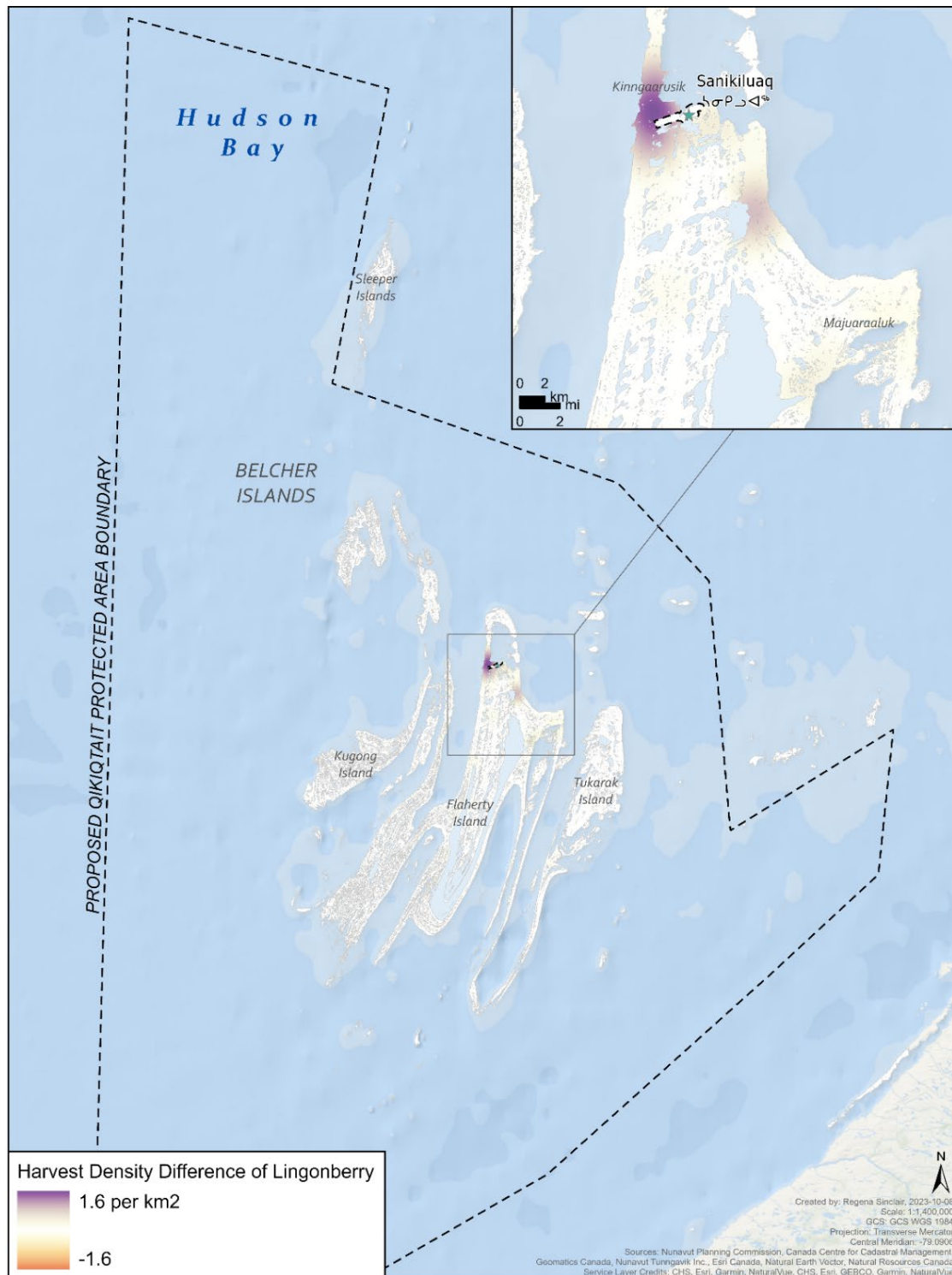
**Appendix Figure 10.1:** Harvest density difference over time for blueberry  
*Where:* dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



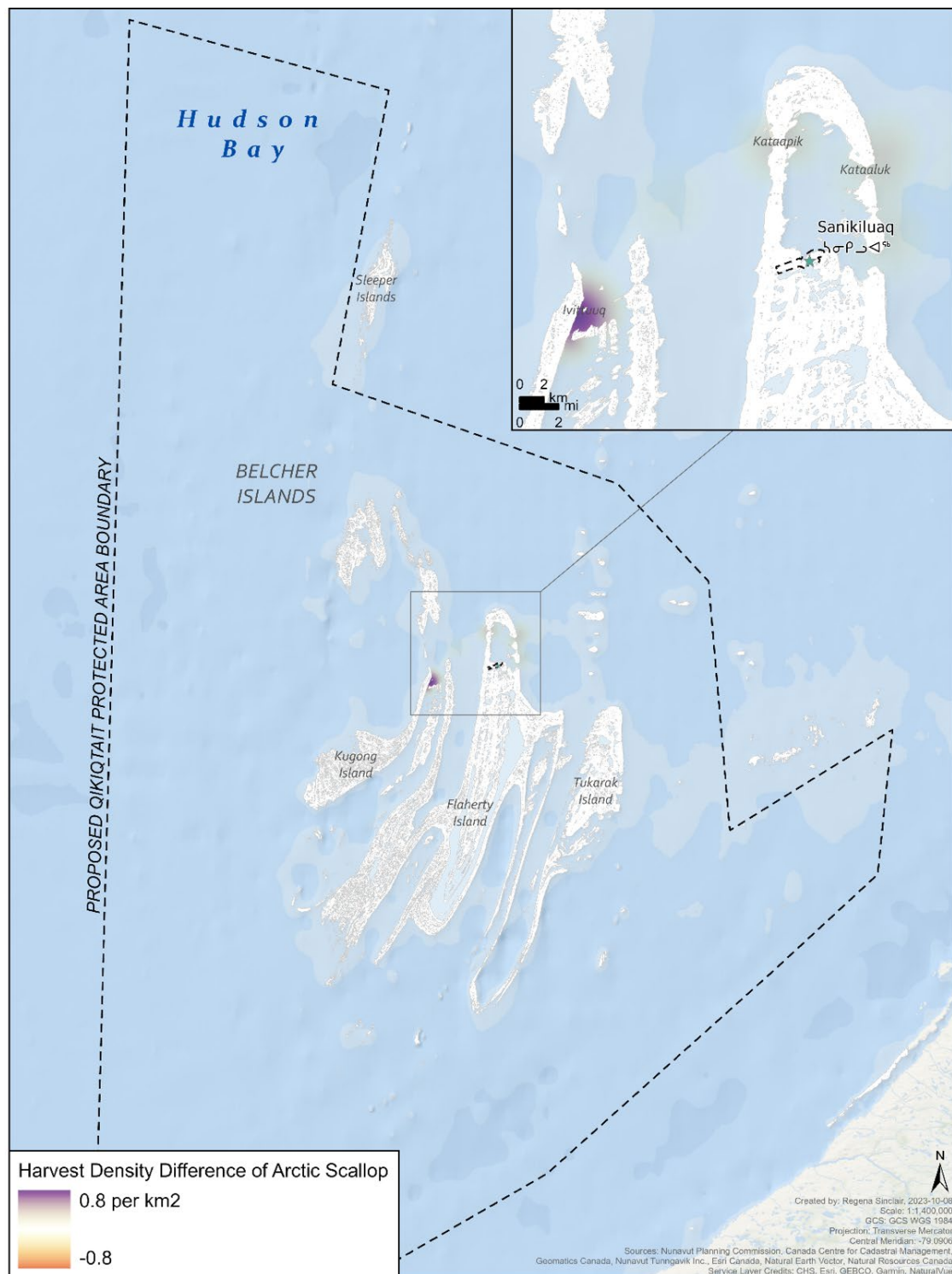
**Appendix Figure 10.2:** Harvest density difference over time for cloudberry  
Where: dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



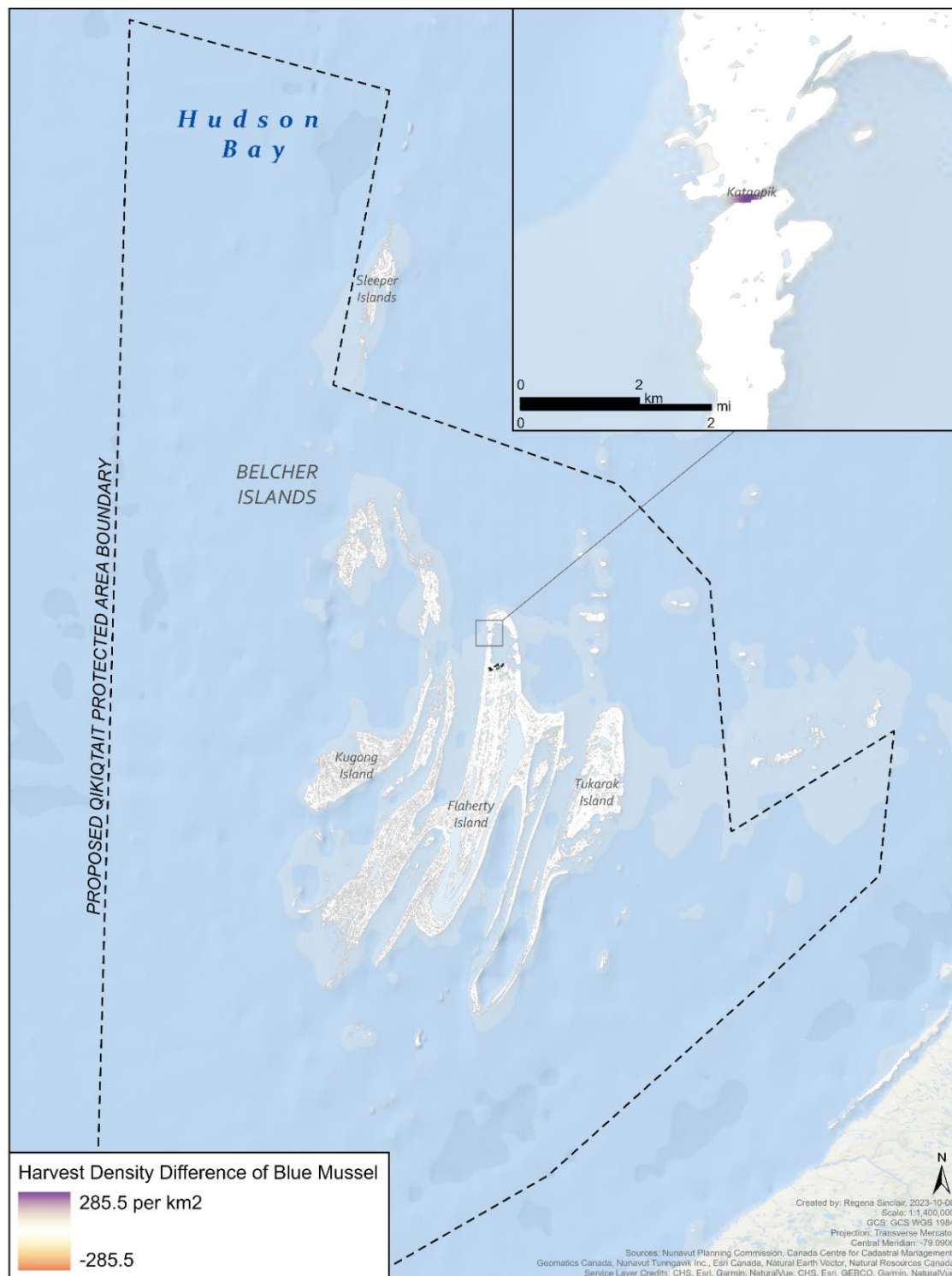
**Appendix Figure 10.3:** Harvest density difference over time for crowberry  
Where: dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



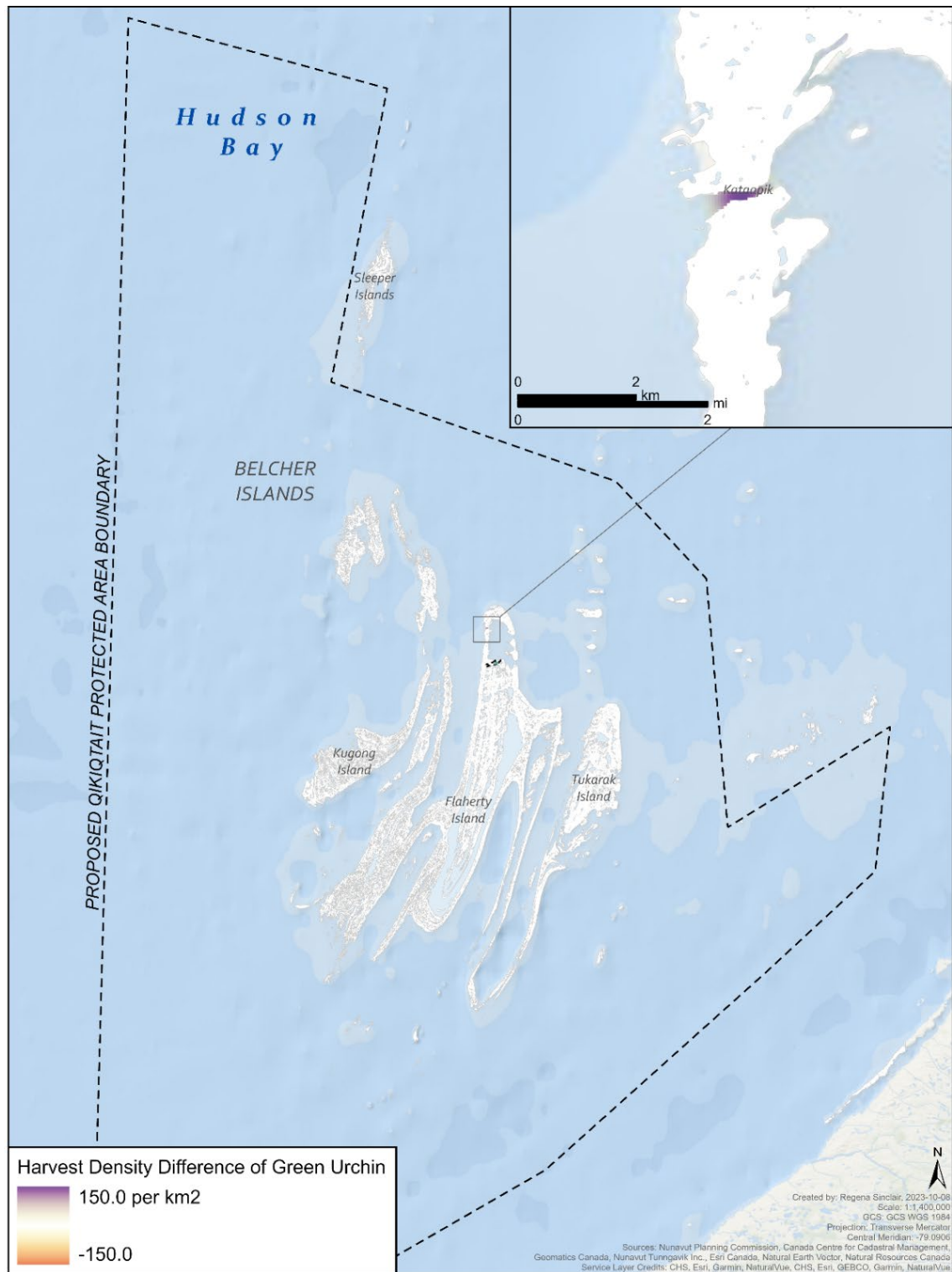
**Appendix Figure 10.4:** Harvest density difference over time for lingonberry  
Where: dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



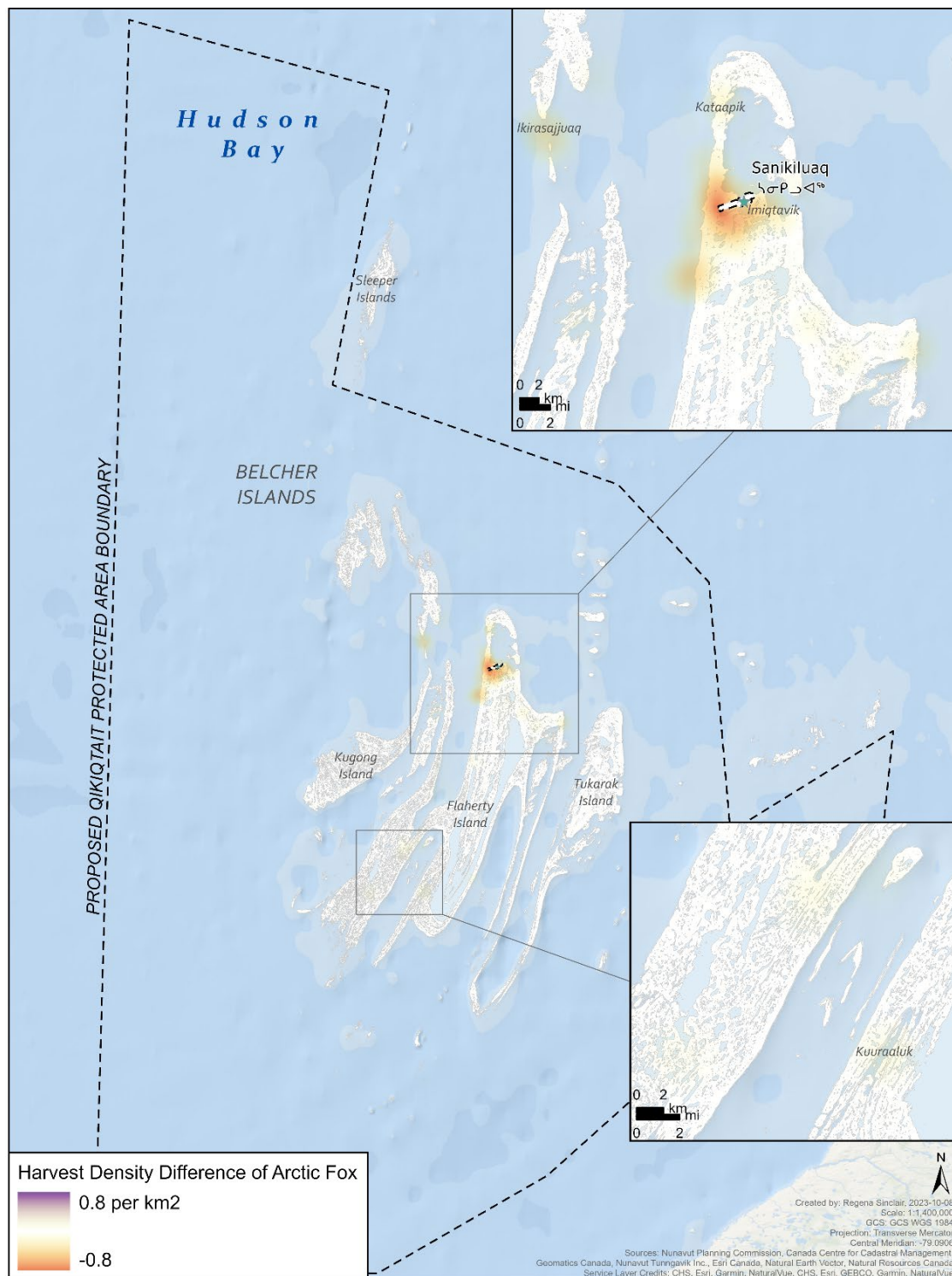
**Appendix Figure 10.5:** Harvest density difference over time for Arctic scallop  
Where: dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



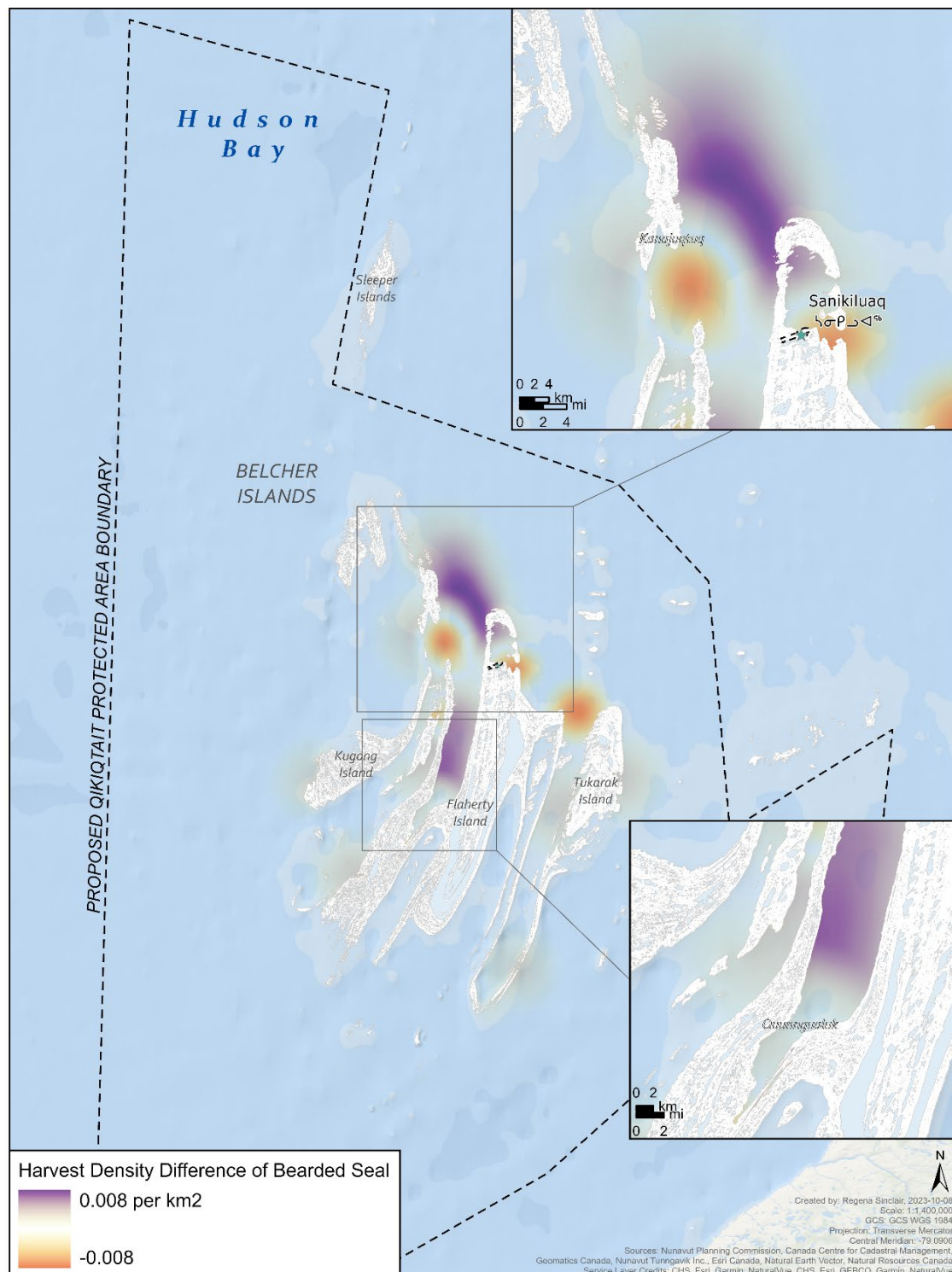
**Appendix Figure 10.6:** Harvest density difference over time for blue mussel  
 Where: dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



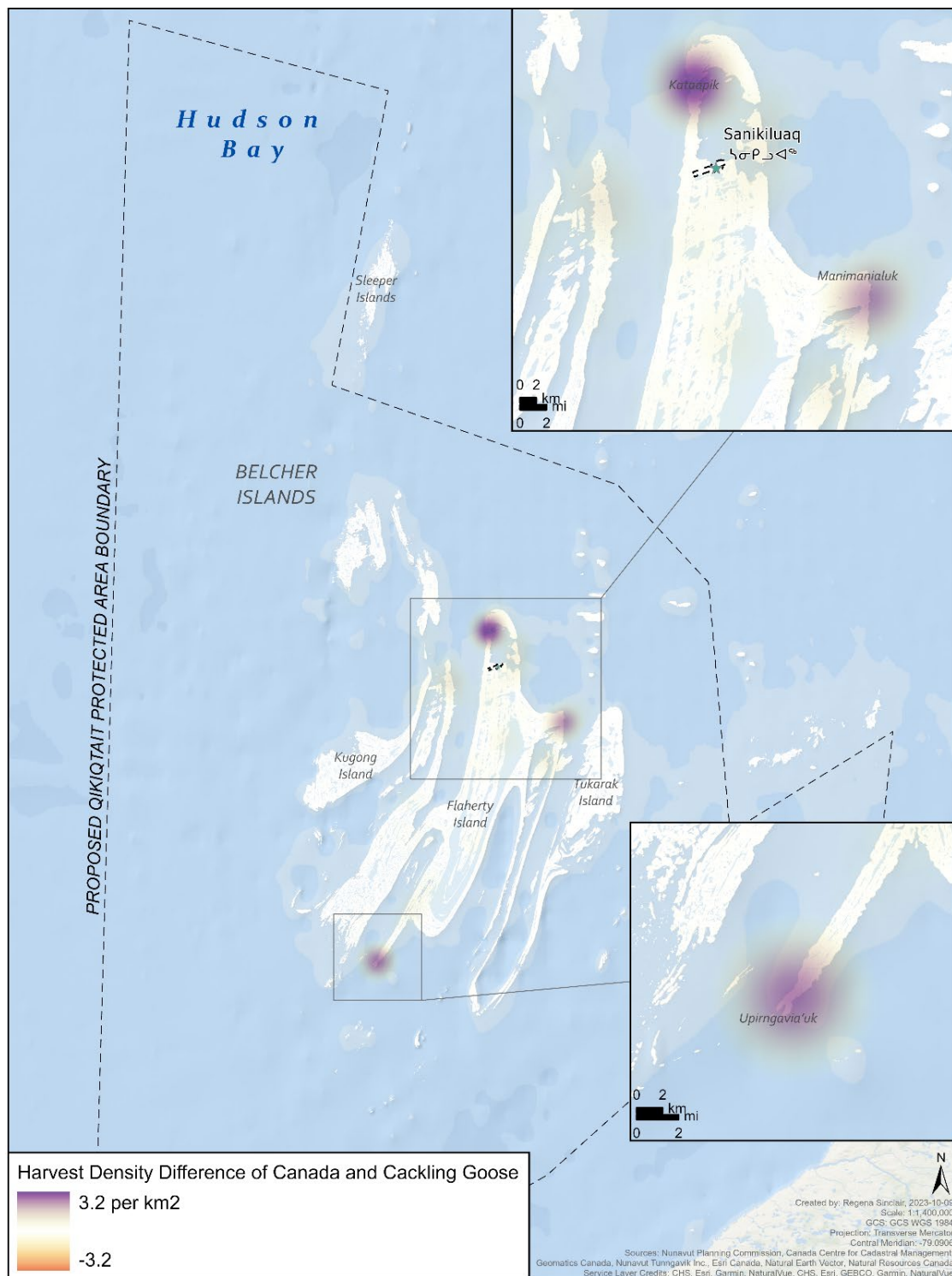
**Appendix Figure 10.7:** Harvest density difference over time for green urchin  
*Where:* dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



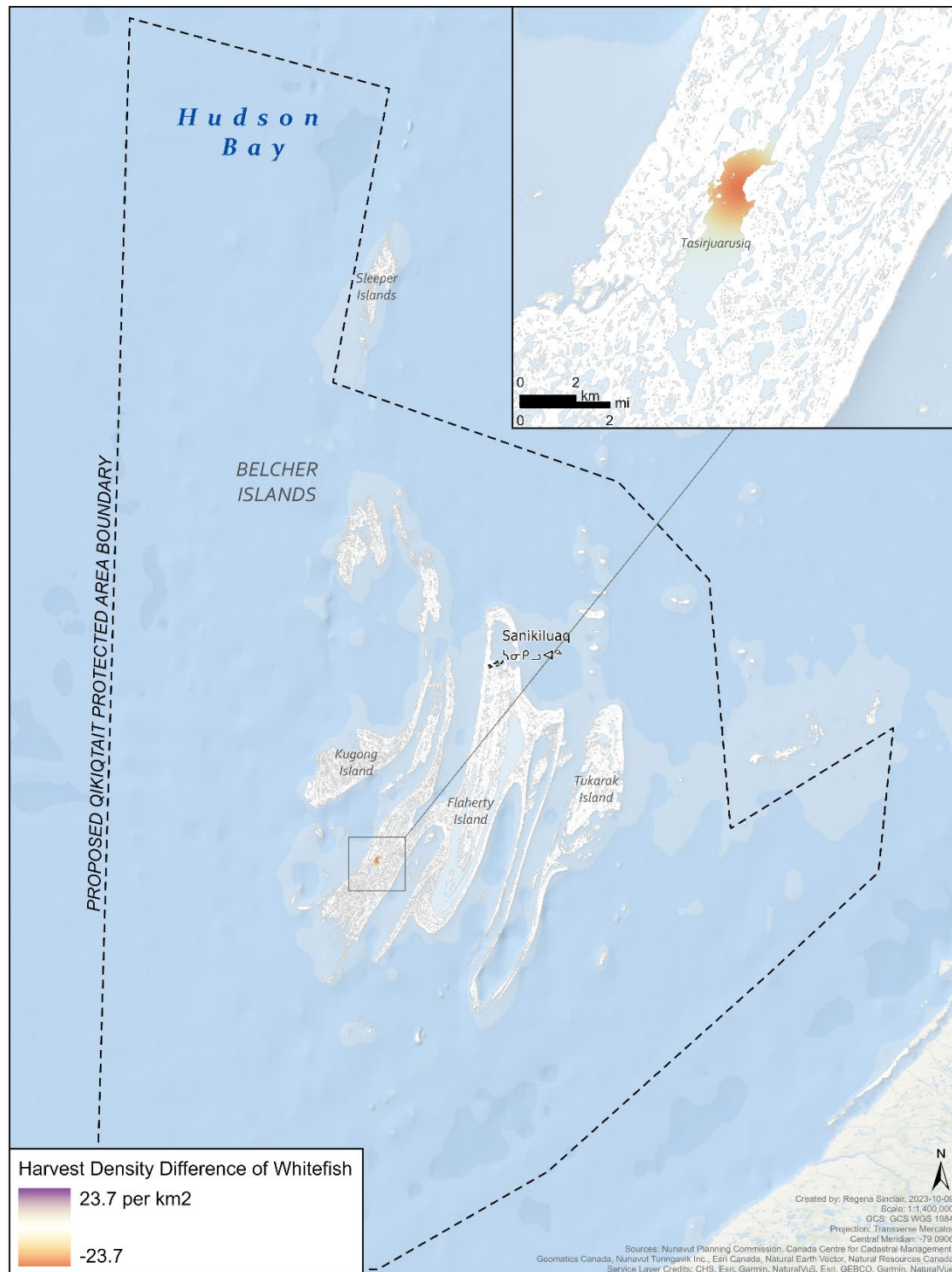
**Appendix Figure 10.8:** Harvest density difference over time for Arctic fox  
Where: dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



**Appendix Figure 10.9:** Harvest density difference over time for bearded seal  
*Where:* dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



**Appendix Figure 10.10:** Harvest density difference over time for Canada/cackling goose  
*Where:* dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest



**Appendix Figure 10.11: Harvest density difference over time for whitefish**  
 Where: dark purple indicated areas of increased harvest and dark orange indicates areas of decreased harvest