Resolute Bay – Community Harbour

Environmental and Socio-Economic Existing Conditions Report

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Table of Contents

List of Tables

List of Figures

List of Drawings

List of Photos

List of Appendices

Appendix A: Supporting Tables (Field Program)

Appendix B: Photos (Field Program)

Appendix C: Supporting Tables (Desktop)

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Any questions concerning the information or its interpretation should be directed to Victoria Burdett-Coutts (Dynamic Ocean) or Chris Meisl (Worley Consulting).

Acronyms and Abbreviations

Acronym /Abbreviation	Definition
AFA	Arctic Fishery Alliance
AIA	Archaeological Impact Assessment
ATCO	ATCO Frontec Ltd.
ATK	Aboriginal Traditional Knowledge
BB	Baffin Bay
BC	British Columbia
BF	Baffin Fisheries
BNL	Basic Needs Level
BOLD	Barcode of Life Datasystem
BV	Bureau Veritas
CAF ATC	Canadian Armed Forces Arctic Training Centre
CALA	Canadian Association for Laboratory Accreditation Inc.
CanNor	Canadian Northern Economic Development Agency
CBMN	Community Based Monitoring Network
CCME	Canadian Council of Ministers of the Environment
CD	Chart Datum
CEGEP	Collège d'enseignement général et professionnel (English translation - General and Vocational College)
CESCC	Canadian Endangered Species Conservation Council
CIRNAC	Crown Indigenous Relations and Northern Affairs Canada
CMIP5	Coupled Model Intercomparison Project Phase 5
CO	Cobble
CO1	Cytochrome Oxidase Subunit 1
CO_2	Carbon Dioxide
CoC	Chain of Custody
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSAS	Canadian Science Advisory Secretariat
CSF	Coastal Shoreline and Flats
CSFL	Cumberland Sound Fisheries Ltd.
CWS	Canadian Wildlife Service
DFCA	Disko Fan Conservation Area

Acronym /Abbreviation	Definition
DFO	Fisheries and Oceans Canada
DFO-SCH	DFO Small Craft Harbour
DHC	Disturbed Human-Caused
DIO	Designated Inuit Organization
DNA	Deoxyribonucleic Acid
DSCA	Davis Strait Conservation Area
Dynamic Ocean	Dynamic Ocean Consulting Ltd.
EBSA	Ecologically and Biologically Significant Area
ECCC	Environment and Climate Change Canada
EEZ	Exclusive Economic Zone
ELC	Ecological Land Classification
EQuIS	Environmental Quality Information System
ESEB	Environmental and Socio-Economic Baseline
ESWG	Ecological Stratification Working Group
FAO	United Nation's Food and Agriculture Organization
FB	Fox Basin
FRP	Forward Regulatory Plan
FYI	First Year Ice
GN	Government of Nunavut
GN-CGS	GN Community and Government Services
GN-C&H	GN Department of Culture & Heritage
GN-DoE	GN Department of Environment
GN-EDT	GN Economic Development and Transportation
GN-TIN	GN-Departments of Transportation and Infrastructure
GPS	Global Positioning System
GR	Gravel
HHWLT	Higher High Water Large Tide
HHWMT	Higher High Water Mean Tide
HRQ	Haul Road Quarry
HTA	Hunters and Trappers Association
HTO	Hunters and Trappers Association
HWL	High Water Line

Acronym /Abbreviation	Definition
IBA	Important Bird Area
IBKS	Inuit Bowhead Knowledge Study
ICSP	Integrated Community Sustainability Plan
IFMP	Integrated Fisheries Management Plans
IIBA	Inuit Impact and Benefit Agreement
IHT	Inuit Heritage Trust
INAC	Indigenous and Northern Affairs Canada
IPCA	Inuit-led Protected and Conserved Areas
IPCC	Intergovernmental Panel on Climate Change
IQ	Inuit Qaujimajatuqangit or Inuit Traditional Knowledge
IUCN	International Union for the Conservation of Nature
kt	knots
LLWLT	Lower Low Water Large Tide
LLWMT	Lower Low Water Mean Tide
LTE	Long Term Evolution
LWL	Low Water Line
MBS	Migratory Bird Sanctuaries
Mbps	Megabits per second
MMR	Marine Mammal Regulations
MOU	Memorandum of Understanding
MPA	Marine Protected Areas
MUN	Memorial University of Newfoundland
MWL	Mean Water Level
MYI	Multi Year Ice
NAC	Nunavut Arctic College
NAMMCO	North Atlantic Marine Mammal Commission
NAFO	North Atlantic Fisheries Organization
NBRLUP	North Baffin Regional Land Use Plan
NCRI	Nunavut Coastal Resources Inventory
NEAS	Nunavut Eastern Arctic Shipping Inc.
NFR	Nunavut Fishery Regulations
NFS	Nunavut Fisheries Strategy

Acronym /Abbreviation	Definition
NGMP	Nunavut General Monitoring Plan
NHC	Nunavut Housing Corporation's
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Lands Claim Agreement
NMCA	National Marine Conservation Area
NPC	Nunavut Planning Commission
NR	Not Ranked
NRCan	Natural Resources Canada
NRI	Nunavut Research Institute
NSA	Nunavut Settlement Area
NSIDC	National Snow and Ice Data Centre
NSSI	Nunavut Sealink and Supply Inc.
NTI	Nunavut Tunngavik Inc.
NWA	National Wildlife Area
NWHB	North and West Hudson Bay
NWHS	Nunavut Wildlife Harvest Study
NWMB	Nunavut Wildlife Management Board
OECM	Other Effective Area-Based Conservation Measures
OTN	Ocean Tracking Network
OW	Open Water
the Project	Resolute Bay Community Harbour Project
PSIR	Project Specific Information Requirements
QA/QC	Quality Assurance/Quality Control
QCorp	Qikiqtaaluk Corporation
QEC	Qulliq Energy Corporation
QFC	Qikiqtaaluk Fisheries Corporation
QIA	Qikiqtani Inuit Association
QP	Qualified Professional
RCMP	Royal Canadian Mounted Police
RDL	Reportable Detection Limit
RNLUP	Recommended Nunavut Land Use Plan
ROV	Remotely Operated Vehicle

Acronym /Abbreviation	Definition
RPD	Relative Percent Difference
RWO	Regional Wildlife Organizations
S1	Critically Imperilled
S2	Imperilled
S3	Vulnerable
S4	Apparently Secure
SA	Sand
SAO	Senior Administrative Officer
SAP	Sampling Analysis Plan
SAR	Species at Risk
SARA	*Species at Risk Act*
SEB	South and East Baffin
SHSUBL	South Hudson Strait-Ungava Bay-Labrador
SoW	Scope of Work
SST	Sea Surface Temperature
SU	Unrankable
TAH	Total Allowable Harvest
TI NMCA	Tallurutiup Imanga (Lancaster Sound) National Marine Conservation Area
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UBC	University of British Columbia
ULB	Upland Lichen Barren
Underhill	Underhill Geomatics Ltd.
UoG	University of Guelph
USDA	United States Department of Agriculture Plants Database
WGD	Wetland Graminoid Drainage
WJS	Western Jones Sound
WMB	Wildlife Management Boards
WML	Wetland Moss Lowland
Worley Consulting	Worley Canada Services Ltd.
WQG	Water Quality Guidelines
WSP	Waste Stabilizer Pond

Acronym /Abbreviation	Definition
WWF	World Wildlife Fund

Executive Summary

Worley Canada Services Ltd., operating as Worley Consulting, has been retained to support the detailed design of a community harbour in Resolute Bay, Nunavut. The Project is being managed by the GN, where GN-Community and Government Services (CGS) is the proponent during the construction stage, and ownership will transfer to GN – Economic Development and Transportation (EDT) during the operations stage. The two GN departments are working collaboratively on the Project and are collectively referred to as GN-CGS/EDT as the proponent for the permitting of the Resolute Bay community harbour. Effective 1 April 2025, GN-CGS and GN-EDT, will be merged and referred to as the Departments of Transportation and Infrastructure (GN-TIN) (GN, 2024b).

The community harbour is part of the Inuit Impact and Benefit Agreement (IIBA) negotiated for the Tallurutiup Imanga (Lancaster Sound) National Marine Conservation Area (NMCA) (see Section 3.2.1). Dynamic Ocean Consulting Ltd. (Dynamic Ocean) is supporting Worley Consulting on the permitting requirements for the Project. This Environmental and Socio-Economic Baseline (ESEB) Report, conducted to support the detailed design and permitting phase for the Resolute Bay community harbour, builds upon the ESES produced by Worley Consulting in January 2020, where Worley Consulting was engaged by DFO-SCH to conduct a feasibility study (Advisian, 2020b).

Resolute Bay is located on the south shore of Cornwallis Island in Parry Channel. It is within the Qikiqtaaluk Region and the North Baffin Regional Land Use Plan (NBRLUP) Region(Nunavut Planning Commission (NPC, 2000)). The environmental baseline studies included both the terrestrial and marine footprints for a quarry, haul road and community harbour. Each Study Area is defined to include the footprint and a 100 m buffered area to include possible residual effects during construction, as defined in Section 1.3. The socio-economic baseline study incorporated information on the community from the Hamlet of Resolute Bay, the Resolute Bay Hunters and Trappers Association (HTA), and other Resolute Bay community leaders. The Socio-Economic Study Area included an area within the municipal borders of Resolute Bay and the marine environment where socio-economic effects of the proposed development are likely to occur. Two Archaeological Impact Assessments (AIAs) (AECOM, 2024; Lifeways of Canada Limited, 2019) have been conducted under Class 2 Archaeologist Permits (2019-53A; 2024-59A) in support of the Project, in 2019 and 2024. If the southern quarry is used, archaeological buffers may need to be implemented, which would require further engagement with the GN-Culture and Heritage Department (C&H). However, no other archaeological sites were recorded within the Project Study Area.

The ESEB Report was undertaken using both desktop review and field survey means to understand the environmental and socio-economic conditions in Resolute Bay. Inuit Qaujimajatuqangit (IQ) was used through desktop review and project specific workshops with the HTA board members and local knowledge holders to identify existing conditions of important environmental and socio-economic resources in and around Resolute Bay. Additionally, early engagement with the community allowed for a collaborative approach between the field team and community members during the field surveys with access to local resources for personnel and equipment, including boats. Integrating Inuit and scientific knowledge advances the understanding of the biological and socio-economic conditions providing a baseline that is not only scientifically sound but also connected to local values, needs, and priorities.

The environmental scope considered terrestrial vegetation, terrestrial wildlife, marine and migratory birds, fish and fish habitat, and marine mammals. These organism groups are important both ecologically and culturally in Nunavut. The habitat values within the Project Study Area were generally low in the terrestrial portions and low to moderate in the marine portions (Community Harbour Study Area), as the areas were dominated by human development and settlement. Details on the specific groups are provided in the relevant sections of this ESEB report. Several Species at Risk (SAR) organisms do have the potential to be present in several study areas, but the Project footprint(s) and study areas do not provide critical habitat requirements for these species. Table 3-2 identifies potential SAR species and the likelihood of their presence in the relevant study areas.

Engagement with the community—including the Hamlet, the HTA, the Guardians, and residents—on the Project's design and construction planning has shown strong support for the Project and its benefits. Hunters do not anticipate significant impacts on wildlife or their ability to continue subsistence activities during construction. The community is eager for the long-awaited harbour, which will provide safer access and improved shelter for boats. Consultation remains ongoing throughout the design and permitting phase to address potential impacts and ensure that any risks to the community or harvesting rights are mitigated.

1 Introduction

This document is the Environmental and Socio-Economic Baseline (ESEB) Report conducted to support the permitting and detailed design of the Resolute Bay community harbour Project (the Project).

The Tallurutiup Imanga National Marine Conservation Area (TI NMCA) is an important designated area located in the Canadian Arctic, specifically in Lancaster Sound (Tallurutiup Imanga) and its adjacent waterways. This conservation area was established to protect and preserve the unique and ecologically important marine environment for Inuit and all Canadians. Establishment of protected areas within Canada's High Arctic basin, such as the TI NMCA, is a requirement of the Inuit Impact and Benefit Agreement (IIBA). A Memorandum of Understanding (MOU) between the Qikiqtani Inuit Association (QIA), the Government of Nunavut (GN), and the Government of Canada has resulted from the creation of the TI NMCA and was signed in the summer of 2021. The purpose of this agreement is to recognize that marine infrastructure is connected to community wellbeing as well as economic and social development, and to address the marine infrastructure deficit in several communities, including Grise Fiord and Resolute Bay. A portion of the waterfront within the several communities (such as Resolute Bay) that are within the TI NMCA is excluded through Article 4 of the IIBA (IIBA, 2019) to allow for the development of marine infrastructure. This will be accomplished with funding from the Government of Canada for a community harbour in both Resolute Bay and Grise Fiord.

The Project is being managed by the GN, where GN-Community and Government Services (GN-CGS) is the proponent during the construction stage, and ownership will transfer to GN-Economic Development and Transportation (GN-EDT) during the operations stage. The two GN departments are working collaboratively on the Project and are collectively referred to as GN-CGS/EDT as the proponent for the permitting of the Resolute Bay community harbour. Effective 1 April 2025, GN-CGS and GN-EDT, will be merged and referred to as the GN-Departments of Transportation and Infrastructure (GN-TIN) (GN, 2024b).

Worley Canada Services Ltd., operating as Worley Consulting, has been retained by the GN-CGS/EDT to support the detailed design of a community harbour facility in Resolute Bay, Nunavut (Figure 1-1). Dynamic Ocean Consulting Ltd. (Dynamic Ocean) is supporting Worley Consulting on the permitting requirements for the Project. The Resolute Bay community harbour was a component of an earlier feasibility study, completed by Fisheries and Oceans Canada – Small Craft Harbour (DFO-SCH) in 2019.

1.1 Project Overview

The Project will improve safety and access to water, functionality of boating activities, and reduce the congestion and environmental risks associated with the current use of the community harbour (see Section 1.3 of the Resolute Bay Project Specific Information Requirements [PSIR] Report for existing infrastructure (Dynamic Ocean & Worley Consulting, 2025a)).

The permanent components of the Project include the construction of:

- A new breakwater (to create a protected harbour).
- Boat launch ramp.

- Small craft floating docks to support mooring of small craft vessels.
- Laydown area.
- Harbour lighting.

Dredging is required on the leeward side of the breakwater to form a berth pocket and approach channel allowing larger boats to access (see Section 2.1.2.2 of the Project Specific Information Requirements [PSIR] Report (Dynamic Ocean & Worley Consulting, 2025b)).

A General Arrangement of the community harbour is provided in Drawing 1-1. The final arrangement of the community harbour may change through the design development phase of the Project as GN-CGS/EDT plans to continue consulting with the community to refine the Project design; however, any design modifications that do occur, are not expected to change the predicted environmental effects discussed in the PSIR Report (Dynamic Ocean & Worley Consulting, 2025b). Temporary components to support construction include a quarry and haul road, with the quarry required to supply rock for construction, and a haul road to transport rock from the quarry to the community harbour. Project components are further described in Section 1.3.

Construction is anticipated to require four years and is planned to occur from the open-water seasons of 2026 through to 2029.

During construction, the Project will use the existing scheduled sealift deliveries and scheduled flights, with the potential for use of chartered flights when additional cargo or construction crew capacity is required. Potable water, sanitary and solid waste disposal are anticipated to be provided via existing facilities. Fuel supply may use existing facilities, if there is sufficient capacity and quantity. If the existing facilities are not adequate, the contractor will be required to install temporary fuel storage facilities and/or arrange additional fuel shipments. Construction crew accommodations will be provided by a construction camp to be established by the construction contractor.

1.2 Project Location

The Project is located at Resolute Bay, a Hamlet on the southern shore of Cornwallis Islands in Parry Channel (74° 41.472'N, 94° 51.549'W; Figure 1-1). The community is located in the Qikiqtaaluk Region, and conforms with the North Baffin Regional Land Use Plan (NBRLUP) (Nunavut Planning Commission (NPC, 2000)). While Resolute Bay is within the NBRLUP, the Recommended Nunavut Wide Land Use Plan (RNLUP) (NPC, 2023b) will replace the NBRLUP once it is approved.

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LEGEND

- HAUL ROAD ON EXISTING ROAD/TRACK
- ALTERNATE/ADDITIONAL HAUL ROUTE
- COMMUNITY STUDY AREA
- QUARRIES STUDY AREA
- EXISTING ROAD STUDY AREA
- STOCKPILE/LAYDOWN AREA
- QUARRY

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GOVERNMENT OF NUNAVUT
RESOLUTE BAY COMMUNITY
HARBOUR DEVELOPMENT

PROJECT COMPONENTS
(QUARRY, HAUL ROAD, COMMUNITY HARBOUR)

Date: 03-APR-25	Drawn by: JLC	Edited by: JLC	App'd by: CM
		Worley Project Number 317086-54175	
		DRG No Figure 1-1	REV 2

Nunavut

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1.3 Project Components

The Project components include temporary and permanent components, which are marine and terrestrial. Temporary components are terrestrial and include a quarry and haul road; the quarry to supply rock for construction, and a haul road to transport rock from the quarry to the community harbour. The permanent component is the community harbour, and is primarily marine with small portions that are terrestrial (Figure 1-1 (community harbour location and components); Figure 1-2 of the PSIR Report (community harbour location) (Dynamic Ocean & Worley Consulting, 2025a); Drawing 1-1 (General Arrangement of community harbour)). Potential requirements for a contractor laydown area are discussed in Section 2.1.1.2 of the PSIR Report (Dynamic Ocean & Worley Consulting, 2025b).

The selected locations to be used for the Project components are discussed in this section. Site selection is determined by a variety of variables including harbour usage, environmental, regulatory, socio-economic, constructability, geological and engineering characteristics, cost, and future maintenance requirements.

1.3.1 Community Harbour

Three options were considered for Resolute Bay, which had been conceptualized in collaboration with DFO-SCH in the early feasibility study in 2019. These generalized arrangements form the basis of this study and were developed based on the local knowledge and feedback received during community consultations in the feasibility (2018) and detailed design (2024) phases. Options 1 and 2 are adjacent to each other on the northeastern side of Resolute Bay, while Option 3 was located on southwestern side of Resolute Bay. Option 2 was selected as the preferred option, since it was provides good protection for small craft vessel, located further from the sewage outfall then Option1 (see Drawing 1-1; Figure 1-2 of the PSIR Report (Dynamic Ocean & Worley Consulting, 2025b)), less dredging, less ongoing maintenance dredging requirements, and better constructability. Option 2 was also the preferred choice through community consultation.

1.3.2 Quarry

Two quarry locations (northern quarry, southern quarry) are under consideration, which are approximately 2.5 km and 4 km southwest of the community harbour (see Photo 1-2 in the PSIR Report (Dynamic Ocean & Worley Consulting, 2025b). Both quarries were assessed at this current phase to confirm all environmental and socio-economic (inclusive of archaeological) concerns were addressed. Only one quarry is required to support construction, and a final decision will be made based on rock quality. If rock quality is suitable, the northern quarry is the preferred location due to its proximity to the community harbour. The northern quarry is a further distance from the water and recreational areas, and would not require archaeological consideration (see Sections 5.4.1, and 7.1.3.6 of the PSIR Report (Dynamic Ocean & Worley Consulting, 2025b).

1.3.3 Haul Road

An existing road can be used to access both quarry locations. The entire length of the road/track is constructed out of beach gravels/frost shattered bedrock and is likely in-situ material which has been graded or constructed using locally available gravel. The road runs parallel to the shoreline along a recent beach terrace (Figure 1-1). Upgrades to the exiting haul road are expected to be required.

PLAN
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NOTES:

1. WATER DEPTHS PROVIDED BY CANADIAN HYDROGRAPHIC SERVICE, DEPARTMENT OF FISHERIES AND OCEANS IN A "LAS" FILE.

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	QAR	REF DRAWING No	REFERENCE DRAWING TITLE
C	28-NOV-24	ISSUED FOR CLIENT REVIEW	JLC	BJM	CM	DH	CM	-		
B	26-JUL-24	RE-ISSUED FOR CLIENT REVIEW	JLC	BJM	CM	DH	CM	-		
A	09-JUL-24	ISSUED FOR CLIENT REVIEW	JLC	-	CM	DH	CM	-		

D SHEET SCALE SHOWN

WORLEY PROJECT No 317086-54175

ENGINEERING AND PERMIT STAMPS (As Required)

PRELIMINARY
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CUSTOMER

Building Nunavut Together
Nunavuliuqatigiingniq
Bâtir le Nunavut ensemble
Nunavut

"This drawing is prepared for the use of the contractual customer of Worley Canada Services Ltd. and Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

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Drawing 1-1

RESOLUTE BAY
COMMUNITY HARBOUR
GENERAL ARRANGEMENT

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1.4 Study Area & Marine Corridor

The Study Areas were developed for the Project components and was determined based on potential temporary and permanent footprints, and alignment with existing quarry, road, and shoreline access infrastructure (Figure 1-1).

Environmental (Physical, Biological) Study Area for the haul road, quarry and community harbour are considered the footprint plus a 100 m buffer. This is to account for potential environmental effects during construction and to be inclusive of any archaeological buffers that may have been required. When the haul road and quarry are collectively discussed, it will be referred to as the HRQ Study Area, and when all Environmental Study Areas are collectively discussed, they will be referred to as the Project Study Area.

The Socio-Economic Study Area is inclusive of the municipal boundary of Resolute Bay and the marine environment where socio-economic effects due to the community harbour have the potential to occur (see Figure 1-1).

For many of the marine organisms discussed, they are mobile with migratory routes or ranges that extend beyond the Community Harbour Study Area. This is particularly true of marine mammals who will be discussed in the broader context of the water bodies pertinent to their migratory routes relevant to potential access to Resolute Bay. Hereafter called Marine Corridors, this is considered inclusive of Baffin Bay, Lancaster Sound, Barrow Strait, Parry Channel. McDougall Sound, and Nares Strait (see Figure 1-2, Section 4.3).

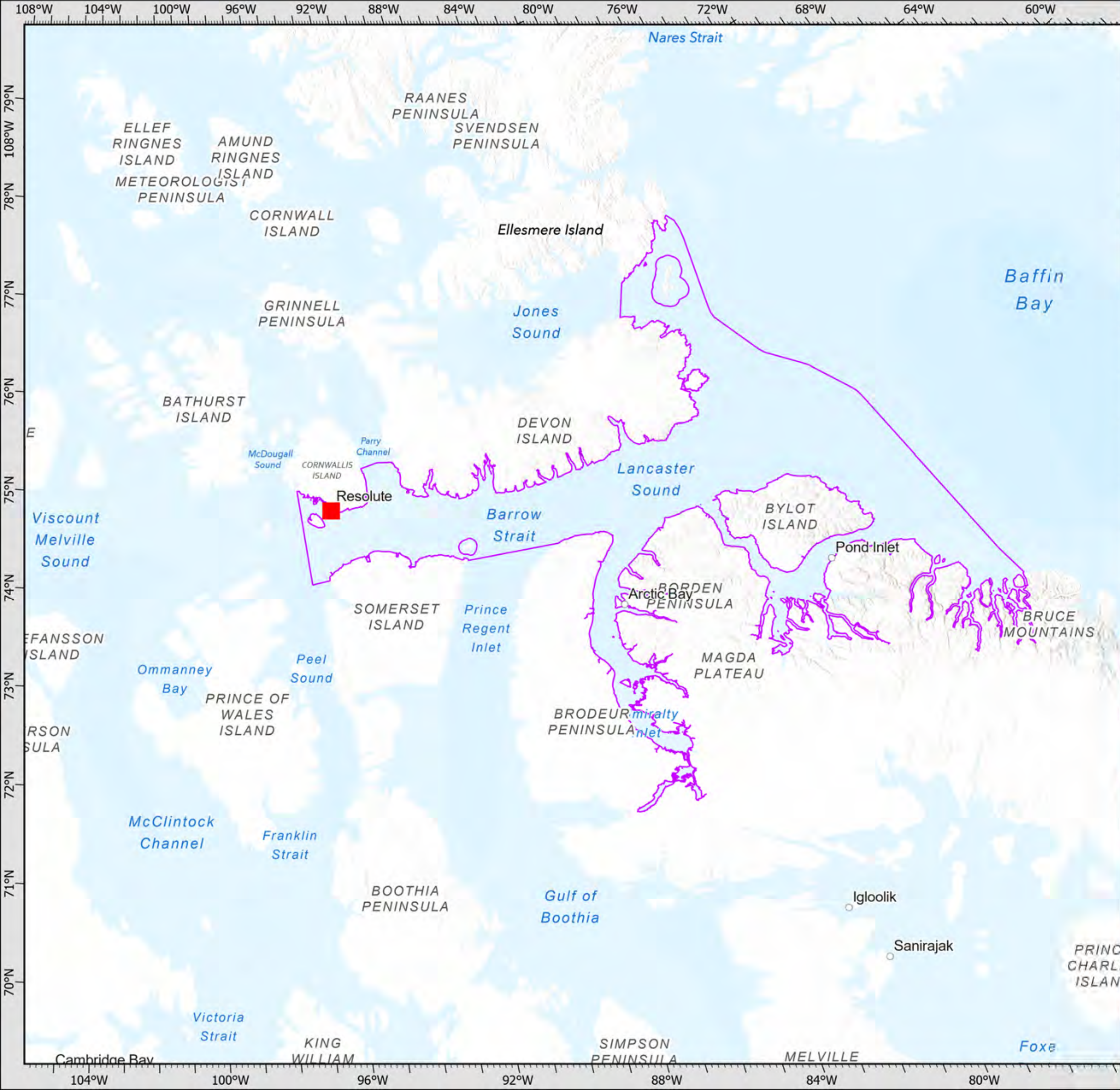


Figure 1-2

Important Marine Water Bodies (Marine Coordinors) Pertinent to the Project

1.5 Scope of Study and Objectives

The objective of the ESEB Report is to summarize the environmental (physical, biological) and socio-economic environment conducted to inform the detailed design phase of the Project. Information was synthesized from a combination of desktop review, field programs, and Inuit Qaujimajatuqangit (IQ). Desktop review and field program methodologies are provided in their respective sections throughout this report. Methodology for the IQ program is provided in Section 2.3. IQ has been incorporated into the desktop review and discussion sections of each discipline.

The Scope of Work (SoW) to support the ESEB Report is summarized below, with a more detailed description provided in Table 1-1:

- Inuit Qaujimajatuqangit.
- Species at Risk and Designated Areas.
- Aquatic Fish Habitats.
- Marine Water and Sediment Quality.
- Terrestrial Vegetation (Including Rare Plants).
- Marine Mammals.
- Marine Fish (including Marine Invertebrates) and Fish Habitat.
- Freshwater Fish and Fish Habitat
- Terrestrial Wildlife.
- Migratory and Marine Birds.
- Socio-Economic Environment.
- Archaeological and Cultural Historic Site Assessment.

Program objectives for the different disciplines are detailed in Table 1-1.

Table 1-1: Project Environmental and Socio-Economic Survey Program Objectives

Category	Relevant Study Area	Program Objectives	Approach	Report Section
IQ	Project	• Document historical and current land use in the Project Study Area including fishing, hunting, trapping, plant harvesting, and any other traditional or cultural uses as identified by local Inuit land users. • Document local Inuit knowledge of fish, marine and land mammals, migratory and marine birds. • Document marine access requirements for users during the open-water and iced-in season (i.e., snowmobile). • Obtain input and feedback to harbour design such as wind direction and strength, currents, seasonal changes to ice, water and ice access, current boating practices, traffic, and community needs.	• Desktop review, IQ workshops, and interviews with Inuit knowledge holders.	Section 2, IQ was incorporated within each discipline chapter. A discussion on local land and resource use can be found in Section 11.2.6.
Archaeological and Cultural Historic Site Assessment	Project	• Archaeological and Cultural Historic Site Assessment. • Assessment to encompass Project Study Area.	• On site assessment by a professional archaeologist recognized by the GN-Culture & Heritage (GN-C&H) occurred in the feasibility (2019) and detailed design (2024) phases. • Services provided by AECOM accompanied the Worley Consulting terrestrial team to assess the Project Study Area. • The Archaeological Impact Assessment (AIA) was permitted as detailed in • Table 1-6 and will be submitted to the GN-C&H.	N/A

Category	Relevant Study Area	Program Objectives	Approach	Report Section
Species at Risk and Designated Habitats	Project	• Species at Risk Assessment to determine the potential for SAR to be present in the vicinity of the Project Study Area.	• Desktop review and field program to determine presence potential. • Review of designations through international, federal, and territorial (when available) processes. • Identification of marine and terrestrial designated habitats were investigated, with documentation of proximity to the Resolute Bay community.	Section 3.1
Aquatic Habitats	Project	• Understanding of the benthic landscape, waterbodies, and water circulation patterns.	• Desktop review of freshwater and marine benthic habitat, vegetation, and water bodies of importance to the Project. • Water circular patterns collected through drogue field program to inform coastal processes.	Section 4
Marine Water and Sediment Quality	Community Harbour	• Understanding of water quality parameters and the impact of tidal fluctuation.	• Desktop study to describe marine water and sediment quality characteristics of the Community Harbour Study Area.	Section 5.1
			• Water quality analysis through physicochemical (YSI) and laboratory analysis (Canadian Council of Ministers of the Environment (CCME) guidelines (CCME, 1999)).	Sections 7.1.4.2, 7.4.4.2
Marine Fish (including Marine Invertebrates) and Fish Habitat	Community Harbour	• Assessment of existing conditions and potential effects on fish and fish habitat. • Determination of species important for harvesting by Inuit, and whether harvesting practices occur within the Community Harbour Study Area.	• Determination of buffer zones for the Project Study Area based on determination of the extent of potential impacts during construction (e.g. turbidity).	Sections 1.1, 1.4
			• Identification of focal fish species to be considered representative of fish habitat utilization in the Community Harbour Study Area.	Section 6.1

Category	Relevant Study Area	Program Objectives	Approach	Report Section
			• Selection of focal fish species driven by IQ and further supported through desktop and a field program.	
			• Development of a habitat map of the Community Harbour Study Area, informed through field data (intertidal, subtidal surveys) and IQ.	Section 7, Figure 2-1, Figure 7-9
			• Determination of habitat utilization (e.g. spawning, nursery, rearing, feeding, migration) by focal fish species. • Accomplished through: ○ Desktop study, IQ, field programs, and laboratory data to identify focal fish species. ○ Collection of amphipods was planned but none were found during the field program in the intertidal area. ○ Collection of fish (sculpin, Arctic cod, Arctic char) was planned to support a dietary study, however there was limited local support available during the field program. Collection of sculpins will be attempted during the spring 2025 geotechnical program. ○ Performance of a plankton survey, dietary analysis on a fish species occupying the Community Harbour Study Area (Arctic cod).	Sections 6, 7
Marine Mammals	Community Harbour	• Assessment of existing conditions and potential effects on marine mammals.	• Desktop study, IQ and incidental observations during the field program to identify focal marine mammal species.	Sections 6.1, 6.4

Category	Relevant Study Area	Program Objectives	Approach	Report Section
		• Determination of species important for harvesting by Inuit, and whether harvesting practices occur within the Community Harbour Study Area.	• Desktop and IQ for confirming presence of marine mammals in vicinity of proposed community harbour or that are important for subsistence purposes.	
Fresh Water Fish and Fish Habitat	Haul Road and Quarry (only if fish bearing water courses)	• Assessment of existing conditions and potential effects on fish and fish habitat.	• Discussion through IQ, desktop study and incidental observations during the field program to determine if there are freshwater water courses in proximity to Project Study Area, and if they are fish bearing.	Sections 4.4, 7.1.5, 7.4.5, 7.5.3
Terrestrial Vegetation	HRQ, Community Harbour	• Terrestrial vegetation assessment including identification of SAR and rare plants in the Project Study Area.	• Desktop review, IQ, and a field program (2019 only) to determine terrestrial plant species, plant communities, and SAR that occur within the Project Study Area.	Sections 3.1, 8
Terrestrial Wildlife	HRQ, Community Harbour	• Assessment of existing conditions and potential effects on terrestrial wildlife. • Determination of species important for harvesting by Inuit, and whether harvesting practices occur within the HRQ Study Area.	• Desktop review, IQ, and a field program (2019 only) to determine presence of terrestrial wildlife (including SAR) and habitat utilization within the HRQ Study Area.	Sections 3.1, 9
Migratory and Marine Birds	Project	• Assessment of existing conditions and potential effects on migratory and marine birds. • Determination of species important for harvesting by Inuit, and whether harvesting practices occur within the Project Study Area.	• Desktop review, IQ, and a field program (2019 only) to determine presence of migratory and marine birds (including SAR) and habitat utilization within the HRQ Study Area.	Sections 3.1, 10
Socio-Economic	Project, Socio-Economic	• Characterization of the socio-economic conditions of the community including: ○ Population, education and labour force activity.	• Desktop review including Statistics Canada census data and GN community data and infrastructure planning.	Section 11

Category	Relevant Study Area	Program Objectives	Approach	Report Section
		○ Infrastructure and services: health services, education, emergency services, utilities, and infrastructure. ○ Resource use in the area, including subsistence harvesting, tourism, and any trapping and guiding operations. ○ Traffic patterns; community health and wellness; and other valued socioeconomic components as determined through community consultation.	• Community consultations and interviews with key community members, service providers, and Hamlet administration.	

1.5.1 Desktop Resources

The desktop review of scientific, government, natural history, and IQ sources focused on species of management importance in Nunavut either through their role in the ecosystem, conservation status, importance for subsistence or commercial fisheries, and based on their potential to occur in the Project Study Area. Species were further assessed for being designated through territorial, federal (e.g., SAR Registry) (Government of Canada, 2024f) and international databases (International Union for the Conservation of Nature [IUCN] registry) (IUCN, 2024). From this, a focal species list was developed for terrestrial wildlife, fish, marine mammals, and migratory birds based on presence within the Marine Corridors (Figure 1-2).

Desktop resources that were particularly helpful in providing regional context for the ESEB Report are summarized in Table 1-2.

Table 1-2: Desktop Resources Used to Support the Environmental Existing Conditions Report

Source	Description	Reference	Environmental	Socioeconomic	IQ
Social Media Posts	Information posted on social media sites such as Facebook and SIKU.	Various online groups such as Resolute Bay Sell/Swap, New and This and Tat; Resolute Bay, Inuit Hunting Stories of the day, posts on the SIKU app. etc.	✓	✓	-
Google Earth Imagery	Evaluated prior to field programs to identify freshwater sources and inform potential site selection for quarries.	Google Earth (2022)	✓	-	-
Online Databases	Various online databases were reviewed to provide information, some examples are below: • Committee on the Status of Endangered Wildlife in Canada (COSEWIC) registry. • IUCN Red List of Threatened Species registry. • Species at Risk Public registry.	CESCC (2022); Government of Canada (2024f); Canadian Endangered Species Conservation Council,IUCN (2024)	✓	-	-
Nunavut Coastal Resources Inventory (NCRI) for Resolute Bay	Nunavut Coastal Resource Inventory studies were launched in 2007 by the Government of Nunavut -Department of Environment (GN-DoE) and serve as an important community-based management tool. Currently, these have been developed for 24 of the 27 Nunavut communities (GN, 2020a).	GN (2012a)	✓	✓	-
North Baffin Land Use Plan	The NBRLUP was approved and implemented by the NPC in 2000, as a document to lay out land use planning for the North Baffin region of the NSA, which contains Resolute Bay. The document contains high level information to ecological and environmental resources important to Inuit subsistence and culture.	NPC (2000)	✓	✓	✓
Recommended Nunavut Land Use Plan	The RNLUP was developed in 2023 by the NPC as an updated plan for the Nunavut Settlement Area (NSA). This document is intended to be a Nunavut-wide update to previous land use plans such as the NBRLUP once	NPC (2023b, 2023c)	✓	✓	✓

Source	Description	Reference	Environmental	Socioeconomic	IQ
	approved. The document contains high level information to ecological and environmental resources important to Inuit sustenance and culture.				
The NPC's Public Hearings Report on the 2021 Draft Nunavut Land Use Plan	Provides a summary of feedback on the 2021 Draft Nunavut Land Use Plan, highlighting key concerns and recommendations from public hearings.	NPC (2023a)	-	✓	✓
Nunavut Wildlife Harvest Study (NWHS)	Described in Part 4 of the Nunavut Agreement. The NWHS was mandated by the Nunavut Lands Claim Agreement (NLCA) and carried out under the direction of the Nunavut Wildlife Management Board (NWMB). Harvest data were collected monthly from Inuit hunters for a total of five years covering the harvest months from June 1996 to May 2001. The purpose of the NWHS was to determine current harvesting levels and patterns of Inuit use of wildlife resources.	Priest and Usher (2004) and summarized in Section 6.2 (Table 6-2).	✓	✓	✓
Arctic Corridors and Northern Voices: governing marine transportation in the Canadian Artic (Resolute, Nunavut, community report	Provides Inuit Knowledge and local perspectives on marine transportation impacts in Resolute Bay.	Carter *et al.* (2019)	-	✓	✓
Qikiqtaaluk Inuit Qaujimajatuqangit and Inuit Qaujimajangit Iliqqusingitigut for the Baffin Bay and Davis Strait Marine Environment	Presents Inuit Knowledge (IQ) on the Baffin Bay and Davis Strait marine environment, highlighting IQ of marine species, seasonal patterns, ecological changes and marine management.	QIA (2018b)	-	✓	✓
Inuit Bowhead Knowledge Study (IBKS)	Described in Part 5 of the Nunavut Agreement. As mandated by the Nunavut Land Claims Agreement of 1993, Inuit knowledge of bowhead whales in Nunavut, Canada was collected by means of 257 individual interviews with 252 Inuit hunters and elders in 18 communities during 1995 and 1996. During 1996 and 1997, follow-up workshops were held in eight of these communities where bowheads appear to be most numerous and seasonally predictable in their occurrence.	NWMB (2000)	✓	-	-

Source	Description	Reference	Environmental	Socioeconomic	IQ
Integrated Community Sustainability Plan (ICSP)	Integrated Community Sustainability Plans are infrastructure profiles that detail the current infrastructure situation in each community in Nunavut and identify future infrastructure needs and goals. They provide a breakdown of all community infrastructure assets and allow for future infrastructure planning based on the goals for each community.	GN – ICSP Toolkit website GN (2024a)	✓	-	-
Community Based Wildlife Monitoring Network	The intention of which is to address concerns affecting wildlife management, conservation, and Inuit harvesting rights and to obtain IQ in a format that can be integrated with western science modelling.	NWMB (2022)	✓	-	-
Tallurutiup Tariunga Inulik: Inuit Participation in Determining the Future of Lancaster Sound	Summary of Inuit participation in shaping the future of Lancaster Sound through traditional knowledge and policy discussions.	QIA (2012).	-	✓	✓
Inuit Heritage Trust (IHT): Place Names Program	Documents Inuit place names, their environmental and landscape features and cultural significance.	IHT (2007).	-	✓	✓
North Atlantic Marine Mammal Commission (NAMMCO)	The NAMMCO is an international regional body for cooperation on conservation, management and study of cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals and walrus) in the North Atlantic. The aims of the NAMMCO are to strengthen and progress the conservation and management measures for marine mammals.	NAMMCO (2022)	✓	-	-
Government Publications	Various government publications on fisheries management and scientific research from DFO including: • Canadian Science Advisory Secretariat ([CSAS], reports, research documents, proceedings). • Integrated Fisheries Management Plans (IFMP).	DFO (2019a, 2019c)	✓	-	-

1.5.2 Field Program and Permitting

Field programs were performed during the feasibility (2019) and detailed design (2024) phases of the Project during the open-water seasons. Based on the nature of the Field Programs, different components of the Project Study Area were targeted. Terrestrial wildlife, migratory and marine bird, and wildlife surveys were not completed in 2024, as it was determined the 2019 field program was sufficient to address existing conditions for those areas. Field Programs undertaken to support the detailed design (geotechnical, geophysical), environmental (fish and fish habitat) and socio-economic (archaeological) are outlined in Table 1-3. Weather conditions and tides during the Field Programs are provided Table 1-4 and Table 1-5. Permits obtained to support the Field Programs are detailed in Table 1-6.

Table 1-3: Summary of the Environmental and Socio-Economic Baseline Discipline, Survey Types, Study Area Focus, and Date

Discipline	Survey Type	Study Area	Year 2019	Year 2024
Environmental (Physical, Biological)				
Marine	Intertidal (quadrat)	Community Harbour	19-Aug	28-Aug
	Intertidal (drone)		-	24-Aug
	Subtidal (ROV)		18 to 19-Aug	27 to 29-Aug
	Water Quality		18-Aug	-
	Plankton		-	29-Aug
	Drogue		-	28-Aug
Terrestrial	Vegetation	HRQ, Community Harbour	17 to 19-Aug	-
	Birds	Project	17 to 19-Aug	-
	Wildlife	HRQ, Community Harbour	17 to 19-Aug	-
Socio-Economic				
Archaeological	Archaeological	Project (excluding subtidal areas of community harbour)	17 to 19-Aug	23 to 25-Aug & 01-Sept
Detailed Design				
Geological	Geological	HRQ	17 to 19-Aug	23 to 25-Aug & 01-Sept
Geophysical	Geophysical (including bathymetric)	Community Harbour	17 to 19-Aug	27 to 29-Aug
Topographic	Topographic	Project	17 to 19-Aug	23 to 25-Aug & 01-Sept

ROV = remotely operated vehicle, HRQ = Haul Road Quarry

Table 1-4: Survey Dates, Weather, and Tides for the Field Program (2024)

Tide Information							
24-Aug-24		27-Aug-24		28-Aug-24		29-Aug-24	
Time	**Height (m)**	**Time**	**Height (m)**	**Time**	**Height (m)**	**Time**	**Height (m)**
03:20	1.85	06:15	1.4	02:34	0.9	05:03	0.9
09:43	0.37	12:58	0.6	07:31	1.1	09:22	1.0
15:51	1.64	20:15	1.5	14:15	0.6	15:43	0.6
21:44	0.49	-	-	21:53	1.5	23:20	1.5
Conditions/Parameters							
24-Aug-24		27-Aug-24		28-Aug-24		29-Aug-24	
Cloud Cover	100 %	Cloud Cover	70 % to 100 %	Cloud Cover	100 %	Cloud Cover	100 %
Precipitation	0 mm	Precipitation	0 mm	Precipitation	0 mm	Precipitation	<5 cm
Temperature	2 °C	Temperature	0 °C	Temperature	0 °C	Temperature	2 °C
Wind	6 kt	Wind	13 kt to 17 kt	Wind	13 kt	Wind	12 kt
Chart Datum Depth Surveyed (m)							
Community Harbour Study Area: Minimum: 0.4 m Maximum: 20.6 m							

Source: Tide information - Resolute Station (05560) in CHS (2024)

Table 1-5: Survey Dates, Weather, and Tides for the Field Program (2019)

Tide Information					
18-Aug-19		**19-Aug-19**		**20-Aug-19**	
Time	**Height (m)**	**Time**	**Height (m)**	**Time**	**Height (m)**
03:17	1.8	03:43	1.8	04:09	1.7
09:37	0.6	10:03	0.6	10:29	0.6
15:08	1.5	15:41	1.5	16:27	1.5
21:06	0.4	21:37	0.4	22:11	0.5
Conditions/Parameters					
18-Aug-19		**19-Aug-19**		**20-Aug-19**	
Cloud Cover	1-100 %				
Precipitation	0 mm				
Temperature	7-10°C				
Wind	17 km/h to 20 km/h				
Chart Datum Depth Surveyed (m)					
Community Harbour Study Area: Minimum: 0.6 m Maximum: 9.4 m					

Source: Tide information - Resolute Station (05560) in CHS (2019)

Table 1-6: Field Program Permits for the Feasibility (2019) and Design (2024) Phases

Authority Having Jurisdiction	Permit/File No.		Permit Type
	2019	2024	
Crown Indigenous Relations and Northern Affairs Canada (CIRNAC)	N/A	N2024X0025	Land Use Permit (CIRNAC, 2024)
NPC	149159	150435	Conformity Determination (NPC, 2019, 2024)
Nunavut Impact Review Board (NIRB)	19YN031	24YN030	Screening Decision Report (NIRB, 2019, 2024)
Nunavut Research Institute (NRI)	02 058 19N-M	02 045 24N-M	Scientific Research License (NRI, 2019, 2024)
DFO	S-19/20-1018-NU	S-24/25-1071-NU	License to Fish for Scientific Purposes (DFO, 2019e, 2024f)
GN-C&H	No. 2019-53A	No. 2024-59A	Class 2 Territory Archaeologist Permit (GN-C&H, 2019, 2024)

2 Inuit Qaujimajatuqangit – Traditional Knowledge

2.1 Program Objectives

Inuit Qaujimajatuqangit, although often translated as Inuit Traditional Knowledge, also includes important Inuit values, principles, cultural beliefs and behaviours. Its literal translation is, “that which has long been known by Inuit”. There are many different definitions of IQ that aim to describe its holistic nature. The following description by the QIA has guided our understanding of IQ (QIA, 2018b):

> *“Inuit Qaujimajatuqangit is a morality that is the base for Inuit existence. It is the belief system at the core of Inuit identity and governs Inuit society. It is born through a collective effort to survive in extreme conditions where no one else could and there is no other way to do so but together. Within this ideal lives a great life-affirming admiration to the land and animals. It is about living through helping each other. It is the Inuit way.”*

Inuit Qaujimajatuqangit, as we understand it, is not merely a collection of information about the land and wildlife, but also an approach and set of principles to conducting research and project development that is based in respect and collaboration. The local knowledge holders we worked jointly with were also actively guiding decisions on the design and construction planning of the community harbour for Resolute Bay. Our IQ program therefore aimed to gather local Inuit knowledge of marine habitat, wildlife, land use, year-round access for harvesting, and areas of cultural value in and around the proposed Project to support early Project decision-making and planning, and to inform the permitting process.

We are grateful to the residents of Resolute Bay who graciously shared their time, knowledge and thoughtful feedback during our workshops and interviews.

Objectives for the IQ program are provided in Table 1-1.

2.2 Intellectual Property

The ESEB Report was prepared with IQ gathered by Worley Consulting and IQ reported in various regional studies. Worley Consulting considers all IQ to be the intellectual property of the knowledge holders. The Land Use and Occupancy map presented in Figure 2-1 was created jointly by local knowledge holders and to inform the GN’s community harbour Project for Resolute Bay. Any use of Figure 2-1, other than for the purpose stated, shall be done only with the express consent of the knowledge holders.

INUIT PLACE NAMES

NAME - ROMAN ORTHOGRAPHY	NAME	TYPE OF FEATURE	DESCRIPTION
UJARALIK	ᐅᔭᕋᓕᒃ	POINT	DIFFERENT KINDS OF ROCK FOUND HERE, INCLUDING POOR QUALITY CARVINGSTONE
UPIRNGIVIK	ᐅᐱᕐᖏᕕᒃ	POINT	SPRING / SUMMER CAMPING PLACE
NUVUALUK	ᓄᕗᐊᓗᒃ	POINT	BIG POINT
QAAJUUKKUVIK	ᖄᔫᒃᑯᕕᒃ	STORAGE AREA	PLACE WHERE EXPLOSIVES WERE STORED
APUSIRIVIK	ᐊᐳᓯᕆᕕᒃ	HILL	PLACE TO LEARN ABOUT SNOW CONDITIONS. MAKING SNOW HOUSES
QIKIQTAUP KANGIA	ᕿᑭᖅᑕᐅᑉ ᑲᖏᐊ	BAY	PASSAGE
QIKIQTAQ	ᕿᑭᖅᑕᖅ	ISLAND	PASSAGE BETWEEN HERE AND MAINLAND GOOD FOR SEAL HUNTING
ITIQSAMIITTUQ	ᐃᑎᖅᓴᒦᑦᑐᖅ	LAKE	IN A VALLEY. AS IF IT WERE CARVED OUT
QUTSITUMIITUQ	ᖁᑦᓯᑐᒦᑐᖅ	LAKE	THE ONE ABOVE

PLAN
1:30000

LEGEND:

- FISHING (NETS)
- ARCTIC TERN (NESTING)
- VARIOUS BIRDS (NESTING)
- MUSKOX
- ARCTIC FOX (POTENTIAL DENS)
- DAY SPOT (RECREATIONAL)
- SEAL / MARINE MAMMAL WAITING AREA
- ARCTIC CHAR (LAND LOCKED)
- ARCTIC CHAR (SEA RUN)
- ARCTIC CHAR (UNKNOWN - LAND LOCKED OR SEA RUN)
- CRUISE SHIP LANDING AREA
- SEALS
- SEAL CRACK (ICE CRACKS FOR SEAL HUNTING)
- YOUNG SEAL SIGHTINGS (APPROXIMATELY 4 TO 6 MONTHS IN AGE)
- RAFTED ICE (SEALS WITH PUPS)
- CLAMS (HISTORICAL HARVESTING)
- CLAMS
- WALRUS HAUL OUT (ON ROCKY SHORE)
- SKIDOO SHORTCUT TRAILS (APPROXIMATE)
- CABIN
- SEAGULL NESTING AREA
- SIGHTING
- WATER SUPPLY RESERVOIR (FISH BEARING)
- OUTFALL
- BOAT LAUNCHING

SOURCE INUIT HERITAGE TRUST:
PLACE NAMES PROGRAM. INUIT HERITAGE TRUST INCORPORATED. 2008

m 0 500 1000 1500 m
1:30000

NOTES:

1. WATER DEPTHS WITHIN THE SURVEY BOUNDARY PROVIDED BY FISHERIES AND OCEANS CANADA. SURVEY WAS PERFORMED ON SEPTEMBER 16, 2018 BY AQUATICS-ESI, PROJECT NO. 18S022002, DRAWING NO. A1, REVISION 2, DATED 19/01/07

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
C	13-JAN-25	FOR DISCUSSION	JLC	-	DP	-	CM	-		
B	21-NOV-24	FOR DISCUSSION	JLC	-	DP	-	CM	-		
A	26-JUL-24	FOR DISCUSSION	JLC	-	DP	-	CM	-		

D SHEET SCALE SHOWN

OneWay to zero harm

WORLEYPARSONS PROJECT No
317086-54175

ENGINEERING AND PERMIT STAMPS (As Required)

PRELIMINARY
DO NOT USE FOR CONSTRUCTION
Last Saved: Jan. 13/25 12:18pm

CUSTOMER

Building Nunavut Together
Nunavuliuqatigiingniq
Bâtir le Nunavut ensemble
Nunavut

"This drawing is prepared for the use of the contractual customer of Worley Canada Services Ltd. and Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

worley consulting

Figure 2-1
RESOLUTE BAY
LAND USE AND OCCUPANCY MAP

DRG No 317086-54175-00-CI-DSK-0001
REV C

PLOT DATE & TIME: 13/1/2025 12:20:53 PM
SAVE DATE & TIME: 13/1/2025 12:18:38 PM
USER NAME: jennifer.coppendale

2.3 Methodology

Inuit Qaujimajatuqangit was obtained during the feasibility and detailed design phases of the Project, as summarized in Table 2-1.

Table 2-1: Inuit Qaujimajatuqangit Workshops

Phase	Workshop Description
Feasibility	• Five design workshops in November 2018, June 2019, November 2019, December 2021 and May 2022 with members of the Resolute Bay Hunters and Trappers Association (HTA) in Resolute Bay. • One land use and wildlife focused workshop with elders and active Inuit hunters and fishers in June 2019. • Verification with knowledge holders in November 2019.
Detailed Design and Permitting	• Two design workshops in August 2024 and December 2024 with the HTA and the Nauttiqsuqtiit (Guardians). • Land use and wildlife focused interviews with knowledge holders in August 2024. • Verification with knowledge holders in December 2024.

Local interpreters were hired as required to support workshops and interviews. Before the start of the IQ workshops and interviews, knowledge holders were asked to read a project information sheet and consent form and then complete and sign the form before the start of the IQ workshops. The consent form was provided in English and Inuktitut and described the workshop's objectives, methodologies, and uses for the information, allowed the knowledge holder to specify where a copy of the transcript and map should be sent, and whether the knowledge holder wished to be acknowledged by name for their contribution.

To better understand the potential interactions between harvesting rights and anticipated Project activities, discussions during the workshops and interviews focused on: harvest locations; water and ice access; local site conditions such as winds, waves, currents, rivers and creeks, sedimentation etc.; fishing; marine and land mammals; birds and other wildlife; carving stone; camps and other culturally important areas; and the potential locations of the proposed community harbour, quarry and haul routes in relation to land use activities (e.g. fishing, hunting, gathering and trapping).

Land use and areas of cultural or ecological value were marked on maps and later digitized. Maps were verified by knowledge holders in December 2024 to confirm that the information gathered during the IQ program was interpreted and presented in the intended manner.

All knowledge holders consented to their knowledge being shared with the team and for the purpose of informing the ESEB Report, the archaeological assessment and the overall Project design and construction planning. Consent was also provided by the knowledge holders to have their knowledge presented as noted in the Land Use and Occupancy map (see Figure 2-1).

Inuit Qaujimajatuqangit has been joined with results from the Field Program to allow the Project team, in collaboration with community members, to make informed decisions on the design and construction planning of the proposed harbours that reflect the communities' needs, priorities and values.

A review for existing and accessible IQ research relevant to the Project Study Area was also conducted. See Table 1-2 for sources that were especially helpful in providing valuable regional context to the ESEB Report.

Where applicable, topic specific IQ information has been incorporated into this report. The land use and occupancy map also includes place names in the area from the IHT database. A discussion on local land and resource use can be found in Section 11.2.6.

The IQ findings are based on a small number of workshops and a selection of readily available literature, and do not represent the full intensity and extent of Inuit use and occupancy of the Study Area or the surrounding region.

3 Species at Risk and Designated Areas

3.1 Species at Risk

Species discussed in this section have been assessed by IUCN, COSEWIC, federal (e.g. SAR registry) territory (e.g. GN-DoE), and the RNLUP (NPC, 2023b). Determining species occurrence to the level of Project Study Area can be difficult with marine species; therefore, likelihood of occurrence was considered within Resolute Bay.

A description of focal species, their federal and territorial status, SAR status, and their probability of occurrence (within Resolute Bay) are listed in Table 3-2. Species at Risk were categorized by international, federal, and territorial designations, and were selected as those having the potential to overlap with the Project Study Area for various life history stages (e.g., breeding, nursery, resident, migration, and feeding). The DFO has generated an aquatic species at risk map; however, at the time of this report there is nothing to note for Resolute Bay (DFO, 2024a).

3.1.1 Federal Designation

The status of individual species is independently and annually reviewed by COSEWIC. As a part of COSEWIC species assessments, Aboriginal Traditional Knowledge (ATK) is incorporated through an ATK subcommittee and regular communication and involvement of Wildlife Management Boards (WMB), including the NWMB (COSEWIC, 2009b). Once a species has been designated by COSEWIC, it is recommended for addition to the List of Wildlife Species at Risk whereby it would obtain legal protection under *Species at Risk Act* (SARA); for marine species, DFO provides listing policy guidance, and for terrestrial species, Environment and Climate Change Canada (ECCC) provides listing guidelines (COSEWIC, 2021; DFO, 2018c; ECCC, 2016b). Once listed, SARA provides legislated protection to recognized threatened, endangered, or extirpated species and requires that the responsible government agencies design and implement an approved recovery plan.

Three sections of the SARA have relevance to the Project:

- Section 32 prohibits the killing, harming, harassing, or capturing of a threatened, endangered, or extirpated species.
- Section 33 prohibits the damage or destruction of the residence of a threatened, endangered, or extirpated species.
- Section 58 prohibits the damage or destruction of any part of designated critical habitat of a threatened, endangered, or extirpated species.

3.1.2 Territorial Designation

There are two processes for Nunavut specific designations of habitat and species types, that are coordinated through a) the Nunavut *Wildlife Act* and b) RNLUP (NPC, 2023b), which are described in Table 3-1.

Table 3-1: Nunavut Designations for Habitats and Species

Nunavut *Wildlife Act*	Recommended Nunavut Land Use Plan
The Nunavut *Wildlife Act* further protects species at risk and provides a framework for the management of wildlife and habitat in Nunavut (GN, 2018d). The territorial status of a native species is assessed by the Nunavut Species at Risk Advisory Committee and a recommendation for the designation of a species is provided to the NWMB, which is responsible for the designation of rare, threatened, and endangered species under both SARA and the NLCA (GN, 2018d). Species status are reviewed and issued every five years in the Wild Species report (CESCC, 2022).	Designated habitats in Nunavut have been categorized in the RNLUP (NPC, 2023b), which discusses: key migratory bird habitat sites, caribou (calving and post calving sites, key access corridors, sea ice crossings, freshwater crossings, polar bear denning areas, walrus terrestrial haul outs, Atlantic cod lakes, and marine areas of importance. Species specific categorizations, when relevant and in proximity to the Project Study Area will be discussed in the respective organism sections. Marine areas of importance, are discussed in designated habitats and is inclusive of Ecologically and Biologically Significant Areas (EBSAs, Section 3.2.4), Polynyas (Section 3.2.5), and Floe Edges (Section 3.2.6).

Table 3-2: Status of Marine Focal and Designated Species and Terrestrial Designated Species in Nunavut

Species	Latin Name	Inuktitut		IUCN Status	COSEWIC Status	SARA Status	Nunavut Rank	Study Area	Likelihood of Occurrence	Species Summary
		Syllabics	Transliteration							
Fish										
Amphipod	*Amphipoda sp.*	Not available	Kingu[3]	No Status	No Status	Not Listed	Not Ranked (NR)	Community Harbour	Likely	See Section 6.3.1. Probability is likely based on a general assumption of coastal areas in Nunavut, however, there were no intertidal amphipods found during a through search for them in the field program.
Arctic char	*Salvelinus alpinus*	ᐃᖃᓗᒃᐲᑦ	Ikaliviit[1], Ivitaruk[2]	Least Concern	No Status	Not Listed	NR	Community Harbour	Likely	See Section 6.3.2.
Arctic cod	*Boreogadus saida*	ᐆᒐᐃᑦ	Ugak[1], Uugaq[3]	Least Concern	No Status	Not Listed	NR	Community Harbour	Likely	See Section 6.3.3.
Sculpin (Shorthorn)	*Myoxocephalus scorpius*	ᑲᓇᔪᐃᑦ	Kanayuk[1], Kanajuq[2]	No Status	No Status	Not Listed	NR	Community Harbour	Likely	See Section 6.3.4.
Sculpin (Staghorn)	*Gymnocanthus tricuspis*			Least Concern	No Status	Not Listed	NR	Community Harbour	Likely	See Section 6.3.4.
Marine Mammals										
Atlantic Walrus (High Arctic population)	*Odobenus rosmarus*	ᐊᐃᕖᑦ	Akvik[1]	Vulnerable	Special Concern	Not Listed	S3	Community Harbour	Likely	See Section 6.4.1
Bearded seal	*Erignathus barbatus*	ᐅᒡᔪᐃᑦ	Ukalik[1], Qilalugaq[3]	Least Concern	Data Deficient	Not Listed	NR	Community Harbour	Likely	See Section 6.4.2
Beluga whale (Eastern High Arctic/Baffin Bay population)	*Delphinapterus leucas*	ᖃᑯᕐᑕᑦ ᕿᓚᓗᒐᑦ	Kilalugak[1], Qilalugak[2]	Least concern	Special Concern	Not Listed	NR	Community Harbour	Possible	See Section 6.4.3
Bowhead whale (Eastern Canada-Western Greenland population)	*Balaena mysticetus*	ᐊᕐᕕᒃ	Arviq[3]	Least Concern	Special Concern	Not Listed	NR	Community Harbour	Unlikely	See Section 6.4.4
Harp seal	*Pagophilus groenlandicus*	ᖃᐃᕈᓖᑦ	Qairulik[2]	Least Concern	Not Assessed	Not Applicable	NR	Community Harbour	Likely	See Section 6.4.5
Killer whale (Northwest Atlantic/Eastern Arctic population)	*Orcinus orca*	Not available	Aarluk[2]	Data Deficient	Special Concern	Not Listed	NR	Community Harbour	Unlikely	See Section 6.4.7

Species	Latin Name	Inuktitut		IUCN Status	COSEWIC Status	SARA Status	Nunavut Rank	Study Area	Likelihood of Occurrence	Species Summary
		Syllabics	Transliteration							
Narwhal	*Monodon monoceros*	ᑑᒑᓕᑦ ᕿᓚᓗᒐᑦ	Allanguaq[2], Tuugaalik[3]	Least Concern	Not at Risk	Not Listed	NR	Community Harbour	Unlikely	See Section 6.4.8
Polar bear	*Ursus maritimus*	ᓇᓄᐃᑦ#	Nanuit[1], Nanuk[2]	Vulnerable	Special Concern	Special Concern	S3	Community Harbour	Possible	See Section 6.4.9
Ringed seal	*Pusa hispida*	ᓇᑦᓯᑦ	Natinat[1], Natsiq[2]	Least Concern	Special Concern	Not Listed	NR	Community Harbour	Likely	See Section 6.4.10
Vegetation										
Porsild's Bryum	*Haplodontium macrocarpum*	Not available	Ivruijak[1]	No Status	Threatened	Threatened	S1	HRQ	Unlikely	Known distribution only on Ellesmere Island in Nunavut.
Migratory Birds										
Buff-breasted sandpiper	*Calidris subruficollis*	Not available	Satqarillak[1], Sitjariaq[2]	Vulnerable	Special Concern	Special Concern	S3	Project	Possible	Outside mapped breeding range and habitat limited.
Ivory gull	*Pagophila eburnean*	ᖃᑯᓪᓗᒃ	Naujat[3]	Near Threatened	Endangered	Endangered	S1	Project	Unlikely	Near year-round mapped range but breeding and nesting habitat is not present therefore unlikely to nest near Project.
Red knot	*Calidris canutus*	ᓯᔾᔭᕆᐊᖅ	Sijjariaq[3]	Near Threatened	Endangered	Endangered	S2	Project	Possible	Within mapped breeding range and nesting habitat present near Project.
Red-necked phalarope	*Phalaropus lobatus*	ᓴᐅᕐᕌᖅ	Saurraaq[1]	Least Concern	Special Concern	Special Concern	S3	Project	Likely	Outside mapped breeding range though habitat present.
Ross's gull	*Rhodostethia rosea*	ᓇᐅᔦᑦ	Naujat[3]	Least Concern	Endangered	Threatened	S1	Project	Unlikely	Outside mapped breeding range and breeding habitat is not present near Project.
Terrestrial Wildlife										
Peary caribou (Western Queen Elizabeth subpopulation)	*Rangifer tarandus pearyi*	ᑐᒃᑐᖏᑦ	Tuktut[1]	Vulnerable	Threatened	Threatened	S3S4	HRQ	Unlikely	Historical harvest records near Project.
Wolverine	*Gulo gulo*	ᖃᑉᕕᒑᕐᔪᒃ	Qavvigaarjuk[1]	Least Concern	Special Concern	Special Concern	S3	HRQ	Unlikely	Within mapped range but observations are rare and not documented locally.

Note:
Sources for species designation: 1. [CESCC (2022)]; 2. [federal Government of Canada (2024f)]; 3. [international IUCN (2019)],
Sources for transliteration: 1. Priest and Usher (2004); 2. Rapinski *et al*. (2018); 3. QIA (2018b). Inuktitut translations provided by various online resources. Transliterations and Inuktitut translations were confirmed in Resolute Bay during the IQ verification workshop in December 2024.
HRQ = Haul Road Quarry.

<u>Terrestrial Vegetation</u>
Likelihood of occurrence within Project Study Area was based upon a qualitative assessment of results of potential habitat. Other factors such as known locations were also incorporated.

Likely: Study Area is located within areas that have known occurrence records and most of the area is habitat for the species.
Possible: Study Area is located within areas that have known occurrence records and some habitat may be available for the species.
Low: Study Area is located outside areas that have known occurrence records and habitat may be available for the species.
Unlikely: Study Area is located outside areas that have known occurrence records and habitat is not identified.

Wildlife and Migratory Birds Probability Description
Likelihood of occurrence within Project Study Area was based upon a qualitative assessment of results of potential habitat. Similarly, other factors such as breeding range, location of known colonies, etc., were incorporated.
Likely: Study Area is located within the mapped range and the majority of the area is available habitat.
Possible: Study Area is located within the mapped range and some of the available habitats may provide suitable breeding or other life-stage requirements.
Low: Study Area is located within the mapped range and some of the available habitat may provide marginal breeding or other life-stage requirements.
Unlikely: Study Area is located outside of the mapped range or outside of known colonies (or the species is colonial and such a colony would likely be known to locals given its proximity to the hamlet), and available habitat is generally not present.

Fish Probability Description
Possible: based on biogeographic range and literature may be in the Community Harbour Study Area.
Unlikely: based on biogeographic range and desktop review is unlikely to be in the Community Harbour Study Area.

Marine Mammal Probability Description
Likely: based on biogeographic range, desktop review and IQ and may be in the proposed Study Area with regularity.
Possible: based on biogeographic range and desktop review and IQ and may be in the proposed Study Area on an irregular basis.
Unlikely: based on biogeographic range and desktop review and IQ and is unlikely to be in the proposed Study Area.
Nunavut Territorial Rank(CESCC, 2022): S1=critically imperilled, S2=imperilled, S3=Vulnerable, S4=apparently secure, SU=unrankable, NR = not ranked.

3.2 Designated Habitats

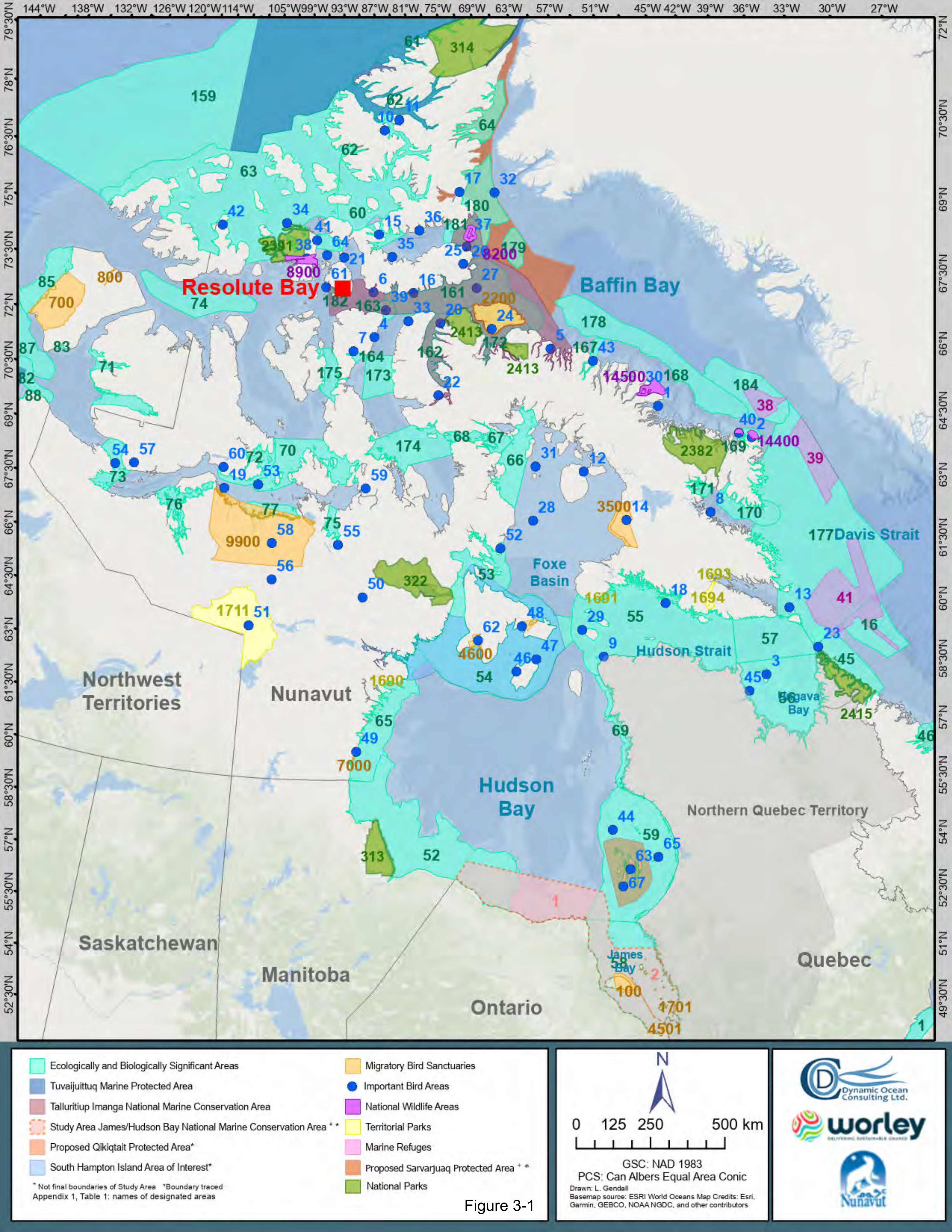
Designated areas in Canada meet the IUCN's definition of protected area, which states protected areas are "a clearly defined geographic space, recognized, dedicated and managed through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural value" Canada, through Target 3 of the Kunman-Montreal Global Biodiversity Framework, has committed to conserving 30 % of marine areas by 2030 (ECCC, 2022). As of the end of 2024, Canada has conserved 13.7 % of terrestrial areas and inland waters (Canadian Parks Council, 2024), and had protected 14.7 % of marine and coastal areas, including two designated conservation areas in the Arctic (DFO, 2021a; National Observer, 2019). In 2022, Canada developed the Other Effective Area-Based Conservation Measures (OECMs) based on international guidance and interpreted into a Canadian context (DFO, 2022b). As of 2024, 10.2 % (213,052 km^2) of the territory of Nunavut is protected (Government of Canada, 2024b).

The NMCAs, Marine Protected Areas (MPAs), National Wildlife Areas (NWAs), Migratory Bird Sanctuaries (MBS) and national parks are designed and designated for the protection or conservation of species and species habitat. Other areas such as territorial parks, EBSAs and Important Bird Areas (IBAs) have been designated by various government and non-governmental organization as providing significant and important habitats.

The RNLUP has presented existing and proposed protected areas, some of which are included in the TI NMCA and MPA described in Sections 3.2.1 and 3.2.2, respectively (NPC, 2023b). Marine habitat designations are managed federally by Parks Canada, DFO, Transport Canada and ECCC (Government of Canada, 2017a). Canadian designated areas can be viewed on DFO's interactive map for designated areas with their contribution to Canada's coastal and marine areas targets (DFO, 2024b).

The location of designated areas that are within the Resolute Bay Marine Corridors (see Figure 1-2) are provided in Figure 3-1 (Nunavut) and Figure 3-2 (Marine Corridors in Proximity to Resolute Bay). The numbers on the figures that correlate to designated areas is provided in Appendix C (Table C-1). To further support a determination of the locations of all designated areas discussed in this section, footnotes with a link to websites has been provided.

Distances and direction are also summarized in Table 6-3 of the PSIR Report (Dynamic Ocean & Worley Consulting, 2025b).



Resolute Bay
Baffin Bay
Davis Strait
Foxe Basin
Hudson Strait
Ungava Bay
Hudson Bay
James Bay
Northwest Territories
Nunavut
Saskatchewan
Manitoba
Ontario
Quebec
Northern Quebec Territory
Ecologically and Biologically Significant Areas
Tuvaijuittuq Marine Protected Area
Talluritiup Imanga National Marine Conservation Area
Study Area James/Hudson Bay National Marine Conservation Area + *
Proposed Qikiqtait Protected Area*
South Hampton Island Area of Interest*
* Not final boundaries of Study Area *Boundary traced
Appendix 1, Table 1: names of designated areas
Migratory Bird Sanctuaries
Important Bird Areas
National Wildlife Areas
Territorial Parks
Marine Refuges
Proposed Sarvarjuaq Protected Area + *
National Parks
N
0 125 250 500 km
GSC: NAD 1983
PCS: Can Albers Equal Area Conic
Drawn: L. Gendall
Basemap source: ESRI World Oceans Map Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors
Dynamic Ocean Consulting Ltd.
worley
Nunavut

Figure 3-1

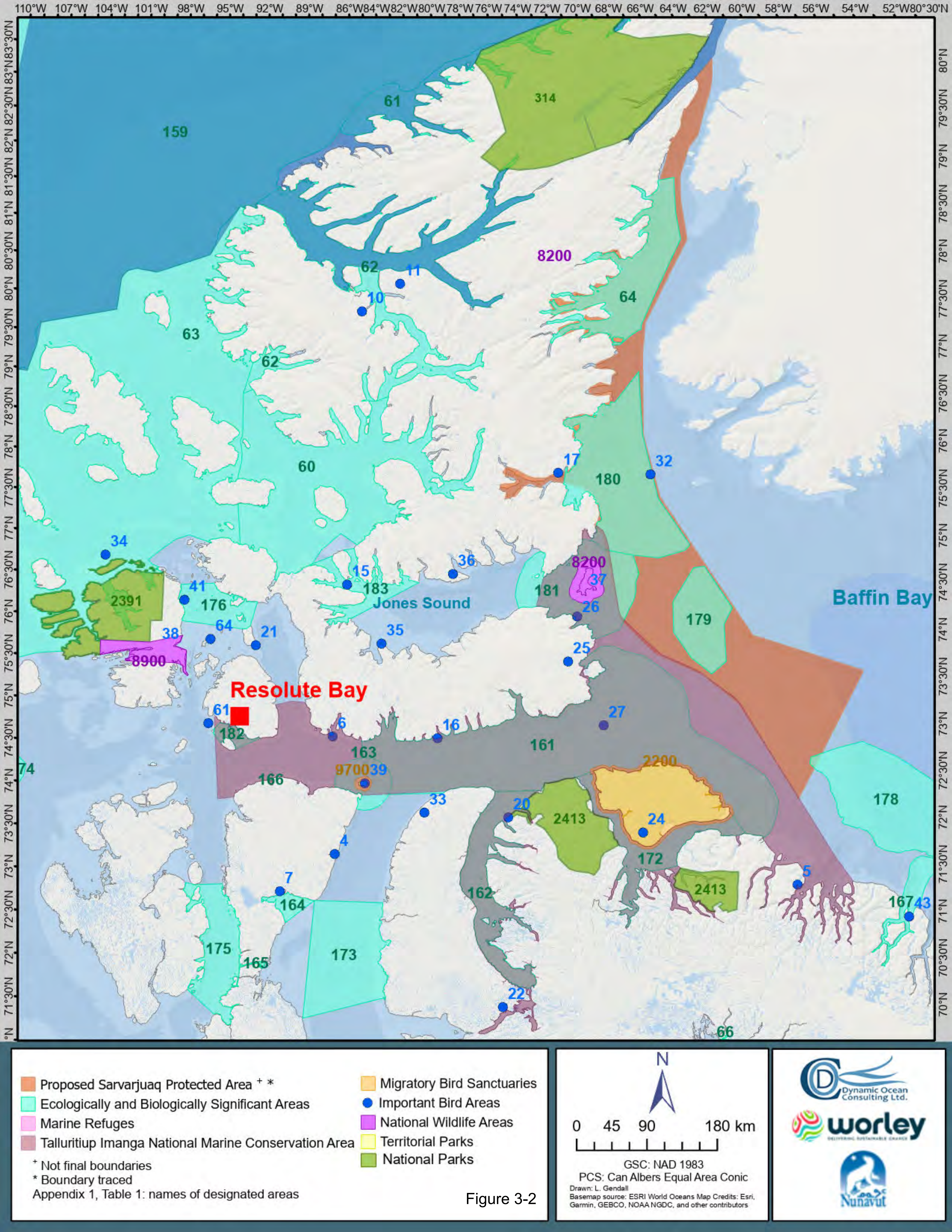

Resolute Bay
Jones Sound
Baffin Bay
Proposed Sarvarjuaq Protected Area + *
Ecologically and Biologically Significant Areas
Marine Refuges
Talluritiup Imanga National Marine Conservation Area
+ Not final boundaries
* Boundary traced
Appendix 1, Table 1: names of designated areas
Migratory Bird Sanctuaries
Important Bird Areas
National Wildlife Areas
Territorial Parks
National Parks
N
0 45 90 180 km
GSC: NAD 1983
PCS: Can Albers Equal Area Conic
Drawn: L. Gendall
Basemap source: ESRI World Oceans Map Credits: Esri, Garmin, GEBCO, NOAA NGDC, and other contributors
Dynamic Ocean Consulting Ltd.
worley
Nunavut

Figure 3-2

3.2.1 National Marine Conservation Areas

The federal government manages NMCAs through Parks Canada. The purpose of these designations is to protect and conserve representative marine habitat for the benefit, education and enjoyment of Canadians (Parks Canada, 2024a). The 2022 *Policy on the Establishment and Management of National Marine Conversation Areas* describes eight interconnected management goals to manage NMCAs and reflects the Government of Canada's commitment to Target 3 of the Kunman-Montreal Global Biodiversity Framework ensuring that 30 % of Canada's marine waters will be protected by 2030 (ECCC, 2022; Parks Canada, 2022).

Areas established as NMCAs represent a marine region and include protection of the seabed, water column above it and may include wetlands, estuaries, islands, and other coastal lands (Parks Canada, 2024a). These areas are protected from activities such as ocean dumping, undersea mining, and oil and gas exploration and development. Traditional fishing activities are permitted but must be managed with the conservation of the ecosystem as the main goal. Parks Canada states NMCAs are designed and designated for the following (Parks Canada, 2017):

- Represent oceanic and lake diversity.
- Maintain ecological processes and life support systems.
- Provide a model for sustainable use of marine species and ecosystems.
- Encourage marine research and ecological monitoring.
- Protect depleted, vulnerable, threatened, or endangered marine species and their habitats.
- Provide for marine interpretation and recreation.
- Contribute to a growing worldwide network of MPAs.

The establishment of the TI NMCA was announced on 1 August 2019 (ITK, 2019; Parks Canada, 2024c). The TI NMCA is approximately 108,000 km^2 and reaches 1.9 % of Canada's 30 % 2030 target (Parks Canada, 2022). In addition, the TI Nauttiqsuqtiit Program secured and utilized $9,658,342 from Parks Canada for activities related to the TI NMCA in 2022-2023 (QIA, 2023). This funding was used to support TI NMCA governance, plan and develop infrastructure projects, support fisheries development, fund the TI major patrol, and support Hunters and Trappers Organizations (QIA, 2023)[1].

Resolute Bay is within the TI NMCA[2]; however, a portion of the waterfront within the community is excluded through Article 4 of the IIBA (IIBA, 2019) to allow for the development of the community harbour.

[1] See Figure 3.1.4 (RNLUP, Appendix C-Chapter 3) for a depiction of NMCAs in proximity to Resolute Bay: https://www.nunavut.ca/sites/default/files/23-015e_2023-09-07-2023_or_appendix_c_maps_chapter_2_english.pdf

[2] TI NMCA image location available at this URL: https://canadiangeographic.ca/articles/mapping-the-lancaster-sound-national-marine-conservation-area/

3.2.2 Marine Protected Areas

Marine Protected Areas are designed for long-term conservation of ocean systems and environments, though some activities are permitted depending on their impacts to the ecological features encompassed within the MPA (DFO, 2024g). Marine Protection Areas are a nature-based solution that contribute to a healthy marine environment by protecting and conserving marine species and populations and the diversity of ecosystems that marine organisms depend on (DFO, 2024g). This includes areas such as connected waterways, underwater canyons, and hydrothermal vents. In addition, MPAs are designed to support economic goals of society and contribute to Canadian culture by protecting areas with cultural heritage value (DFO, 2024g).

3.2.2.1 Sarvarjuaq (Proposed) MPA

The North Water Polynya[3] is under consideration by DFO and the QIA to be designated as the Sarvarjuaq MPA. This area is the largest open-water area surrounded by ice in the Arctic and is one of the most productive ecosystems in the world supporting marine life as a feeding area and migration corridor (DFO, 2023, 2024h). The Sarvarjuaq MPA will cover an area of approximately 73,737 km^2 (DFO, 2024h).

The DFO and the QIA have been collaborating on options to protect the Sarvarjuaq (North Water Polynya) since 2019, where the Sarvarjuaq Working Group was established in 2021 (NIRB, 2025a, 2025b), to allow for appropriate consultation with the six Nunavut communities that are in closest proximity (Resolute Bay, Grise Fiord, Arctic Bay, Pond Inlet, Clyde River, Qikiqtarjuaq). The Sarvarjuaq (NPC No: 126016, NIRB No: 24VN054 (NIRB, 2025b)) MPA was submitted to the NIRB by DFO and QIA for designation by Ministerial Order and the SDR was issued on 12 December 2024.

The proposed Sarvarjuaq MPA[4] is approximately 375 km northeast of Resolute Bay.

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[3] See Figure 2.8.4 (RNLUP, Appendix C-Chapter 2) for a depiction of the north water polynyas in proximity to Resolute Bay: https://www.nunavut.ca/sites/default/files/23-015e_2023-09-07-2023_or_appendix_c_maps_chapter_2_english.pdf, and see Figure 3.2.6 (RNLUP, Appendix C- Chapter 3) for a depiction of MPAs in proximity to Resolute Bay: https://www.nunavut.ca/sites/default/files/23-016e_2023-09-07-2023_or_appendix_c_maps_chapter_3_english.pdf

[4] Proposed Sarvarjuaq MPA location depiction available at this URL: https://www.dfo-mpo.gc.ca/oceans/aoi-si/sarvarjuaq-eng.html

3.2.2.2 Tuvaijuittuq MPA

The Tuvaijuittuq MPA was designated on 29 July 2019 and reached 5.6 % of Canada's 10 % target (DFO, 2021b). A second ministerial order MPA for the Tuvaijuittuq MPA has been designated on 14 August 2024 to describe human activities that will be allowed in this area for the next five years, while DFO works collaboratively with Inuit and northern partners to consider long-term protection priorities including supporting Inuit-led Protected and Conserved Areas (IPCA) (DFO, 2019h).

Located off the coast of northwest Ellesmere Island, this MPA is approximately 319,411 km^2 and includes the marine waters off northern Ellesmere Island starting from the low water mark and extending to the outward boundary of Canada's Exclusive Economic Zone (EEZ) (DFO, 2019h).

The Tuvaijuittuq MPA[5] is approximately 570 km north of Resolute Bay.

3.2.3 Other Effective Area-Based Conservation Measures

Protected areas and OECMs that qualify as fisheries area closures are known as marine refuges (DFO, 2024c). The OECMs are coined as a Pan-Canadian conservation tool that recognizes the collaborative efforts federal, provincial, territorial and municipal jurisdictions, Indigenous Peoples, non-governmental organizations, for-profit organizations and philanthropic organizations (Government of Canada, 2023a). When implemented in Canada's oceans, OECMs are similar to MPAs in that they manage conservation of biodiversity by managing and/or prohibiting human activities within their boundaries (DFO, 2022b). Marine refuges, aka Fisheries-area closures that have been assessed and recognized as OECMs, are the only OECMs in Canada's Oceans at present (DFO, 2022b).The measures are intended to last long-term and contribute to Canada's marine conservation targets (Government of Canada, 2023a).

The Davis Strait Conservation Area (DSCA) and the Disko Fan Conservation Area (DFCA) are marine refuges in closest proximity to Resolute Bay, which fit the classification of an OECM, and are located within the Eastern Arctic Bioregion of Baffin Bay near Davis Strait. The objective of the DSCA is to conserve sensitive benthic areas, to minimize impacts within food and overwintering habitat for narwhal (*Monodon monoceros*) and to conserve coral concentrations (Government of Canada, 2024e). Both marine refuges prohibit all bottom-contact fishing activities.

The DSCA[6] and the DFCA are approximately 1,700 km and 1,500 km southeast of Resolute Bay.

3.2.4 Ecologically and Biologically Significant Areas

Ecologically and Biologically Significant Areas are areas within Canada's oceans that have been identified through formal scientific assessments as having special biological or ecological significance when compared with the surrounding marine ecosystem (DFO, 2005a). The identification of EBSAs is a key component of basis for the development of federally designated areas (DFO, 2011a). The government

[5] Tuvaijuittuq MPA location depiction available at this URL: https://www.dfo-mpo.gc.ca/oceans/mpa-zpm/tuvaijuittuq/index-eng.html

[6] DSCA and DFCA location depiction available at this URL: https://www.dfo-mpo.gc.ca/oceans/oecm-amcepz/refuges/diskofan-eng.html

designated ESEBs by using criteria set out by, and facilitated by, the Conference of the Parties to the Convention on Biological Diversity (Convention on Biological Diversity, 2019).

The criteria include:

- Uniqueness or rarity.
- Special importance for species' life history.
- Important for at-risk species and habitats.
- Vulnerability, fragility, sensitivity, or slow recovery.
- Biological productivity and diversity.
- Naturalness.

Resolute Bay is within the Eastern Arctic bioregion[7], which contains twenty EBSAs (Schimnowski *et al.*, 2018). The RNLUP also demonstrates EBSAs (see Section 3.3) (NPC, 2023b).

The EBSAs in closest proximity to Resolute Bay[8, 9] are summarized below:

- Resolute Passage: Resolute Bay is within it.
    - Located between Cornwallis Island and Griffith Island (DFO, 2015a; Schimnowski *et al.*, 2018), and was identified as an EBSA because of its high ice algal biomass and benthic productivity from March to June (DFO, 2015a). Browne Island which lies south of Cornwallis Island, west of the EBSA, northwest of Somerville Island, and 46 km northwest of the Project, is a Key Migratory Bird Terrestrial Habitat site (Alexander *et al.*, 1991).
- Prince Leopold Island: approximately 150 km southeast.
    - Prince Leopold Island EBSA is 13 km off the northeastern tip of Somerset Island at the junction of Prince Regent Inlet and Barrow Strait (Bird Studies Canada, 2024; DFO, 2015a; Mallory & Fontaine, 2004; Schimnowski *et al.*, 2018). It was designated as an EBSA for its large multi-specie as aggregations of breeding seabirds from May to September (Schimnowski *et al.*, 2018).
    - Also designated as an Important Bird Area (IBA) (Section 3.2.8) and as an MBS (Section 3.2.9) in 1995 (Bird Studies Canada, 2024; DFO, 2015a; Mallory & Fontaine, 2004; Schimnowski *et al.*, 2018).
- Peel Sound: approximately 100 km south.

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[7] See Figure 1 for a depiction of the spatial boundaries of the Eastern Arctic Bioregion, and Figure 2 for location boundaries relative to Resolute Bay https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/40656123.pdf

[8] EBSAs in proximity to Resolute Bay figure locations: Resolute Passage (Figure 30, p. 57), Prince Leopold Island (Figure 32, p. 61), Peel Sound (Figure 28, p. 52) https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/40656123.pdf

[9] See Figure 2.7.3 (RNLUP, Appendix C-Chapter 2) for a depiction of EBSAs in proximity to Resolute Bay: Resolute Passage (No. 45), Prince Leopold Island (No. 27), Peel Sound (No. 39) https://www.nunavut.ca/sites/default/files/23-015e_2023-09-07-2023_or_appendix_c_maps_chapter_2_english.pdf

- Identified as an EBSA due to its importance to the Baffin Bay narwhal population during the months of July and August, and is considered to be a potential feeding and calf rearing area (DFO, 2015a).
- Penny Strait: 100 km north.
    - Located between Devon and Bathurst Islands, the Penny Strait was identified as an EBSA based due to supporting the largest nesting colony of Ross's gull in the Canadian Arctic (DFO, 2015a; Schimnowski *et al.*, 2018).

Further details on the importance of these EBSAs to marine mammals and migratory birds is available in Sections 6.4 and 10, respectively.

3.2.5 Polynyas

A polynya is an area of open-water that remains ice-free all year round (National Snow & Ice Data Center) (NSIDC, 2019). Polynyas are fundamental components of Arctic environments that has a significant effect on the spatial and temporal distribution of marine life across all trophic levels. There are 23 polynyas in Canada's Arctic[10], of which 14 exist in the Eastern Arctic Biogeographic Region[11].

Polynyas and their ice edge habitat are characteristically areas of higher productivity, have a long history of cultural significance to the Inuit (NPC, 2000). The North Water Polynya[10,11] for example is one of the most productive food webs in the Arctic Ocean and have provided the basis for subsistence hunting and human presence on Ellesmere Island and the northernmost part of Baffin Bay (Heide-Jørgensen *et al.*, 2013). The North Water Polynya is host to a rich and diverse array of Arctic species, including beluga, narwhal, walrus, bearded seal, ringed seal, and polar bear (Heide-Jørgensen *et al.*, 2013). Polynya characteristics are dependent on a combination of bathymetric, coastal, and atmospheric variables, including tidal forces and vertical excursions (Hannah *et al.*, 2009).

The polynyas in closest proximity to Resolute Bay[10,11] are summarized below:

- Karluk Brooman Polynya: approximately 80 km west.
- Dundas Island: approximately 150 km north.
- Queen's Channel and Penny Strait, approximately 200 km north.

3.2.6 Floe Edges

The floe edge, or "Sinaaq" in Inuktitut are locations where landfast ice meets open water[12]. Floe edges are seasonally important areas for migratory birds and marine mammals, which concentrate at the floe

[10] Arctic Polynya locations depiction available in Figure 1 of this URL: North Water (No. 21), Karluk Brooman (No. 14), Dundas Island (No. 16), and Queens Channel and Penny strait (No. 15) : https://journalhosting.ucalgary.ca/index.php/arctic/article/view/63179/47117
[11] Arctic Polynya Locations in East Arctic Biogeographic region available in Figure 8 of this URL: North Water (No. 14), Karluk Brooman (No. 8), Dundas Island (No. 9), and Queens Channel and Penny strait (No. 10) : https://waves-vagues.dfo-mpo.gc.ca/library-bibliotheque/40656123.pdf
[12] See Figure 2.7.4 (RNLUP, Appendix C-Chapter 2) for a locations of polynyas in proximity to Resolute Bay: https://www.nunavut.ca/sites/default/files/23-015e_2023-09-07-2023_or_appendix_c_maps_chapter_2_english.pdf

edge as it retreats and breaks up in the spring and summer (DFO, 2015a). Floe edges are particularly important for Inuit during Springtime, as hunters travel to the floe edge and shore leads, where beluga, narwhal, and polar bear concentrate (NPC, 2023b).

The entrance to Resolute Bay is within a floe edge[13], extending from Cornwallis Island to Somerset Island, and intersected by Griffith island (NPC, 2023c).

3.2.7 National Wildlife Areas

National Wildlife Areas (NWA) contain nationally significant terrestrial and/or marine habitats for animals or plants (DFO, 2024a). Under the *Canada Wildlife Act,* NWAs are created and managed for the purposes of wildlife conservation, research, and interpretation. They are established through the Wildlife Area Regulations, and can only be designated on federally owned lands; however, partnerships can be created with territories, provinces, aboriginal groups, and private land owners to establish and cooperatively manage a wildlife area (DFO, 2024a).

The NWA in closest proximity to Resolute Bay[14] is the Polar Bear Pass (*Nanuit Itillinga*) NWA. The Polar Bear Pass NWA is located on Bathurst Island approximately 100 km northwest of Resolute (ECCC, 2019). Polar Bear Pass was designated an NWA in 1986, and it supports at least 54 bird species such as red phalarope (*Phalaropus fulicarius*) and some mammals including SAR such as Peary caribou (*Rangifer tarandus perryi*). As the name implies, polar bears (*Ursus maritimus*) pass through the area in spring and summer on their way to Graham Moore Bay where they hunt walrus (*Odobenus rosmarus*) and ringed seals (*Pusa hispida*) (DFO, 2024a).

3.2.8 Important Bird Areas

Important Bird Areas are sites that have been identified as internationally significant for the conservation of birds and biodiversity (Bird Studies Canada, 2024). The IBAs support birds such as threatened species, large congregations of birds, and birds restricted in range or habitat. These IBAs are identified according to internationally agreed upon, standardized, quantitative, and scientifically defensible criteria. The IBAs have been identified for their global and continental significance for species that congregate, and concentrations of waterfowl, and colonial waterbird and seabirds. Though IBAs are located outside the Project Study Area, birds are highly mobile, and most are migratory. Consequently, there is potential for these species to occupy, stop-over, or pass through on their way to nearby IBAs. Some IBAs have also been identified as Key Bird and Habitat Sites and in some cases are also designated as EBSAs (DFO, 2015a; Oceans North Conservation Society *et al.*, 2018).

The IBAs in closest proximity to Resolute Bay are summarized below (Bird Studies Canada, 2024):

- Cape Liddon: approximately 100 km east.

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[13] See Figure 2.7.5 (RNLUP, Appendix C-Chapter 2) for a depiction of floe edges in proximity to Resolute Bay: https://www.nunavut.ca/sites/default/files/23-015e_2023-09-07-2023_or_appendix_c_maps_chapter_2_english.pdf

[14] See Figure 3.2.5 (RNLUP, Appendix C-Chapter 3) for a depiction of NWAs in proximity to Resolute Bay: https://www.nunavut.ca/sites/default/files/23-016e_2023-09-07-2023_or_appendix_c_maps_chapter_3_english.pdf

- Located on the southwestern coast of Devon Island and at the western headland of Radstock Bay.
- Prince Leopold Island: approximately 150 km southeast (described in EBSA Section 3.2.4).
  - Located off the northeastern tip of Somerset Island at the junction of Prince Regent Inlet and Barrow Strait.
- Washington Point: approximately 115 km north.
  - Located on Baillie-Hamilton Island north of Cornwallis Island, 15 km across Maury Channel (Bird Studies Canada, 2024). The greater area is known as Queens Channel and Penny Strait to the north (see Penny Strait EBSA described in Section).
- Cheyne Islands: approximately 190 km north.
  - Support the largest known nesting population of Ross's gull (*Rhodostethia rosea*), in the Canadian Arctic (Mallory & Fontaine, 2004).

Refer to Section 10 and Table 10-1 for further information relative to migratory and marine birds.

3.2.9 Migratory Bird Sanctuaries

Under the *Migratory Birds Convention Act*, ECCC, through the Canadian Wildlife Service (CWS), can establish MBSs on federal, provincial/territorial, or private land to protect terrestrial and marine habitat and provide safe refuge for migratory birds (Government of Canada, 2017b). Once established, hunting of a listed species is not permitted, and rules and prohibitions are established with respect to taking, injuring, destruction, and molestation of migratory birds, their nests, or eggs. The RNLUP has further defined migratory bird habitat sites that align with the above designated habitats such as MBSs, IBAs, MPAs, Polynyas, and EBSAs. These habitats for migratory birds under the RNLUP are categorized in three classes[15] based on their importance to sustaining bird habitats, risk intolerances of the species' populations, and include set back requirements for aerial, marine, and terrestrial activities from bird groups such as migratory birds, seabirds, and coastal waterfowl (NPC, 2023b).

The MBS in closest proximity to Resolute Bay is Prince Leopold Island approximately 150 km southeast (described in EBSA Section 3.2.4).

Refer to Section 10 and for further information relative to migratory and marine birds.

[15] See RNLUP, Appendix C-Chapter 2) for a depiction of MBA in proximity to Resolute Bay: Figure 2.1A (Class 1), Figure 2.1B (Class 2, 3) https://www.nunavut.ca/sites/default/files/23-015e_2023-09-07-2023_or_appendix_c_maps_chapter_2_english.pdf

3.3 Recommended Nunavut Land Use Plan

While Resolute is within the NBRLUP (NPC, 2000), it will be replaced with the RNLUP (NPC, 2023b). For the purposes of this ESEB Report, the RNLUP[16] has been used. Summaries of the contents of both land use plans can be found in Table 1-2.

3.4 National Parks

Nunavut has five national parks, three of which are in proximity to Resolute Bay, which are described in Table 3-3.

Table 3-3: List of National Parks near Resolute Bay

National Park	Distance/direction relative to Resolute Bay, and description
Sirmilik National Park	Approximately 500 km southeast. Located on North Baffin Island, extending from the eastern entrance to Admiralty Inlet to west of the Hamlet of Pond Inlet. Established in 2001 (McNamee & Finkelstein, 2012) and protects 22,252 km^2 of geological, natural history, and cultural values within the Eastern Arctic Lowlands and North Davis Natural Regions (Parks Canada, 2024b)The park is divided into four parcels: Bylot Island, Borden Peninsula, Baillarge Bay, and Oliver Sound. With respect to wildlife, Sirmilik hosts the most diverse avian community in the High Arctic with more than 74 species of birds, of which 45 are confirmed breeders. Bylot Island in particular has up to 320,000 thick-billed murres and 50,000 black-legged kittiwakes. In addition to its avian diversity, 19 mammal species inhabit Bylot Island, of which, nine are terrestrial (Laval, 2016).
Qausuittuq National Park	Approximately 150 km northwest. Located on northern Bathurst Island and smaller surrounding islands, and was established in 2015 and protects 11,000 km^2 of traditional hunting and fishing areas (McNamee & Finkelstein, 2012; Parks Canada, 2024b). It includes the waters of May Inlet and Young Inlet and is boarded to the south by Polar Bear Pass NWA Together these two areas protect a large, ecologically intact area in the Canadian Arctic Archipelago. Much of the landscape is tundra and varies from wetlands and lowlands to plateaux, bluffs, and hills. Vegetation is sparse and found mostly on irregular surfaces of small hummocks. Terrestrial wildlife is not abundant and marine mammals inhabit the waters off Bathurst Island. The rich ocean life supports abundant seabirds and the wet sedge meadows support nesting grounds for geese and shorebirds (McNamee & Finkelstein, 2012).

[16] Interactive maps from 2014, 2016, 2021 and 2023 Nunavut Land Use Plans are available on Interactive Maps from this URL: https://www.nunavut.ca/land-use-planning/interactive-maps.

National Park	Distance/direction relative to Resolute Bay, and description
Quttinirpaaq National Park	Located approximately 950 km north. Located on northern Ellesmere Island and was established in 1988 protects 37,775 km^2 of land with hundreds of archaeological sites (McNamee & Finkelstein, 2012). It is Canada's second largest and most northern national park. The landscape is dominated by hundreds of glaciers. Vegetation is sparse in upland areas and relatively lush in lowland areas. Few terrestrial wildlife species are present but species that are present can be abundant. About 30 species of birds nest in meadows of the park (McNamee & Finkelstein, 2012).

3.5 Territorial Parks

Territorial parks in Nunavut are managed by the GN-DoE. Each park is established to meet three objectives: protect Nunavut's cultural and natural landscapes, enhance community and visitor experience, and engage with community in heritage appreciation and conservation (GN, 2016b). Territorial parks create a place to highlight the cultural importance and rich history of Nunavut, while aiming to protect representative examples of Nunavut's natural landscapes.

The GN-DoE put out a call for people interested in participating in a joint planning and management committee for four territorial parks, which included Kinngaaluk Territorial Park near Sanikiluaq, Aguttinni Territorial Park near Clyde River, Napartulik Territorial Park near Grise Fiord and Kugluk Territorial Park near Kugluktuk. The Committees are composed of six people, based on interest, knowledge, Inuit culture and heritage. Community interest in the development of territorial parks is based on; Inuit rights to continue to use and enjoy parks; protecting culturally significant sites and important wildlife areas; promoting cultural and natural heritage; and developing economic and education benefits (Nunavut News, 2019).

Tamaarvik Territorial Park is approximately 560 km southeast of Resolute Bay.

3.6 Critical Habitat

In the context of this report, critical habitat is classified as crucial to the survival and recovery of wildlife species (DFO, 2020a). For aquatic species, critical habitat includes spawning, rearing or nursery grounds, and aquatic areas with associated physical, chemical and biological properties necessary for a fish species' full life cycle (Duenas Camacho & Associates Inc., 2019).

For all designated species, the SARA defines critical habitat as *"the habitat that is necessary for the survival or recovery of listed extirpated, endangered, or threatened species, and that is identified as critical habitat in a recovery strategy or action plan"* (DFO, 2020a). Further to this, a Critical Habitat Order provides legal protection to the critical habitats of listed species through the application of the prohibition in subsection 58(1) of SARA . Terrestrial species critical habitat management in Canada is carried out by several legislative bodies; the federal government (on federal lands only) and provincial or territorial government (non-federally administered lands). Conversely, aquatic species and migratory birds are protected on all lands in Canada. The main legislative tool used to protect critical habitat for designated species is SARA.

Critical habitat for Peary caribou (*Rangifer tarandus pearyi*) has been designated for sea ice corridors. These corridors support caribou migration and are adjacent to Resolute Bay between the Western Queen Elizabeth Islands to the west, and surrounding Cornwallis Island on the west, north, and east during the winter[17] (Government of Canada, 2024c). This habitat is seasonal and exists when ice starts forming in the fall until ice breakup in the following spring and summer. The sea ice in these mapped areas is protected from marine traffic that could break sea ice, or prevent ice from forming when needed by caribou (Government of Canada, 2024c). During the winter pack ice that forms within mapped areas is protected; however, during the summer pack ice is not designated as critical habitat. To date the waters surrounding Resolute Bay have not been assigned as critical habitat for any marine species.

[17] See Figure 2.2.12 of the Recommended Nunavut Land Use Plan Appendix C for a map showing the sea ice crossings for caribou in Nunavut. Available at: https://www.nunavut.ca/sites/default/files/23-015e_2023-09-07-2023_or_appendix_c_maps_chapter_2_english.pdf

4 Aquatic Habitats

Arctic environments are characterized by dramatic shifts in light, temperature, and frozen versus open-water states of the ocean (Carmack *et al.*, 2006). Variations in the extent and quality of sea ice in the Arctic has a fundamental influence on Arctic ecosystems and the Inuit who rely on marine life for subsistence (Ford J.D. *et al.*, 2021; Oceans North Conservation Society *et al.*, 2018).

The coastal marine environment in Nunavut represents a distinctive ecosystem for aquatic marine life. Intertidal areas are inaccessible throughout periods of the year when the ocean is frozen, and scouring of the shoreline by sea ice virtually wipes out intertidal communities annually (Conlan & Kvitek, 2005). Marine vegetation has limited periods of time to facilitate growth because sufficient light and nutrients are only available during the short period of summer conditions (Wiencke *et al.*, 2007). These variables have led to uniquely adapted species that can tolerate the experience of harsh Arctic climate conditions (Lindgren *et al.*, 2016). It has also established an important socio-economic function for the Inuit who are dependent on fish and marine mammals for subsistence harvesting.

Aquatic habitats, like their terrestrial counterparts, are undergoing rapid change due to warming effects of climate change (Intergovernmental Panel of Climate Change [IPCC], 2019). Northward shifts of southern species (e.g., killer whales) and the potential for longer growing seasons for marine vegetation (Krause-Jensen *et al.*, 2020) present challenges for resident marine species, consequently impacting the year-round resource harvesting carried out by the Inuit.

4.1 Marine Benthic Habitat

Arctic benthic flora and fauna have adapted to be resilient due to extreme fluctuations in temperature, salinity, light availability, and ice scouring (Brown *et al.*, 2011; Conlan & Kvitek, 2005; Kupper *et al.*, 2016; Wiencke *et al.*, 2007), which varies with depth. For these reasons, vertical zonation is one of the most important variables shaping intertidal and shallow subtidal benthic communities. Disturbance from ice scouring is believed to be the most important 'architect' of Arctic biodiversity (Conlan & Kvitek, 2005) in intertidal and shallow subtidal waters. Substrate of Arctic shorelines is predominantly sand intermixed with small rocks and gravel (Greenwood, 2016) and a barren high intertidal (Ellis, 1955).

Limited available research describes the Resolute Bay benthic substrate as predominantly composed of fine-grained sediment interspersed with gravel and cobbles (Devine *et al.*, 2019; Greenwood, 2016). The Arctic region generally exhibits a barren high intertidal and in the subtidal marine vegetation is controlled by availability of hard substrates (e.g., cobble, boulder) for attachment. (Ellis, 1955).

4.2 Marine Vegetation

Marine vegetation has a large influence on biomass and biodiversity of marine species in temperate environments (Brown *et al.*, 2011; Cristie *et al.*, 2003; Warfe *et al.*, 2008; Wikstrom & Kautsky, 2007), providing three-dimensional habitat functioning as shelter and sustenance for multiple life history stages of marine fish and invertebrates (Radio Canada International, 2019). The extent to which this interaction exists in the Arctic has gone mostly unstudied. Włodarska-Kowalczuk *et al.* (2009) hypothesize that holdfasts of larger kelps provide refuge for organisms such as amphipods, as they offer protection from ice scour events. It is likely that established seaweed beds are important for a variety of life stages of marine species occurring in the coastal waters of Arctic environments.

Marine vegetation species are primary producers and thus play an important role in broader ecosystem productivity during a relatively short open-water season (Glud *et al.*, 2002). It is not well understood how subtidal kelp species within the crush zone (the area where ice impact destroys marine life annually) survive from year to year, but some kelp species may continue to survive or even grow during the iced season (CBC, 2019b). Winter growth of kelp has been documented for the endemic Arctic species Arctic suction-cup kelp (*Laminaria solidungula*) where growth is lowest during the ice-free period and most rapid during winter (Chapman & Lindley, 1980). Marine vegetation specific to Resolute Bay is not well documented, however a recent study from Goldsmit *et al.* (2021) in the region focused on the expanding distribution of sea colander (*Agarum clathratum)*, winged kelp *(Alaria esculenta)*, brown kelp (*Laminaria solidungula)*, and sugar kelp (*Saccharina latissimi).*

4.2.1 Biogeographic Distribution

Marine vegetation within Resolute Bay is still poorly documented on the local scale. Recent efforts to document kelp forests in the Canadian Arctic between Ellesmere Island and Labrador, and along coasts in Lancaster Sound, Ungava Bay, Hudson Bay, Baffin Bay and Resolute Bay have improved our understanding of the distribution and importance of seaweeds in Arctic ecosystems (Filbee-Dexter *et al.*, 2019; Goldsmit *et al.*, 2021). The NCRI issued for Resolute bay shows the current range of eel grass, edible kelp, dulse, hollow stemmed kelp, and sea colander (GN, 2018b). Site-specific studies that document subtidal kelp populations in the region have focused in and around northern Baffin Island (Cape Hatt in Eclipse Sound) (Kupper *et al.*, 2016), and Pond Inlet (Phillipe Archambault, unpublished). There is interest in expanding this documentation given that the sea ice season continues to shorten, where it is predicted that the extent and range of seaweeds will change (CBC, 2019a). A recent publication predicts an increase in the overall suitable habitat for kelp forests in the Arctic, but a zero net increase in percent kelp coverage by local species (Goldsmit *et al.*, 2021). Increase in the northern extent of some kelp species, including rockweed, has been predicted and observed in some cases (Jueterbock *et al.*, 2016); (Filbee-Dexter *et al.*, 2019; Jueterbock *et al.*, 2016).

4.2.2 Harvesting

Seaweed harvesting occurs throughout Nunavut and seaweed is primarily used to flavour food and provide salt (QIA, 2018b). *Kuanniq,* or edible kelp, is most commonly harvested (QIA, 2018b). No kelp or seaweed is harvested in Resolute Bay due to the wastewater outfall (pers. comm. IQ Workshop December 2024).

4.3 Water Bodies (and Marine Corridors)

The Arctic Ocean is a unique environment that fluctuates between open-water and iced ocean conditions, and it is the smallest, shallowest and coldest of the worlds five major oceans (Arctic, Pacific, Atlantic, Indian, and Southern) (Pidwirny, 2006). Canada's Arctic Ocean region experiences extreme variations in daylight, temperature, and frozen versus open-water states of the ocean (Carmack *et al.*, 2006). As previously mentioned, Marine Corridors are the water bodies that interconnect providing extensive migratory routes for many marine organisms. Marine Corridors in proximity to Resolute Bay are discussed below (see Section 1.4, Figure 1-2).

4.3.1 Baffin Bay

Baffin Bay is a deep body of water located between Greenland and Baffin Island with an area of 1400 km by 550 km (Tang *et al.*, 2004). A large abyssal plain in the central region contributes to maximum water depths of 2400 m near its centre and water depths less than 1000 m throughout the bay (Clarke & Drinkwater, 2015). The continental shelf off Baffin Island is narrower than Greenland, but both continental shelves are deeply cut by canyons (Tang *et al.*, 2004). Baffin Bay is connected to the Labrador Sea by its biggest and deepest channel, Davis Strait, and connects to the Arctic Ocean through Jones Sound, Nares Strait, and Lancaster Sound (Preußer *et al.*, 2015; Tang *et al.*, 2004).

Baffin Bay has marginal sea-ice coverage with complete ice coverage from December to April and open waters from August to September, where only icebergs are present (Britannica & Encyclopaedia, 1998; Tang *et al.*, 2004). Northern Baffin Bay is fed by Lancaster and Jones Sounds to the west, and Nares Strait to the north (Addison & Bourke, 1987). The water flow within Baffin Bay is cyclonic, pushing the fresh and cold Arctic water into the Labrador Sea, contributing to the salinity of the Labrador Sea and the thermohaline circulation of the North Atlantic ocean (Tang *et al.*, 2004; Zhang *et al.*, 2021). The annual fluctuation of sea-ice from the Canadian Arctic Archipelago, through Baffin Bay, plays a significant role in the Atlantic Meridional Overturning Circulation which could regulate the global climate system as an important component of great ocean conveyor (Zhang *et al.*, 2021). Furthermore, the annual fluctuation of sea-ice coverage further contributes to the interannual variability of deep convection and stabilization of the water column in the Labrador Sea (Tang *et al.*, 2004).

4.3.2 Lancaster Sound

Located north of Baffin Island and south of Devon Island, Lancaster sound connects the Arctic Ocean to Baffin Bay. The western end of Lancaster Sound connects to the Arctic Ocean through Barrow Strait where the depth is ~125 m and width is ~55 km (Tang *et al.*, 2004). The eastern end of Lancaster Sound flows to Baffin Bay through a ~100 km wide passage (Zhang *et al.*, 2021). Lancaster Sound is the second principal pathway for the Canadian Arctic Archipelago and provides a net inflow to Baffin Bay twice that of Jones and Smith Sound (Addison & Bourke, 1987; Zhang *et al.*, 2021). Lancaster Sound experiences interannual variability with a larger flux of water outflow in winter and spring and contributes to 33.9 % of the water flowing into Baffin Bay (Zhang *et al.*, 2021). Due to the cyclonic water currents in Baffin Bay, a large inflow of water from Baffin Bay is also pushed over the Baffin Island slope, into the eastern side of Lancaster Sound (Tang *et al.*, 2004).

4.3.3 Barrow Strait

The Barrow Strait is located north of Somerset Island, forming part of the Parry Channel and connecting the Arctic Ocean in the west to Baffin Bay in the east through Lancaster Sound (Prinsenberg & Bennett, 1987). The strait spans approximately 270 km long and 45 km wide, with a depth ranging between 125 m to 165 m in the direction of Lancaster Sound where depth rapidly drops to 500 m. Land-fast ice typically covers the strait from late November to late June (Pharand & Legault, 1984).

4.3.4 Parry Channel

The Parry Channel is a passage running east to west from Baffin Bay, flowing through Lancaster Sound, Barrow Strait, Viscount Melville Sound, exiting through McClure Strait into the Beaufort Sea, and ultimately the Arctic Ocean (MacLean, 2017; Smiley, 1979). The channel is a section of the Northwest Passage and separates the Queen Elizabeth islands from the southern Archipelago and mainland Nunavut. Parry Channel is the largest strait within the Canadian Arctic Archipelago spanning a width of 52.3 km at it's smallest point (Wekerle, 2013). Sea ice conditions are severe within this channel accumulating to more than 50 % coverage of landfast ice (Chen, 2023; Smiley, 1979). Early ice break-up and high food production in eastern Parry Channel are the main attractors to migrating marine organisms annually. The net flow from west to east is greatest in McClure Strait moving into cyclonic circulation around Prince of Wales Island, south into McClintock Channel and then re-entering Parry Channel to the north through Peel Sound (Wekerle, 2013).

4.3.5 McDougall Sound

Located between Bathurst Island and Cornwallis Island, the McDougall Sound opens into the Barrow Strait of the Parry Channel (Pharand & Legault, 1984). Further, characteristics for this water body have not been well documented in published literature.

4.3.6 Nares Strait

Located east of Ellsemere Island and west of Greenland, Nares Strait includes Robertson Channel, Hall Basin, Kennedy Channel, Kane Basin, and Smith from north to south (Kalenitchenko *et al.*, 2019). The northern end of Nares strait connects to the Arctic Ocean through Robertson Channel where an ice arch forms between Nares Strait and the Lincon Sea (Kalenitchenko *et al.*, 2019). The southern end of Nares Strait connects to Baffin Bay through a 25 km wide channel with a deep sill at Smith Sound where an ice arch typically forms in winter (Kalenitchenko *et al.*, 2019). These ice arches are crucial for maintaining the North Water Polynya, also known as *Pikialasorsuaq* (Jennings *et al.*, 2015). The two ice arches breach in summer, followed by sea ice transported through Nares Strait into Baffin Bay, influencing the salinity and temperature of the Labrador Sea Nares (Kalenitchenko *et al.*, 2019). Nares Strait is the first principal narrow path of through flow in the Canadian Arctic Archipelago and contributes to 50.6 % of the water flowing into Baffin Bay (Zhang *et al.*, 2021). Simulations based on a long-term dataset (1978-2016) indicated that the water volume transported by Nares Strait played the most significant role in the volume on transport in Davis Strait (Zhang *et al.*, 2021). Due to the cyclonic water currents in Baffin Bay, a large inflow of water from Baffin Bay is also pushed into Nares Strait through Smith Sound (Tang *et al.*, 2004).

4.4 Fresh Water

There are at least 38 lakes and ponds located across Cornwallis Islands, including Char and Resolute Lakes located near Resolute Bay (Michelutti *et al.*, 2007). NPC (2023c) demonstrates essential char fishing rivers surrounding Resolute Bay and throughout Cornwallis Island, as seen in Figure 4.1.8 in Appendix C of the 2023 RNLUP[18]. Shallow tundra ponds dominate the High Arctic which are characterised by small volumes (> 2 m depth), low dilution of solutes, high sensitivity to external inputs and freezing completely during the winter months (Antoniades *et al.*, 2003). A major difference between lakes and ponds in the High Arctic is lakes will remain completely frozen for nine months of the year

[18] URL to access the figure: https://www.nunavut.ca/sites/default/files/23-017e_2023-09-07-2023_or_appendix_c_maps_chapter_4_english.pdf

verses ponds, with lower thermal capacities, will freeze and thaw earlier than lakes (Antoniades *et al.*, 2003).

Near Resolute Bay there are two waterway crossings that intersect the haul road, one of which drains into the foreshore of the community harbour (see Figure 7-11). The creeks are small, non-fish bearing, and connected to drainage from small upland lakes. One of the crossings has culverts (74° 40.955'N, 94° 47.743'W, Creek No. 1 [unnamed], see Photo 7-7, Panel a), and the second creek would require culverts as the road intersects it (74° 41.401'N, 94° 49.656'W, Mecham River, see Photo 7-7, Panel b. Mecham River is fed by numerous small lakes, with the mouth of this river 0.2 km south of the community harbour footprint (see Photo 4-1). There are no concerns about the community harbour footprint impacting near by lakes (Advisian, 2020b).

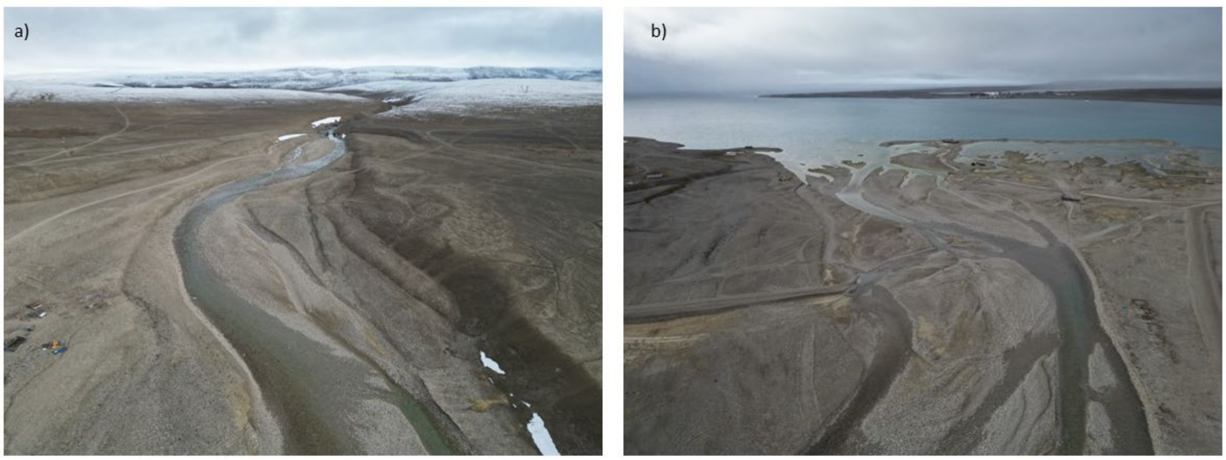

Photo 4-1: Mecham River: a) Inland View; b) Seaward View

Source: Dynamic Ocean, 2024

4.4.1 Anadromous River Systems

Resolute River, located on the western shore of Resolute Bay, is fed primarily by Resolute and Char Lakes, where there may be some sea run Arctic char (described in Section 6.3.2) in these lakes (IQ Workshop 2019 - Peter Amarualik), and in the nearby rivers (IQ Workshop 2019 - Joadamee Amagoalik) (see Figure 2-1). The mouth of Resolute River is located about 1.5 km northwest of the community harbour footprint on the opposite side of Resolute Bay and will not be affected by any Project components.

4.5 Ocean Currents

There are two major wind-driven currents in the Arctic Ocean, the Beaufort Gyre and the Transpolar Drift Stream. Surface water circulates clockwise from east to west. The Arctic Ocean connects to the Atlantic Ocean through the Baffin Island Current, a combination of the West Greenland current inflow, and Artic outflow from channels of the Canadian Artic Archipelago (Figure 4-1) (Britannica & The Editors of Encyclopaedia, 1998).

Surface current data was collected in Resolute Bay using a drogue (a surface float with a Global Positioning System [GPS] tracker) in the feasibility (2019) and detailed design (2024) phases. The drogue was visually monitored using binoculars to track its location. Current data was collected for approximately one hour. In 2024, the average and maximum current speed were 0.7 km/h and 4.1 km/h, respectively. In 2019, the average current speed was 0.4 km/h, with maximum current speed of 2.6 km/h. The net displacement was towards the southeast at both surveys (see Section 4.6).

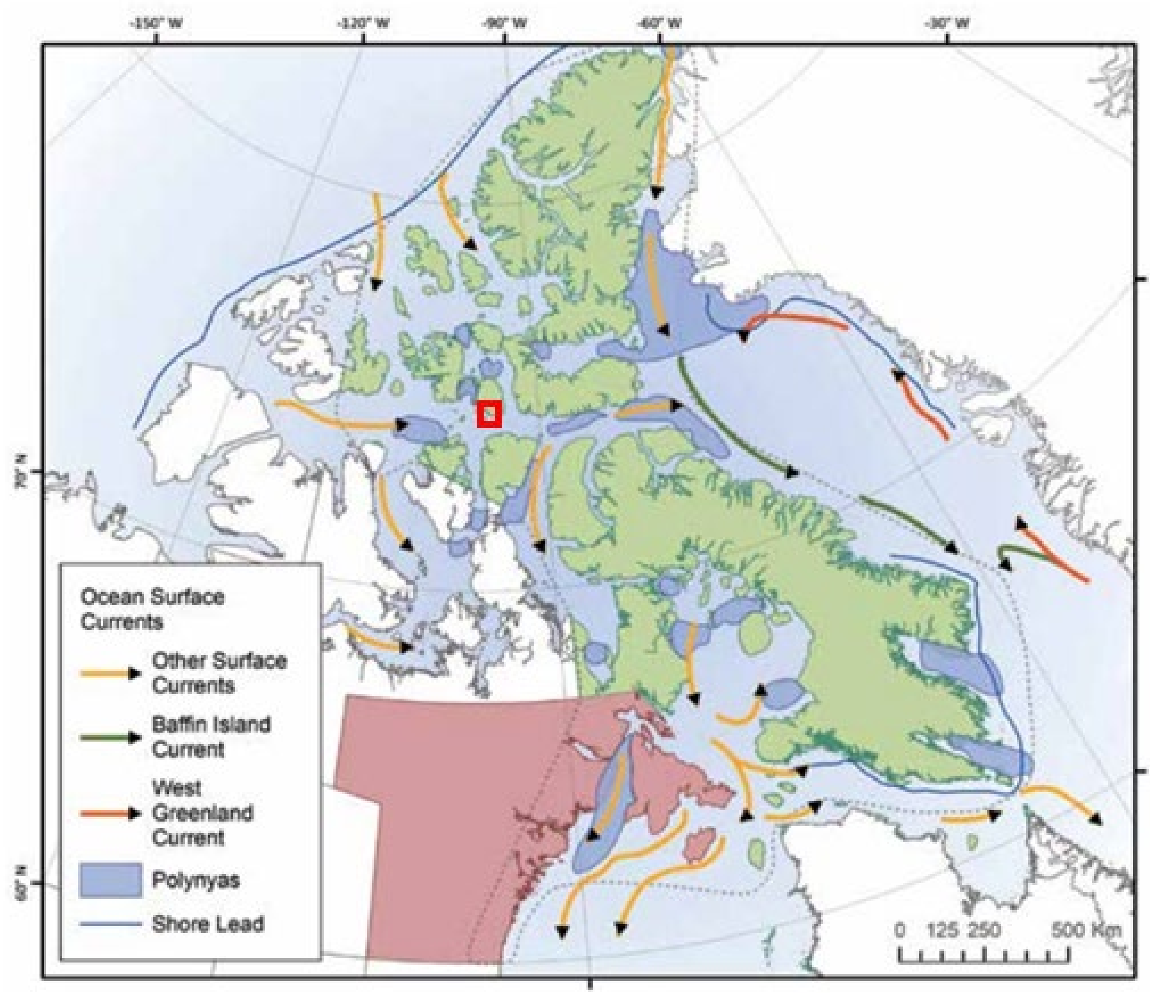

Figure 4-1: Ocean Currents of the Canadian Arctic

Source: Figure 8 in Copland *et al.* (2018)

4.6 Surface Circulation Drogue Program

Surface current data was collected using a drogue (a surface float with a GPS tracker). The surface float was set up with a Bad Elf GPS Pro, which enabled recording of the trajectory during the survey in conjunction with visual tracking using binoculars.

A surface drogue was deployed during the feasibility (18 August 2019) and detailed design (28 August 2024) phases in the southern and northern extent of Resolute Bay respectively (see Figure 4-2). The drogue was tracked visually by the field team with binoculars and a GPS tracker attached to it. The GPS was turned on in 'track' mode, and a deployment and retrieval GPS position was documented by the field team. See Photo 4-2 for a photograph of the drogue during deployment. Results of the two drogue surveys are provided in Table 4-1, and the tidal variation during which the drogue was deployed can been see in Figure 4-3.

Photo 4-2: Demonstrative Photo of Drogue Deployment

Source: Dynamic Ocean, 2024

Table 4-1: Feasibility (2019) and Detailed Design (2024) Drogue Results

Survey Year	Start Position		Ending Position		Time		Distance Travelled	Tide Height (m)		Travel Speed	
	Latitude (N)	Longitude (W)	Latitude (N)	Longitude (W)	Deployment	Retrieval		Deployment	Retrieval	Max	Mean
2024	74°41.505	94° 51.934	74° 41.312	94° 50.676	15:09	16:18	0.8 km SE	0.8	0.9	2.2 NM/h	0.4 NM/h
2019	74°41.053	94°51.448	74°40.780	94°50.253	15:10	17:35	0.95 km SE	1.5	1.1	1.4 NM/h	0.2 NM/h

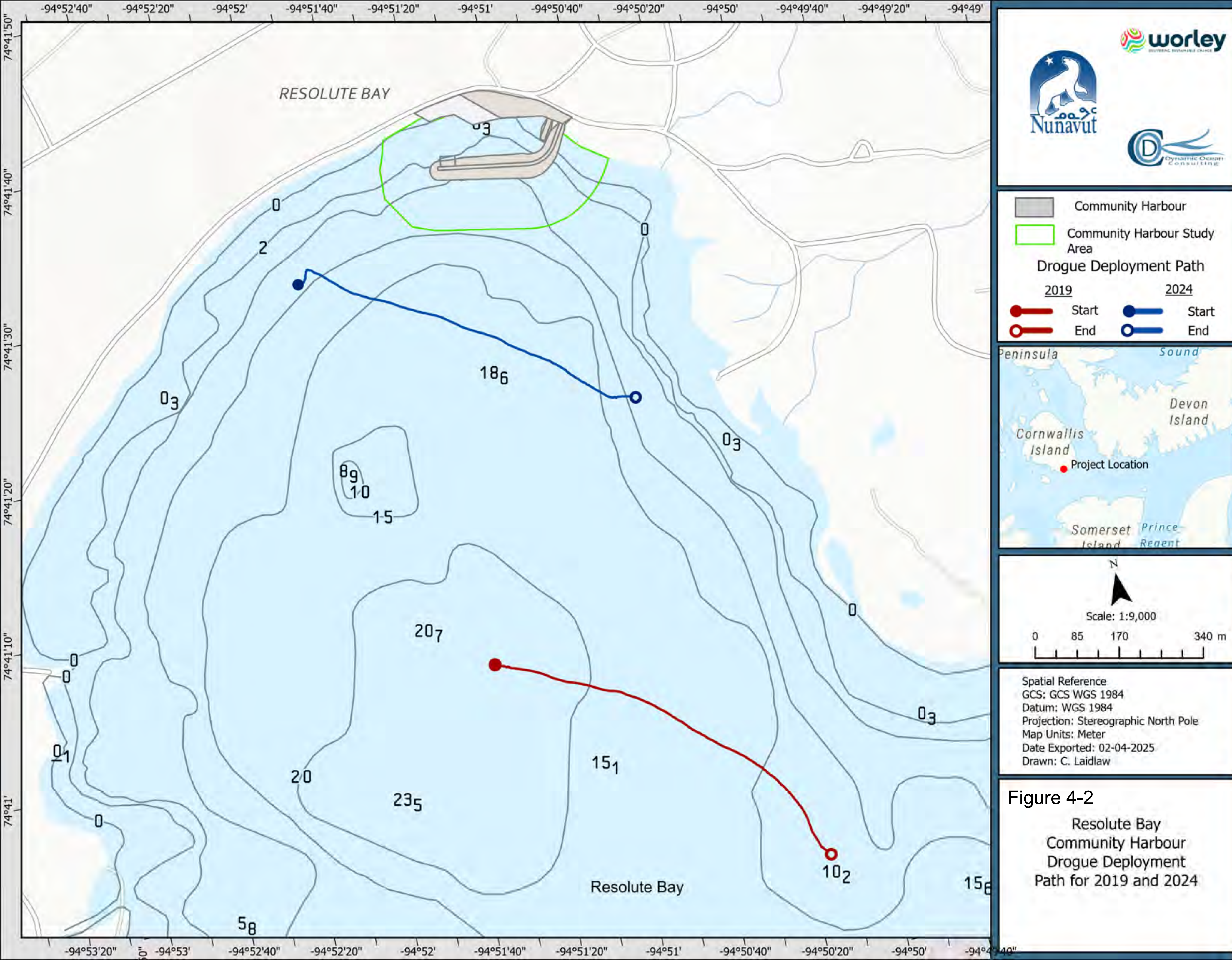

Figure 4-2

Resolute Bay Community Harbour Drogue Deployment Path for 2019 and 2024

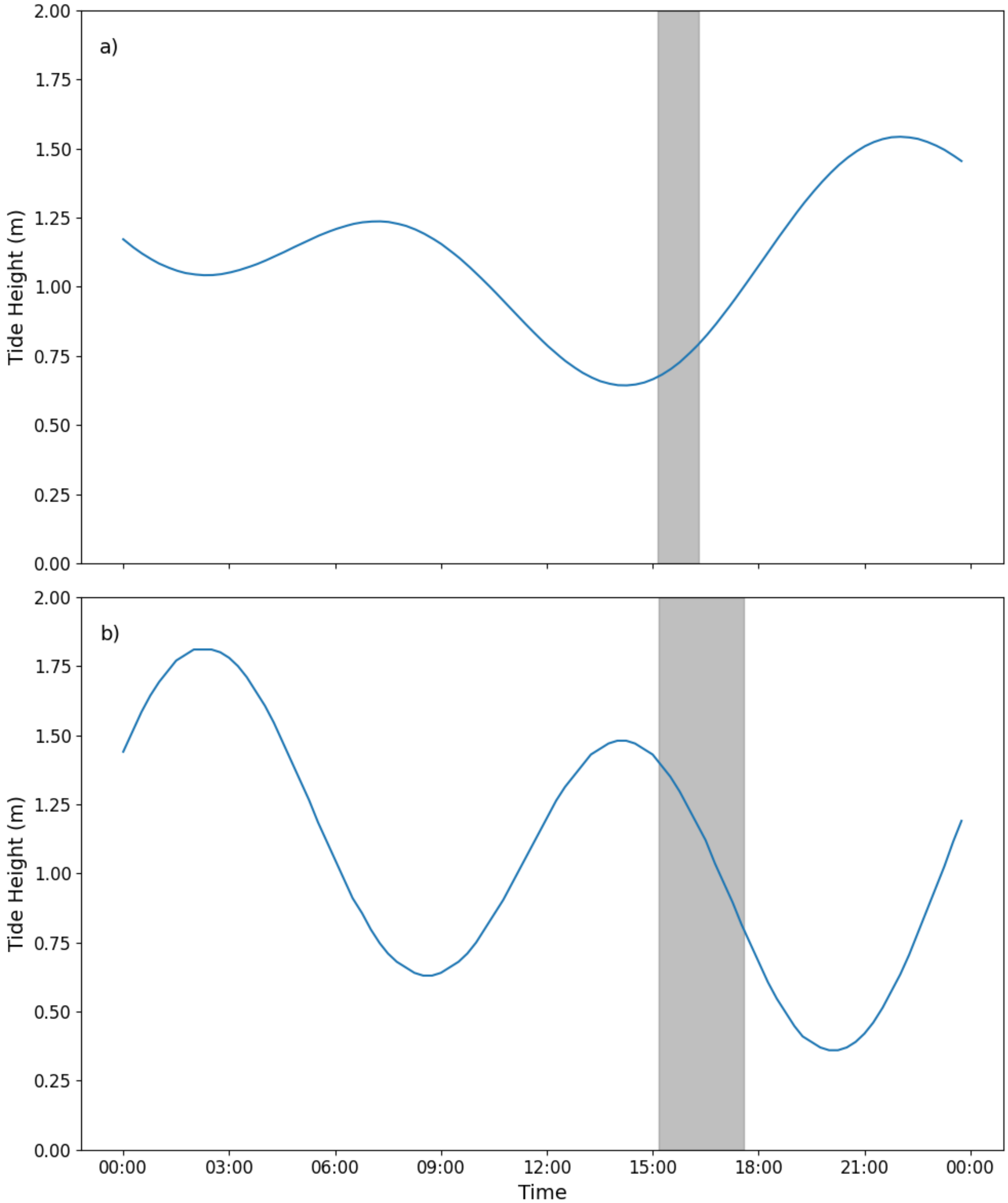

Figure 4-3: Drogue Survey Time and Tide Information: a) 28 August 2024, b) 18 August 2019

Source: Resolute Station (05560) in CHS (2019, 2024)
Note: Duration of drogue program represented by grey column

4.7 Tidal Range

Tide levels for Resolute Bay were obtained from Canadian Tide and Current Tables, Volume 4 (CHS, 2025), and are provided in Table 4-2. Average half-daily tidal range for the Arctic is represented in Figure 4-4.

Table 4-2: Tide Levels at Resolute Bay

Tide	Elevation (m, CD)
Highest High Water (HHW)	2.3
Higher High Water Mean Tide (HHWLT)	2.0
Higher High Water Large Tide (HHWMT)	1.6
Mean Water Level (MWL)	1.7
Lower Low Water Mean Tide (LLWMT)	0.4
Lower Low Water Large Tide (LLWLT)	0.0
Lowest Low Water (LLW)	-0.4

Source: Resolute Station (05560) - CHS (2025)

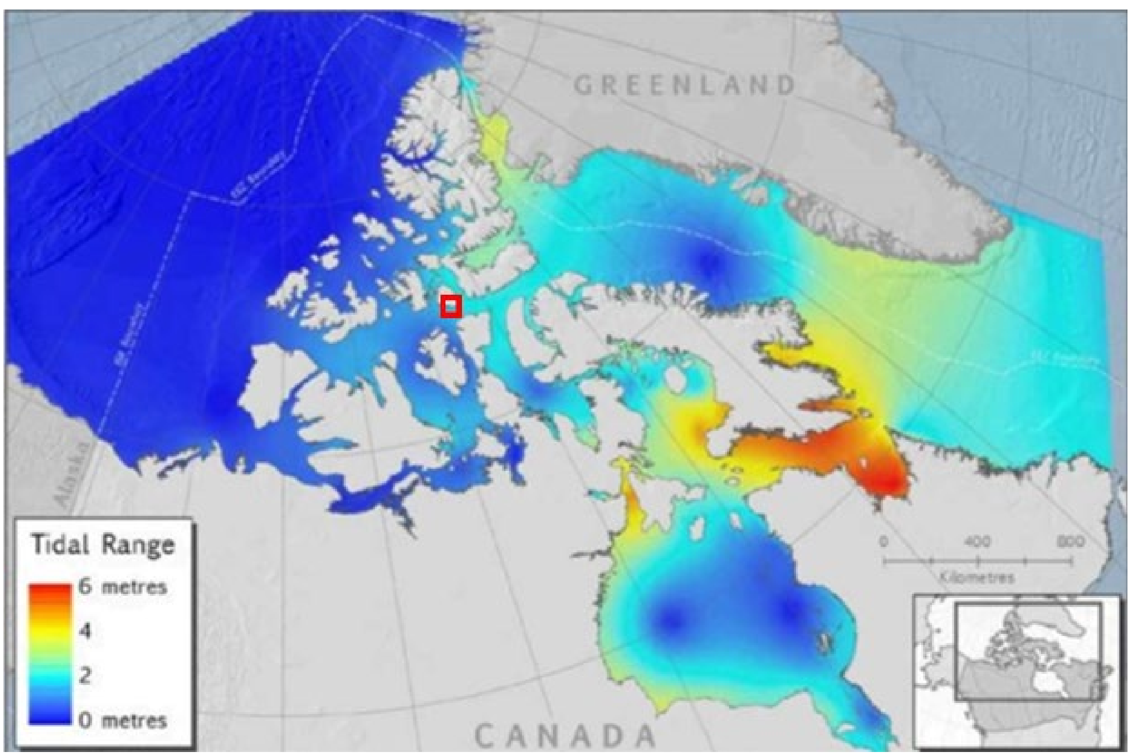

Figure 4-4: Changes in Sea-Level with the Dominant Half-Daily Tide

Source: Change in Sea Level with the Dominant Half-Daily Tide in Oceans North Conservation Society *et al.* (2018)
Note: Red square depicts Resolute Bay location

4.8 Ocean State

Arctic circulation flows in a quasi-closed circuit counterclockwise in the Beaufort Gyre with an eastern coastal flow. Pacific water entering the Arctic flow through the Arctic Archipelago to Baffin Bay and then south to the Labrador Sea (Greenan *et al.*, 2019).

4.8.1 Ocean Temperature

Documentation of ocean temperatures is of critical interest at this time when climate change is thought to be driving increased water temperatures in the Arctic (Greenan *et al.*, 2019). Arctic Sea Surface Temperature (SST) has increased by greater than 0.5 °C per decade from 1982 to 2017 in open-water areas of the Beaufort Sea, Hudson Bay and Baffin Bay (Greenan *et al.*, 2019). Temperature trends near the seabed of Lancaster Sound have increased by 0.2 °C (2002-2011), while the Baffin Island Shelf in depths of 50 m to 200 m there is slight cooling of -0.05 °C per decade. Additional cooling trends recorded in central Baffin Bay in the surface (0 m to 50 m) of -0.16 °C per decade (Greenan *et al.*, 2019). Conversely, further warming trends were observed in off-shelf basins at subsurface (150 m to 900 m) temperatures increasing by 0.48 °C per decade since 1970.

4.8.2 Open and Iced Water Conditions

One of the major environmental forces against marine infrastructure in the Arctic is the formation, breakup, and movement of ice. The relationship between the Arctic's annual snow, ice and daylight compared to the time of year is represented in Figure 4-6. Based on the 30-year average between 1991 to 2020, the typical dates in Resolute Bay for break-up and freeze-up are the weeks of 16 to 23 July, and 1 to 8 October, respectively (Figure 4-7). Recent years are seeing the effects of climate change, and the 30-year averages are not necessarily applicable

Overall, the Arctic has been experiencing a significant reduction in Multi-Year Ice (MYI). Currently, over 70 % of the Arctic Sea ice is First Year Ice (FYI) and melts seasonally. This thin ice melts faster and breaks up easier than MYI and can be moved more easily by wind (Kwok 2018). Large sheets of ice floating into a marine structure can have higher impact forces than normal berthing energy. Within the community harbour, the thickness of the ice combined with the tidal range can significantly impact the mooring system; therefore, ice thickness is considered a crucial aspect in the design of marine infrastructure. In Resolute Bay, the presence of MYI is 67 % to 84 % during the time of the ice break-up.

4.8.3 Sea Ice Conditions and Thickness

Sea ice conditions are described in four distinct annual cycles which are termed: freeze-up, iced, break-up, and open-water (see Figure 4-5, Figure 4-6, Figure 4-7). Additional categories of ice cover which may be referred to in other sections of this report are provided in Table 4-3.

Annual mean sea ice extent has on average declined since 1979, at a current rate of 13.1 % per decade (ECCC, 2021). Depending on the region, the Canadian Arctic summer sea ice area has decreased by 5 % to 20 % per decade from 1968 to 2016 (Derksen *et al.*, 2019). The fraction of open-water varies significantly from year to year, especially in the summer months, though it is generally on the rise (see Figure 4-5) (Canatec Associates International Ltd., 2014). According to Coupled Model Intercomparison

Project Phase 5 (CMIP5) models, by 2050 the majority of the Canadian Arctic sea will have at least one ice-free month (Derksen *et al.*, 2019).

The north coastline of Ellesmere Island hosts all remaining ice shelves in Canada (Government of Canada, 2020a). These ice shelves were formed after the Ellesmere Ice Shelf, 8597 km^2 in size in 1906, broke apart in 1959 (Government of Canada, 2020a; Mueller *et al.*, 2017). By 2015, the total ice shelf area dropped to a total of 525 km^2 (Government of Canada, 2020a). Ice shelves decline as large sections calve off into the Arctic Ocean. For example, the last fully intact ice shelf, Milne Ice Shelf, lost 79 km^2 (43 % of its mass) into the Arctic Ocean in less than 48 hours at the end of July 2020 (Kubny, 2020; Nunavut News, 2020).

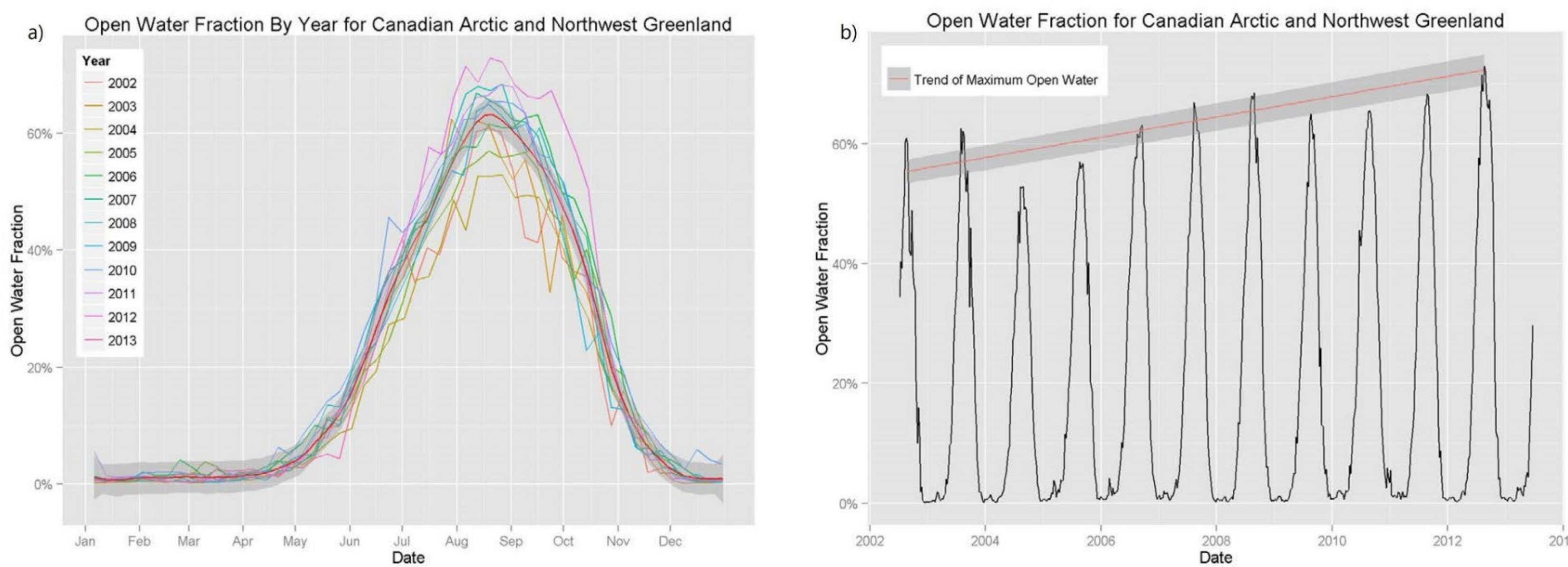

Figure 4-5: Fraction of Open-Water: a) January to December; b) 2002 to 2013

Source: Canatec Associates International Ltd. (2014)

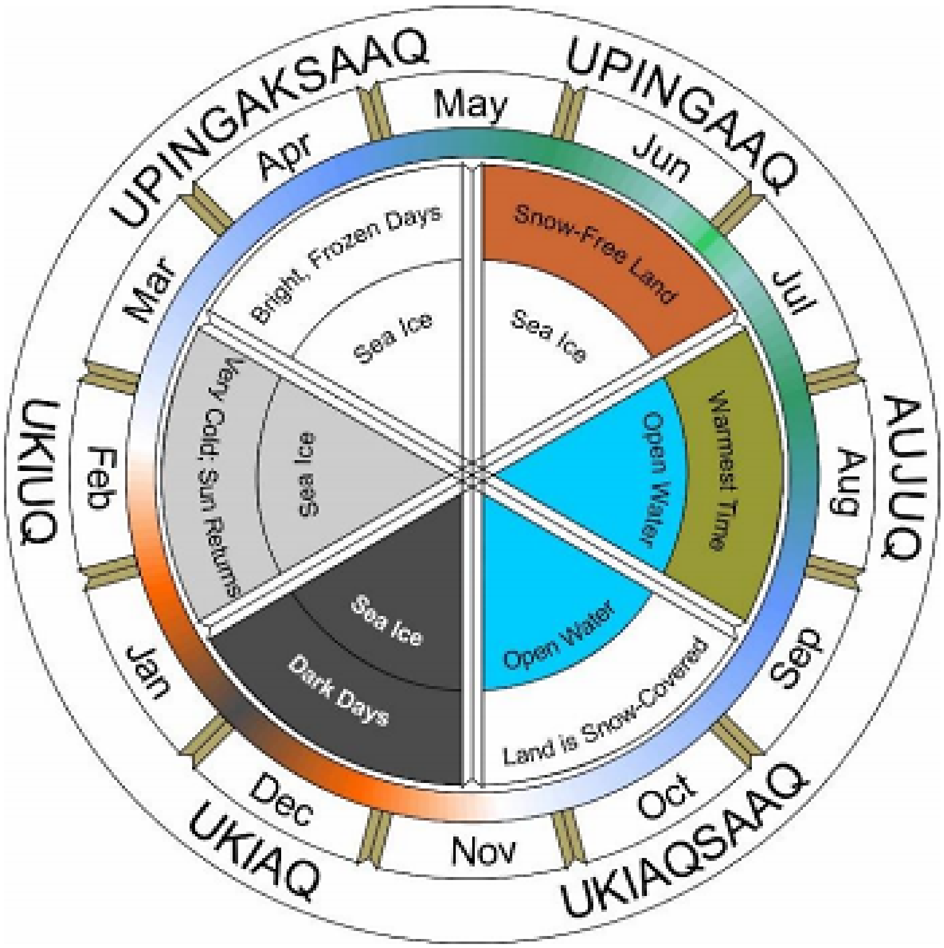

Figure 4-6: Generalized Annual Snow, Ice, Water and Light Cycles in Nunavut

Source: Figure 4 in NPC (2023b)

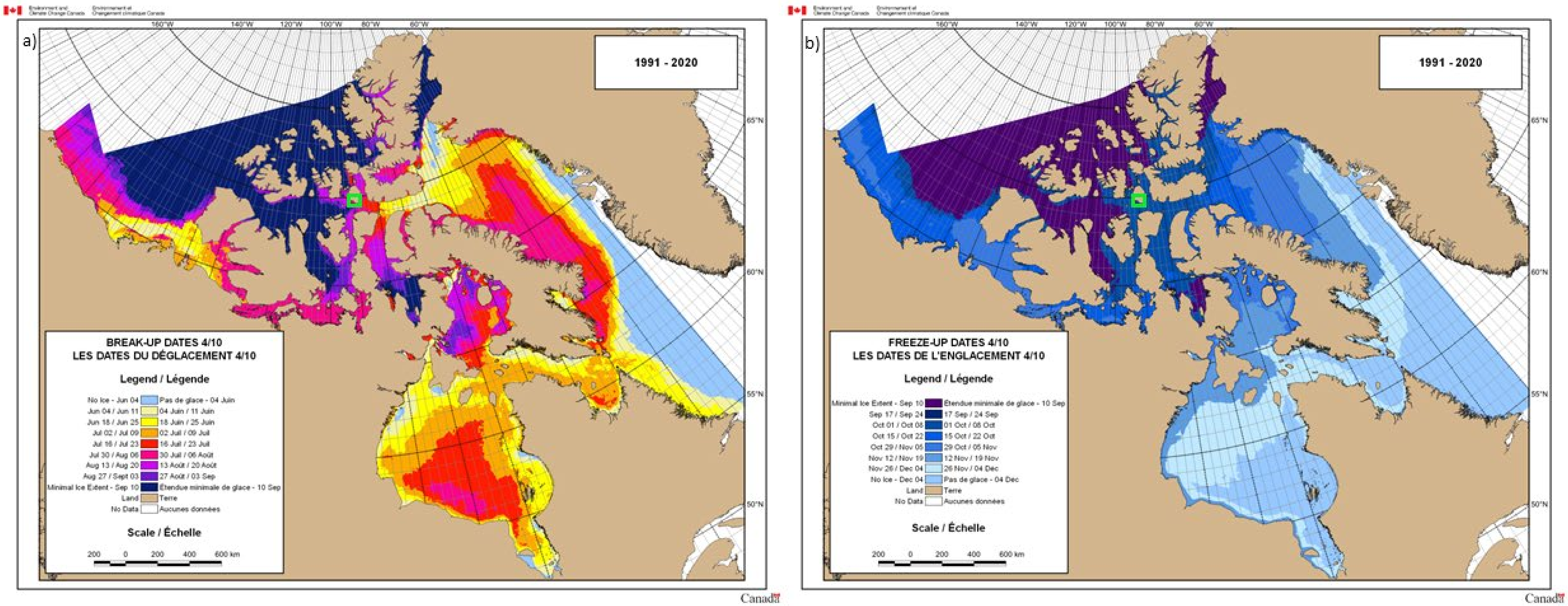

Figure 4-7: 30-Year Ice: a) Break-Up; b) Freeze-Up

Source: Government of Canada (2021)
Note: Resolute Bay depicted by green square

Table 4-3: Categories of Arctic Sea Ice

Term	Definition
Anchor Ice	Submerged ice attached or anchored to the bottom, irrespective of the nature of its formation.
Fast Ice	Ice which forms and remains fast along the coast. It may be attached to the shore, to an ice wall, to an ice front, between shoals or grounded icebergs. Vertical fluctuations may be observed during changes of sea level. It may be formed in-situ from water or by the freezing of floating ice of any age to shore and can extend a few metres or several hundred kilometres from the coast. It may be more than one year old in which case it may be prefixed with the appropriate age category (old, second year, or multi-year). If higher than 2 m above sea level, it is called an ice shelf.
First Year Ice	Sea ice of not more than one winter's growth, developing from young ice; 30 cm or greater. It may be subdivided into thin first year ice (sometimes referred to as white ice), medium first year ice, and thick first year ice.
Floe Edges	Created at the end of winter/beginning of spring as non-land-fixed ice breaks away from landfixed ice. Floe edges are composed of thick land-fixed ice at the interface of fully or partially open-water.
Freeze-Up	This term refers to a particular length of time over which ice appears in a given area (generally one to two weeks). However, freeze up does not necessarily imply a growth of ice, but can also indicate a movement of ice into a particular area.
Ice Edge	The demarcation at any given time between open-water and sea, lake or river ice, whether fast or drifting.
Ice Foot	A narrow fringe of ice attached to the coast, unmoved by tides and remaining after the fast ice has moved away.
Landfast Ice	A type of largely immobile sea ice that primarily forms off coasts in shallow water for a certain period of time. In High Arctic, landfast ice may linger for several years, dependent on weather conditions. Typically, landfast ice starts to grow in fall and melts away completely in summer. The offshore extension of landfast ice varies, dependent largely on coastal bathymetry and topography. This type of sea ice has a profound influence on coastal resources and residents.
Multi-Year Ice	Old ice which has survived at least two summer melts. Hummocks are smoother than on second year ice and the ice is almost salt-free. Where bare, this ice is usually blue in colour. The melt pattern consists of large interconnecting, irregular puddles and a well-developed drainage system.
Polynya	Areas of persistent open-water surrounded by sea ice (see Section 3.2.5).
Ice Shelf	Ice shelves are extensions of thick land ice that flow out over a cold coastal ocean. Ice shelves range in thickness from about 50 m to 600 m (160 to 2000 feet) and can extend tens to hundreds of miles from the coast, where the ice first goes afloat. Some ice shelves have persisted for thousands of years. When an ice shelf is narrower than the bay it occupies, it is sometimes called an ice tongue.

Source: Government of Canada (2020b); Lemieux *et al.* (2018); NPC (2016); Polar Science Center (2010)

4.9 Seasonal Daylight Regimes

Resolute Bay experiences 24 hours of sunlight from late April to mid August. During the winter, the community experiences 24 hours of darkness. Figure 4-8 breaks down hours of sunshine, dusk, darkness, and dawn over the course of the year.

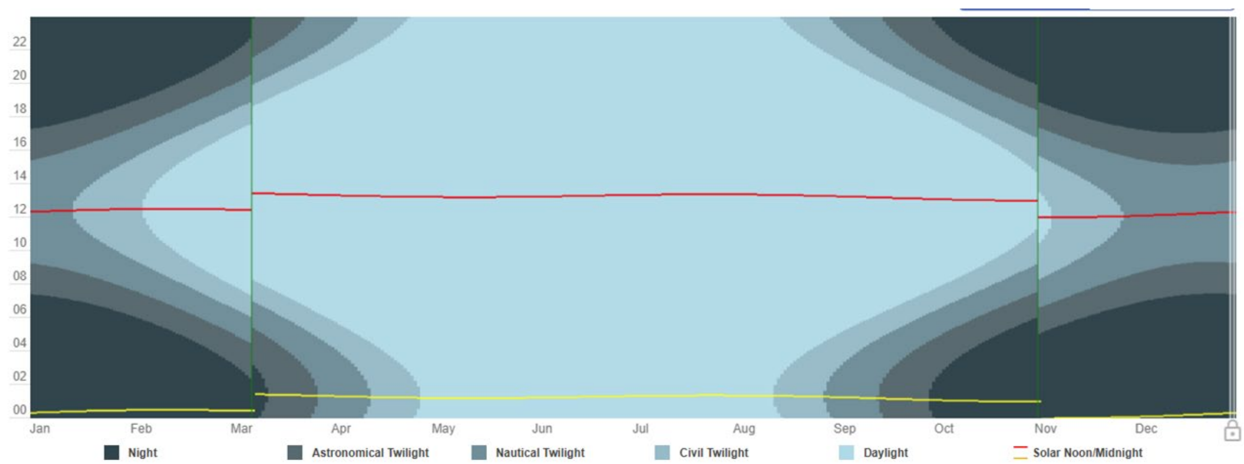

Figure 4-8: Sunrise, Sunset, Dawn, and Dusk Time in Resolute Bay

Source: Time and Date (2024)

4.10 Precipitation

Average rainfall, snowfall, and snow depth in Resolute Bay were obtained from the Canadian Climate Normals station data from 1991-2020 and are presented in Table 4-4.

Table 4-4: Precipitation Averages in Resolute Bay, Nunavut

Month	Total Precipitation (mm)	Average Snow Depth (cm)
January	4.9	17
February	4.4	17
March	7.4	16
April	8.3	17
May	8.6	16
June	15.7	7
July	29.3	0
August	32.6	0
September	19.0	3
October	15.1	11
November	12.0	15
December	6.7	18

Month	Total Precipitation (mm)	Average Snow Depth (cm)
Yearly Total	164.1	11

Source: Resolute Bay - Government of Canada (2024a)

5 Marine Water and Sediment Quality

Program objectives for marine water and sediment quality are provided in Section 1.5 (Table 1-1).

5.1 Desktop Review

Water and sediment quality data for Nunavut, including Resolute Bay, is limited. The Nunavut General Monitoring Plan (NGMP) classifies water and sediment quality monitoring into two categories: project monitoring (project specific within a local study area), and general monitoring (addresses information on the long-term state and health of aquatic ecosystems in the Nunavut territory) (NGMP, 2013).

There is no established mechanism for the monitoring of marine water quality in the NGMP (NGMP, 2013), however, the lack of marine water quality data for the Arctic is identified as knowledge gap by NPC due to its potential impact on marine mammals and seabirds (Government of Canada, 2018c). The Northern Contaminants Program is one organization that collects marine water quality information (Government of Canada, 2018a). Understanding marine water quality is important in Nunavut, particularly in the context of climate change, where changing conditions of sea ice and freshwater runoff are important drivers in Arctic water quality (Nummelin *et al.*, 2015). Understanding these variables provides a broader understanding of variable seasonal effects on coastal and offshore processes (Government of Canada, 2002).

Within Nunavut communities, the influence of storm water runoff, the effectiveness of wastewater treatment, and localized spills can influence marine water and sediment quality. Storm water run off in Resolute Bay is poorly understood, but its impact is likely at a localized level since Resolute Bay is a relatively unimpacted area. The majority of communities in Nunavut use trucks for wastewater and effluent for disposal in Wastewater Stabilization Ponds (WSPs). Sewage from some public facilities in Resolute Bay is trucked to a WSP near the airport. However, Resolute Bay is one of three communities that utilise utility tunnels to transport untreated wastewater from households for disposal (Wooton *et al.*, 2008). A wastewater treatment plant is planned, but currently untreated wastewater is conveyed from houses through the utility tunnel for discharge to the marine environment. The wastewater outfall is on the east side of Resolute Bay, east of the community harbour (Figure 1-1). While there was no information relayed by knowledge holders directly in regard to marine water and sediment quality, it was stated that harvesting for bottom dwelling organisms (whelks, sea urchins, and clams) is not done due to the outfall (IQ Workshop 2019 - Peter Amarualik).

5.2 Field Program (Water Quality)

A field program for water or sediment quality was not conducted in 2024, as the 2019 water quality data was considered sufficient.

5.2.1 Survey Location

Marine water quality in Resolute Bay was assessed over one sampling event on 18 August 2019 by an experienced marine scientist and a local Inuit assistant. Water samples were taken from four locations as shown in Figure 5-1. Sample locations were selected to give a broad overview of water quality in the vicinity of the Community Harbour Study Area. Sample locations were delineated and georeferenced using the Avenza App on an iPad.

Marine water quality survey locations and depth sampled are provided in Table 5-1.

Table 5-1: Marine Water Quality Sampling Locations (18 August 2019)

Sample ID	Start		Time	Sample Depth Category	Depth (m)	Station Depth (m)	Tide Height (m)	Chart Datum Depth (m)
	Latitude (N)	Longitude (W)						
RB 1	74° 41.452	94° 51.647	15:42	S	1	22	1.5	20.5
			15:27	D	21			
RB 2	74° 41.450	94° 51.125	16:15	S	1	18	1.4	16.6
			16:00	D	17			
RB 3	74° 41.580	94° 51.451	16:30	M	3.5	7.0	1.4	5.6
			16:45	M	3.5			
RB 4	74° 41.284	94° 52.329	17:02	S	1	16	1.2	14.8
			16:52	D	15			

Note: S = Shallow (1 m below sea surface), D = Deep (1 m above seabed), M = Midwater

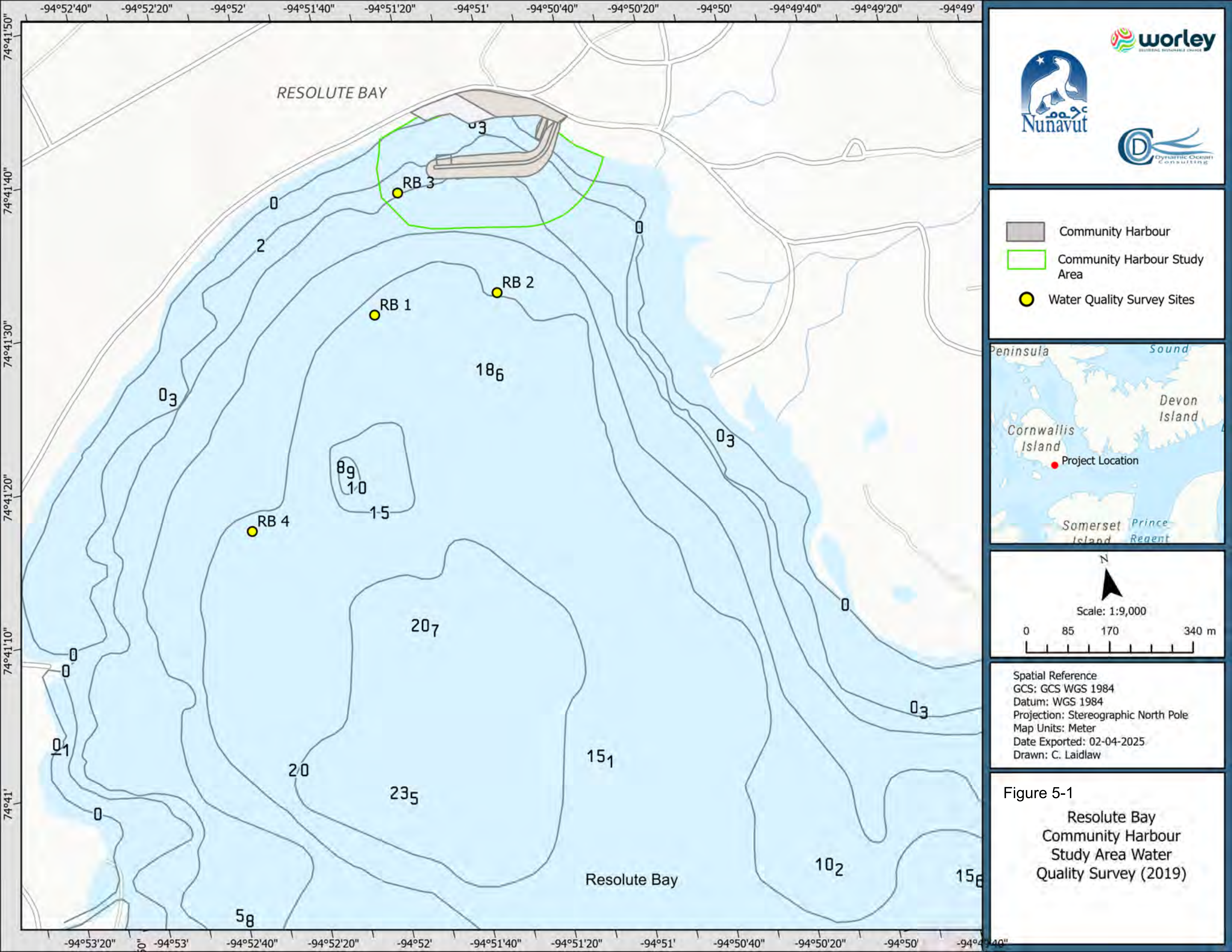

Figure 5-1

Resolute Bay Community Harbour Study Area Water Quality Survey (2019)

5.2.2 Methodology

5.2.2.1 Field

Samples for chemical analysis were collected from each sampling site using a 5.0 L Teflon lined Niskin bottle deployed from the vessel. The Niskin was cleaned with Alconox metals-free soap to remove any contaminants, then rinsed with site water prior to each deployment. When depths were greater than 8 m, two samples were taken from each site, one at the surface (1 m below surface) of the water column and one from the bottom of the water column (1 m above seabed). The Niskin was lowered over the side of the vessel to the required depth, a messenger was deployed and the Niskin retrieved to the surface with contained sample. Once at the surface, the water sample was decanted into specific containers, supplied by the laboratory, for the required analyses. Any bottles intended to receive analysis for dissolved analytes (e.g. metals) were filtered using a sterile 0.45 µm suction filtration system before decanting to the required bottle. Samples were preserved in the field per laboratory guidance, appropriately labelled using indelible ink to write the sample location number, depth of sample and date, and were immediately stored in coolers. Samples remained in refrigerated condition until dispatched to the analytical testing laboratory, where they are maintained at 4°C.

All samples were retained at the analytical laboratory for three months from the date of submission for repeat/verification testing, if required. In 2024, YSI Specific Conductivity, Temperature, pH, Turbidity, and Depth were taken during the plankton field program (see Sections 7.1.4.2, 7.4.4).

5.2.2.2 Laboratory

Samples sent to the laboratory for chemical analysis were analyzed for the following:

- Nutrients (ammonia, nitrate, nitrite, phosphate, orthophosphate).
- Physical parameters (pH, total suspended solids, total organic carbon).
- Total metals, including mercury.
- Dissolved metals, including mercury.

5.2.3 Data Analysis

Laboratory data were directly imported into the Environmental Quality Information System (EQuIS) 5.5.1 database (Earthsoft, Concord, MA). Checks for data quality were conducted to confirm data are admissible for use. Analytical water quality results were compared to the CCME - Canadian Water Quality Guidelines (WQG) for the Protection of Aquatic Life (CCME, 2003). These guidelines provide nationally endorsed, sciencebased goals for maintaining quality in aquatic ecosystems and are used for guidance to assess marine water quality. Water quality results were compared to long term guidelines.

5.2.4 Quality Assurance/Quality Control

5.2.4.1 Field QA/QC

The field Quality Assurance/Quality Control (QA/QC) measures for the water quality field program included procedures to reduce the risk of cross-contamination. The following QA/QC procedures were incorporated during sampling to ensure the highest quality results:

- Using qualified environmental staff experienced in marine water sampling and field supervision of local assistants.
- Decontaminating all water sampling equipment by washing with a phosphate-free detergent solution, followed by thorough rinsing with site water, prior to collecting a sample at each location.
- Prevention of cross-contamination by wearing a new pair of nitrile gloves for each sampling location when handling samples and sampling equipment.
- Storing samples in the appropriately cleaned and labelled sample containers.
- 'Blind labelling' all field QA/QC duplicate samples in the field with QA/QC field numbers which do not relate to the sampling location names.
- Keeping water samples cool (4°C) after sampling and during transport.
- Avoiding headspace in the sample containers.
- Maintaining a clean and organized work area.
- A regimented process for sample documentation was used, including:
    - Labelling all field sample containers and field data sheets with pencil/indelible ink and waterproof labels.
    - Backing up electronic data (i.e. positional data from GPS, photographs), in duplicate, at the end of each field day and labelling electronic files.
    - Keeping thorough notes, including photographs, GPS coordinates, tidal/weather conditions, and recording potential confounding factors observed during field days and at sites.
- Transporting samples under Chain of Custody (CoC) documentation.

5.2.4.2 Laboratory QA/QC

Laboratory analysis was conducted in accordance with professional standards using accepted testing methodologies, quality assurance, and quality control. The laboratory used for sediment sample analyses is a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited for the methodologies used and is experienced in the analysis of marine sediments.

QA/QC procedures for contaminant assessment were used from sampling through to completion of laboratory analysis included:

- Chain of Custody documentation

- Field and intra-laboratory QA/QC protocols

One field duplicate sample was collected in Resolute Bay and analyzed to determine the variability in analytical parameters.

Laboratory QA/QC included procedures to promote high quality laboratory results as well as measures to verify the results. These procedures included analysis of laboratory methodology blank, laboratory matrix spike, laboratory spiked blank, and laboratory duplicate.

A validation of the analytical data was undertaken to confirm that the data quality was suitable for undertaking an assessment to characterize water quality (see Section 5.2.2.2). This validation included a consideration of results for laboratory blanks, standards, spikes, and field and laboratory duplicate samples and is assessed against (CCME, 2016).

5.2.5 Results

5.2.5.1 Chemical

The results for chemical analyses for water quality are summarized below and presented in Appendix A Table A-1 (General Water Chemistry), Table A-2 (Total Metals); and Table A-3 (Dissolved Metals). Results are compared against the CCME (2003) long-term marine water quality guideline for the protection of aquatic life.

Laboratory analytical results are available on request.

5.2.5.2 Major Ions, Nutrients, and Physicochemical

Results of laboratory analysis for major ions, nutrients and physiochemical parameters are summarized as follows:

- pH was consistent across depth and sample location, ranging from 7.88 to 7.96.
- Nutrients were generally elevated at the surface (ranged from 0.012 mg/L to 0.030 mg/L) compared to deeper depths (ranged from 0.012 mg/L to 0.023 mg/L).
- Water hardness was consistent across sampling locations and was generally elevated at depth compared to surface samples. Total hardness (as $CaCO_3$) ranged from 4650 mg/L to 6870 mg/L.
- Total organic carbon was relatively consistent across sample location and depth, ranging from 81 mg/L to 100 mg/L.

5.2.5.3 Total Metals

Results of laboratory analysis for total metals are summarized as follows:

- All metals, except cadmium (RB-4 shallow; 0.220 µg/L, and RB-4 deep; 0.289 µg/L) and chromium (RB-4 shallow; 4.03 µg/L and RB-4 deep; 3.97 µg/L) were below their respective CCME long-term marine water quality guideline, where a guideline exists.

- Beryllium, bismuth, boron, lithium, selenium, silicon, titanium, vanadium and zirconium were below Reportable Detection Limit (RDL) in all samples and therefore lower than the CCME long-term marine water quality guideline, where a guideline exists.
- Aluminum, arsenic, barium, cobalt, molybdenum, nickel, strontium, calcium, magnesium, potassium and sulphur were present above respective RDLs in all samples. Concentrations of all analytes were relatively consistent across depth and sample location.
- Antimony, lead, silver and tin were above RDL in two of eight samples, at all of the same location (RB-4 shallow and RB-4 deep).
- Cadmium was above the RDL in four samples: RB-1 deep, RD-2 deep, RB-4 shallow and RB-4 deep. These samples ranged from 0.051 µg/L to 0.289 µg/L.
- Chromium was above the RDL in four samples: RB-1 shallow, RB-3 shallow, RB-4 shallow and RB-4 deep. These samples ranged from 0.73 µg/L to 4.03 µg/L.
- Copper was above the RDL in four samples: RB-1 shallow, RB-2 shallow, RB-4 shallow and RB-4 deep. These samples ranged from 0.57 µg/L to 80.4 µg/L.
- Iron was above the RDL in three samples (RB-1 deep, RB-4 shallow and RB-4 deep). The concentrations equalled the RDL in one sample at RB-2 deep. Iron levels ranged from 17 µg/L to 147 µg/L.
- Manganese was above the RDL in four samples (RB-1 deep, RB-2 deep and RB-4 shallow and RB-4 deep), ranging from 1.57 µg/L to 105 µg/L.

5.2.5.4 Dissolved Metals

Results of laboratory analysis for dissolved metals are summarized as follows:

- All dissolved metals, except chromium (RB-3 shallow; 1.58 µg/L.) were below their respective CCME long- term marine water quality guideline, where a guideline exists.
- Antimony, beryllium, bismuth, selenium, silicon, silver thallium, titanium and zirconium were below RDL in all samples.
- Boron, lithium, strontium, uranium, calcium, magnesium, potassium and sulphur were present above respective RDLs in all samples. Concentrations of all analytes were relatively consistent across depth and sample location.
- Aluminum, arsenic, barium, molybdenum, nickel and iron were all above the RDL in the same five samples (RB1- shallow and deep, RB-2 shallow and deep and RB-3 shallow). For each of the metals, the concentrations above the RDL were relatively consistent.
- Cadmium was above the RDL in four of eight samples: RB-1 shallow, RB-1 deep, RB-2 deep and RB-3 shallow. These samples ranged from 0.56 µg/L to 0.92 µg/L.
- Chromium was above RDL in four samples: RB-1 shallow, RB-1 shallow, RB-2 shallow and RB-3 shallow. These samples ranged from 1.13 µg/L to 1.58 µg/L.
- Cobalt was above the RDL in one sample (RB-2 shallow; 0.20 µg/L).

- Copper was above the RDL in four samples: RB-1 shallow and deep, RB-2 deep and RB-3 shallow. These samples ranged from 0.56 µg/L to 0.92 µg/L.
- Lead was above the RDL in one sample (RB-2 shallow; 0.24 µg/L).
- Manganese was above the RDL in three of eight samples: RB-1 deep and shallow, and RB-2 deep. These samples ranged from 0.68 µg/L to 2.24 µg/L.
- Tin was above the RDL in two samples (RB-1 shallow; 1.3 µg/L and RB-3 shallow; 1.1 µg/L). Concentrations at RB-2 shallow were equal to the RDL (1.0 µg/L).
- Vanadium was above the RDL in two samples (RB-1 shallow; 11 µg/L, and RB-1 deep; 11 µg/L). Concentrations at RB-2 shallow were equal to the RDL (10 µg/L).
- Zinc was above the RDL in one sample (RB-1 shallow; 6.1 µg/L).

5.2.6 Data Validation

5.2.6.1 Laboratory Accuracy and Precision

Bureau Veritas (BV) incorporated a range of QA/QC methodologies to ensure accuracy and precision of data. The results of the QA/QC completed are detailed below.

5.2.6.1.1 Laboratory Methodology Blanks

An assessment of laboratory blank samples reported by BV demonstrates concentrations below the RDL for the majority of parameters, so cross-contamination of samples does not appear to have occurred.

5.2.6.1.2 Laboratory Duplicates

The CCME (2016) recommends that laboratory duplicate samples should be within a Relative Percent Difference (RPD) of ±20 % for metals and nutrients and ±0.3 pH units for pH (CCME, 2016).

Review of BV QC results shows all RPDs to be within acceptable limits.

5.2.6.1.3 Matrix Spikes

To verify that the physical properties or characteristics of the matrix do not interfere with the analytical result, a known concentration of the chemical of interest is mixed into a sample of the required matrix. Matrix spikes measure the analytical methodologies' performance on a specific matrix type. CCME (2016) states that recovery limits of 70 % to 130 % for metals in water or 80 % to 120 % for metals in sediment are acceptable.

Review of BV QC results identified that all matrix spike recovery met the acceptability criteria for all metals except total molybdenum (126 %), total tin (135 %) and total ammonia (62 %). Dissolved mercury also did not meet the acceptability criteria (78 %).

5.2.6.2 Field Duplicate Analysis

Field replicates are samples that are split from the original sample. These QC samples identify variation associated with sub-sample handling and repeatability of laboratory analysis. One field duplicate sample at RB 4 Deep was collected. The CCME (2016) states that RPD for water quality field duplicates should be within ±40 %.

Review of the field duplicate QC results showed all RPDs to be within acceptable limits.

5.2.6.3 Holding Times

All water and sediment samples were stored in coolers and then transported to the laboratory chilled, where samples were stored under refrigeration until analyzed.

Samples were in accordance with recommended holding times. Standard methodologies for pH analysis state that pH should be analyzed within 15 minutes of sampling, and therefore, generally is measured in the field. Therefore, analysis of pH was completed outside of standard holding times. A summary is provided in Table 5-2.

Table 5-2: Resolute Bay Marine Water Quality Holding Times

<table>
<tr><th rowspan="2">Parameter</th><th colspan="3">Date</th><th rowspan="2">Number of Days Passed</th><th rowspan="2">Recommended Holding Time (days)</th></tr>
<tr><th>Sample Taken</th><th>Sample Delivered</th><th>Sample Analyzed</th></tr>
<tr><td>Mercury (dissolved)</td><td rowspan="4">18-Aug-19</td><td rowspan="4">03-Sep-19</td><td rowspan="3">12-Sep-19</td><td rowspan="3">25 days</td><td>28</td></tr>
<tr><td>Mercury (total)</td><td>28</td></tr>
<tr><td>Total Organic Carbon</td><td>28</td></tr>
<tr><td>Total Metals</td><td>11-Sep-19</td><td>24 days</td><td>180</td></tr>
</table>

5.3 Discussion

Marine water quality in Resolute Bay was consistent across sites and depth profiles.

Metal concentrations were below respective (CCME, 2003) guidelines for all metals, except cadmium and chromium. Both exceeded CCME guidelines at the same location (RB 4), and for both shallow and deep water. Chromium is a naturally occurring mineral and increased levels can be attributed to industrial waste leakage and disposal (EPA, 2019). Due to the remote nature of Resolute Bay, it is unlikely that the raised levels of chromium are due to industry and are naturally occurring. Fluctuations in mineral levels in Arctic waters are common due to dilution from sea ice melt (Zhang *et al.*, 2019) and this could be responsible for the raised levels of chromium observed.

Across all sample locations, dissolved metal concentrations were comparable to total concentrations, indicating that metals typically are not bound to solids. pH, hardness, alkalinity, TOC, TSS, sulphur and metal concentrations were consistent across shallow and deep samples.

Additional observations from within the Community Harbour Study Area included: during the intertidal habitat survey, a sulphur odour and visual observations of green algae were noted, therefore only a visual survey was performed (e.g., rocks were not lifted to look for amphipods); during the subtidal habitat survey, seaweed was noticeably more silt covered compared to areas on the western portion of Resolute Bay; and, during the terrestrial habitat surveys, sewage debris was visually observed near the outfall (e.g., wet wipes, etc.).

Marine water and sediment quality is a concern for the Resolute Bay community due to the location of the wastewater outfall, which has impacted the ability of residents to harvest marine organisms. During an HTA design workshop, there were discussions surrounding consideration for the orientation of the community harbour entrance relative to currents in Resolute Bay, which if not considered could result in sewage within the community harbour (see Appendix 2 - Community Consultations of the main report).

6 Fish and Marine Mammals

The coastal marine environment of the Arctic Ocean surrounding Nunavut represents an important ecosystem for fish and marine mammals. Intertidal areas are inaccessible throughout periods of the year when the ocean is frozen and along with shallow subtidal areas, are impacted by seasonal ice scouring. Changing seasons and ice movement play an important role in the distribution of marine mammals. These variables have led to uniquely adapted species that have tolerance for extreme climatic regimes (Lindgren *et al.*, 2016). It also represents an important socio-economic function for the Inuit who are dependent on fish and marine mammals for subsistence harvesting.

Program objectives for fish and marine mammals are provided in Section 1.5 (Table 1-1).

6.1 Fish and Marine Mammal Focal Species and Species Categories

Focal fish and marine mammal species were selected based on several variables which included: their importance to Inuit for subsistence and food security; their geographic ranges which includes the potential to occur in the Project Study Area; and for their representative role in food chain dynamics. Each species was then further categorized based on their use of the habitat (e.g. migratory, resident) to understand their potential for occurrence within the Project Study Area.

The IQ workshop (see Section 2) provided valuable insight and local knowledge into the seasonality, distributions and habitat use of marine species in Resolute Bay. Species identified as focal are listed in Table 6-1. The Marine Corridors relevant to water bodies for migratory organisms is provided in Figure 1-2. See Table 3-1 for species designations and probability of occurrence with the Project Study Area and Marine Corridors. Species categories were defined to represent the extent to which the marine species migrate and whether they are permanent residents of Arctic waters.

6.1.1 Fish

Marine fish species that are found in the Arctic occupy the ocean either as residents, migratory species, or anadromous, as defined below:

- Migratory: species that migrate exclusively in the marine environment on an annual or seasonal basis, triggered by local climate, food availability, or for mating reasons.
- Resident: species that occupy the same general area throughout the year.
- Anadromous: species that move between freshwater and marine environments for the purposes of feeding in one environment and spawning.

6.1.2 Marine Mammals

Marine mammals that are found in the Arctic were categorized as either Arctic Residents or Seasonal Visitors, as defined below:

- **Arctic Resident:** species that reside in the Arctic year-round.

- **Seasonal Visitor:** species that predictably reside within the Arctic region for a portion of the year, most typically the open-water season.

Table 6-1: Occurrence of Focal Species

Species Type	Species (Common Name)	Species (Latin Name)	Species Spatial Category	Type	Seasonal Occurrence	Report Section
Fish	Amphipod	*Gammarus* sp.	Resident	Benthic invertebrate	Year-round	6.3.1
	Arctic char	*Salvelinus alpinus*	Anadromous	Pelagic fish	Year-round	6.3.2
	Arctic cod	*Boreogadus saida*	Migratory	Pelagic fish	Year-round	6.3.3
	Arctic Sculpin	*Myoxocephalus Scorpius* (shorthorn) *Gymnocanthus tricuspis* (Arctic staghorn)	Resident	Bottom dwelling fish	Year-round	6.3.4
	Truncated Soft-Shell Clam	*Mya truncata*	Resident	Benthic invertebrate	Year-round	6.3.5
Marine Mammal	Atlantic walrus	*Odobenus rosmarus ssp. rosmarus*	Resident	Pinniped	Summer, Fall	6.4.1
	Bearded seal	*Erignathus barbatus ssp. barbatus*	Resident	Pinniped	Year-round	6.4.2
	Beluga whale	*Delphinapterus leucas*	Resident	Cetacean	Spring, Summer, Fall	6.4.3
	Bowhead whale	*Balaena mysticetus*	Resident	Cetacean	Summer	6.4.4
	Harp seal	*Pagophilus groenlandicus*	Visitor	Pinniped	Summer, Fall, Other seasons indicated by harvest data	6.4.5

Species Type	Species (Common Name)	Species (Latin Name)	Species Spatial Category	Type	Seasonal Occurrence	Report Section
	Hooded Seal	*Cystophora cristata*	Visitor	Pinniped	Summer, Fall, Spring and Winter ice dependent	6.4.6
	Narwhal	*Monodon monoceros*	Resident	Cetacean	Summer	6.4.7
	Killer whale	*Orcinus orca*	Visitor	Cetacean	Spring, Summer, Fall	6.4.8
	Polar bear	*Ursus maritimus*	Resident	Ursid	Spring, Summer, Fall	6.4.9
	Ringed seal	*Pusa hispida ssp. hispida*	Resident	Pinniped	Year-round	6.4.10

6.2 Resource Harvesting

The Inuit have a strong connection to the land and sea through resource harvesting and other cultural practices and are an integral part of the Arctic ecosystem (see Figure 6-1 for generalized diagram). Traditional resources, frequently termed as 'country foods' are critical to health of the people of Nunavut (Nunavummiut) (Wenzel *et al.*, 2016). Inuit have a unique depth of knowledge of the abundance and distribution of marine and terrestrial species and rely on access to the land and water during all seasons for the acquisition of country foods. The transitions between seasons and ocean state conditions (e.g., iced, open-water) is displayed in Figure 4-6 and the Marine Corridors are depicted in Figure 1-2 and described in Section 4.3.

Inuit are dependent on access to country foods, and as a result, there is a close alignment between the management of marine resources in Nunavut and a co-management approach with the inclusion of IQ. This relationship between Inuit harvesters and resources is a significant consideration in the selection of 'focal species' and assessment of existing conditions in Arctic environments for this ESEB Report.

The QIA (2018a) converted country foods into a monetary value, where the value of Arctic char country foods fishery for a study which involved six communities (Grise Fiord, Arctic Bay, Pond Inlet, Clyde River, Qikiqtaarjuak, Pangnirtung), provided a substitution value of $1,120,755. Arctic char represent the second-most widely consumed country food (Hurtubise, 2016). As of 2024, Arctic char market value within Nunavut is $7.2 million per year (Harris L. *et al.*, 2022).

Arctic communities such as Resolute Bay rely heavily on country foods, and the communities recognize the important of productive and responsible land use (NPC, 2023b). With changes in climate comes reductions in wildlife population size in conjunction with longer periods of open seaways (NPC, 2023b).

The NWHS, which was mandated by the NLCA and carried out under the direction of the NWMB, was carried out from June 1996 to May 2001, and documented monthly harvest data from Inuit Harvesters in Nunavut Communities. Summary data from the five-year study specific to Resolute Bay is provided in Table 6-2). North Baffin seasonal harvesting cycles are also depicted in Figure 3[19] of the NBRLUP (NPC, 2000).

Table 6-2: Harvest and Hunter Estimates

Species	Harvest Five Year Mean	Total Number of Harvesters
Arctic char*	741	50
Arctic Cisco	69	13
Arctic Cod*	13	2
Arctic Hare	31	6
Arctic Sculpin*	1	1
Arctic Tern Egg	9	5

[19] See Figure 3 (p. 20) for a depiction of the North Baffin harvesting cycles https://www.nunavut.ca/sites/default/files/north_baffin_regional_land_use_plan.pdf

Species	Harvest Five Year Mean	Total Number of Harvesters
Atlantic walrus*	5	8
Bearded seal*	20	20
Beluga whale*	21	32
Brant Goose	9	14
Canada Goose	<1	1
Caribou	17	15
Clam*	163	10
Common Loon	<1	1
Duck Egg	36	6
Eider Duck	48	19
Eggs (unspecified)	<1	1
Goose Egg	3	2
Harp seal*	7	9
Inconnu	19	1
Muskox	7	17
Narwhal*	8	8
Old Squaw	<1	2
Polar bear*	18	n/d
Ptarmigan	378	39
Wolf	1	7
Red-throated Loon	<1	1
Ringed seal*	562	52
Seagull Egg	25	9
Snow goose	17	19
Thick-billed murre	1	3
Turbot	<1	1
White Winged Scoter	<1	1

Source: Table 267 to 290 in Priest and Usher (2004)
Note: Species with * are focal species identified for the Project

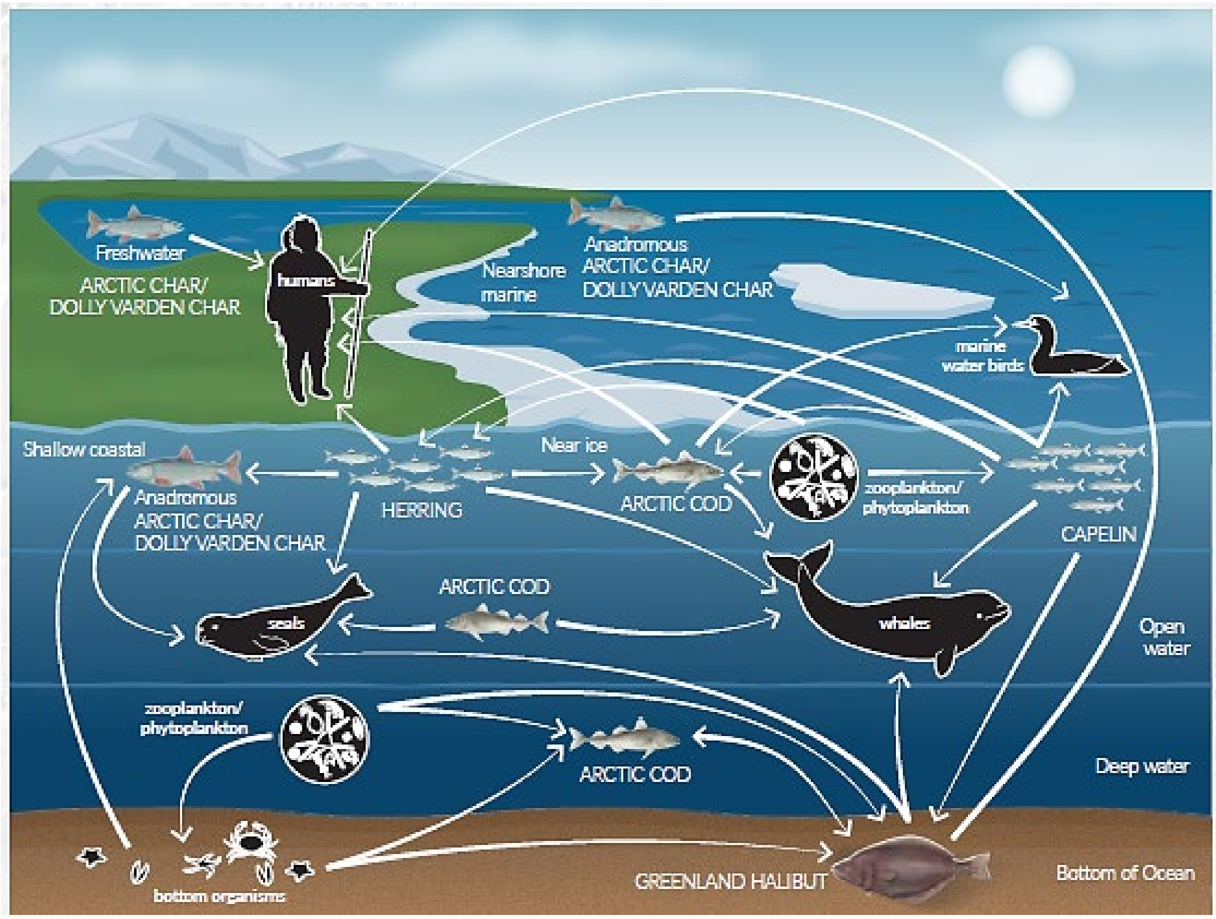

Figure 6-1: Ecosystem Connectivity in Nunavut

Source: Oceans North Conservation Society *et al.* (2018)

6.2.1 Food Chain Dynamics

Understanding food chain dynamics requires an assessment of carbon transfer through different trophic levels. Carbon-based fats are transferred to animals from the bottom of the food chain (e.g., phytoplankton) to the top (e.g. polar bear) (CIRES CEEE, 2021; Rapinski *et al.*, 2018). In Arctic ecosystems, there are several key species/organism types that can store large amounts of energy as lipids, an energy resource crucial for many large vertebrate species and Inuit.

Phytoplankton, often referred to as primary producers, build the base of the food chain. This group contains bacteria, algae and marine plants (Darnis *et al.*, 2012; Graeve *et al.*, 2016) able to store atmospheric and/or aqueous carbon dioxide (CO_2) in form of organic compounds, which then can be transported as energy-rich lipids up the food chain (Graeve *et al.*, 2016). Organisms preying on phytoplankton are known as zooplankton. One of the most common and important zooplankton groups are copepods (e.g. small crustaceans) belonging to the genus *Calanus* (Tarling *et al.*, 2022), which includes two species typical for the Arctic (*C. glacialis* and *C. hyperboreus*) and one species (*C. finmarchicus*) that has recently been observed to start moving northwards (Wassmann *et al.*, 2020). These larger copepods are able to build up huge lipid reserves, reaching up to 60 % of their dry mass, over the duration of a few weeks by feeding intensively on phytoplankton. Therefore, energy stored within *Calanus* species are key for the energy transfer up the Arctic food chain (Darnis *et al.*, 2012). During the iced season, plankton contribute to carbon cycling in the deep ocean through respiration and mortality at depth (Darnis *et al.*, 2012). Since plankton are a common prey for marine mammals, birds and fish (Tarling *et al.*, 2022), these organisms represent a critical link connecting primary producing microalgae and meso-predators (Graeve *et al.*, 2016). Bowhead whales consume large amounts of zooplankton and are believed to prey on pelagic and epibenthic species during summer and fall (Finley, 2001; Lowry *et al.*, 2004; Pomerleau *et al.*, 2011), while calanoid copepods represent the primary prey species during winter and spring (Heide-Jørgensen *et al.*, 2012; Laidre *et al.*, 2007).

Anadromous Arctic char (*Salvelinus alpinus*) and Arctic cod (*Boreogadus saida*) are considered key species in the Arctic marine ecosystem. Both play a crucial role in transferring energy to higher tropic levels including Arctic fish, birds, and mammals (Ivanova *et al.*, 2020; Welch *et al.*, 1993). Arctic char is a highly valued fish species to the people of Nunavut for subsistence and commercial fisheries (Galappaththi *et al.*, 2022; Roux *et al.*, 2011), whereas Arctic cod, though less valuable for subsistence harvests, is rich in fat and believed to be the source of up to 75 % of energy transfer in Arctic food webs (Oceans North Conservation Society *et al.*, 2018). Arctic cod are hypothesized to be the primary consumer of Arctic copepods (Darnis *et al.*, 2012), while in turn, represent a main prey species for numerous high trophic level species such ringed seal (*Pusa hispida ssp. hispida)*, narwhal (*Monodon monoceros)*, beluga whale (*Delphinapterus leucas*) and various seabirds (Gaston *et al.*, 2012; Welch *et al.*, 1993), most of which play an important role in the annual subsistence hunt by Inuit (GN, 2018b).

Polar bears are considered the apex predator within the Arctic and are highly dependent on the intake of these energy resources when preying on seals, beluga and narwhal, among others. As climate change is causing warmer sea surface temperatures, smaller and less energy-rich copepods are hypothesized to be better adapted to the new conditions of the Arctic, consequently resulting in a shift within the zooplankton community, with an increase in smaller plankton species (Li *et al*., 2009). The magnitude of such a shift and its significance for marine mammals and predatory fish is unknown (Darnis *et al*., 2012), raising further concern about the effects this will have on the usually nutritious and omega-3-rich subsistence food consumed by Inuit.

6.2.2 Fishery Management Structure

Fisheries in Nunavut occur as traditional food (subsistence), commercial (inshore traditional and offshore non traditional), and recreational fisheries (Boudreau & Fanning, 2016; Nunatsiaq News, 2018). Nunavut's first 'Nunavut Fishery Strategy' (NFS) published in 2005 and a second publication in 2016 (GN, 2016a). The intention of the NFS was to identify development potential of Nunavut fisheries in the commercial sector. Commercial and subsistence fisheries are managed collaboratively under the *Nunavut Agreement* (Boudreau & Fanning, 2016; Kristofferson & Berkes, 2005). Management of fisheries by the *Nunavut Agreement* is accomplished with a co-management approach that includes: the NWMB, Nunavut Tunngavik Incorporated (NTI), GN, DFO, Regional Wildlife Organizations (RWOs), and Hunters and Trappers Organization/Association (HTOs/HTAs) (DFO, 2018b; GN, 2016a) (see depiction in Figure 6-2). While the Nunavut Agreement came into effect in 1993 and Nunavut was established in 1999, Nunavut fisheries are managed under the Northwest Territories Fishery Regulations (DFO, 2024a; Government of Canada, 2019a). Nunavut Fishery Regulations are being developed cooperatively between DFO, NTI, NWMB, the GN and the Makivik Corporation. A consultation period ran from 11 February 2018 to 31 July 2019 (Government of Canada, 2019a). Initial stages of the Forward Regulatory

Plan (FRP) for a draft policy proposal and pre-publication of the regulatory proposal of Nunavut Fishery Regulations began during the 2024-2026 planning period (DFO, 2024d).

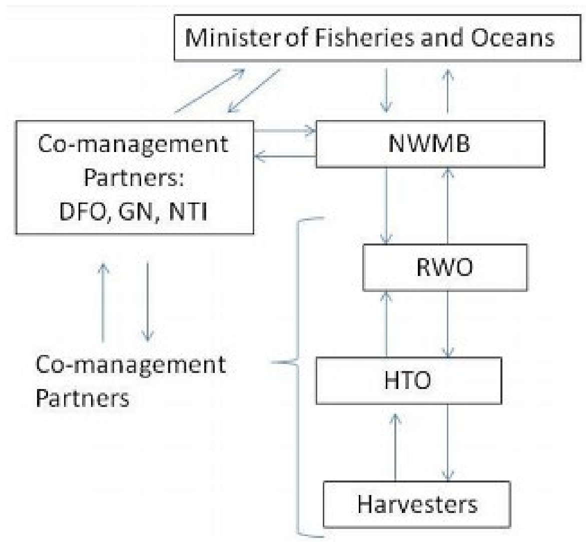

Figure 6-2: Governance of Fisheries in Nunavut

Source: Figure 3 in Boudreau and Fanning (2016)
Note: DFO = Fisheries and Oceans Canada; GN = Government of Nunavut; NTI = Nunavut Tunngavik Incorporated; NWMB = Nunavut Wildlife Management Board; RWO = Regional Wildlife Organizations; HTO = Hunters and Trappers Organization

The NTI is the primary Designated Inuit Organization (DIO) under the *Nunavut Agreement* and is responsible for confirming that Inuit rights and obligations are being met (DFO, 2013b). Regulated fisheries are governed by the *Fisheries Act* and in accordance with the Fishery (General) Regulations and the Marine Mammal Regulations (MMR). When either of these acts and regulations are inconsistent with the *Nunavut Agreement*, the latter shall prevail (DFO, 2013b).

Integrated Fisheries Management Plans are developed by DFO for harvested species to provide a planning framework for the conservation and sustainable use of fisheries resources (DFO, 2013c). IFMPs exist for the following Arctic species:

- Arctic char commercial Cambridge Bay fishery (DFO, 2018a) - no subsistence fishery component.
- Atlantic seal IFMP[20] (DFO, 2011b) - targets the commercial, but not the subsistence harvest of all seals in Atlantic Canada.
- Narwhal (DFO, 2013b).
- Atlantic walrus (*Odobenus rosmarus ssp. rosmarus*) (DFO, 2018b).

20 The IFMP covers six species of seals: harp, hooded, grey, ringed, bearded and harbour, with the majority of commercial harvest being the harp seal.

- Greenland Halibut (*Reinhardtius hippoglossoides*) Northwest Atlantic Fisheries Organization Subarea 0 (DFO, 2019d).
- Northern shrimp (*Pandalus borealis*) and striped shrimp (*Pandalus montagui*) – Shrimp fishing areas 0, 1, 4-7, the Eastern and Western Assessment Zones and the North Atlantic Fisheries Organization (NAFO) Division 3M (DFO, 2018d).

The Bering-Chukchi-Beaufort population of Bowhead Whale (*Balaena mysticetus*) was listed under SARA in 2007, and the SARA management plan was published in 2014 (DFO, 2014b, 2022c). Section 72 of SARA requires a progress report every five-years until the management plan objectives are met. From 2014 to 2019 conservation actions for habitat protection, research of threat evaluation and mitigation, monitoring and assessment, and outreach and communication were established and are currently ongoing (DFO, 2022c).

Table 6-3: Fishery Management Measures in Nunavut

Species Group	Detail
Fish, Invertebrates	Fisheries harvesting in the High Arctic is reported to Fisheries and Oceans Canada (DFO) through the Arctic Fishery Alliance (AFA). The AFA is an Inuit-owned fishing enterprise that works to benefit the four communities of Arctic Bay, Grise Fiord, Qikiqtarjuaq, and Resolute Bay (AFA, 2018). Nunavut Fishery Regulations are being co-developed between DFO, Nunavut Tunngavik Incorporated, Nunavut Wildlife Management Board, GN, and the Makivik Corporation for both domestic and international management. The regulations would apply to all fish and marine mammals within Nunavut and adjacent to Areas of Equal Use and Occupancy, Nunavik Marine Region and the Eeyou Marine Region (DFO, 2024d).
Marine Mammals	Harvesting regulations are identified in the MMR (beluga: S.20, bowhead S22: narwhal: S23, walrus: S25 seals S26.1). Quotas are further discussed in the respective species sections (beluga: Section 6.4.3 bowhead whale: Section 6.4.4, narwhal: Section 6.4.8, walrus: Section 6.4.1).
Seals	Commercial and subsistence harvesting of seals is managed under three management areas, with Nunavut encompassed in the Arctic Region (Sealing Areas 1-3). See Figure 2 in Library of Parliament (2017). Harbour, ringed and bearded seals are not harvested commercially, but harvests do exist for subsistence fisheries in Nunavut, with ringed seals being the most preferred (NPC, 2012).
Polar Bear	A Polar Bear Co-Management Plan has been developed for Nunavut by the Nunavut Wildlife Management Board (NWMB) and ECCC to address subsistence harvesting of this species (GN, 2019a). ECCC anticipated publishing a national polar bear management plan under the *SARA* for a 60-day public comment period in spring 2023 (Government of Canada, 2023b). At the time of this report there has been no further updates on the progress of the plan development since March 2023. Once published, the plan is expected to include:

Species Group	Detail
	• Part 1: Federal addition. • Part 2 to 7: Compendium of jurisdictional management plans and recovery strategies.

6.2.2.1 Commercial Fisheries

Commercial fisheries in Nunavut are considered as offshore and inshore fisheries, with offshore targeting Greenland halibut and northern shrimp, and the inshore targeting Arctic char and Greenland halibut. The potential for clams, scallops and crab are being explored (Nunavut Marine Council, 2019). The Hamlet of Resolute Bay is a co-owner of AFA (AFA, 2018).

For the offshore fishery, there are four Nunavut-based companies that participate directly in the offshore fishery: Qikiqtaaluk Fisheries Corporation (QFC), Baffin Fisheries (BF), Cumberland Sound Fisheries Ltd. (CSFL) and the AFA. QFC is a subsidiary of the Qikiqtaaluk Corporation (QCorp), which is a for-profit arm of the QIA (Bernauer, 2022). There is also interest in developing marine infrastructure in Nunavut, for the landing, processing and shipping of fish products; however, currently all offshore fish caught in Nunavut waters are processed in Greenland or Atlantic Canada.

The inshore commercial fishery is currently exclusive to Arctic char, with the exception of Pangnirtung which has both an Arctic char and turbot fishery. Fish that are processed in the Kivalliq (Rankin Inlet, Chesterfield Inlet, Whale Cove) and Qikiqtani (Pangnirtung) Regions (Bernauer, 2022). The potential for several invertebrate species is being explored (Nunavut Marine Council, 2019).

Although the *Nunavut Agreement* came into effect in 1993 and Nunavut was established in 1999, Nunavut fisheries are still managed under the Northwest Territories Fishery Regulations (DFO, 2019b, 2024a). Nunavut Fishery Regulations (NFR) are being developed cooperatively between DFO, NTI, NWMB, the GN and the Makivik Corporation (representation for Nunavik Inuit interests; (DFO, 2019b). A consultation period was run from 11 February 2018 to 31 July 2019 (DFO, 2019b), where the goal was to obtain feedback on how to meet the key objectives of the NFR as listed below:

- Recognize the existing responsibilities and authorities for fisheries management in Nunavut.
- Recognize Inuit harvesting rights.
- Support the implementation of the fisheries (wildlife) management provisions of the *Nunavut Agreement.*
- Ensure the sustainability of fish stocks and fisheries.
- Support and preserve access to markets for Nunavut fish products.

The NFR is a co-development with NTI, GN, Nunavut Wildlfe Management board, and Makivik Coporation representing Nunavik Inuit interests (DFO, 2024d). A 2019 DFO information release states the spatial scope of the NFR includes the NSA, the Nunavik Marine Region, Hudson Bay and James Bay (DFO, 2019g). From 2019 to 2022 Arctic char harvested increased by 10,000 kg and the total landed value was $624,000 by the end of 2022 (DFO, 2024e). The GN developed a Fisheries and Sealing Division Strategic Plan for the five-year period of 2023-2028, prioritising offshore fishery through advocacy in quota and license allocations, research in offshore stocks, advocacy of sustainable emerging fisheries, and development of a deep-sea port (GN, 2023).

6.2.2.2 Exploratory Commercial Fishery Interests

Exploratory fisheries occur in lakes and rivers that have never been fished before with the purpose of stock assessment and future commercial fisheries (DFO, 2004). Exploratory fishing licenses are issued by DFO, but approved by the NWMB (GN, 2016a). Prior to submission, applications must be approved by the local HTAs (Boudreau & Fanning, 2016). Licenses are issued over a five-year period and the total harvest for each year is used to assess the efficacy of a commercial fishery both from a stock size and financial viability perspective (DFO, 2019f). As of 2018, Canadian North Economic Development Agency (CanNor) investments have expanded fisheries quotas and industry developments from exploratory fisheries research (Government of Canada, 2018b). In 2022 Northern Affairs began a $2.4 million investment into three Nunavut fisheries projects (Government of Canada, 2022a). The three areas are fisheries research to support industry development, advancement of fisheries and sealing economies, and training consortium for fisheries and marine.

The region of Qikiqtani includes Resolute Bay and encompasses 10 % of Canada's landmass. Qikiqtaaluk Corporation (QC) conducted ghost fishing detection, seabed and habitat classification, environmental monitoring, and scientific research to strengthen the socio-economic health of the Qikiqtani region (Qikiqtaaluk Corporation, 2022).

The AFA have a vessel (Kiviuq 1) used for exploratory fisheries (AFA, 2018) which in recent years has regularly been in the High Arctic Waters, including Parry Sound seeking opportunities for commercial harvests for Greenland halibut and shrimp (Navigator, 2015). The AFA works with Memorial University of Newfoundland (MUN) on this endeavor. An exploratory license was first requested from DFO in 2008 by the HTAs of Resolute Bay, Grise Fiord, and Arctic Bay for inshore fishing in Jones Sound, Admiralty Inlet, and Parry Sound, respectively (DFO, 2008). An exploratory fishery study in the open-water season of 2014 was supposed to include Resolute Bay, however the Kiviuq 1 had to detour to Greenland for fuel, and the six day delay resulted in ice conditions that made Resolute Bay inaccessible (Nunatsiaq News, 2014). Resolute Bay was part of study in the open-water season of 2015 that also included Arctic Bay and Qikiqtarjuaq (Cision, 2016). This study was partially funded by the federal Department of Innovation, Science and Economic Development, who provided $1.2M to study fisheries data gathered in the Eastern and High Arctic. As quoted by then Minister Honourable Navdeep Bains, "*The Government of Canada is committed to economic development and diversification in the North. The research from this project has the potential to help Inuit-owned businesses expand and innovate, and could lead to high quality jobs for Inuit."* (Cision, 2016). The partners in the funding include: CanNor, the AFA, the GN-EDT and GN-DoE, the National Research Council (NRC), Oceans North, and the Ocean Tracking Network (OTN) (Cision, 2016).. The goal of the research was to examine the commercial value of Greenland halibut, shrimp and whelk (Cision, 2016; Navigator, 2015).

6.2.2.3 Subsistence Fisheries

Subsistence harvesting in Nunavut is intrinsic to the Inuit way of life.

Inuit harvesting rights are described in Part 6 of the *Nunavut Act*, where species may be restricted by a Total Allowable Harvest (TAH). For species without a TAH restriction, the species can be harvested by an

Inuk ‘to the full level of his or her economic, social, and cultural needs, subject to the terms of this Article” (S.5.6.1 Nunavut Agreement). For species that have a TAH restriction and are also a commercially harvested species, a Basic Needs Level (BNL) for Inuit is established (NWMB, 2019). When the BNL is less than the TAH, the NWMB will determine commercial allocations. The allocation and enforcement of the BNL is the responsibility of respective HTAs and RWOs (Nunavut Agreement S.5.7.3[b], 5.7.6[b]). BNLs do not exist for most species, but have been determined for narwhal, walrus, beluga and bowhead whales (Boudreau & Fanning, 2016). Implementation of fisheries regulations can be dependent on the migratory nature of the species. For example, allocation of tags for narwhal is through the RWOs and the HTAs to develop local hunting rules whereas Arctic char management can be implemented by the HTAs as stocks are more local (Boudreau & Fanning, 2016).

Subsistence harvesting of seals provides many resources for Inuit and is a significant part of their lifestyle and culture. Passing on the skill of hunting and knowledge of the environment is crucial for intergenerational links (Wenzel, 1983). Hunters will harvest seals by the traditional methods of lair breaking or using a needle technique, or by the modern methods of approaching basking seals or seal breathing holes (Furgal *et al.*, 2002). Bearded (*Erignathus barbatus ssp. barbatus*), harp (*Pagophilus groenlandicus*), hooded (*Cystophora cristata*), and ringed (*Pusa hispida ssp. hispida*) seals are all targets of subsistence hunts in Nunavut. Seal hunting occurs year-round with harvesters hunting seals in both open-water and iced ocean conditions. In the iced season, Inuit exclusively hunt ringed and bearded seals, with the largest harvests occurring in the Hudson Strait, Foxe Basin and the eastern region of Hudson Bay (Hurtubise, 2016).

Cetaceans are not harvested commercially in Nunavut, but most species are harvested for subsistence purposes. Inuit hunters will harvest whales close to the shore by methods using harpoons from a boat (Tyrrell, 2007). Hunters may herd whales to shallow waters where the whales will be more easily harpooned (Tyrrell, 2007). Another method of harvesting whales is by use of whale nets (Tyrrell, 2007). Based on the location, hunting rifles may be used instead of harpoons (Tyrrell, 2007). Most species of whale that are present in Nunavut are harvested for subsistence purposes and generally fall under the BNL system with harvesting limitations. The exception to this is the killer whale (*Orcinus orca*) which is generally not harvested by Inuit of Nunavut (Westdal *et al.*, 2013).

The Community Based Monitoring Network (CBMN) developed by the NWMB is an important tool to identify species harvested by communities. The most frequently documented species by harvesters in 2021 included ringed seal, narwhal, beluga, walrus, shellfish and fishes (CBMN & NWMB, 2021). As per Priest and Usher (2004), the top marine species for the total number of harvesters hunting them over the five-year period (1996 to 2001) were ringed seal, Arctic char, beluga, and bearded seal (see Section 6.2 (Table 6-2)). Specific information on species, when available, is summarized in the respective components of Sections 6.3 and 6.4.

6.3 Fish

Focal fish species were selected based on those that are important to ecosystem and to the Inuit for harvesting as identified through the Project-specific IQ (see Section 2.3 for methodologies), online IQ, and published literature. Species identified as focal were Amphipod, Arctic char, Arctic cod, Arctic sculpin (*Myoxacephalius spp.*) and Truncate softshell clam (*Mya truncata).*

Fish species SAR status is listed in Table 3-2 for each species.

6.3.1 Amphipod

The amphipod is an Arctic resident and is referred to by Inuit as 'Kingu' (Inuktut Tusaalanga & GN, 2024).

6.3.1.1 Biogeographic Distribution

Amphipods are a group (order Amphipoda) of crustaceans. They are common throughout the Arctic in both benthic and pelagic environments, with many species being endemic to the Arctic. Generally, the *Gammaridae* family dominates benthic species, and *Hyperiidae* dominates pelagic species (Oceans North Conservation Society *et al.*, 2018). Amphipods are a key link in the Arctic food web and are a significant food source for marine fish, mammals and bird (Coad & Reist, 2017; Oceans North Conservation Society *et al.*, 2018).

Amphipod species can be found in a diverse range of habitats, including the sea floor, open-water environments, and beneath the sea ice in coastal and offshore areas (Conover, 1988; Gradinger & Bluhm, 2004, 2010; Siferd, 2010). Benthic (bottom-dwelling) amphipods occupy a variety of substrates such as rocky intertidal and soft-bottomed subtidal areas. When amphipods are present in intertidal environments, there is a tendency to be associated with moist habitats, as amphipods appear to prefer areas that stay moist in out-of-water tidal conditions or in small tide pools that remain inundated (pers. obs. Victoria Burdett-Coutts). Except for tube-building amphipods, amphipods are generally not present when there are silty or muddy habitats (Conlan *et al.*, 2019). Like most marine species, the distribution of Arctic amphipods is primarily guided by habitat type and available food resources (Oceans North Conservation Society *et al.*, 2018).

A systematic search of peer-reviewed literature within the Web of Science Core collection was conducted on 23 July 2024, with results of published literature on amphipods in Nunavut summarized in Appendix C (Table C-2) (Web of Science, 2022). Furthermore, amphipod collection was part of the Field Program in 2024, to assess the abundance and species assemblage on amphipods in Resolute Bay. However, no amphipods were observed during the Field Program.

6.3.1.2 Ecology and Reproductive Behaviour

Arctic amphipods tend to be larger than those in lower latitudes, on average 20 mm and can range up to 50 mm in length. There are over 900 known species of benthic amphipod in the Arctic (Census of Marine Life, 2017), and it is thought that benthic diversity is higher than pelagic diversity (Tempestini *et al.*, 2018). Most known benthic amphipod species have multi-year lifespans (on average two and up to five-years depending on the species). All amphipods are sexually dimorphic, and eggs are incubated in the female's brooding pouch. Upon hatching, juveniles often linger in the female's brooding pouch for a few days before being released (Chang, 1972).

Amphipods utilize a variety of habitats. The adaptability of amphipods to diverse habitats likely emerges from opportunistic feeding strategies; many benthic amphipods are detritivores. Large food falls (e.g. sinking of deceased megafauna such as beluga whales, bowhead whales, and ringed seals) attracting aggregations of benthic amphipods within minutes (Soltwedel *et al.*, 2017).

Seasonality plays a large role in determining diet composition in some amphipod species. *Onisimus litoralis* primarily consumes benthic detritus early in the year then shifts to sea ice-associated diatoms (microalgae) during and after the onset of ice melt in the spring (Gradinger & Bluhm, 2010). An exception to the observation that many amphipods are habitat generalists is tube-building *ampeliscid* amphipods. Species such as *Haploops* spp., *Ampeliscus* spp., and *Byplis* spp. live their entire lives in tubes built from fine sediments and consume diatoms, detritus, and microorganisms through suspension feeding (Conlan *et al.*, 2019). Most benthic amphipods may occupy a range of depths, including shallow, nearshore areas fewer than 5 m, to deep sea floor environments upwards of 500 m deep (Conlan *et al.*, 2019; Cusson *et al.*, 2007).

Some amphipod species found in Nunavut are carnivorous, including *Themisto libellula*, which has been observed in both surface and benthic environments, and consumes *calanoid* copepods (Hobson *et al*., 2002), a key trophic link in Arctic food webs (Dunbar, 1957).

In shallow, nearshore areas across the Arctic much of the food web energy is derived from benthic environments. Ampeliscid (tube-building amphipods), most commonly *Ampeliscus eschricti*, have a widespread geographic distribution and are a main food source for grey whales (*Eschrictius robustus*) during their residence in the Arctic (Demchenko *et al.*, 2016).

6.3.1.3 Harvesting

There is no evidence that amphipods are directly harvested for consumption in the Arctic. During the December 2024 IQ workshop, amphipods were not discussed. Despite a lack of direct harvesting, amphipods are a primary food source for higher trophic level animals of commercial and cultural interest, highlighting their importance to the integrity of Arctic food webs.

6.3.2 Arctic char

Arctic char are an Arctic resident and are referred to by the Inuit as 'Ikaliviit' or 'Ivitaruk'; however, there are several other Inuktitut and Innuinaqtun names for the fish that refer to specific ecotypes or life history stages (Coad & Reist, 2017). Arctic char exists in both anadromous (referred to as sea run char in IQ) and lacustrine (land locked) forms. Anadromous Arctic char were selected as the focal species because the Project occurs in the marine environment.

6.3.2.1 Biogeographic Distribution

Arctic char are ecologically and socio-economically important in Canada's Arctic and can be either anadromous (referred to as sea run char by Nunavummiut) or lacustrine (land-locked) forms (GN, 2018a). Anadromous (sea run) char are not considered to be common in the High Arctic, but they sometimes occur where outflows are substantial enough to ensure a return migration in August (GN, 2010).

Arctic char are the northernmost freshwater fish species (Brunner *et al.*, 2001; Evans *et al.*, 2015; Oceans North Conservation Society, 2018) with a circumpolar distribution north of 75 °N with documented occurrences sporadically within Parry Sound (Figure 6-3). Various morphological forms of char have been found in southern and northern locations, as far north as Lake Hazen on Ellesmere Island (DFO, 2018a). Arctic char have the potential to be misidentified with other salmonid species, such as Dolly Varden (*Salvenus malma*), Atlantic (*Salmo salar*) and Pacific Salmon (*Oncorhynchus*), which are increasingly being observed in Nunavut, however these other species are not common enough in

Nunavut to influence the occurrences of char referenced in Figure 6-3 (Oceans North Conservation Society, 2018). Anadromous (sea run) char are not considered to be common in the High Arctic, but they sometimes occur where outflows are substantial enough to ensure a return migration in August (GN, 2014).

The Resolute Bay NCRI document contains one reference by one interviewee to the presence of anadromous Arctic char all around Cornwallis Island, close to the shore[21]. Sea run Arctic char have been caught in Allen Bay, which is northwest of Resolute Bay, at the mouth of the river during high tide; however, the lake of origin is unknown (IQ Workshop 2019 - Joadamee Amagoalik) (see Figure 2-1). Arctic char are caught in lakes northwest of Allen Bay, but there is uncertainty if these are sea run or land-locked Arctic char (IQ Workshop 2019 - Joadamee Amagoalik). Multiple interviewees noted the presence of char in several lakes on Cornwallis Island, with one interviewee mentioning that the char migrate from these lakes to the sea in July and return in August[21]. Multiple interviewees noted the best char fishing was in lakes and shorelines of Somerset and Prince of Wales Islands to the South of Cornwallis Island[21].

[21] See Figure 8 in the Resolute Bay NCRI Report for a depiction of 'probability of occurrence' for Arctic char https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

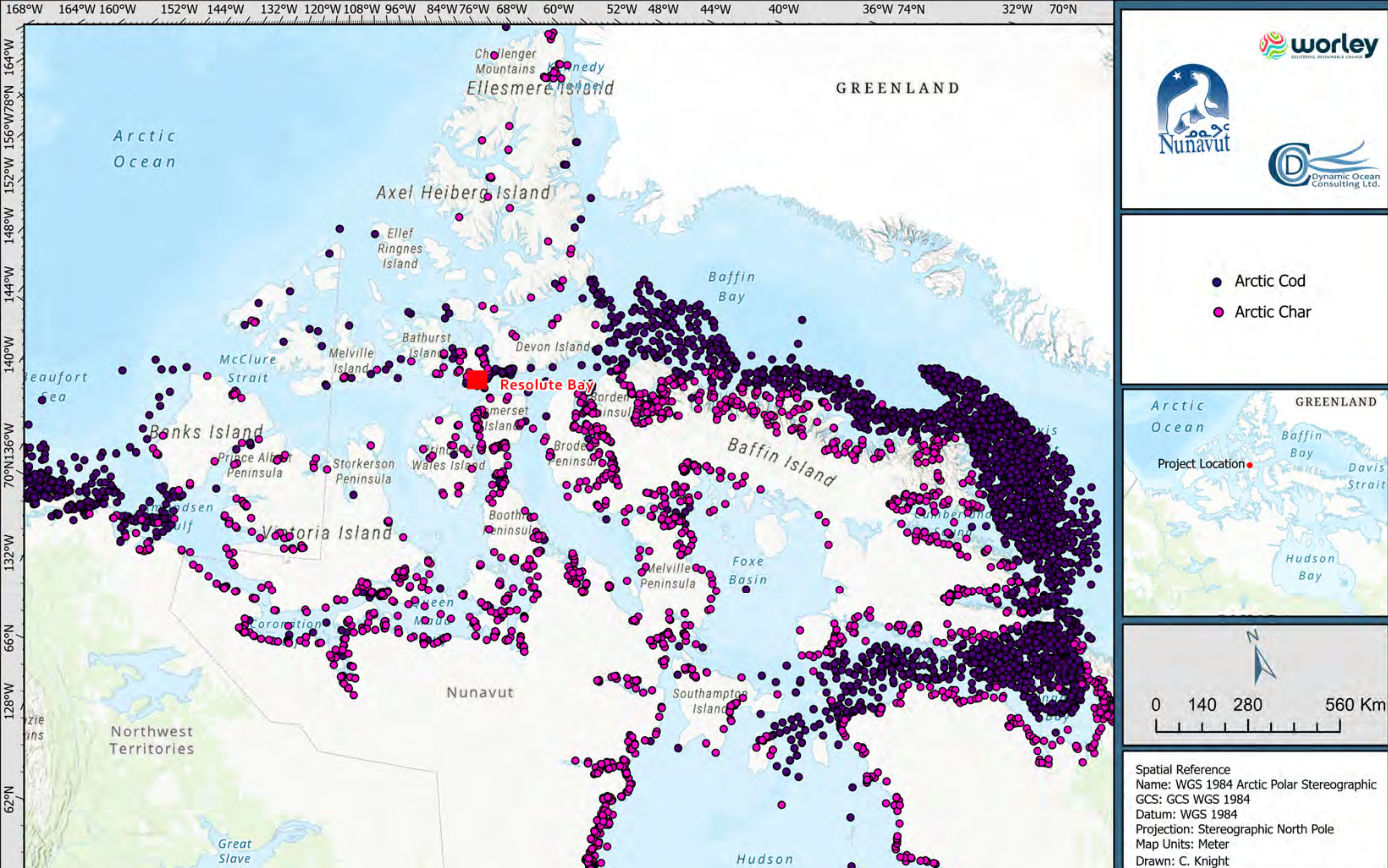

Figure 6-3

Arctic Cod and Arctic Char Distribution Throughout the Canadian Arctic

6.3.2.2 Ecology and Reproductive Behaviour

Arctic char has been referred to as a highly variable species, owing to a diversity of morphologies and life history strategies across its range (Coad & Reist, 2017). There is considerable variability within and among populations in life-history tactics such as age to first migration, spawning frequency, and migration length and spawning location. Owing to this variability, understanding Arctic char ecology is a highly site- and population-specific endeavour (Reist *et al.*, 2018).

Anadromous Arctic char begin migrating to marine environments between two and 11 years old when they are 150 mm to 200 mm in length (Reist *et al.*, 2018). Marine environments generally offer more foraging opportunities than freshwater systems, and thus allow for higher growth (Jørgensen *et al.*, 1997), survival (Jensen *et al.*, 2018) and reproductive output (Tallman *et al.*, 1996), assuming the energetic costs and mortality risks of migrations can be overcome. Given the energetic costs of migration, anadromous Arctic char are generally shorter-lived than their land-locked counterparts (Coad & Reist, 2017).

Acoustic telemetry technology has facilitated the ability to understand habitat use and migratory routes of anadromous species (Drenner *et al.*, 2012; GN, 2012b; Spares *et al.*, 2012). Some studies show that Arctic char prefer migrating along coastlines as opposed to across water bodies (Moore *et al.*, 2016; Moore, 1975), and thus are typically found within 30 km of their natal rivers (Bégout *et al.*, 1999). In Cambridge Bay, coastline distance has been shown to be the closest genetic link between individual fish (Harris *et al.*, 2014).

Marine migration is primarily driven by dietary requirements; however, little is known about the diet of anadromous Arctic char. Arctic char are opportunistic predators, feeding on fish (capelin, northern sand lance), crustaceans (mysids, amphipods, decapods), polychaetes, and insects (Guiguer *et al.*, 2002; Johnson, 1989; Moore & Moore, 1974; Rikardsen & Elliot, 2000). Recent studies have been undertaken in proximity to Hudson Bay communities (e.g. Naujaat, Coral Harbour [Salliq]) to understand the diet of Arctic char in the region, with results showing that Arctic char diet consists largely of amphipods (NWSF, 2019a, 2019b).

Arctic char typically return to their natal rivers to spawn in freshwater (Gilbert *et al.*, 2016), regardless of their sexual maturity. This is likely an adaptation to avoid harsh environmental conditions (e.g. freezing temperatures; (Klemetsen *et al.*, 2003). Arctic char are iteroparous and spawn over redds in gravel during September and October (Duitil, 1986; Harwood & Babaluk, 2014). Eggs incubate under the ice for approximately six months and once hatching occurs, juveniles spend their early life history in freshwater (DFO, 2013d). Spawning season in the fall and spring migrations are key characteristics of anadromous Arctic char life history (QIA, 2018b).

6.3.2.3 Harvesting

Arctic char is a highly valued fish species to the people of Nunavut for subsistence and commercial fisheries. Arctic char represent the second-most widely consumed country food (Hurtubise, 2016).

Commercial

The commercial fishery is primarily in Cambridge Bay and Cumberland Sound (DFO, 2018a; NWMB & DFO, 2020). Commercially, Arctic char are harvested using gillnet or weir (DFO, 2013d), typically near the mouth of rivers in July (DFO, 2014a). An IFMP has been developed for the Cambridge Bay fishery (DFO, 2018a), and are not developed for subsistence fisheries in the territory. Exploratory fisheries for Arctic char are not currently occurring in Resolute Bay or Parry Sound, however locations of known commercial Arctic char fisheries are provided in Figure 5.4.2.1[22] of the RNLUP (NPC, 2023c). There is no available information to confirm or hypothesis on the condition of Arctic char sea-run fish stocks. DFO has a study that provides information on stock condition for several subsistence fisheries (DFO, 2013a). The most northern stock is for a southern Prince of Wales Island, which is approximately 400 km south of southern Cornwallis Island (DFO, 2013a). Several collaborative research projects occurring throughout Nunavut between DFO and the relevant HTOs/HTAs to fill these information gaps.

Arctic char fisheries are managed by DFO on the assumption that each river system supports a discrete fish stock (Kristofferson *et al.*, 1984), leading DFO to conclude there are vulnerabilities in assessing the sustainability of Arctic char in the Admiralty Inlet region, as these stocks have not been defined (DFO, 2013a). Arctic char are not harvested in Resolute Bay due to contamination concerns from residents.

Subsistence

Subsistence fisheries are an important component of the diets of the people of Nunavut, who depend on these fisheries for their livelihood. QIA (2018b) converted country foods into a monetary value, where the value of Arctic char country foods fishery for a study which involved six communities (Grise Fiord, Arctic Bay, Pond Inlet, Clyde River, Qikiqtaarjuak, Pangnirtung), provided a substitution value of $1,120,755.

In Resolute Bay, Arctic char are harvested using gillnets and only for subsistence and recreational purposes. Subsistence fisheries are an important component of the diets of the people of Nunavut, who depend on these fisheries for their livelihood. Read (2000) conducted a study to summarize information on Arctic char in the Baffin Region from 1995 to 1999. Resolute Bay and Grise Fiord were not included in the study because, at the time, these communities did minimal fishing (Read, 2000). Priest and Usher (2004) documented that a total of 50 harvesters were fishing for Arctic char during the five-year NWHS Study (June 1996 – May 2001) (see Table 6-2). Arctic char fishing in Resolute Bay has grown to be an important subsistence fishery and was recorded during the IQ Workshop (May 2019). Land-locked Arctic char are regularly harvested by locals in Resolute Lake, Teardrop Lake, Marida Lake, and unnamed waterbodies southwest of Resolute Bay Airport (IQ Workshop December 2024, see Figure 2-1).

6.3.3 Arctic cod

The Arctic cod is an Arctic resident species and referred to by Inuit as ‘Ugak’ (Inuktut Tusaalanga & GN, 2024).

[22] See Figure 5.4.2.1 (RNLUP, Appendix C-Chapter 5) for a depiction of the location of Arctic char commercial fisheries in proximity to Resolute Bay: https://www.nunavut.ca/sites/default/files/23-018e_2023-09-07-2023_or_appendix_c_maps_chapter_5_english.pdf

6.3.3.1 Biogeographic Distribution

Arctic cod, Atlantic cod and Greenland cod are all present in Baffin Bay and Davis Strait but Arctic cod are the most common (QIA, 2018b). As a very cold-water fish (0-4°C), Arctic cod have one of the northernmost ranges among all fish species (DFO, 2016).

Migratory patterns of Arctic cod are not fully understood, with the exception of a pre-spawning late-summer migration to coastal waters (Aune *et al.*, 2021). Arctic cod can migrate fairly long distances, in the hundreds of kilometres (Kessel *et al.*, 2017), and move from open-water to under-ice in their first year of life. The floe edge is an important ecological niche for Arctic cod, likely because they are feeding on the abundant sea ice zooplankton (Bradstreet, 1982). At the floe edge, Arctic cod are predated on by numerous marine mammal and marine bird species. Arctic cod are known to form large schools in bays and inlets (Crawford & Jorgensen, 1993; Hop *et al.*, 1992), with approximate densities of 80 fish/m^3 and surface areas up to 4.6 hectares (Crawford & Jorgensen, 1996).

Arctic cod have been observed in large schools in the vicinity of Resolute Bay during a study that spanned 1985 to 1988, with one occurrence documenting a trap net yielding 6,000 to 16,000 fish (Welch *et al.*, 1993). Arctic cod were confirmed by IQ to be present in large numbers in Resolute Bay and around Cornwallis Island[23]. This was also confirmed during the IQ Workshop *"we see huge schools of cod coming in, they look like a huge serpent moving in the bay close to shore*." (IQ Workshop 2019 - Joadamee Amagoalik). Seals, Belugas and Narwhals follow the cod into the bay to feed *"They come in chasing the cod. They'll stick around and feed on cod"* (IQ Workshop 2019 - Joadamee Amagoalik) *"Narwhals come in close to the shore also, feeding on cod"* (IQ Workshop 2019 - Allie Salluviniq).

6.3.3.2 Ecology and Reproductive Behaviour

Arctic cod (*Boreogadus saida*) are a pelagic marine species believed to be the single most important species in the trophic link between plankton, and marine birds and mammals in the Arctic ecosystem (Sekerak, 1982; Welch *et al.*, 1992). Arctic cod are believed to be the source of up to 75 % of energy transfer in Arctic food web dynamics (Oceans North Conservation Society *et al.*, 2018). They are considered an important 'indicator species' as their presence in large numbers generally attracts other species that are important for harvesting (e.g. narwhal) (Oceans North Conservation Society *et al.*, 2018). This species is considered to be inferior to Arctic char in terms of a harvestable species, "*The cods poor diet and high water content leads to poorer tasting meat and shorter preservation*," (Hurtubise, 2016; p43, pers comm July 13 2015). However, while they are less important than Arctic char in regard to human consumption, they are more important in consideration of the food chain of marine birds and mammals (Sekerak, 1982).

Arctic cod are a semelparous (single reproductive episode) highly fecund, fast-growing, short-lived fish species highly specialized to living in cold Arctic waters that are partially frozen for portions of the year (DFO, 2016; Lawson *et al.*, 1998). Arctic cod spawning occurs in winter underneath sea ice, and hatching occurs in the spring, with precise timing depending on the bloom of ice microalgae (January to July, peaks April to May) (Bouchard & Fortier, 2011; Bradstreet, 1982; Hop *et al.*, 1992).

[23] See Figure 12 in the Resolute Bay NCRI Report for a depiction of 'probability of occurrence' for Arctic cod https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

Juvenile and adult Arctic cod have different prey species preferences but feed primarily on plankton and small fish (Matley *et al.*, 2013). In the Atlantic fishery, Arctic cod are considered a demersal fish; however,, their water column distribution spans both pelagic and benthic areas (DFO, 2020b). The floe edge is an important ecological niche for Arctic cod, likely because they are feeding on the abundant sea ice plankton or hiding in crevices in the ice undersurface (Bradstreet, 1982). At the floe edge, Arctic cod are predated on by numerous marine mammal and marine bird species. They are generally considered an aggregate or schooling species and have been found in offshore (Majewski *et al.*, 2016) and coastal settings (Welch *et al.*, 1992) with approximate densities of 80 fish/m^3 and surface areas up to 4.6 ha (Crawford & Jorgensen, 1996). Cod at the floe edge is an essential to the Arctic food web in the spring migration and are known to be an important dietary item for narwhal (QIA, 2018b).

6.3.3.3 Harvesting

There are currently no commercial fisheries or exploratory fishery licenses for Arctic cod in the Canadian Arctic. There is interest in commercial fisheries for this species but viability is affected by the lack of local fuelling facilities for large commercial vessels. (CBC, 2015; Nunatsiaq News, 2016). An experimental license for Arctic cod was issued from 1996 to 1997 (License No. Exp. 96/97-02) to be fished with traps or nets and a quota of 250 kg (DFO, 1999). The harvested weight and level of effort expended is not publicly available, other than to state 'minimal harvest' (DFO, 1999). The primarily consideration for commercial fisheries and Arctic cod are concerns over Arctic cod as bycatch in Arctic shrimp fisheries, particularly in Baffin Bay (Shrimp Fishing Area 1) and Hudson Strait (Shrimp Fishing Area 3)(DFO, 2022a, Figure 2). Internationally, commercial fishery for Arctic cod were popular in Scandinavia and Russia in the late 1900s (Aune *et al.*, 2021).

Arctic cod are generally not a primary subsistence fishery in Nunavut. This species is considered to be inferior to Arctic char in terms of a harvestable species; "*The cods poor diet and high water content leads to poorer tasting meat and shorter preservation*," (Hurtubise, 2016; p43, pers comm July 13 2015) and are considered too small to fish (IQ Workshop 2019 - Amon Akeeagok; IQ Workshop 2019 - Manasie Noah; IQ Workshop 2019 - Marty Kuluguqtuq).

No commercial fisheries or exploratory fishery licenses for fishing Arctic cod are present in or around Resolute Bay. Arctic cod are considered abundant at times during the open-water season in Resolute Bay (see Resolute Bay IQ summaries in Section 2). There was no mention of Arctic cod harvesting by residents in Resolute Bay during the IQ Workshop, however some interviewees from the Resolute Bay NCRI mentioned catching them recreationally, and one reported using them for bait (GN, 2018b). During the NWHS five-year study period (1996-2001) just two harvesters were documented for fishing for Arctic cod (Priest & Usher, 2004) (see Table 6-2).

6.3.4 Arctic Sculpin

The Arctic sculpin is an Arctic resident and is referred to by Inuit as 'Kanayuk' or 'Kanajuq' (Inuktut Tusaalanga & GN, 2024). Amongst the 14 species of marine sculpin found in Nunavut (Coad & Reist, 2017), the most common species in the region are the Shorthorn sculpin (*Myoxocephalus scorpius*), Arctic staghorn sculpin (*Gymnocanthus tricuspis*) and Arctic sculpin (*M. scorpioides*), which are the focus of this desktop review.

6.3.4.1 Biogeographic Distribution

Sculpins are ubiquitous in the Canadian Arctic and generally inhabit shallow coastal water, however, some are known to range as deep as 2,000 m (Mecklenburg *et al.*, 2016). Arctic sculpin and Arctic staghorn sculpin are considered high-latitude species and are restricted to colder habitats compared to shorthorn sculpin, which is found globally in marine environments ranging from 0 to 18°C (Coad & Reist, 2017). The shorthorn sculpin and Arctic staghorn sculpin have documented records in proximity to Resolute Bay (Alfonso *et al.*, 2018) (see Figure 6-4 for distribution of each species of sculpin), and have also been reported in the Resolute Bay NCRI[24]. Sculpins were also observed at other high-arctic communities at past field surveys, including Sanikiluaq, Naujaat, Coral Harbour [Salliq], Chesterfield Inlet, Arctic Bay, Pond Inlet, and Iqaluit, confirming their range (see Table 6-4).

Sculpins are found on all types of substrate, including underneath fronds of large-bladed kelp species (Moeller, 2018). As their distribution suggests, experimental data have shown that Arctic sculpin and Arctic staghorn sculpin have optimal cardiorespiratory performance at temperatures between 1°C and 4°C, whereas shorthorn sculpin has optimal performance between 2°C and 10°C. This suggest that the former two species may be more sensitive to climate change (Franklin *et al.*, 2013). To date, no studies have been conducted to determine the movement patterns of sculpins in Resolute Bay. Sculpins were not discussed during the Resolute Bay IQ Workshop in May 2019. Although, no sculpins were observed during 2019, three sculpins were observed in 2024 during the Community Harbour Study Area subtidal field survey (described in Section 7.4.3).

[24] See Figure 13 in the Grise Fiord NCRI Report for a depiction of 'probability of occurrence' for Arctic sculpin https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI_%20Resolute_%20Bay_EN_WEB.pdf

Table 6-4: Observation of Sculpin in Field Surveys Near Resolute Bay

Location	Year	Sculpin Species Observed			
		Shorthorn sculpin	Arctic staghorn sculpin	Arctic sculpin	Other sculpin species
Arctic Bay	2019	2	-	-	2
Chesterfield	2022	-	-	-	2
Coral Harbour [Salliq]	2022	2	8	-	-
Grise Fiord	2019	3	-	-	2
Iqaluit	2024	-	-	-	17
Naujaat	2022	-	32	-	8
Pond Inlet	2024	-	-	-	6
Resolute Bay	2019	-	-	-	-
Sanikiluaq	2022	-	1	-	2

Source: Advisian-Ikpiaryuk JV (2021, 2023a, 2023b, 2023c, 2023d); Advisian (2020a, 2020b); Dynamic Ocean (2025a, 2025c)

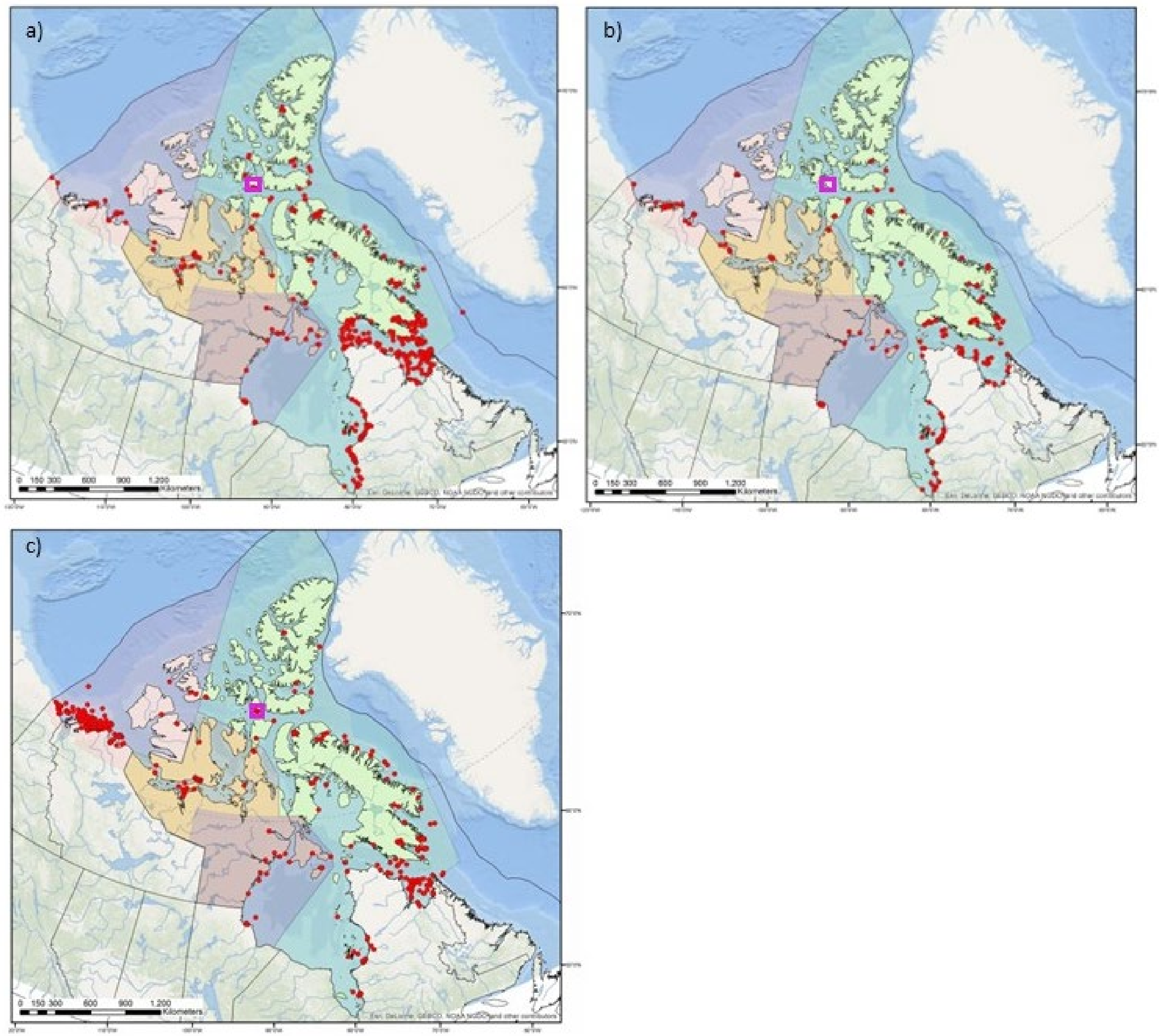

Figure 6-4: Marine Fishes of Canada Database Sculpin Records: a) Shorthorn; b) Arctic; c) Arctic Staghorn

Source: Figures 157, 156, and 91 in Alfonso *et al.* (2018)
Note: Pink square depicts Resolute Bay location.

6.3.4.2 Ecology and Reproductive Behaviour

Sculpins are generally solitary, benthic marine fishes belonging to the superfamily Cottidae. Distinguished by a large broad head with a body that tapers toward the tail, large mouths with small teeth, two dorsal fins, large pectoral fins and one anal fin (University of Guelph, 2019). The largest of species are from the genus *Myoxocephalus*, which can reach up to 60 cm in length, although most are much smaller (Alfonso *et al.*, 2018). Shorthorn sculpin generally reach up to 30 cm length. Unlike their other scorpaeniform relatives, most sculpin do not have scales but instead are naked or have modified scales in the form of spines (Coad & Reist, 2017). Adults tend to lack a swim bladder, making it difficult to swim in pelagic environments (Coad & Reist, 2017).

All sculpin in the region are generalist feeders, preying on plankton, benthic molluscs, small fishes, crustaceans, polychaete worms, kelp, and sea urchins (Landry *et al.*, 2018). Amphipods tend to dominate their diets by abundance, with common genera such as *Themisto*, *Onisimus,* and *Gammarus* (Coad & Reist, 2017). Shorthorn sculpin, in particular, has been observed to consume a diversity of smaller fishes based on regional availability, including capelin, herring, eelpouts, other sculpins, and small Arctic cod. A study on the stomach content of a high-arctic sculpin population identified that their diet consists of amphipod, polychaete worms, cetaceans, shrimps, cnidarians, and bivalves (Dynamic Ocean, 2025b). Due to limited number of studies on sculpin feeding behaviour, there is a lack of quantitative, localized diet information available for Resolute Bay. Sculpins also serve as an important forage fish for larger organisms, being found in the stomachs of narwhal, belugas, bowheads and seals (GN, 2010; QIA, 2018b).

Sculpins reach sexual maturity between three to five years, with females reaching sexual maturity slightly later than males. Spawning tends to occur in the fall between September and December, and hatching occurs in the springtime depending on the region. Sculpins lay demersal eggs that become planktonic larvae after hatching (Coad & Reist, 2017; Landry *et al.*, 2018). These larvae are sometimes guarded by the male (Ivanova *et al.*, 2018). Sculpin lifespans may exceed 20 years, though most adult specimens are under 10 years old.

6.3.4.3 Harvesting

There are no commercial fisheries for Arctic sculpins in Nunavut. Although the third most commonly hunted marine species by the Inuit (Hurtubise, 2016), sculpins are not the primary targets for subsistence fishing (GN, 2014; QIA, 2018b). Sculpins are often by-catch to other targeted fisheries, used as bait, or caught for scientific research (Department of Fisheries and Aquaculture, 2019). Specific documented uses for sculpin vary considerably by community. Over a five year period, only one harvester fished for sculpin in Resolute Bay (Priest & Usher, 2004) (see Table 6-2). Sculpin were not discussed during the IQ Workshop.

6.3.5 Truncate Soft-Shell Clam

The truncate softshell clam (*Mya truncata*) is important infaunal species in the Arctic and is referred to by Inuit as ‘ammuumajuq’ (Inuktut Tusaalanga & GN, 2024). Three different kinds of clam are known to be found in Resolute Bay (IQ Workshop 2019 - Peter Amarualik). However, the truncate soft-shell clam (*Mya truncata*) was selected as a focal species because it is an important infaunal species in the Arctic.

6.3.5.1 Biogeographic Distribution

The distribution of truncate softshell clam is largely influenced by ice scour events, either by direct mechanical interference, or modification of seafloor topography (Conlan & Kvitek, 2005). Habitat preferences of this particular species have not been studied extensively, but a similar sub-arctic species (*M. arenaria*) showed higher densities in eddies, estuaries, and in slack water adjacent to swift currents (Christian *et al.*, 2010).

There is no published literature available that documents the abundance of clams in and around Resolute Bay. However, they were observed during the Community Harbour Study Area subtidal survey (see description in Section 7.4.3), and there are some IQ reports of truncate softshell clams in resolute bay[25]. A clam bed was identified in Allen Bay during the IQ Workshop that used to be harvested by one individual but is no longer harvested by anyone (see Figure 2-1).

6.3.5.2 Ecology and Reproductive Behaviour

This clam species is important to Arctic ecosystems for its role in carbon cycling, providing prey for many species of marine mammals. Given their sedentary adult life stage, they are a predictable food source for higher trophic level species (Highsmith & Coyle, 1990). As is characteristic of other Arctic bivalves, the truncate soft shell clam has a long life span and low annual growth, where growth is influenced largely by the length of the open-water season (Piepenburg *et al.*, 2011).

Like most species of the Myidae family, adult truncate softshell clam burrow deeply into sandy and muddy sediments or dwell in rocky crevices and abandoned bore holes (da Costa, 2012). Their shells are widely oval in shape with a compressed, grooved foot, byssal gland, and byssus which is used to anchor to substrate (da Costa, 2012). Truncate softshell clams remain in the same level of sediment depth and cannot dig again into the sediment when taken out and thus become victims of predators (da Costa, 2012). They are also facultative anaerobes and are able to go without oxygen for many days (da Costa, 2012).

Individuals are gonochoric and fertilization occurs in the water column which is followed by a free-floating plankton larvae phase that drifts through the water as they feed and grow (Wood *et al.*, 2022). After the pediveliger stage, the clam undergoes metamorphosis to transform into a sedentary benthic stage where they burrow into the sediment and grow extensively (da Costa, 2012).

6.3.5.3 Harvesting

There is no commercial fishery for benthic species, including clams in Resolute Bay, but this species is currently harvested for subsistence purposes. Clams are included in the category of sea floor dwellers in QIA (2018b) and are considered to be critical for food chain dynamics of larger predators such as marine mammals, fish and marine birds.

There is interest in expanding commercially exploited fisheries in Nunavut, some of which include soft shell clam, soft corals, amphipods, brittle stars, and brown sea cucumber (*Cucumaria frondosa*) (Boudreau & Fanning, 2016). However, there are no known exploratory fisheries occurring in the vicinity of Resolute Bay at this time. Priest and Usher (2004) documented that a total of ten harvesters were fishing for truncate soft-shell clam during the five-year NWHS Study (June 1996 – May 2001) (see Table 6-2). Clams are ‘all over’ Resolute Bay, but they are not harvested over concerns due to the wastewater outfall (May 2019) (IQ Workshop 2019 - Peter Amarualik). Clams are harvested historically along the coastline of Cornwallis Island in early September; after washing up on the beach or collected in shallow

[25] See Figure 15 in the Resolute Bay NCRI Report for a depiction of ‘probability of occurrence’ for truncate softshell clam https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

areas (GN, 2018b). Based on discussions in the December 2024 IQ workshop, clam harvesting is now isolated to east of the mouth of Resolute Bay (see location in Figure 2-1).

6.4 Marine Mammals

Focal marine mammals were selected based on those that are important to the ecosystem and to the Inuit for harvesting as identified through the Project-specific IQ (see Section 2.3 for methodologies), online IQ and published literature. Species identified as focal include three species of seal, one species of walrus, four species of whale and the polar bear (*Ursus maritimus*).

Marine mammal SAR status is listed in Table 3-2 for each species. The seasonal distributions of all focal marine mammals can be seen in Figure 6-5.

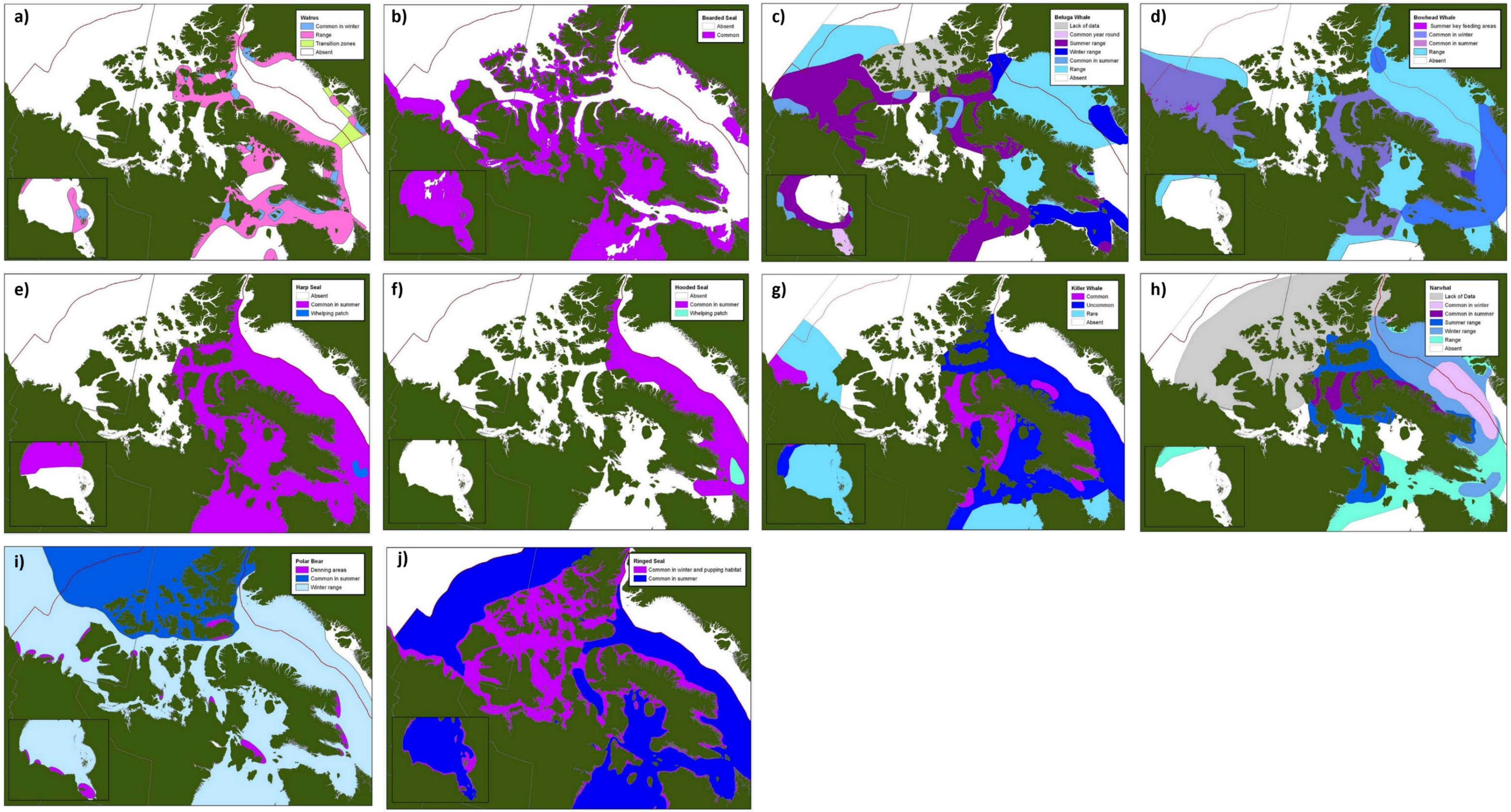

Figure 6-5: Marine Mammal Seasonal Distributions: a) Atlantic Walrus; b) Bearded Seal;, c) Beluga whale; d) Bowhead Whale; e) Harp Seal; f) Hooded Seal; g) Killer Whale; h) Narwhal; i) Polar Bear; j) Ringed Seal in the East Canadian Arctic

Source: a) Figures 2 (Panel j),4(b),5 (e),6(f),7 (a),8(d),9(g), 10(c), and 11(h) in Stephenson and Hartwig (2010)

6.4.1 Atlantic Walrus

The Atlantic walrus (*Odobenus rosmarus*) is an Arctic resident and is referred to by Inuit as 'Akvik' (Inuktut Tusaalanga & GN, 2024).

6.4.1.1 Biogeographic Distribution

The Atlantic walrus can be found in Arctic and sub-Arctic waters, usually around the shallow continental shelf (Lowry, 2016b). They are native to Canada, Greenland, Russian Federation, Svalbard and Jan Mayen, and the United States (i.e. Alaska) (Lowry, 2016b). Atlantic walrus are globally listed as *Vulnerable* by the IUCN (Lowry, 2016b). Based on the Species at Risk Public Registry there are two populations of walrus that occur in the Canadian Arctic (i.e., Central Low Arctic population, and the High Arctic population). Both are listed as *Special Concern* by (COSEWIC, 2017a), with no status under SARA (Government of Canada, 2024f). The Central Low Arctic and High Arctic populations are under consideration for addition to Schedule 1 of SARA (Government of Canada, 2024f).

Seasonal distribution of Walrus across the East Canadian Arctic can be found in Figure 6-5, Panel a. The Central/Low Arctic population can be found in Foxe Basin, Hudson Bay, south and east Baffin, southern Hudson Strait-Ungava Bay-Labrador Bay, and James Bay (COSEWIC, 2017a). The High Arctic population can be found in Penny Strait-Lancaster Sound, western Jones Sound, and Baffin Bay (see Figure 6-6). A 2009 survey resulted in an estimate of 2,481 animals in the High Arctic population (COSEWIC, 2017a), and a minimum of 18,900 animals in the Central/Low Arctic population, though survey coverage is incomplete in the latter case, and trends are unknown (COSEWIC, 2017a).

Atlantic walrus are year-round residents in the Arctic, though seasonal changes in distribution are noted in relation to ice cover (COSEWIC, 2017a). They are known to aggregate in the waters off northwestern Bylot Island in Lancaster Sound (Baffinland Iron Mines Corporation, 2012). Summer concentrations of walrus are known to occur along the southern coast of Devon Island (COSEWIC, 2017a). Walrus are known to winter in several locations in Lancaster Sound, Jones Sound, Devon Island, and the North Water Polynya, including the floe edges of Lancaster and Jones Sounds (Born *et al.*, 1995; DFO, 2018b).

Resolute Bay is located within Barrow Strait, an area where walrus have been documented at haul-out sites and feeding along the coast (DFO, 2018b). Resolute Bay and surrounding waters are within the Nirjutiqavvik National Wildlife Area, and this area provides important feeding grounds for walrus (Government of Canada, 2022b). Other reported summer haul outs are scattered on the shores of Bathurst Island, Cornwallis Island, Ellesmere Island, and Devon Island (NPC, 2023c; Stewart *et al.*, 2014a; Stewart *et al.*, 2014b).

Inuit Qaujimajatuqangit informs that walrus have been observed in Resolute Bay, surrounding waters and on haul-with seasonal occurrence[26]. They reportedly migrate from the Dundas island and Queens Chanel and Penny Strait polynyas where they overwinter south towards McDougal and Barrow Strait

[26] See Figure 24 in the Resolute Bay NCRI Report for a depiction of 'frequency of occurrence' for Atlantic walrus https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

where they are present from July to October (GN, 2018b). Inuit Qaujimajatuqangit also includes mentions of walrus migrating to and from the

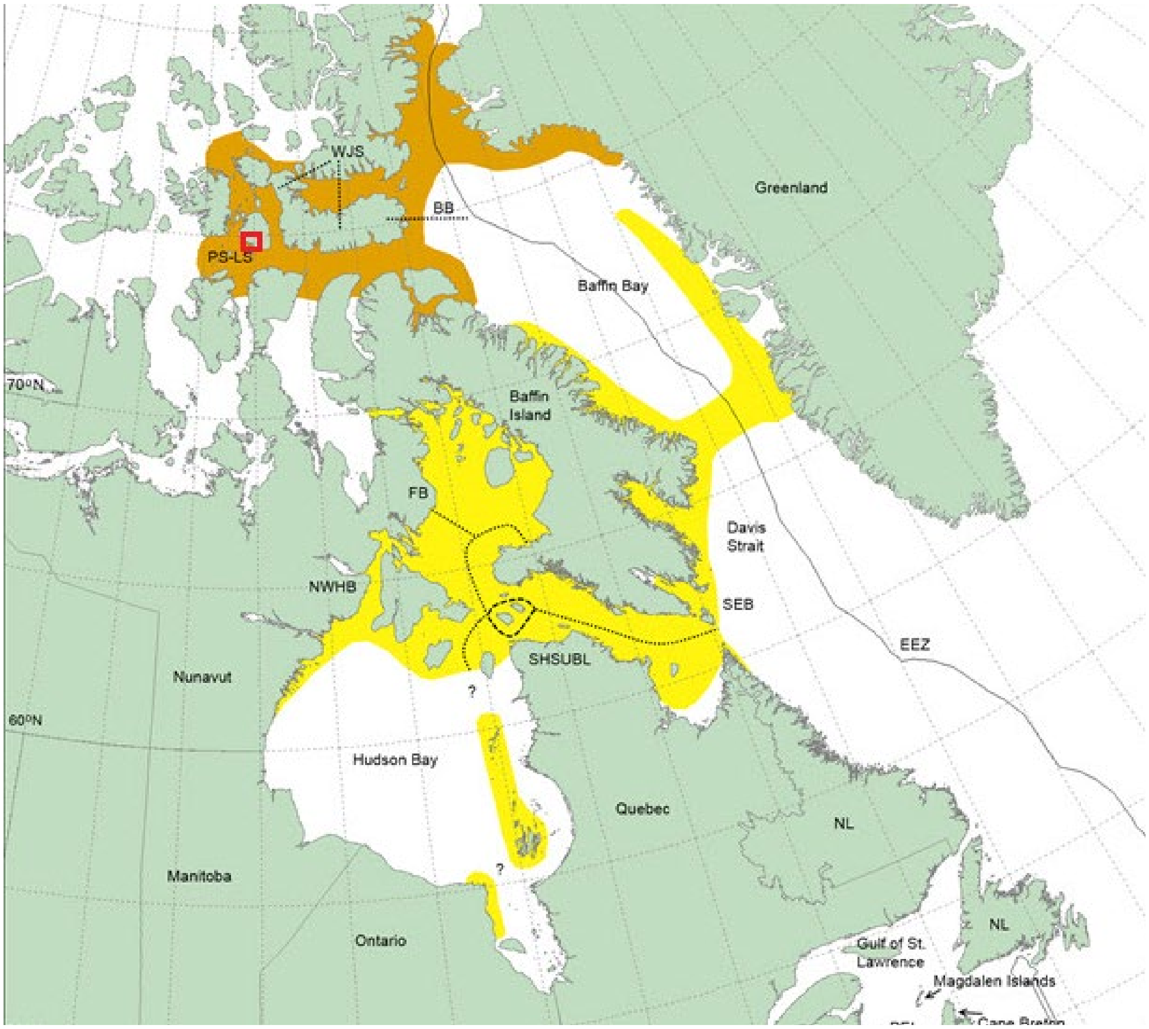

Figure 6-6: Atlantic Walrus Distribution of the High Arctic (orange) and Central/Low Arctic (yellow) designatable units

Source: Figure 4 in COSEWIC (2017a)
Note:

1. Red square depicts Resolute Bay location
2. PS-LS – Penny Strait-Lancaster Sound; WJS – western Jones Sound; BB – Baffin Bay; SEB – South and East Baffin; SHSUBL – South Hudson Strait-Ungava Bay-Labrador; NWHB – North and West Hudson Bay; FB – Foxe Basin

area from Lancaster Sound, implying walrus in Resolute Bay may overwinter in multiple regions (GN, 2018b).

6.4.1.2 Ecology and Reproductive Behaviour

Walrus spend approximately two-thirds of their lives at sea, with the other third spent hauled out on drifting pack ice or on land to rest, pup, and moult (COSEWIC, 2017a; Godwin, 1990). They typically prefer near-shore areas during the open-water season that provide haul out locations and shallow water (less than 100 m) that provide suitable habitat for foraging (Outridge *et al.*, 2003). Walrus require shallow, coastal, ice-free waters with significant bivalve populations, as well as haul out sites close by dense prey areas (Lowry, 2016b) and are often seen at the mouth of Admiralty Inlet in the winter, near the edge of the ice floe. Walrus can devote a large period of time foraging, up to 72 hours between haul-outs and can remain submerged for nearly half an hour (COSEWIC, 2017a). Though walrus have a diverse diet ranging from clams and worms, to fish, squid, sea birds, and occasionally seals, they are primarily benthic feeders and use soft substrate in shallow waters (-10 m to -80 m in depth). Walrus are a gregarious species, that are often found in groups (Lowry, 2016b). Males establish territories at rookeries in the winter and during the mating season pups are born in May the following year (Lowry, 2016b). Walrus have an extended pup weaning period of up to 27 months (COSEWIC, 2017a; Godwin, 1990).

6.4.1.3 Harvesting

Walrus have been historically used for food, hides, ivory and bones by Indigenous communities (Lowry, 2016b). Walrus are hunted in Nunavut, with inter-annual variation in the numbers taken and the months hunted (Priest & Usher, 2004). Walrus are harvested in Nunavut, with harvests recorded to occur in most months from June to August, and in January, from Resolute Bay, with inter-annual variation in the numbers taken and the months harvested (Priest & Usher, 2004). An average of five walrus are killed annually in Resolute Bay (Priest & Usher, 2004), most of which are taken during the open-water season (Carter *et al.*, 2019). The main harvesting area for walrus is in Barrow Strait along the south coast of Cornwallis Island, out to Griffith Island (Carter *et al.*, 2019).

Based on life history, ecology, habitat use, IQ, and harvest reports, walrus could occur in the area year-round with much lower likelihood of occurrence during the winter months. Natural predators include polar bears and killer whales (Lowry, 2016b). Other threats include harvesting, degradation of feeding areas (e.g. disturbance by benthic trawl fisheries, industrial development), anthropogenic disturbance (including vessel and aircraft traffic), oil and gas exploration, and climate change (and effects on ice conditions)(COSEWIC, 2017a).

6.4.2 Bearded Seal

The bearded seal (*Erignathus barbatus*) is an Arctic resident and is referred to by Inuit as 'Ukalik' or 'Qilalugaq' (Inuktut Tusaalanga & GN, 2024).

6.4.2.1 Biogeographic Distribution

Bearded seals inhabit Arctic and sub-Arctic waters year-round, and are native to Canada, Greenland, Iceland, Norway, Russian Federation, Svalbard and Jan Mayen, and the United States (i.e. Alaska)

(COSEWIC, 2007b; Kovacs, K.M., 2016). Two separate subspecies, the Atlantic and the Pacific, can be found in the Canadian Arctic (Kovacs, K.M., 2016). The Atlantic bearded seal (*E. b. barbatus*) is listed by the IUCN as *Least Concern* (Kovacs, K.M., 2016). Bearded seals are present in the Arctic year-round and are the largest of the Arctic phocids (i.e., true seals) (Godwin, 1990; Natures Edge, 2015). This species is listed as *Data Deficient* in Canada (COSEWIC, 2007b).

Ecology of bearded seals has limited data but Resolute Bay and adjacent waters are within their known distribution during spring and summer (COSEWIC, 2007b). Bearded seals are known to winter in Lancaster Sound and Davis Strait (COSEWIC, 2007b). According to the NPC, Resolute Bay is located just south of the identified high-density area for bearded seals (GN, 2018b), where they can be seen year-round (IQ Workshop 2019 - Simon Idlout). Most observations are of individuals feeding in the area south of Bathurst Island (Carter *et al.*, 2019). Bearded seals are expected in Jones Sound from July to October and can be seen around Coburg Island throughout the year (GN, 2010).

Inuit Qaujimajatuqangit informs that the bearded seals are present around Resolute Bay[27], and that their presence has decreased in recent years, and shipping traffic and anchorage creates a disturbance to these pinnipeds (Carter *et al.*, 2019). In the waters near Resolute Bay, bearded seals are said to be present during the open-water season and occur from June to September (IQ Workshop 2019 - Allie Salluviniq; IQ Workshop 2019 - Joadamee Amagoalik; IQ Workshop 2019 - Peter Amarualik; IQ Workshop 2019 - Simon Idlout). Local reports indicate bearded seals return at the same time as harp seals when ice leads start opening up in June (QIA, 2018b). Both species of seal summer near Coburg Island in the mouth of Lancaster Sound and at other sites (unspecified) (QIA, 2018b). Bearded seals make use of breathing holes in *Upirngasaaq* (March - mid May), leads in *Qupirngaaq* (mid May to early July) and open-water until *Ukiaq* (November and December) (QIA, 2018b).

The global distribution range of both bearded seal subspecies is displayed in Figure 6-7. Their presence in the Canadian Arctic is mapped on Figure 6-5, Panel b.

[27] See Figure 28 in the Resolute Bay NCRI Report for a depiction of 'areas of occurrence' for bearded seal https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

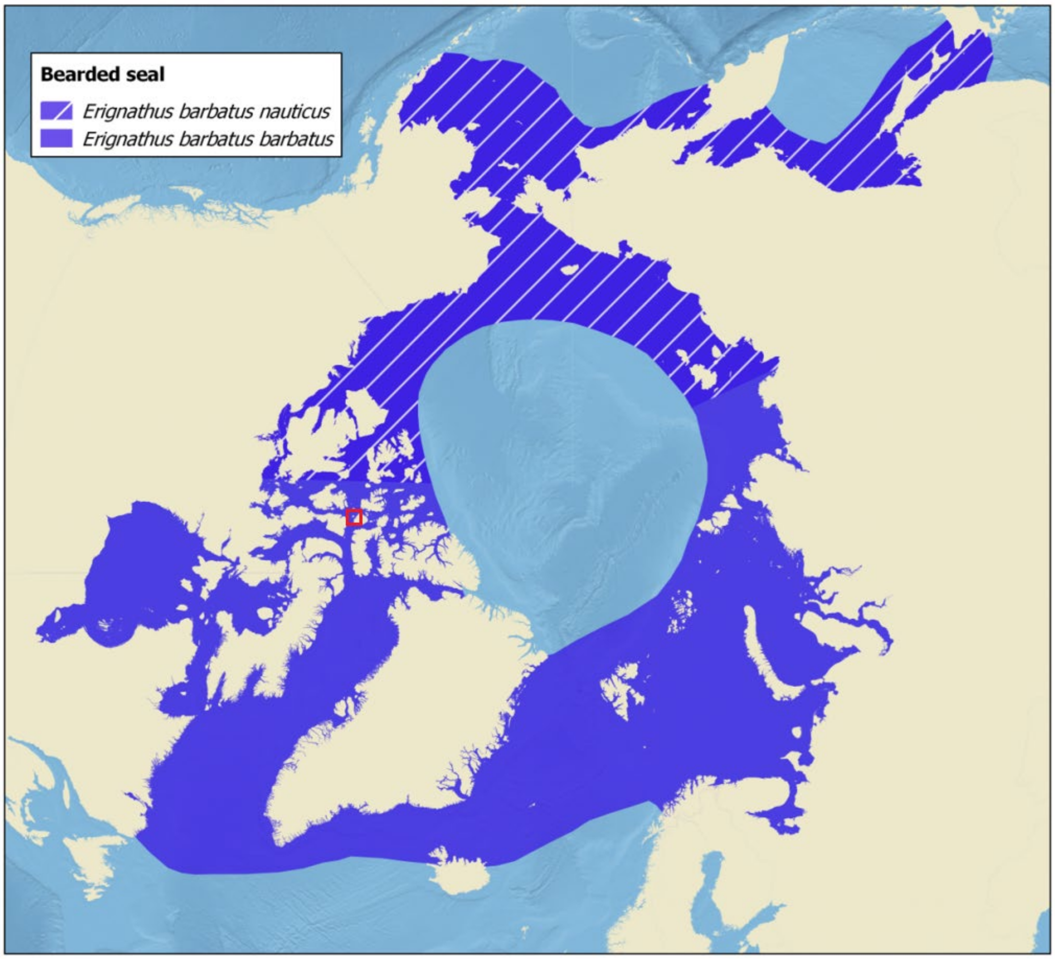

Figure 6-7: Global Distribution of Bearded Seal

Source: NAMMCO (2020)
Note: Red square depicts Resolute Bay location

6.4.2.2 Ecology and Reproductive Behaviour

Bearded seals show a preference for open-water less than 200 m deep with broken ice (COSEWIC, 2007b), and their seasonal movements depend upon prey availability and ice distribution (Kovacs, 2018). Bearded seals are primarily benthic feeders but have a varied diet including pelagic fishes, crustaceans and molluscs (COSEWIC, 2007b). Cornwallis Island, at the entrance of Lancaster Sound, is part of the Nirjutiqavvik NWA, and this area provides important feeding ground for bearded seals (GN, 2018b). When not feeding, they typically use pack ice to haul out on for resting, pupping, and moulting (COSEWIC, 2007b). Bearded seals are reported foraging around drifting ice floes, and feeding in shallower waters (GN, 2018b).

Pups are born in the spring (April-May), and are nursed for around 24 days, maintaining a close bond with their mothers even after weaning (COSEWIC, 2007b). Mating occurs in the water following weaning, followed by a period of moulting (COSEWIC, 2007b; Godwin, 1990). Bearded seals use waters northwest of Bylot Island in Lancaster Sound, with pupping sites identified along north and east coasts of Bylot Island (Baffinland Iron Mines Corporation, 2012). Large aggregations of bearded seals are not often encountered as this species is typically not a social animal and occurs alone or in small groups (Godwin, 1990). Vocalizations range from 0.02 kHz to 11 kHz (Todd *et al.*, 2015). In the spring, the calls of bearded seals can be audible under the water for up to 25 km, likely as part of courtship behaviours (COSEWIC, 2007b). Dives are usually a few minutes in length and to depths shallower than 100 m, but they have been recorded longer than 20 minutes and up to 450 m (COSEWIC, 2007b).

6.4.2.3 Harvesting

Bearded seals have been subject to subsistence hunting for thousands of years throughout their range. Bearded seals are still hunted year-round by Indigenous people either on sea ice during winter or by boat during the open-water period. The NWHS (1996-2001) reported a total annual catch between 584 and 786 bearded seals within Nunavut (Priest & Usher, 2004). One study (Wein *et al.*, 1996) found that 80 % of households consumed bearded seals on an annual basis, with an average annual consumption of 25 times per household. Both cooked meat and intestines are the most preferred body parts of bearded seals according to 60/102 and 50/102 households, respectively (Wein *et al.*, 1996). Another study reported similar numbers, with an average of 30 animals harvested yearly by the community between 1996-2001 (see Table 6-2). Bearded seal meat is consumed and shared among local people and their dogs, while other anatomic structures such as the hide are used for both private purposes and for commercial sales (Hovelsrud *et al.*, 2008; NAMMCO, 2022).

6.4.3 Beluga Whale

The beluga whale (*Delphinapterus leucas*) is an Arctic resident and is referred to by Inuit as 'Kilalugak' or 'Qilalugak' (Inuktut Tusaalanga & GN, 2024).

6.4.3.1 Biogeographic Distribution

Beluga whales are circumpolar in distribution, and can be found throughout Arctic and subarctic waters; as far south as the Gulf of Saint Lawrence, and as far north as 82°N (COSEWIC, 2020; Lowry *et al.*, 2017b). Their range includes Canada, Greenland, the Russian Federation, Svalbard and Jan Mayen, and the United States (i.e. Alaska); though occasional sightings have been reported in areas like Japan, New Jersey, Scotland and France, among others (Jefferson *et al.*, 2012a). Globally, there is only one species of beluga, and it is listed by the IUCN as *Least Concern* (Lowry *et al.*, 2017b). In Canada, there are eight identified populations (designatable units) by COSEWIC (COSEWIC, 2020) (Figure 6-8). Resolute Bay is within the primary range of the Eastern High Arctic/Baffin Bay population (Table 3-2), with a COSEWIC status of *Special Concern* and no listing under SARA (Government of Canada, 2024f). Seasonal distributions of beluga whales across the Canadian Arctic can be seen in Figure 6-5, Panel c.

The Eastern High Arctic/Baffin Bay population may actually consist of two separate populations: the North Water population numbering around 15,000, and the West Greenland population of around 5,000 (COSEWIC, 2020). Innes *et al.* (2002) found an estimated 21,123 beluga whales during an aerial survey of the Canadian High Arctic. The TI NMCA provides essential habitat for up to 20 % of the Canadian beluga whale population (Parks Canada, 2024c).

The Eastern High Arctic/Baffin Bay population is found from the eastern Canadian Arctic to Greenland (COSEWIC, 2020; Jefferson *et al.*, 2012a). These animals summer around Somerset Island in Barrow Strait, Lancaster Sound, Prince Regent Inlet and Peel Sound, and winter amongst the heavy pack ice in the North Water Polynya in northern Baffin Bay and off Greenland (see Figure 6-9) (COSEWIC, 2020; DFO, 2015b; Lowry *et al.*, 2017b). Resolute Bay is located within the Lancaster Sound EBSA and is considered a marine mammal migration corridor for Eastern High Arctic/Baffin Bay beluga whale (DFO, 2011a).

Resolute Bay**,** on Cornwallis Island, is within the summer range of beluga whales (see Figure 6-9) (Vard Marine Inc., 2016). Inuit Qaujimajatuqangit describes the habitat and distribution of beluga whales as occurring along the east coast of Ellesmere Island, travelling northward as the ice dissipates and open-water increases, and then returning to Jones Inlet as the ice starts to freeze over again (see Figure 6-9) (QIA, 2018b). Inuit Qaujimajatuqangit informs that beluga whale presence within the region is influenced by the North Water Polynya that extends into Jones Sound (QIA, 2018b). This natural feature enables beluga whales to be present year-round (QIA, 2018b).

Beluga whales come in very close to Resolute Bay, right along the shoreline and have been seen in large numbers[28]. Three belugas were observed travelling close to shore during the terrestrial field on 24 August 2024 and were located within 10m of the boat launch (see Photo 6-1, Underhill Geomatics, pers. obs.)

[28] See Figure 31 in the Resolute Bay NCRI Report for a depiction of 'areas of occurrence' for beluga https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

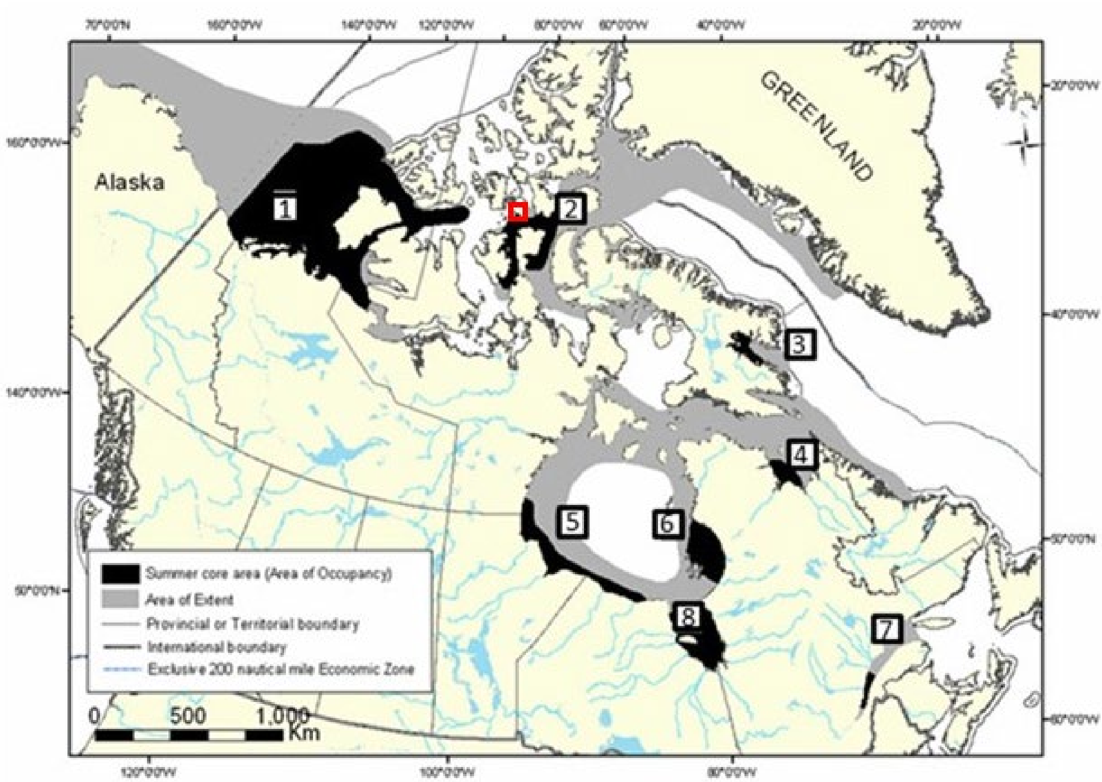

Figure 6-8: Distribution of belugas in Canada and the designable units currently recognized: (1) Eastern Beaufort Sea; (2) Eastern High Arctic-Baffin Bay; (3) Cumberland Sound; (4) Ungava Bay; (5) Western Hudson Bay; (6) Eastern Hudson Bay; (7) St. Lawrence Estuary; (8) James Bay

Source: Figure 2 in COSEWIC (2020)
Note: Red square depicts Resolute Bay location

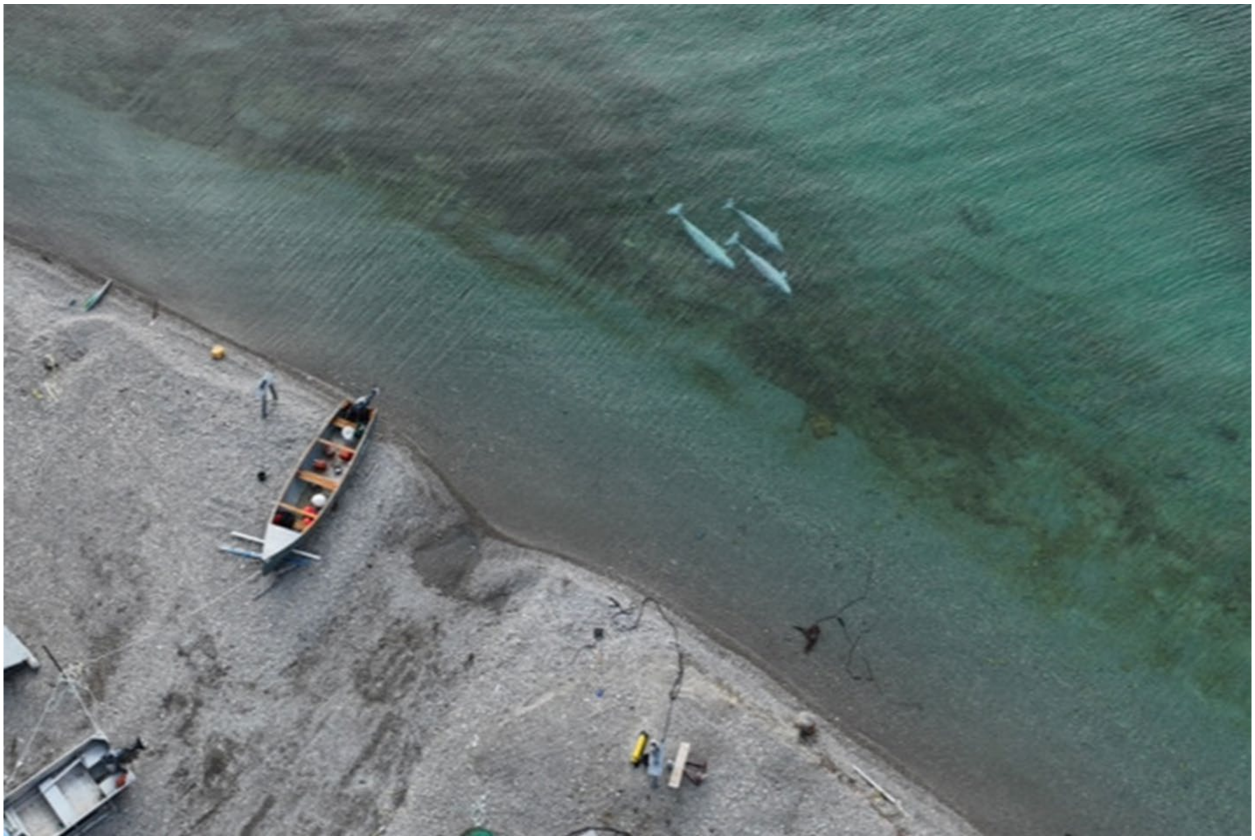

Photo 6-1: Three beluga swimming past boat launch on 24 August at 16:00, approximately 10 m west of the boat launch

Source: Underhill, 2024

6.4.3.2 Ecology and Reproductive Behaviour

In late spring as the sea ice breaks, beluga whales follow leads in the ice to river estuaries, and throughout the summer they are found in the coastal shallows and at glacier fronts (COSEWIC, 2020). In mid-August they move away from land to deeper waters then overwinter in areas with loose pack ice or polynyas (COSEWIC, 2020). Beluga whales have a seasonal cycle of mating and parturition, mating occurring earlier in the year during the late-winter to early-spring (Brodie *et al.*, 1981; Kleinenberg *et al.*, 1964), with a peak before mid-April (Burns & Seaman, 1985). Beluga whales are believed to calve offshore, and coastal habitats in their summer habitats are understood to be important for rearing and nursing (Higdon, 2017), including summer habitat close to Resolute Bay[29]. Nearby Lancaster Sound is likely a calf rearing habitat as females have been observed returning in the summer with calves, rather than having their calves there (Higdon, 2017). In general, parturition occurs offshore during the summer months (June to September), with the peak occurring from mid-June to early-July (Higdon, 2017; Stewart *et al.*, 1995). However, calving has also been noted in Jones Sound during *Aujaq* (July to September) along the floe edge (QIA, 2018b). Calves have also been reported from February to October suggesting that perhaps beluga whales do not have a single calving period (QIA, 2018b). This species seasonal movements are heavily influenced by both prey species and ice cover (COSEWIC, 2020).

The beluga whale diet is diverse with pelagic and benthic prey (Ellis, 1980), and includes a variety of fish, squid, octopus, crustaceans, molluscs, and polychaete worms (Bluhm & Gradinger, 2008). Beluga whale habitat use and presence at ice floe edges is likely related to prey distribution, in particular Arctic cod, which is an important prey species (Kilabuk, 1998). Beluga whales commonly use the waters near Devon, Cornwallis and Somerset islands (Higdon, 2017). The importance of these High Arctic waters for beluga whale survival was recognised in the formation of TI NMCA, which includes essential habitat for beluga whales (Parks Canada, 2024c).

Beluga whales are a social and highly vocal species that make a wide range of underwater calls and echolocation clicks (Ellis, 1980). The frequency range is broad for beluga whales, ranging from 0.1 kHz - 120 kHz (Todd *et al.*, 2015), and they have been called the “sea canaries” because of their frequent use of underwater acoustics (Ellis, 1980). This species can remain submerged for up to about 15 minutes (Ridgeway *et al.*, 1984) and are known to make forays under ice. Beluga whales often use the same coastal habitats from year to year and have long been targeted by hunters throughout their distribution. Natural predators include killer whales and polar bears (COSEWIC, 2020).

6.4.3.3 Harvesting

Hunts for beluga whales are reported to occur throughout Nunavut, with harvests in Resolute Bay during the summer open-water season from July to September (Carter *et al.*, 2019; Priest & Usher, 2004) . Inter-annual variability in the numbers taken and the monthly effort is evident in harvest data, with less than 100 animals harvested per year in the High Arctic (Priest & Usher, 2004). The Eastern High Arctic/Baffin Bay population is also heavily harvested in west Greenland (COSEWIC, 2020). According to IQ, there are no quotas for beluga whales with six or seven harvested in Resolute Bay during the last

[29] See Figure 2.5.3 (RNLUP, Appendix C-Chapter 2) for a depiction of critical calving and rearing habitat for beluga whales in proximity to Resolute Bay: https://www.nunavut.ca/sites/default/files/23-015e_2023-09-07-2023_or_appendix_c_maps_chapter_2_english.pdf

season (IQ Workshop - Joadamee Amagoalik). Carter *et al.* (2019) reports that 12 belugas used to be harvested yearly, but there are now so few that only four or five animals have been harvested the past few years. Other threats to beluga whale conservation include climate change (loss of sea ice), human activities (oil and gas development, shipping), pollution and disease (COSEWIC, 2020; DFO, 2014c; Lowry *et al.*, 2017b).

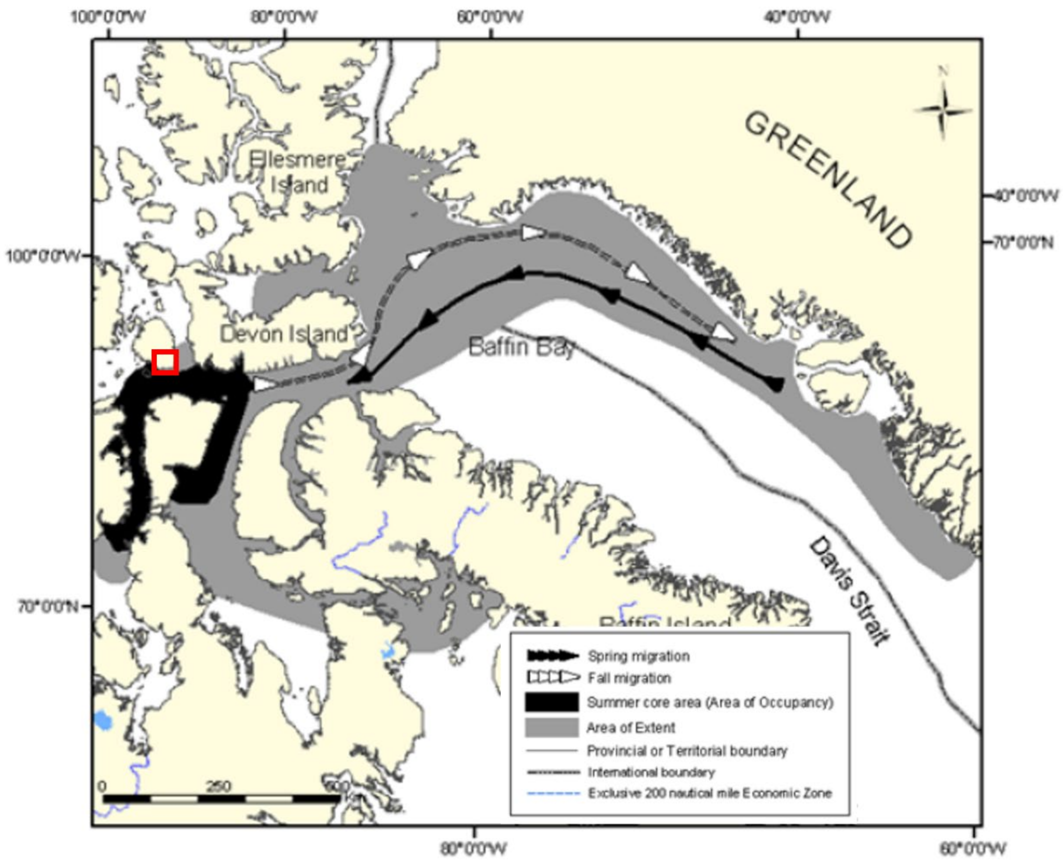

Figure 6-9: Biogeographic Range and Migratory Routes of the Eastern High Arctic – Baffin Bay Beluga Population

Source: Figure 3a in COSEWIC (2020)
Note: Red square depicts Resolute Bay location

6.4.4 Bowhead Whale

The bowhead whale (*Balaena mysticetus*) is an Arctic resident and is referred to by Inuit as 'Arviq' (Inuktut Tusaalanga & GN, 2024).

6.4.4.1 Biogeographic Distribution

Bowhead whales inhabit the Arctic and subarctic waters of Canada, Greenland, and the United States (i.e. Alaska) (Bluhm & Gradinger, 2008; Ellis, 1980; Reilly *et al.*, 2012). There is only one species of bowhead whale and is listed globally as *Least Concern* (Bluhm & Gradinger, 2008; Ellis, 1980; Reilly *et al.*,

2012) by IUCN. Of the four recognized subpopulations, two are in Canada; the Eastern Canada-West Greenland population is relevant to Lancaster Sound (see Figure 6-10) (ESWG, 1995). The Eastern Canada-West Greenland population has *Special Concern* status under COSEWIC and is not listed under the Species at Risk Public Registry, but is currently under consideration for addition to Schedule 1 (GN, 2018b).

Bowhead whales seasonally move into the region during the summer and may be seen in the Lancaster Sound in late spring, summer and early fall (COSEWIC, 2009a; DFO, 2010; Thomas *et al.*, 2016). The seasonal migration path follows the eastern shore of Baffin Island, into and out of Lancaster Sound and Admiralty and Prince Regent Inlets (Figure 6-10) (COSEWIC, 2009a). Sightings come from northern Hudson Bay and Foxe Basin, along the eastern coast of Baffin Island, and south of Lancaster Sound in Pond Inlet, Eclipse Sound, Navy Board Inlet, Admiralty Inlet, Prince Regent Inlet, and the Gulf of Boothia (QIA, 2012). Regent Inlet, specifically south of Creswell Bay, is thought to be a highly utilized area by bowhead whales in the summer season (Dueck & Ferguson, 2008). In addition, bowhead whales also are observed in Isabella Bay on the east coast of Baffin Island. Seasonal distribution of bowhead whales in the Canadian Arctic can be seen on Figure 6-5, Panel d.

Bowhead whales can sometimes be seen in the waters just south and west of Resolute Bay, but are infrequently observed (GN, 2018b; QIA, 2018b)[30].

6.4.4.2 Ecology and Reproductive Behaviour

Bowhead whales inhabit the Arctic and subarctic waters of Canada, Greenland, and the United States (i.e. Alaska) (Bluhm & Gradinger, 2008; Ellis, 1980; Reilly *et al.*, 2012). There is only one species of bowhead whale and is listed globally as *Least Concern* (Bluhm & Gradinger, 2008; Ellis, 1980; Reilly *et al.*, 2012) by IUCN. Of the four recognized subpopulations, two are in Canada; the Eastern Canada-West Greenland population is relevant to Lancaster Sound (Cooke & Reeves, 2019; COSEWIC, 2009a). The Eastern Canada-West Greenland population has *Special Concern* status under COSEWIC and is not listed under the Species at Risk Public Registry, but is currently under consideration for addition to Schedule 1 (COSEWIC, 2009a; GN, 2018b).

Bowhead whales forage during the open-water season, taking advantage of productive arctic waters. The main prey is pelagic zooplankton (Bluhm & Gradinger, 2008; Reilly *et al.*, 2012). Bowhead whales can remain submerged for up to an hour and will swim under ice while foraging (Ellis, 1980; Krutzikowsky & Mate, 2011). They can break through thick ice due to their large skulls and powerful bodies (World Wildlife Fund [WWF, 2019]). Bowhead whales can communicate over large distances and use a frequency range from 0.02 kHz to 5 kHz (Todd *et al.*, 2015). Seasonal distribution over the years is dependent upon timing and distribution of sea ice (Cooke & Reeves, 2019).

6.4.4.3 Harvesting

Bowhead whales are not often harvested in the Eastern Canadian Arctic compared with other harvested species(NWMB, 2000; Priest & Usher, 2004). However, throughout Nunavut Inuit communities now

[30] See Figure 33 in the Resolute Bay NCRI Report for a depiction of 'areas of occurrence' for bowhead whale https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

harvest between one and three bowhead whales per year. The frequency and numbers killed in the eastern Canadian Arctic may change in the future if the population continues to increase. Based on this species' life history, ecology, habitat use, and IQ, bowhead whales can be expected at the floe edge in the spring, can occur in Jones Sound during the open-water season, and will leave these areas in the early fall. Currently, they are infrequently sighted in Resolute Bay. Threats to bowhead whale conservation include increased human activity, vessel strikes, pollution, and climate change (COSEWIC, 2009a).

The Eastern Canada-West Greenland subpopulation was heavily hunted from the 1500s until the early 1900s. The population is thought to be over 4,000 animals (Ferguson *et al.*, 2021) and is increasing but still well below pre-whaling levels of over 25,000 (Cooke & Reeves, 2019). This population summers in western Baffin Bay, northwestern Hudson Bay, Foxe Basin, and the Lancaster Sound region, and winters in Davis Strait and Hudson Strait (Cooke & Reeves, 2019; COSEWIC, 2009a).

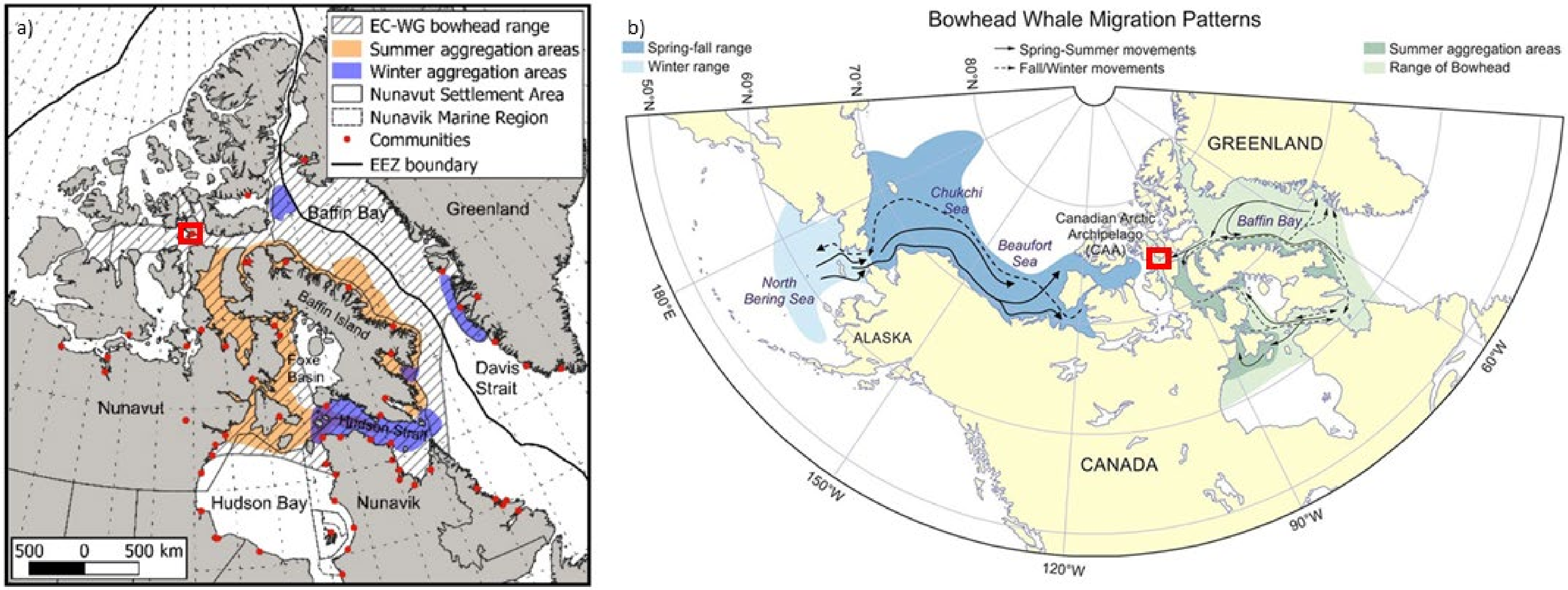

Figure 6-10: a) Distribution (Summer & Winter) of Bowhead Whale Populations in Canada; b) Generalized Seasonal Occurrences and Movements for Bowhead Whale Population

Source: a) Figure 1 in Ferguson *et al*. (2021), and b) Figure 1 in Pomerleau *et al*. (2018)
Note: Red square depicts Resolute Bay location

6.4.5 Harp seal

The harp seal (*Phagophilus groenlandicus*) is a seasonal visitor to the Arctic and is referred to by Inuit as 'Qairulik' (Inuktut Tusaalanga & GN, 2024).

6.4.5.1 Biogeographic Distribution

Harp seals can be found in the North Atlantic and Arctic oceans (Figure 6-11), and are native to Canada, Greenland, Iceland, Norway, Russian Federation, Svalbard and Jan Mayen (Kovacs, 2015). Globally, harp seals are listed as *Least Concern* by the IUCN, with the stipulation that climate change could seriously affect this species and it should be reassessed within a decade (Kovacs, 2015). While they are considered a single species, there is some taxonomic uncertainty related to breeding populations (Kovacs, 2015). Harp seals have not yet been assessed by COSEWIC.

Summer and whelping areas for harp seal in the Canadian Arctic can be seen on Figure 6-5, Panel e. Harp seals are the most abundant marine mammal species in the North Atlantic (NAMMCO, 2021a; Stenson *et al.*, 2022) and the most abundant pinniped in the northern hemisphere, with a stable Northwest Atlantic population around 7.5 million animals (Kovacs, 2015). Harp seals occur in numerous places throughout Nunavut, including in Lancaster Sound along the coast of Devon Island (Indigenous and Northern Affairs Canada (INAC, 1983 cited in QIA, 2012)). Resolute Bay and surrounding waters are located near a recognized high-density area (NPC, 2008).

Harp Seals are regularly seen near Resolute Bay and surrounding waters during the open-water season, before returning to their wintering grounds around the Gulf of St. Lawrence and Newfoundland(IQ Workshop 2019 - Allie Salluviniq; IQ Workshop 2019 - Simon Idlout)[31].

6.4.5.2 Ecology and Reproductive Behaviour

Harp seal live their entire lives (approximately 30 years) at sea - never touching land (Goodwin, 1990). Highly migratory, traveling about 4,800 km per year, harp seals complete one of the longest known animal migrations (Goodwin, 1990). This species travels to the Arctic during the open-water season feeding grounds each year, and returns south to the Gulf of St. Lawrence, southern Labrador and northern Newfoundland for the winter (DFO, 2012; Goodwin, 1990; Kovacs, 2015). The annual movements of harp seals appears to follow fluctuations of the pack ice, as they forage at the ice edge during the year (Stenson, 2015).

Harp seals forage along the ice edge throughout the year, feeding mainly on a variety of fish such as capelin, Arctic cod, polar cod, herring, sculpin, Greenland halibut and plaice among others (Bluhm & Gradinger, 2008; DFO, 2005b). Euphausiids and pelagic amphipods have also been reported as common prey species mainly in pups and juvenile animals based on stomach contents (Haug *et al.*, 2000; Nilssen *et al.*, 2001). According to Wallace and Lawson (1997), at least 67 fin fish species and

[31] See Figure 30 in the Resolute Bay NCRI Report for a depiction of 'areas of occurrence' for harp seal https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

70 species of invertebrates have been documented as prey species for harp seals. Foraging dives are typically shallow (<-100m) and last less than 15 minutes (Lydersen & Kovacs, 1993), although Folkow *et al.* (2004) reported on a single individual diving to a maximum depth of 568 m.

Harp seals are extremely social, except for the first year of life, when the pups must migrate alone (Godwin, 1990). Pups are born from late-February to early-March on the pack ice in their southern wintering grounds (DFO, 2012; Godwin, 1990; Stenson, 2015). Pupping is followed by the annual moult, which occurs from April to May (DFO, 2012). Coastal locations of Bylot Island in Lancaster Sound and Baffin Bay have been identified by Inuit as harp seal pupping sites (Baffinland Iron Mines Corporation, 2012)Harp seals have a variety of calls including growls, grunts, squeaks and knocks in a frequency range <16 kHz (Todd *et al.*, 2015).

6.4.5.3 Harvesting

By the early 1970s, commercial hunting for oil and later pelts drastically reduced the number of harp seals and led to a low of 1.8 million individuals (Kovacs, 2015). The population has since recovered and now, harp seals are the most abundant pinniped in the northern hemisphere. The Northwest Atlantic population is stable at around 7.5 million animals (Kovacs, 2015). By-yearly quotas are set at 400,000; however, only half of this number is killed in Greenland and Canada combined (Kovacs, 2015). Currently, harp seals can be harvested in subsistence hunts without permit by Indigenous people and anyone living north of 53 degrees latitude (Kovacs, 2015).

Harp seals are harvested in Nunavut, with hunts occurring out of Resolute Bay during the summer and fall months, from July through to October, with variation in the monthly timing and numbers taken annually (Priest & Usher, 2004). An average of seven animals are harvested annually in Resolute Bay (Priest & Usher, 2004). Predators include polar bears, killer whales and Greenland sharks (Kovacs, 2015). Threats to the species includes reduction of prey availability, entanglement, oil spills, vessel traffic, contamination, and climate change.

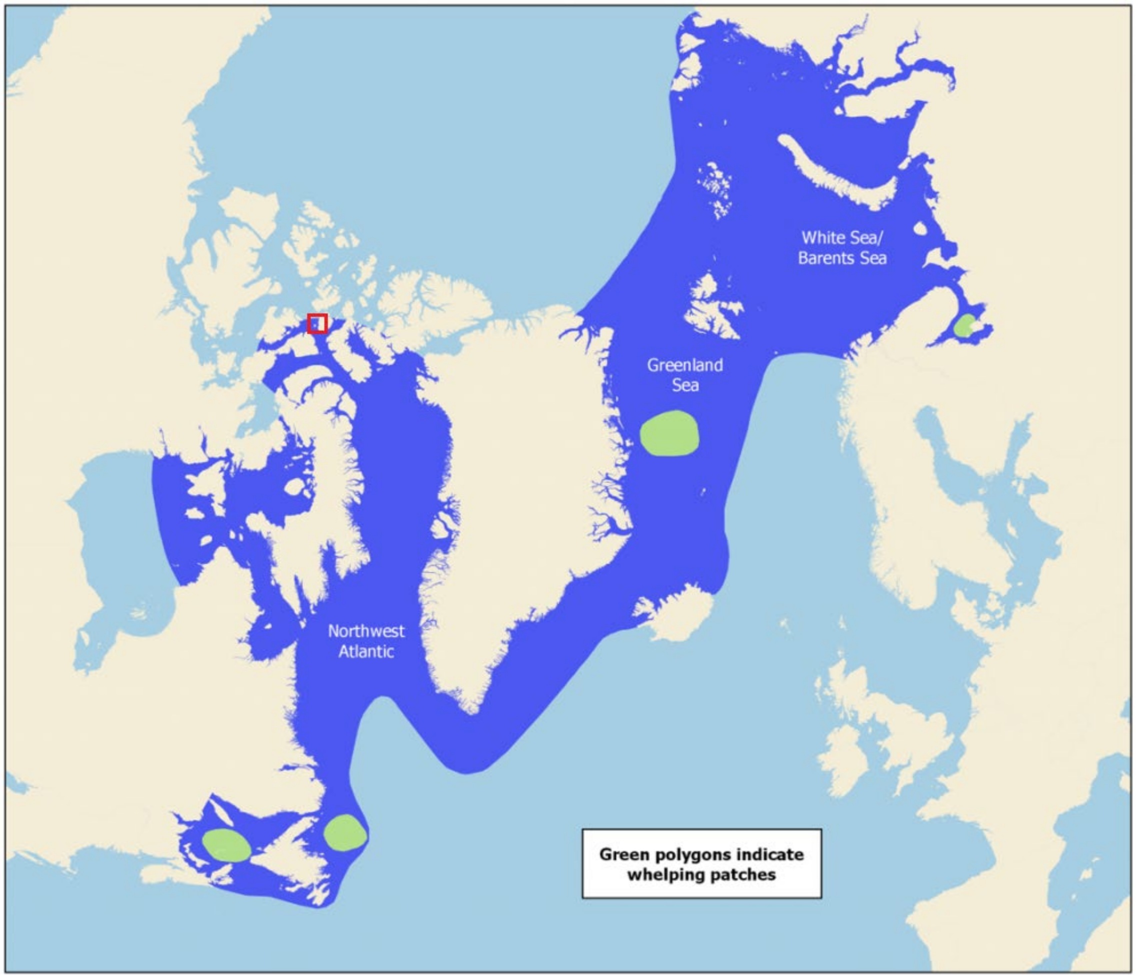

Figure 6-11: Global Range and Whelping Locations of Harp Seals

Source: NAMMCO (2021a)
Note: Red square depicts Resolute Bay location

6.4.6 Hooded seal

The hooded seal (*Cystophora cristata*) is an Arctic resident and referred to by Inuit as 'natsivak' (Inuktut Tusaalanga & GN, 2024).

6.4.6.1 Biogeographic Distribution

Summer distribution and whelping areas for hooded seals in the Canadian Arctic can be seen on Figure 6-5, Panel f. Hooded seals can be found in the North Atlantic and seasonally in the Arctic ocean (Figure 6-12), and are native to the waters of Canada, Greenland, Iceland, and Norway (Kovacs, K.M, 2016). Globally, hooded seals are listed as *Vulnerable* by the IUCN (Kovacs, K.M, 2016), due in part to changing sea ice conditions, and are recommended for re-evaluation once new data become available. Three separate breeding populations are recognized; Lancaster Sound is within range of the Davis Strait population (Campbell, 1997; Kovacs, K.M, 2016). Last assessed in Canada in 1986 and determined to be *Not At Risk* (Campbell, 1997), hooded seals have recently been identified by COSEWIC as a Candidate Priority Species to be scientifically re-assessed (COSEWIC, 2025). The global population is thought to be in the hundreds of thousands, though no recent estimate is available, and likely declining due to reduction in pack ice required for breeding (Kovacs, K.M, 2016). One of four main pupping areas is located in central Davis Strait, and was assessed in 1984 at 19,000 pups and again in 2005 at 3,346 indicating a significant decline (Kovacs, K.M, 2016).

Hooded seal distribution is influenced by sea ice availability and they tend to move south in winter and north in summer (Campbell, 1997; Kovacs, K.M, 2016). The hooded seal is considered uncommon in the Lancaster and north Baffin Bay region (Andersen *et al.*, 2013; QIA, 2012). This species is described as sometimes being present in the summer but is not common (IQ Workshop 2019 - Allie Salluviniq; IQ Workshop 2019 - Joadamee Amagoalik; IQ Workshop 2019 - Peter Amarualik; IQ Workshop 2019 - Simon Idlout)[32].

6.4.6.2 Ecology and Reproductive Behaviour

Hooded seals prefer drifting on ice floes over deep water habitats and are solitary animals outside the breeding season (Godwin, 1990; Goodwin, 1990). In February, mature individuals congregate near the ice prior to pupping and mating (Campbell, 1997). Pups are born on pack ice (in Davis Strait) in the late spring, when break-up has begun (Campbell, 1997; Godwin, 1990; Goodwin, 1990; Kovacs, K.M, 2016). Pups nurse for only four days—the shortest lactation period of any mammal—before transitioning to an adult diet (Godwin, 1990). Nursing is followed by a compressed breeding season lasting only about 2.5 weeks, with mating occurring in the water (Campbell, 1997; Kovacs, K.M, 2016). Animals move northward after the mating season (Campbell, 1997), congregating again for the summer moult (Campbell, 1997; Godwin, 1990; Goodwin, 1990; Kovacs, K.M, 2016). These seals can remain submerged for up to 30 minutes, though longer dives have been recorded (Kovacs, K.M, 2016). Hooded seals are generalists and eat a diverse range of prey that includes zooplankton, benthic and pelagic fish, crustaceans, molluscs, and squid (Kovacs, K.M, 2016). The vocal frequency range for this species is <6 kHz (Todd *et al.*, 2015).

6.4.6.3 Harvesting

Hooded seals are a harvested species in Nunavut but are not reported in the Resolute Bay hunt statistics Priest and Usher (2004). Natural predators include polar bears, killer whales and Greenland sharks (Kovacs, K.M, 2016).

Based on life history, ecology, habitat use, IQ, and harvest reports, hooded seals are not expected to occur in this region with any regularity; however, if they were to occur it would likely be during the open-water season. Threats include harvesting, by-catch/entanglement, competition for food

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[32] See Figure 30 in the Resolute Bay NCRI Report for a depiction of 'areas of occurrence' for hooded seal https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

with local fisheries, pollution, and climate change and associated reduced pack ice habitat required for pupping and moulting.

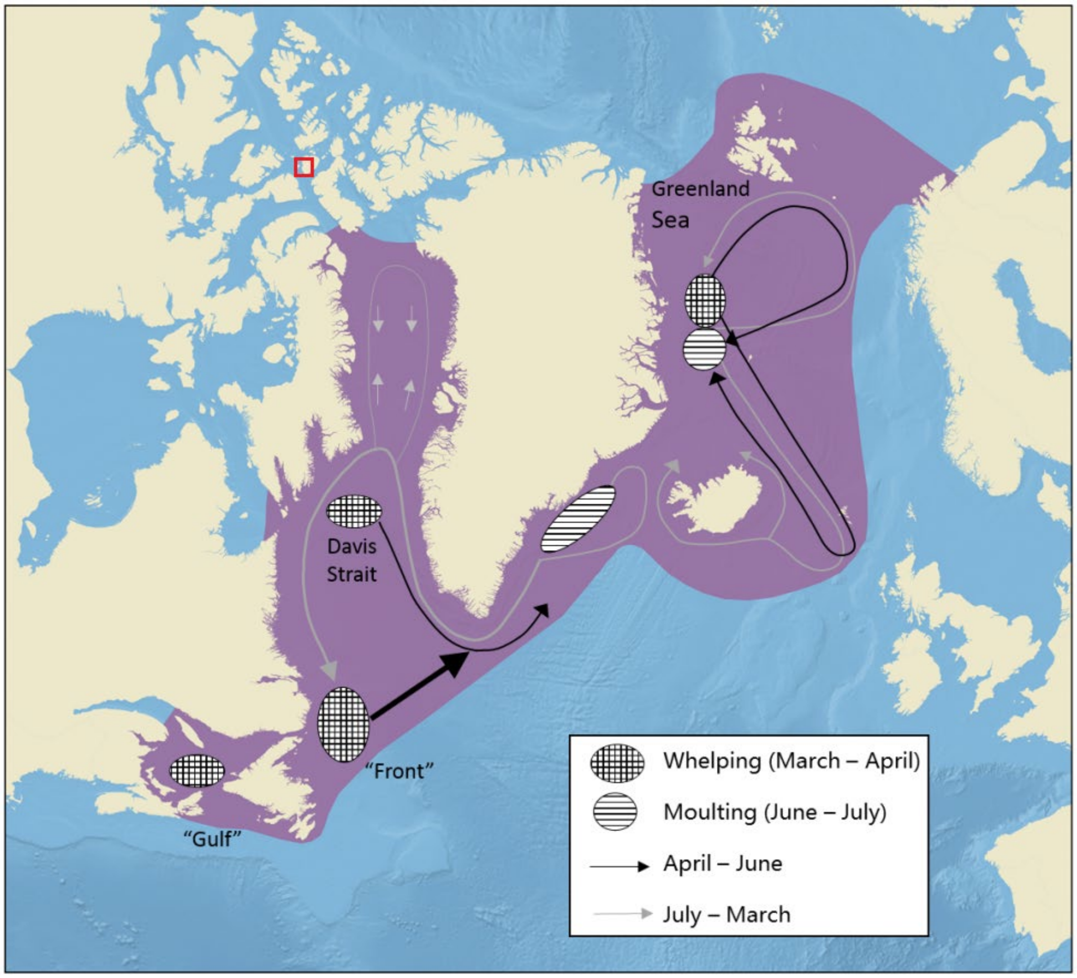


Figure 6-12: North Atlantic Distribution, Whelping Zones, Moulting Zones and Migration Patterns of Hooded Seals (Gulf and Front Populations)

Source: NAMMCO (2021b)
Note: Red square depicts Resolute Bay location

6.4.7 Killer Whale

The killer whale (*Orcinus orca*) is an Arctic visitor and referred to by Inuit as 'Aarluk' (Inuktut Tusaalanga & GN, 2024).

6.4.7.1 Biogeographic Distribution

Killer whale are a cosmopolitan species found throughout the world's oceans, and are known to be native to more than 150 countries (Reeves *et al.*, 2017). Globally listed as *Data Deficient* by the

IUCN (Reeves *et al.*, 2017), the species consists of many distinct populations or ecotypes, which do not interbreed. It is important to note, that taxonomic complexity exists, and the classification of this species may be refined as research continues and global conservation statuses may change accordingly (Taylor *et al.*, 2013). Killer whales are seen throughout the region of Lancaster Sound, generally in small pods, with occasional sightings of single animals (Ferguson *et al.*, 2012). Higdon *et al.* (2012) compiled historical data to document the occurrence of killer whales in the Arctic. The highest number of killer whale sightings to date are from southwest Greenland and Lancaster Sound, with notable areas being in the Pond Inlet/Bylot Island area, Lancaster Sound, and Admiralty Inlet (see Figure 6-13) ((Higdon, 2007). Areas of occurrence for killer whales in the Canadian Arctic can be seen on Figure 6-5, Panel g.

Killer whales arrive in the region in *Upirngaaq* (late spring - arriving in July), are present throughout *Aujaq* (summer; often seen near groups of other marine mammals (Laidre *et al.*, 2006)) and leave in September in *Ukiassaaq* (early fall) (QIA, 2018b). This species is not present in *Ukiaq* (fall/early winter), *Ukiuq* (winter) and *Upirngasaaq* (early spring) (QIA, 2018b). Killer whales have recently shown increased occurrence and range expansion in the Arctic, likely as the climate changes and sea ice declines, making new areas available to them (Ferguson *et al.*, 2010; Higdon *et al.*, 2012; Reeves *et al.*, 2017); these environmental changes could influence the distribution of other marine mammals.

6.4.7.2 Ecology and Reproductive Behaviour

Five separate killer whale populations are recognized in Canada, with four occurring in the Pacific off British Columbia (BC). The fifth, the Northwest Atlantic/Eastern Arctic population, which is likely to be found around Resolute Bay and the surrounding waters of Lancaster Sound are listed as *Special Concern* (COSEWIC, 2008; NPC, 2017), but are considered *Data Deficient* and are not listed under the SARA (COSEWIC, 2008; Government of Canada, 2024f). The small size of this population (less than 250 mature individuals), and their susceptibility to disturbance, contributes to their COSEWIC designation. Relatively little is known about the range and distribution of the Northwestern Atlantic/Eastern Arctic killer whales, and there is no total population estimate available (COSEWIC, 2008).

Killer whales are social animals capable of communicating over large distances underwater, using a variety of clicks and whistles. The frequency range is broad, ranging from 0.5 kHz to 75 kHz (Todd *et al.*, 2015). Killer whales eat marine mammals have relatively short dive times of less than about 15 minutes (Morton, 1990).

Given their predatory nature, there is interest in determining their abundance and distribution in Arctic waters. Ferguson *et al.* (2012) conducted a series of IQ interviews, and it is believed that killer whales inhabiting eastern Canadian Arctic waters are primarily predators of marine mammals, as no interviewees have observed them eating fish. The results of this survey state that killer whales are predators of narwhal, beluga whale, bowhead whale, ringed and bearded seals. Reported predation events on narwhals and beluga whales far outnumbered those on bowhead whales or pinnipeds, with the majority reported in Lancaster Sound, and bowhead whale predation more frequently reported in Davis Strait-Baffin Bay in the late spring, summer and early fall (Higdon *et al.*, 2012). Killer whale sightings from the Lancaster Sound region represent 24.2 % of all reported sightings (Higdon *et al.*, 2012).

6.4.7.3 Harvesting

Residents within the Resolute Bay area and surrounding waters do not harvest killer whales (IQ Workshop 2019 - Amon Akeeagok; IQ Workshop 2019 - Manasie Noah; IQ Workshop 2019 - Marty Kuluguqtuq). Threats include harvesting (in Greenland), anthropogenic disturbance (acoustic and physical), prey depletion, vessel strikes, interaction with commercial fisheries, and contaminants (COSEWIC, 2008). With increasing presence of killer whales in the East Canadian Arctic, competitive interactions with Inuit hunters are more likely to occur, which has potential for negative consequences for the killer whale population.

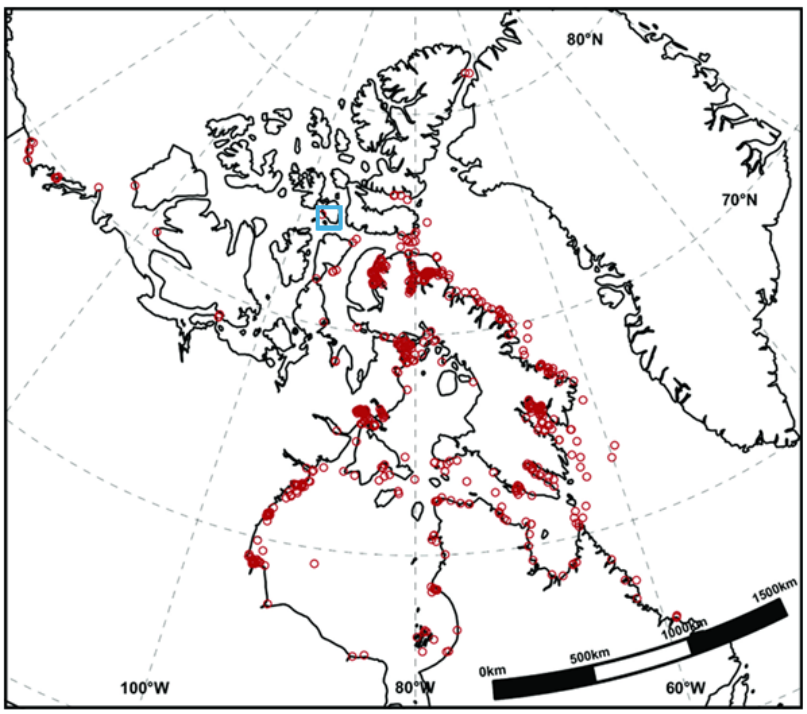


Figure 6-13: Killer Whale Sightings Between 1850 -2018

Source: Figure 2 in Lefort *et al*. (2020)
Note: Blue square depicts Resolute Bay location

6.4.8 Narwhal

The narwhal (*Monodon monoceros*) is an Arctic resident and is referred to by Inuit as 'Allanguaq' or 'Tuugaalik' (Inuktut Tusaalanga & GN, 2024)

6.4.8.1 Biogeographic Distribution

Narwhal are the most northerly of all cetaceans (Ellis, 1980), and occur in Arctic waters throughout Canada, Greenland, Russian Federation, Svalbard and Jan Mayen (Jefferson *et al.*, 2012b). Only one species of narwhal has been identified globally, though 12 populations exist (Jefferson *et al.*, 2012b). Narwhal are globally listed by the IUCN as *Least Concern* (Lowry *et al*., 2017a). Narwhals summering in the Eastern Arctic are listed as *not at risk* by COSEWIC (COSEWIC, 2024b), and no status under SARA (Government of Canada, 2024f). Approximately 45,000-50,000 narwhals from the Baffin Bay population are estimated to summer in Canadian waters of the High Arctic (COSEWIC, 2024b). This population consists of five summering subpopulations including Somerset Island, which is likely to be seen around Resolute Bay (DFO, 2013b; Watt *et al.*, 2012). The seasonal distribution and ranges of narwhal in the Canadian Arctic can be seen on Figure 6-5, Panel h.

Resolute Bay is located within the Barrow Strait, and narwhal are known to visit nearby areas of open-water in the vicinity of Devon Island (DFO, 2013b). Northeast of Devon Island is the Nirjutiqavvik National Wildlife Area surrounding Coburg Island. This area maintains open-water year-round and provides an important feeding ground for narwhal (GN, 2018b; Government of Canada, 2022b). The waters of the TI NMCA provide essential habitat for up to 75 % of the global narwhal population during the open-water season (COSEWIC, 2024a; Parks Canada, 2024c).

Narwhal from the Somerset Island subpopulation summer in the waters between Cornwallis Island and the fiords of Somerset Island (see Figure 6-14). Large numbers of narwhal from the Somerset subpopulation feed along the southwest coast of Devon Island and known mating, migration, and calving areas around Resolute Bay are reported (Higdon & Ferguson, 2017; Remnant R.A. & Thomas, 1992)[33]. Inuit Qaujimajatuqangit report that narwhal calve in July and feed throughout July and August north of Cornwallis Island between Bathurst, Cornwallis, Devon Islands, and Peel Sound (Carter *et al.*, 2019). Narwhal from the Somerset Island subpopulation spend the summer around Somerset Island and winter in Baffin Bay (see Figure 6-14) (Jefferson *et al.*, 2012b; QIA, 2018b). In August, they move in very close to shore to feed on cod (IQ Workshop 2019 - Marty Kuluguqtuq) . Large numbers of narwhal, up to 200, have been reported (IQ Workshop 2019 - Marty Kuluguqtuq). Calves are seen from *Upirngaaq* (June/July) through to *Ukiaksaaq* (September to mid-October) (QIA, 2018b), and hunters from this area have reported seeing calves in August and September (Higdon & Ferguson, 2017). Narwhal are not present near Resolute Bay from *Ukiaq* (November and December) through *Ukiuq* (January and February) (QIA, 2018b). The winter range and population status are unknown (Lowry *et al.*, 2017a).

[33] See Figure 32 in the Resolute Bay NCRI Report for a depiction of 'areas of occurrence' for narwhal https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

6.4.8.2 Ecology and Reproductive Behaviour

The deep diving narwhal has a broad diet that includes benthic and pelagic fish, squid, and crustaceans (Bluhm & Gradinger, 2008; Elijah Panipakochoo Transcript, 2007). Diet varies seasonally with a winter emphasis on benthic prey (Jefferson *et al.*, 2012b). Narwhals likely target ice edges for foraging, based on comparison of stomach samples taken at the ice edge or from ice cracks, compared with those from open-water (Bradstreet, 1982; COSEWIC, 2024a). Narwhal are a social and vocal species with a diversity of calls and clicks (Ellis, 1980). The frequency range is broad, from 0.3 kHz to 48 kHz (Radtke *et al.*, 2023; Todd *et al.*, 2015). DFO Science has expressed concerns about potential masking by shipping noise and the effect that would have on narwhal in the area, especially in narrow bodies of water (DFO, 2013b; Williams *et al.*, 2022). Narwhal can remain submerged for up to about 15 minutes (Laidre *et al.*, 2003), and can make forays under the ice. Killer whales are known to avoid areas with ice, thus IQ studies indicate narwhals may congregate in these areas to avoid being hunted by killer whales (Ferguson *et al.*, 2012).

6.4.8.3 Harvesting

Narwhal are currently harvested by some indigenous communities in Canada and Greenland (Lowry *et al.*, 2017a; NWMB, 2020), including in Nunavut (QIA, 2018b). Hunting for narwhal has been reported from July to October, with inter-annual variation in the timing and numbers taken (Priest & Usher, 2004). In Resolute Bay, narwhal are considered a very important country food (IQ Workshop 2019 - Simon Idlout). The main hunting area for narwhal is in Barrow Strait along the south coast of Cornwallis Island, out to Griffith Island (Carter *et al.*, 2019). Resolute Bay hunters note that narwhal, which are harvested during the summer open-water season (Carter *et al.*, 2019; Priest & Usher, 2004), have changed their habitat use (since the 1960s) spending more time in the middle of the inlet, possibly due to increased harvesting pressure and the presence of motorboats and snowmobiles near the community (COSEWIC, 2024a). As with beluga whale, harvesting of narwhal takes place along the floe edge and in more open waters (QIA, 2018b).

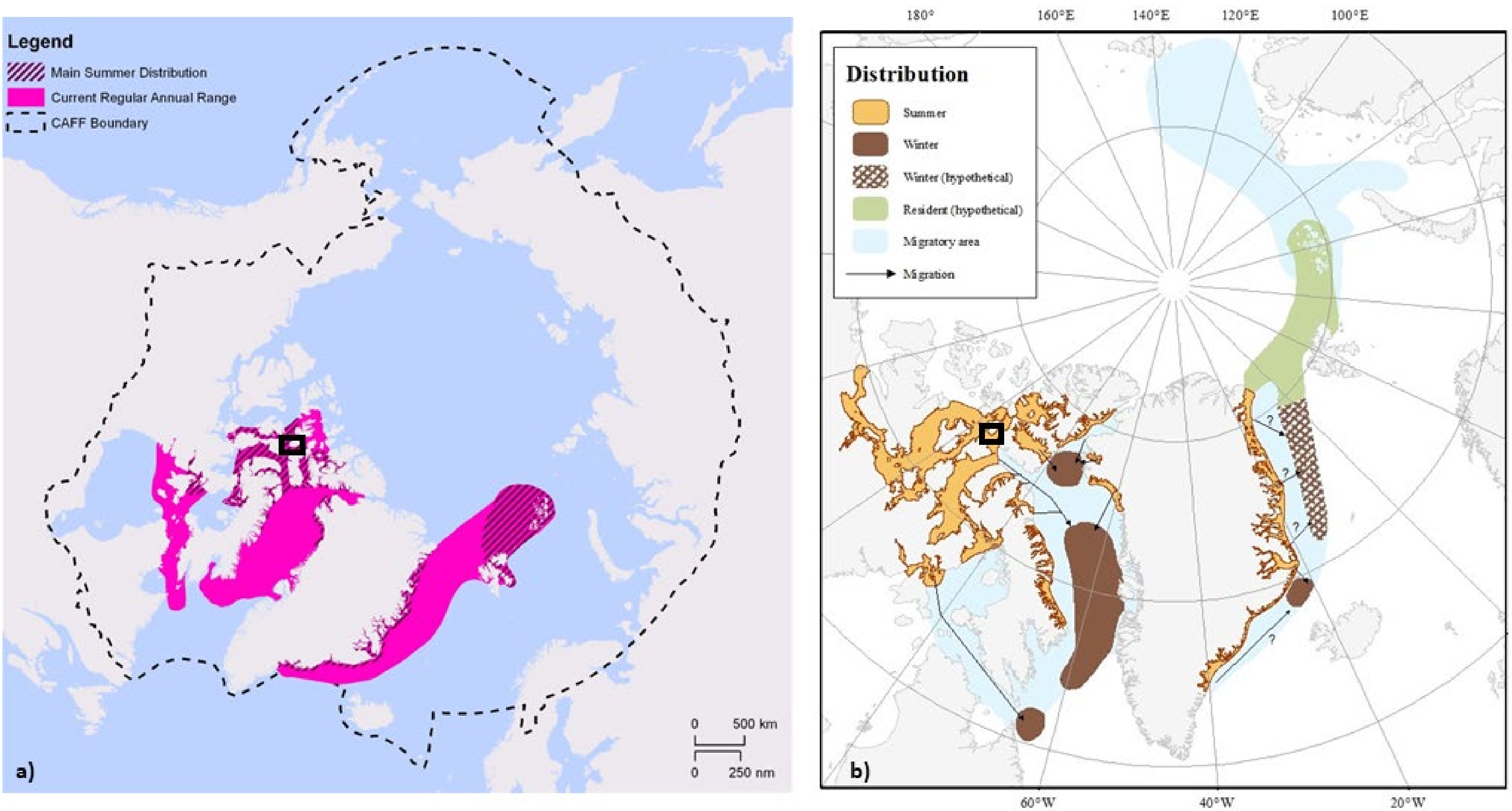


Figure 6-14: a) Narwhal Global Distribution Map and High-Density Summering Grounds; b) Distribution (Summer & Wintering Grounds) and Migration Patterns of Narwhal

Source: a) Figure 2 in Reeves *et al*. (2014); b) Figure 3 in Hobbs *et al*. (2019)
Note: Black square depicts Resolute Bay location

6.4.9 Polar Bear

The polar bear (*Ursus maritimus*) is an Arctic resident and referred to by Inuit as 'Nauit' or 'Nanuk' (Inuktut Tusaalanga & GN, 2024).

6.4.9.1 Biogeographic Distribution

Polar bears are circumpolar and can be found throughout the Arctic (Figure 6-15), with a preference for shallow, ice-covered areas with productive upwelling (Wiig *et al.*, 2015). Habitat selection is closely related to sea ice concentration. Polar bears are native to Canada, Greenland, Norway, the Russian Federation, Svalbard and Jan Mayen, and the United States (i.e., Alaska), and are occasionally spotted in Iceland (Wiig *et al.*, 2015). Globally classified as *Vulnerable* under the IUCN, there are 19 recognized subpopulations of polar bears (Wiig *et al.*, 2015), 14 of which can be found in Canada (COSEWIC, 2018). The Lancaster Sound subpopulation (Lancaster Sound Management Unit) overlaps with Resolute Bay, with the Norwegian Bay subpopulation in close proximity to the North[34]. Polar bears are listed as *Special Concern* under COSEWIC (COSEWIC, 2018) and *Special Concern* on Schedule 1 of SARA (Government of Canada, 2019n). Polar bears are found year-round throughout the Resolute Bay area (Carter *et al.*, 2019; IQ Workshop 2019 - Joadamee Amagoalik) and use the entire shoreline of Cornwallis Island (Carter *et al.*, 2019; QIA, 2012, 2018b), with most sightings occurring from March to June, though they can also be seen into the early fall in some years (GN, 2018b)[35]. Seasonal ranges and denning areas of polar bears in the Canadian Arctic can be seen in Figure 6-5, Panel i and in Figure 6-15, Panel b.

There were four sighting of polar bear in the Project area during the 2024 field season by the marine and terrestrial field teams on the 24,25,26 August, and 4 September at distances ranging between 1 km and 50 m distance to the observers on the boat launch (see Photo 6-2, Underhill Geomatics, pers. obs.).

[34] Map of Polar Bear subpopulations in Nunavut available this URL : https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/related-information/maps-sub-populations-polar-bears-protected.html

[35] See Figure 22 in the Resolute Bay NCRI Report for a depiction of 'frequency of occurrence' for polar bear https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

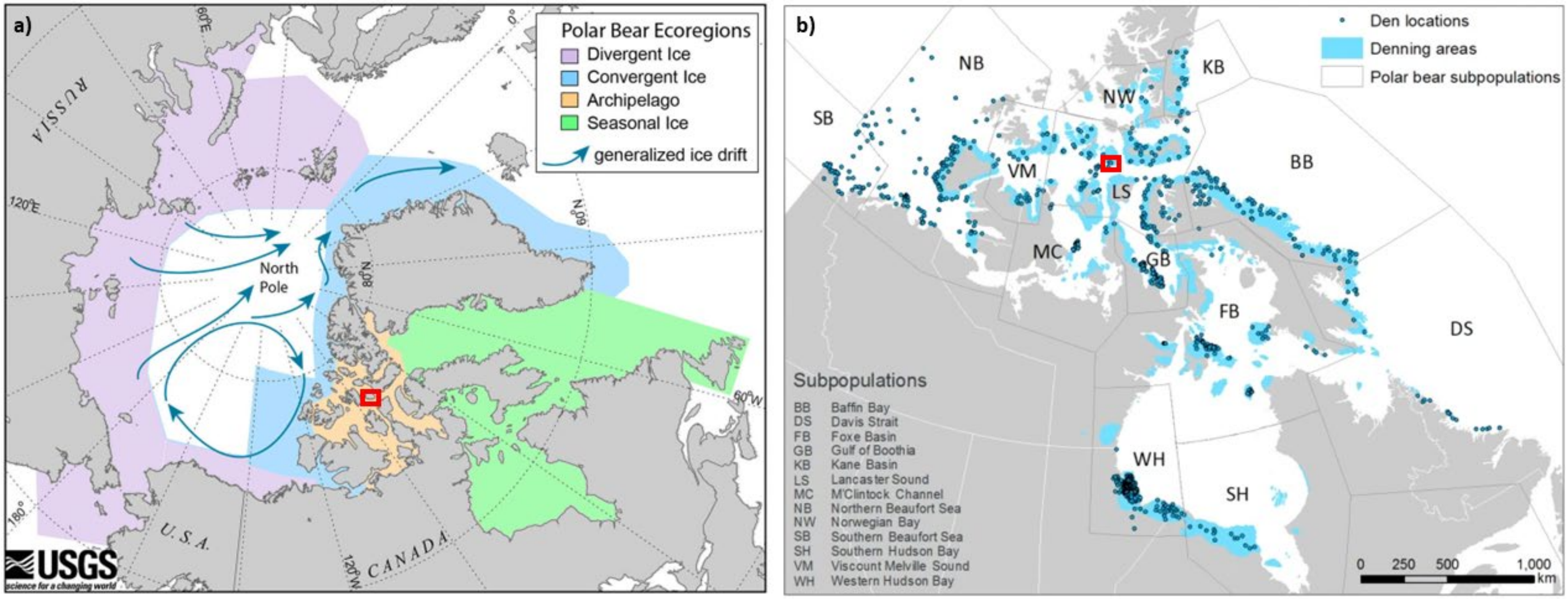


Figure 6-15: a) Global Range of Polar Bear Associated with the Seasonal Ice Ecoregions and Motion; b) Observed Polar Bear Maternity Dens (blue points) and Denning Areas (blue polygons) in Canadian Arctic

Source: a) Figure 1 in Atwood *et al.* (2014); b) Figure 1 in Florko *et al.* (2020)
Note: Red square depicts Resolute Bay Location

Photo 6-2: Polar bear sightings by marine and terrestrial teams: a) 24 August 2024, 20:00 (approximately 500 m north of Community Harbour); b) 26 August 2024, 09:00 (approximately 50 m away of the boat launch)

Source: Underhill, 2024

6.4.9.2 Ecology and Reproductive Behaviour

Polar bears occur at low densities and have low reproductive rates, with mating occurring in the spring and implantation delayed until autumn (Wiig *et al.*, 2015). Female bears move to dens in late autumn and cubs, usually twins, are born in December or January, leaving the den in early spring (Wiig *et al.*, 2015). Preferred diet consists of ringed seals, bearded seals, harp seals and hooded seals, walrus, narwhal and beluga whale (COSEWIC, 2018; Wiig *et al.*, 2015). The life history of polar bears is closely tied to that of the ringed seal (their primary prey species) (QIA, 2018b). Polar bears give birth, prior to when ringed seals give birth, and hunt ringed seal pups either from their dens, or out on open ice (QIA, 2018b). Coburg Island, and the surrounding waters are designated the Nirjutiqavvik National Wildlife Area, and this area provides important feeding ground for polar bears (Government of Canada, 2022b)

Polar bears show site fidelity to feeding and denning areas, based on sea-ice concentration, ice type, bathymetry, distance to ice edge, and distance to land (COSEWIC, 2018). Bear migration patterns show deliberate movements on drifting sea ice to stay within productive habitats (Vard Marine Inc., 2016). Southern subpopulations have seen significant decline in sea-ice habitat and polar bears have shifted their movements northward and landward (COSEWIC, 2018).

6.4.9.3 Harvesting

Harvesting of polar bears in Nunavut is managed under the Nunavut Polar Bear Co-Management Plan (GN, 2019a), where only Inuit (or an assignee) can harvest polar bears based on set restrictions, and they can only otherwise be killed in defense of human life or property; but, this typically counts towards the quota for a community (COSEWIC, 2018). Section 6.2.2 (Table 6-2) for more information about regulations surrounding the harvesting of polar bears. Polar bears have been harvested from Resolute Bay throughout the year, with records from October to January and March to May when the ocean is frozen (Carter *et al.*, 2019; Priest & Usher, 2004). An average of 18 animals are harvested annually by residents of Resolute Bay (Priest & Usher, 2004). Areas throughout Admiralty Inlet, Prince Regent Inlet, Lancaster Sound and northern Baffin Bay have been noted as high value polar bear hunting grounds for Inuit (QIA, 2012). Hunt sites are located throughout the waterways and along the shores of Cornwallis Island, and throughout the contiguous waterways of this region, including Lancaster Sound (QIA, 2018b). The most valuable item obtained by subsistence hunts are the hides; utilized for clothing, kept as trophies or sold for commercial purposes. The meat is usually consumed by Inuit (Oceans North Conservation Society *et al.*, 2018; Wiig *et al.*, 2015). Sport hunting of polar bears is legal in Canada, but only under strict regulations, and must be guided by a local Inuit hunter and included within the annual quota assigned to a community (Lee & Taylor, 1994; Taylor *et al.*, 1987). The total quota for the 2018/2019 season in Nunavut was 502 bears (331 males, 171 females; (GN, 2020b).

6.4.10 Ringed Seal

The ringed seal (*Pusa hispida*) is an Arctic resident and is known by Inuit as 'Natinat' or 'Natsiq' (Inuktut Tusaalanga & GN, 2024).

6.4.10.1 Biogeographic Distribution

Ringed seals, the most common seal in the Arctic, have a circumpolar distribution (Figure 6-16) (COSEWIC, 2019; Goodwin, 1990). Native to Canada, Estonia, Finland, Greenland, Japan, Latvia, Norway, Russian Federation, Svalbard and Jan Mayen, Sweden, and the United States, these are the smallest pinnipeds in the world (COSEWIC, 2019; Lowry, 2016a). The five recognized subspecies of ringed seal have been assessed individually by the IUCN, with a global listing of *Least Concern* (Lowry, 2016a).

The Arctic ringed seal subspecies (*P. h. hispida*) (Lowry, 2016a) can be spotted near every community in Nunavut during the spring (GN, 2023). Ringed seals are listed as *Special Concern* under COSEWIC and are under consideration for addition under SARA (Government of Canada, 2024f). A 2016 IUCN Red List assessment found 1,450,000 mature individuals in the Arctic population, with a likely total population greater than three million animals (Lowry, 2016a).

Ringed seals are a non-migratory species, that remain in the Arctic year-round and can be found in Lancaster Sound and the contiguous waterways, including Parry Channel and in Resolute Bay (COSEWIC, 2019; Goodwin, 1990; Natures Edge, 2015). The distribution of ringed seals and their pupping habitat in the Canadian Arctic can be seen on Figure 6-5, Panel j. Resolute Bay is located within the Barrow Strait

Figure 6-16: Geographic Range of Ringed Seal in Canadian and Adjacent Waters

Source: Figure 2 in COSEWIC (2019)
Note: Red square depicts Resolute Bay location. Dotted line depicts the EEZ

(DFO, 2011a), near a high-density area of ringed seals (NPC, 2008). Coburg Island (at the mouth of the Sound) and the surrounding waters are designated the Nirjutiqavvik National Wildlife Area, and this area provides important feeding grounds for ringed seals (Government of Canada, 2022b). Ringed seals are non-migratory and can be observed along the shoreline in Resolute Bay (NPC, 2008)[36]. Inuit Qaujimajatuqangit reports that the number of seals around Resolute Bay has decreased in recent years, and shipping traffic and anchorage creates disturbance (Carter *et al.*, 2019).

The resident seal population is augmented by the migratory animals that come from Baffin Bay, with the migratory animals returning in *Upirngasaaq* (April) during the breeding season (QIA, 2018b). Ringed seals are found along the shores of Resolute Bay during the open-water season, they make use of the floe edge and breathing holes through the winter and up to *Upirngaaq* (mid May to early July), and use the open-water during *Aujaq* (early July to August) and *Ukiassaaq* (September and October)(QIA, 2018b).

6.4.10.2 Ecology and Reproductive Behaviour

The seasonal distribution of the ringed seal is highly influenced by sea ice. Bradstreet (1982) observed in Lancaster Sound that seals were in noticeably higher densities within 24 km of the ice edge than farther away. Ringed seals use landfast ice and pack ice during the winter, maintaining breathing holes (COSEWIC, 2019), and frequent multiyear ice (GN, 2018b). In mid-May, ringed seals haul out to moult and fast during this (McLaren, 1958). Most mating occurs in April. Shortly after, pups are born (Godwin, 1990) in lairs on fast ice and are nursed for 30 days, with parental care lasting until the ice break-up (McLaren, 1958).

Ringed seals forage in both shallow coastal waters and offshore waters as deep as 150 m, where they eat a variety of planktonic, nektonic, and benthic prey (Bluhm & Gradinger, 2008; Goodwin, 1990; McLaren, 1958).

The ringed seal produces sounds that range from 0.4 kHz to 16 kHz (Stirling, 1973; Todd *et al.*, 2015) with vocalizations consisting of barks, yelps, and growls that can be heard year-round, with peaks during winter and spring (Barbosa *et al.*, 2024; Halliday *et al.*, 2017; Halliday *et al.*, 2019; Jones *et al.*, 2014). Individuals can remain submerged for up to 17 minutes (Lydersen, 1991).

6.4.10.3 Harvesting

Ringed seals are harvested year-round with variations in the monthly effort and numbers taken (Priest & Usher, 2004). An average of 562 ringed seals are harvested annually in Resolute Bay (Priest & Usher, 2004), with the majority killed in the summer (Priest & Usher, 2004). Seals are harvested at the ice cracks throughout the bay. The other main harvesting area for ringed seals is in Barrow Strait along the south coast of Cornwallis Island, and out towards Griffith Island (Carter *et al.*, 2019). Natural predators include killer whales, walrus, polar bears and Arctic foxes, and predation on pups by birds such as gulls

[36] See Figure 26 in the Resolute Bay NCRI Report for a depiction of 'frequency of occurrence' for ringed seal https://www.gov.nu.ca/sites/default/files/documents/2024-03/NCRI %20Resolute %20Bay_EN_WEB.pdf

and ravens has been observed (COSEWIC, 2019). Other threats include pollution, climate change (habitat loss with reduced sea ice and snow cover), and anthropogenic disturbance (Lowry, 2016a).

7 Fish and Fish Habitat - Field Program

Quantitative field programs were undertaken during the feasibility (18 and 19 August 2019) and detailed design (27 to 29 August 2024) phases of the Project to characterize habitat of the intertidal and subtidal areas of the Community Harbour Study Area in Resolute Bay. For a description of the Study Area for the Project see Section 1.4, Figure 1-1, and for weather details on each field program see Table 1-4.

Program objectives for fish and fish habitat are provided in Section 1.5 (Table 1-1).

7.1 Field Methodology

Fish and fish habitat conditions were characterized within the Community Harbour Study Area and surrounding reference sites. The marine habitat was surveyed using a combination of survey techniques to assess intertidal, subtidal and surface conditions as summarized below with survey dates provided in Section 1.5.2 (Table 1-3), and weather conditions (including tidal state) are provided in Table 1-4 (2024) and Table 1-5 (2019). Fish and fish habitat surveys conducted include:

- Intertidal transect surveys at low tide in out-of-water tidal conditions (2019, 2024).
- Subtidal surveys using a remote operated vehicle (ROV) (2019, 2024).
- Aerial surveys with a drone which targeted low slack tide (2024).
- Plankton tow surveys (2024).
- Surface current survey with a drogue (2019, 2024).

The survey zones are defined as follows:

- Intertidal: High Water Line (HWL) to the Low Water Line (LWL).
- Subtidal: All water below LWL.

Freshwater habitats, when present in proximity to the Project Study Area, were documented qualitatively.

For data that is depicted from 2019, only those performed in proximity to the design selected to be the community harbour are presented, therefore those surveys that occurred in proximity to Option 3 were not included in this report (see Figure 1-2 in the PSIR Report (Dynamic Ocean & Worley Consulting, 2025b)).

Georeferenced maps were made in advance of the field program, which documented the community harbour footprints. The field team geospatially referenced field program locations using the Avenza App on an iPad.

7.1.1 Intertidal Surveys

7.1.1.1 Traditional

Intertidal surveys were undertaken using traditional (on foot, out of water) and novel (drone) techniques to determine habitat characteristics along the foreshore of the Community Harbour Study Area (see Section 1.4 for Study Area definitions). The surveys were undertaken at low tide with the intention of observing the benthic habitat (seabed) in out of water tidal conditions. Transect locations for the intertidal surveys are provided in Table 7-1, and tide information is provided in Figure 7-1.

Perpendicular to shore transects were established from the HWL to the accessible water line, with seven transects performed in 2019 and eight in 2024. Transects were spaced between 80 m and 280 m apart across the Project Footprint shoreline. A Qualified Professional (QP) considered this distance apart was acceptable based on the probability of relatively homogenous habitat types, differentiated by soft or hard substrates for the heterogeneity.

Transects established perpendicular to the shore were selected to assess for the variability in habitat from the high to low intertidal area. In advance of the transect survey, a QP assessed the intertidal area to confirm the number of habitat bands along with their characteristics. A habitat band was defined as an observable differentiation on biophysical features (substrate, vegetation, fauna). The QP also confirmed whether there were differences in the number of habitat bands along each transect. A transect was established from the HWL to the accessible portion of the LWL. Quadrats were spaced along the transect according to habitat variability (as per habitat bands), as determined by the Qualified Professional (QP), to ensure systematic sampling. A minimum of three equidistant quadrats were performed per transect line, starting from the HWL and extending seaward to the LWL.

The transects' start and stop locations were georeferenced using the Avenza App on an iPad. The transect total length and the length of individual habitat bands within each transect was measured. At the start of each transect, seaward and landward photographs were taken, and a broad-scale photograph of the intertidal was taken on the iPad. For each quadrat, an overhead photograph was taken. Photographs of organisms present on the transect were taken with an object for scale, when relevant. Broad scale photographs across the intertidal landscape were taken to facilitate the identification of habitat bands.

Photographs from the intertidal survey were analyzed by the enumeration techniques described in Table 7-6 for substrate and Table 7-7 for categorizations of marine organisms and vegetation. Habitat was categorized by the quality definitions provided in Table 7-8. Sessile and motile organism abundance estimates included counts, percent cover, or relative estimates, depending on the organism being assessed. Marine vegetation was assessed through a percent cover estimate and sessile invertebrates were assessed through a combination of counts and aerial coverage (m^2), depending on their abundance. Identification of reference and controls for surveyed sites will be determined during the detailed design phase.

Table 7-1: Information on Intertidal Transects Conducted at the Community Harbour Study Area

Type	Transect No.[1]	Start		Transect Length (m)	Number of Quadrats	Quadrat Spacing (m)	Distance from Previous Transect (m)
		Latitude (N)	Longitude (W)				
28-Aug-24							
Reference	1	74° 41.632	94° 51.707	7.0	5	1.5	-
Reference	2	74° 41.639	94° 51.507	7.0	5	1.5	100
Community Harbour	3	74° 41.651	94° 51.308	5.5	5	1.3	100
Community Harbour	4	74° 41.658	94° 51.111	8.0	5	1.9	97
Community Harbour	5	74° 41.653	94° 50.924	9.4	5	2.4	92
Community Harbour	6	74° 41.619	94° 50.767	8.3	5	2.1	100
Reference	7	74° 41.584	94° 50.606	7.8	5	1.9	103
Reference	8	74° 41.555	94° 50.414	8.3	5	2.1	108
19-Aug-19							
Reference	1	74° 41.476	94° 50.395	10.0	6	2.0	-
Reference	2	74° 41.513	94° 50.318	25.0	6	5.0	80
Reference	3	74° 41.555	94° 50.408	20.0	6	4.0	100
Community Harbour	4	74° 41.643	94° 50.841	7.5	6	1.5	280
Community Harbour	5	74° 41.658	94° 51.030	7.5	6	1.5	105
Community Harbour	6	74° 41.654	94° 51.291	10.0	6	2.0	130
Community Harbour	7	74° 41.639	94° 51.567	10.5	6	1.5	140

Note: 1. All transect starts at HWL

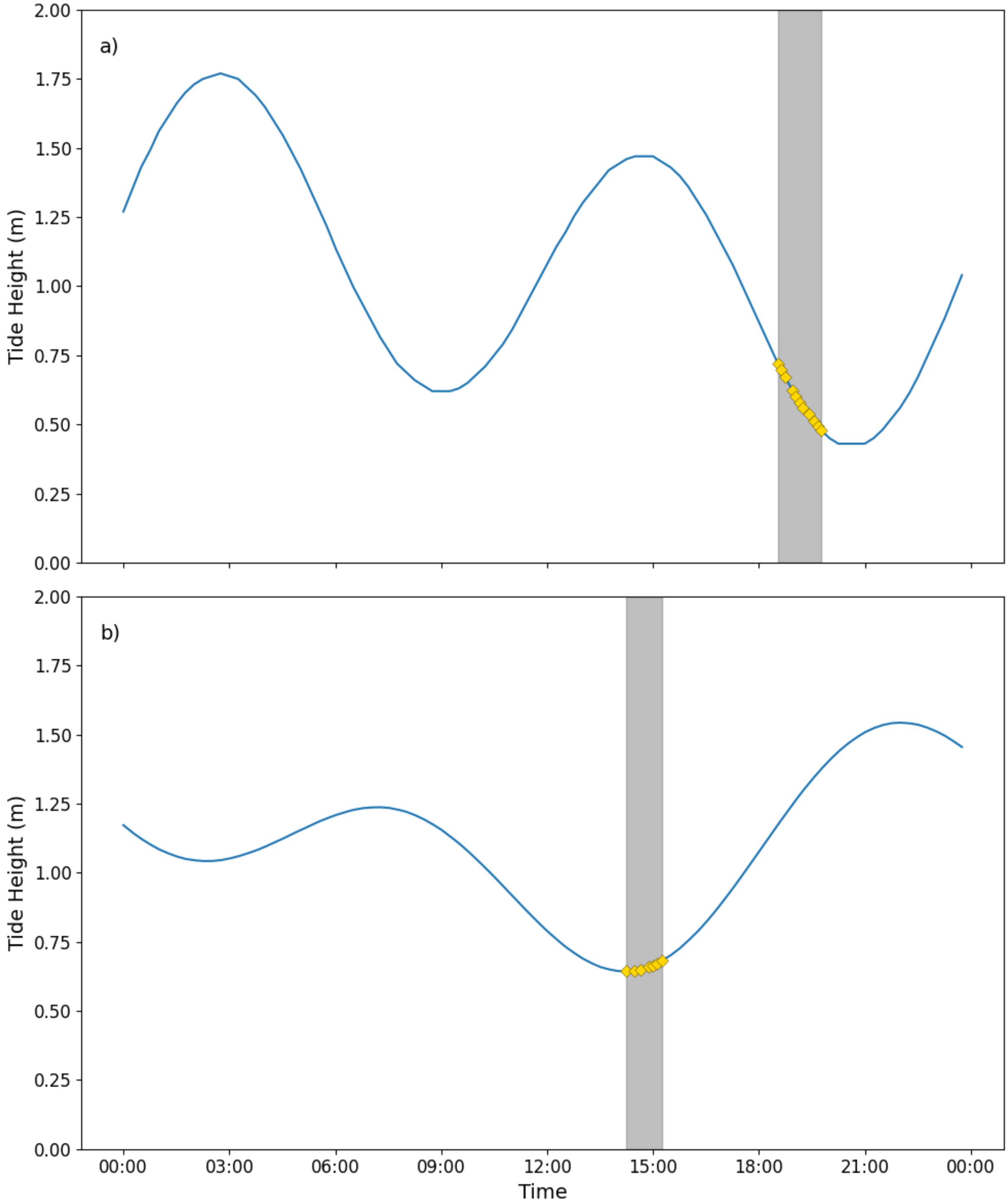


Figure 7-1: Intertidal Survey Time and Tide Information: a) 19 August 2019; b) 28 August 2024

Source: Resolute Station (05560) - CHS (2019, 2024)
Note: Duration of intertidal program represented by grey column and yellow diamonds represent the time of each transect

7.1.1.2 Drone

The drone survey within the Community Harbour Study Area was performed by Underhill Geomatics Ltd. (Underhill) during the terrestrial 2024 field program. The drone imagery, while intended for detailed design purposes, has been used to further document habitat conditions within Community Harbour Study Area (in addition to Haul Road freshwater crossings as described in Section 7.1.5).

Pre-flight planning was carried out using Google Earth, with careful consideration given to potential aviation hazards and the terrain characteristics of the Project Study Area. A DJI Mavic 3 Enterprise RTK was utilized with the survey conducted at approximately 15:30 on 24 August 2024 (see Table 1-3 and Table 1-4). While low tide had been the intention, there were unpredictable weather patterns posed significant challenges, preventing precise coordination with the low tide schedule. Following data collection, the imagery was post-processed using Agisoft Metashape to generate georeferenced orthophotos of the harbour areas. This process ensured accurate spatial representation and alignment with the Project's geospatial requirements.

7.1.2 Subtidal Remote Operated Vehicle Survey

Remote Operated Vehicle (ROV) surveys were undertaken within the Community Harbour Study Area to delineate seabed conditions, where a VideoRay Pro 4 (2019) and Blue Robotics ROV2 (2024) were used. Transects were performed from a stational platform (vessel of a local), where the length of the transect was known based on the length of tether run out (marked in 1 m increments). The transect start position was delineated and georeferenced using the Avenza App on an iPad, with the end position marked using the Avenza measure tool. The number of transects conducted at each site and other descriptive characteristics are provided in Figure 7-4, Table 7-2, and Table 7-3, and tide information is provided in Figure 7-2 and Figure 7-3.

In 2019, a total of 30 ROV transects were conducted. Transect length varied from 40 m to 65 m, with start depths varying from 0.2 m to 7.4 m, chart datum (CD). In 2024, a total of 39 ROV transects were conducted. Transect length varied from 30 m to 119 m, with start depths varying from 0.4 m to 20.7 m, CD.

Video recordings were later analyzed by the enumeration techniques as described in Table 7-6 for substrate and Table 7-7 for categorizations of marine fauna/flora. Habitat was categorized by the quality definitions provided in Table 7-8. Sessile and motile fauna abundance estimates are counts, percent cover, or relative estimates, depending on the organism being assessed. Additional images were taken either during survey, or as video snapshots using the program Adobe Premiere Pro CC 2019 (Version 24.6.1). Where possible, exact counts were provided but were otherwise in relative abundance. When there was uncertainly in the species identification, an indication of 'possible' (poss) or 'probable' (prob) was provided.

Table 7-2: Information on Subtidal Transects Conducted at the Community Harbour Study Area (2024)

Date	Transect No.	Start		Time	Tide Height (m)	Max ROV Depth (m)		Distance (m) and Direction
		Latitude (N)	Longitude (W)	Start		ROV (Gauge)	Chart Datum (m, CD)	
Community Harbour								
27-Aug-24	15	74° 41.573	94° 51.067	15:52	0.9	5.3	4.4	70 W
	16	74° 41.573	94° 51.067	16:02	0.9	9.1	8.2	90 SW
	17A	74° 41.573	94° 51.067	16:12	1.0	11.2	10.2	70 SW
28-Aug-24	17B	74° 41.605	94° 51.236	09:15	1.1	5.4	4.4	87 W
	18	74° 41.605	94° 51.236	09:26	1.1	8.4	7.3	81 NW
	19	74° 41.605	94° 51.236	09:34	1.1	5.4	4.3	90 E
	20	74° 41.605	94° 51.236	09:47	1.1	3.8	2.7	60 S
	21	74° 41.622	94° 50.907	10:03	1.1	2.3	1.3	25 S
	22	74° 41.596	94° 50.851	10:16	1.0	4.5	3.5	20 NW
	24	74° 41.563	94° 50.903	10:39	1.0	7.4	6.5	50 ENE
	25	74° 41.563	94° 50.903	10:47	1.0	7.5	6.6	90 NW
	26	74° 41.563	94° 50.903	10:56	0.9	10.5	9.6	90 SSW
	27	74° 41.549	94° 51.256	11:14	0.9	9.8	8.9	140 NE
	28	74° 41.549	94° 51.256	11:28	0.9	10.5	9.7	80 SE
	29	74° 41.549	94° 51.256	11:37	0.8	11.5	10.3	90 WNW
	30	74° 41.549	94° 51.256	11:51	0.8	12.7	11.9	45 S
	31	74° 41.524	94° 51.881	12:25	0.8	9.6	8.9	111 NE
	32	74° 41.524	94° 51.881	12:33	0.7	14.8	14.1	100 E
	33	74° 41.524	94° 51.881	12:46	0.7	10.4	9.7	83 SW

Date	Transect No.	Start		Time	Tide Height (m)	Max ROV Depth (m)		Distance (m) and Direction
		Latitude (N)	Longitude (W)	Start		ROV (Gauge)	Chart Datum (m, CD)	
	34	74° 41.524	94° 51.881	12:56	0.7	15.6	14.9	140 S
29-Aug-24	35	74° 41.584	94° 51.578	11:40	1.0	2.7	1.7	80 NW
	36	74° 41.584	94° 51.578	11:47	1.0	5.2	4.2	80 E
	37	74° 41.584	94° 51.578	11:55	1.0	11.1	10.7	80 SE
	38	74° 41.417	94° 51.712	12:12	0.9	21.5	20.7	119 ALL
	39	74° 41.359	94° 51.000	12:27	0.9	21.5	20.7	98 ALL
Reference								
27-Aug-24	1	74° 41.498	94° 50.619	10:36	0.8	6.9	6.1	88 SE
	2	74° 41.498	94° 50.619	10:49	0.8	6.1	5.4	79 SSE
	3	74° 41.498	94° 50.619	10:59	0.7	6.2	5.5	89 SE
	4	74° 41.498	94° 50.619	11:14	0.7	7.0	6.3	61 E
	5	74° 41.523	94° 50.765	11:54	0.6	2.4	1.8	98 E
	6	74° 41.523	94° 50.765	12:06	0.6	1.7	1.1	60 NE
	7	74° 41.523	94° 50.765	12:15	0.6	1.0	0.4	53 N
	8	74° 41.523	94° 50.765	12:20	0.6	9.9	9.3	110 S
	9	74° 41.520	94° 50.468	14:08	0.7	1.5	0.9	30 N
	10	74° 41.520	94° 50.468	14:20	0.7	1.4	0.8	76 N
	11	74° 41.520	94° 50.468	14:30	0.7	3.6	2.9	90 W
	12	74° 41.520	94° 50.468	14:40	0.7	5.4	4.7	90 S
	13	74° 41.459	94° 50.600	15:18	0.8	9.9	9.1	87 NE
	14	74° 41.459	94° 50.600	15:27	0.8	-	-	103 NW

Note*Perpendicular to shore transect

Table 7-3: Information on Subtidal Transects Conducted at the Community Harbour Study Area (2019)

Date	Transect No.	Start		Time	Tide Height (m)	Depth (m)		Length (m)
		Latitude (N)	Longitude (W)	Start		ROV (Gauge)	Chart Datum (m, CD)	
Community Harbour								
18-Aug-19	1	74° 41.581	94° 50.877	10:28	0.6	5.1	4.5	60
	2	74° 41.593	94° 50.790	11:12	0.8	1.2	0.4	60
	3	74° 41.608	94° 50.733	11:26	0.8	0.6	-0.2	65
	4	74° 41.620	94° 50.948	11:36	0.8	2.4	1.6	60
	5	74° 41.637	94° 50.931	11:47	0.8	0.6	-0.2	60
	6	74° 41.646	94° 51.042	12:03	1.0	1.7	0.7	60
	7	74° 41.615	94° 51.017	12:18	1.0	4.0	3.0	60
	8	74° 41.610	94° 51.043	12:43	1.0	3.3	2.3	55
	9	74° 41.593	94° 51.120	14:02	1.4	6.2	4.8	40
	10	74° 41.555	94° 51.560	15:15	1.5	9.4	7.9	60
	11	74° 41.593	94° 51.598	15:26	1.5	3.2	1.7	60
	12	74° 41.607	94° 51.591	15:37	1.5	2.3	0.7	60
	13	74° 41.624	94° 51.516	15:45	1.5	-1.9	-0.4	60
	14	74° 41.643	94° 51.356	15:56	1.5	-1.9	-0.4	60
	15	74° 41.631	94° 51.162	16:06	1.4	-2.3	-0.9	55
19-Aug-19	16	74° 41.644	94° 51.115	08:50	0.9	-1.4	-0.5	60
	17	74° 41.621	94° 51.352	9:26	0.7	-1.8	-1.1	60

Date	Transect No.	Start		Time	Tide Height (m)	Depth (m)		Length (m)
		Latitude (N)	Longitude (W)	Start		ROV (Gauge)	Chart Datum (m, CD)	
	18	74° 41.593	94° 51.381	9:34	0.7	-5.4	-4.7	65
Reference								
19-Aug-19	1	74° 41.216	94° 53.188	13:48	1.1	-3.0	-1.9	55
	2	74° 41.243	94° 53.196	14:03	1.3	-1.8	-0.5	60
	3	74° 41.281	94° 52.973	14:15	1.3	-7.9	-6.6	60
	4	74° 41.345	94° 52.894	14:50	1.3	-2.8	-1.5	60
	5	74° 41.262	94° 53.218	14:27	1.3	-1.9	-0.6	60
	6	74° 41.309	94° 53.042	14:38	1.1	-2.5	-1.4	60
	7*	74° 41.361	94° 52.710	14:59	1.3	-5.2	-3.9	60
	8	74° 41.192	94° 53.229	10:39	0.6	-3.5	-2.9	55
	9	74° 41.191	94° 53.297	10:49	0.6	-0.9	-0.3	60
	10	74° 41.231	94° 53.189	10:59	0.6	-1.4	-0.8	60
	11	74° 41.228	94° 53.082	11:10	0.6	-3.0	-2.4	60
	12	74° 41.303	94° 52.833	11:19	0.6	-8.0	-7.4	60

Note: * Transect perpendicular to shore

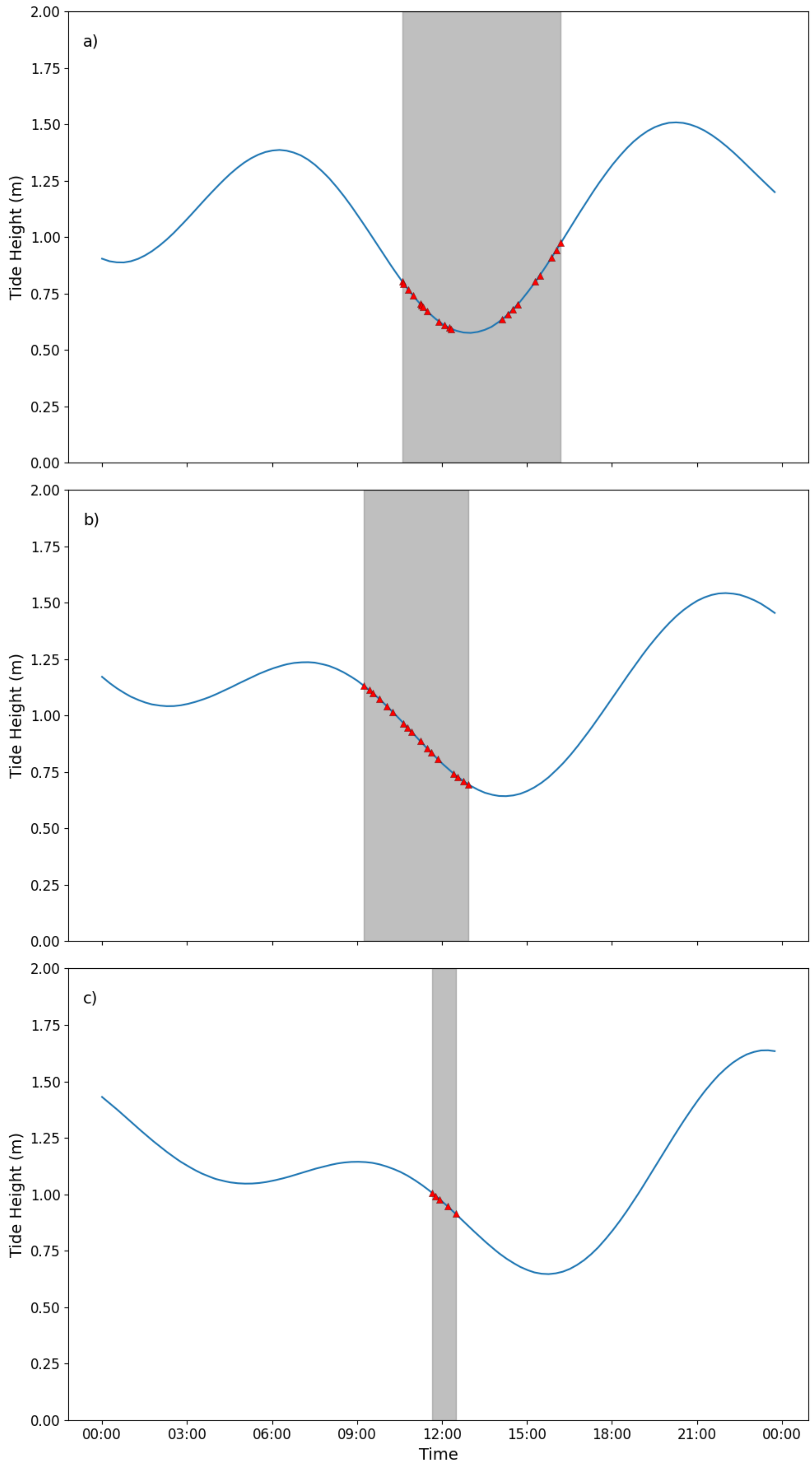


Figure 7-2: ROV Survey Tide and Time Information: a) 27 August 2024; b) 28 August 2024; c) 29 August 2024

Source: Resolute Station (05560) - CHS (2024)
Note: Duration of subtidal program represented by grey column and red triangles represent the time of each transect

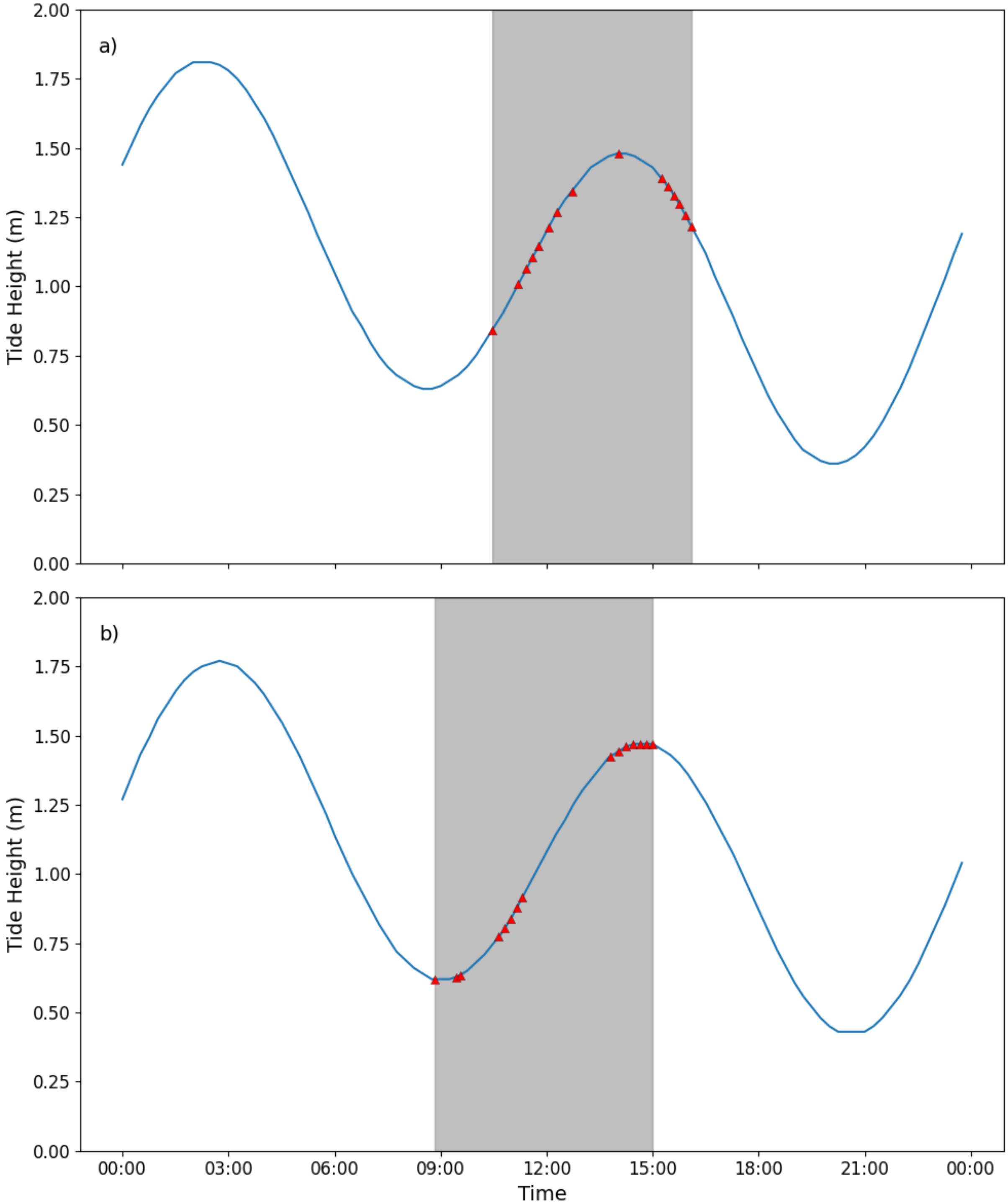


Figure 7-3: ROV Survey Tide and Time Information on a) 18 August 2019; b) 19 August 2019

Source: Resolute Station (05560) - CHS (2019)

Note: Duration of subtidal program represented by grey column. Red triangles represent the time of each transect

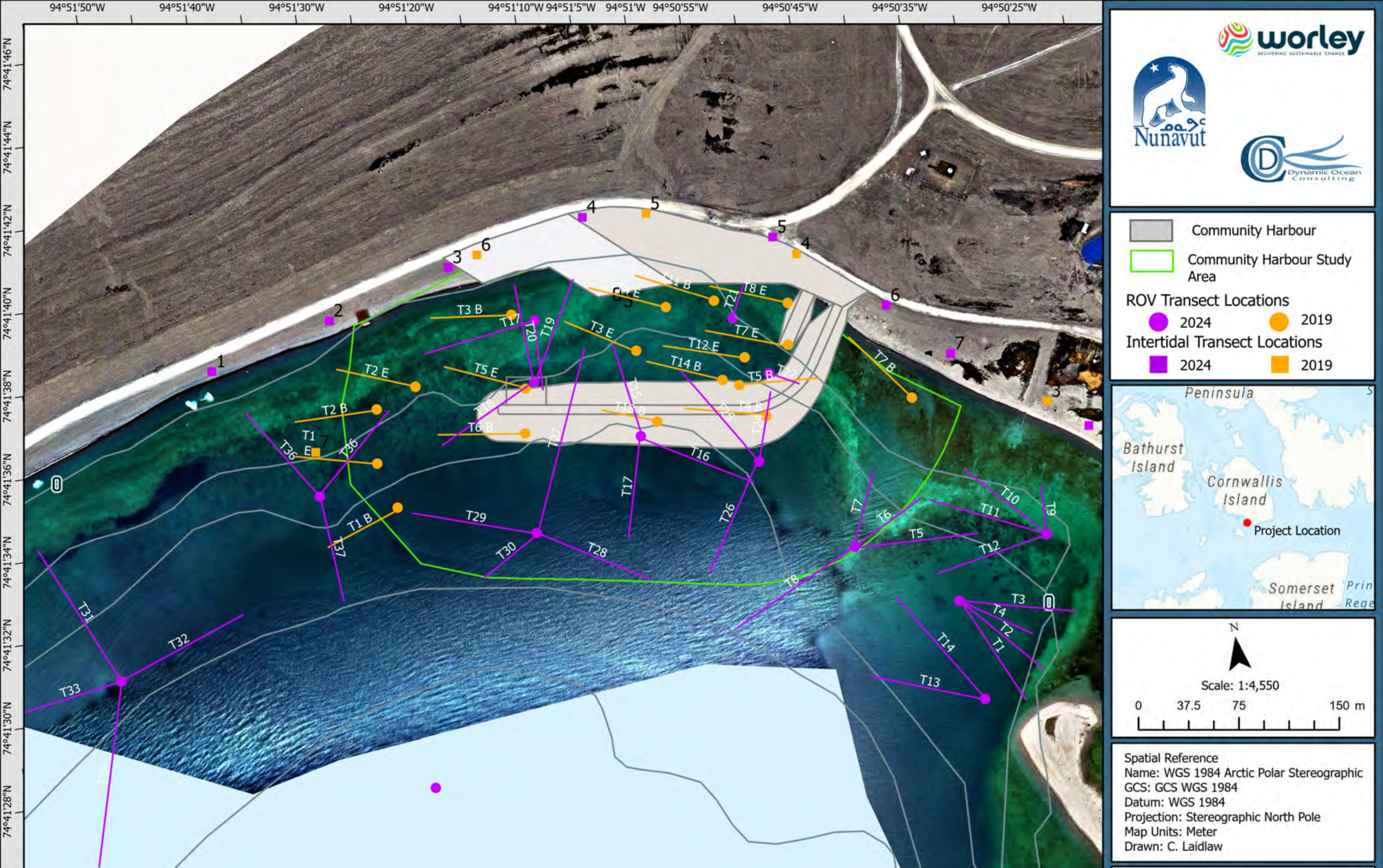


Figure 7-4

Community Harbour Study Area Fish Habitat (Intertidal & ROV (2019,2024))

7.1.3 Amphipod

The survey was performed as part of the intertidal survey at low tide, with searches under rocks in areas identified as 'ideal amphipod habitat'. Ideal amphipod habitat was considered areas that offered some form of multi-dimensional habitat consisting of either hard substrate (e.g. boulder, cobble) or rockweed. No amphipods were found throughout the intertidal. The full extent of the Community Harbour Study Area was assessed for the presence of amphipods on 28 August 2024, during the intertidal program. No amphipods were located in Resolute Bay and are not discussed further.

7.1.4 Plankton

7.1.4.1 Tow Methodology

During the 2024 field program, a plankton survey was carried out in the Community Harbour Study Area, where six sites were selected, and each was repeated twice (replicates) for a total of 12 tows. Information on tides at the time of the survey is provided in Table 7-4 and depicted in Figure 7-5, with tide and time information presented in Figure 7-6. Representative photos of a similar plankton field program are provided in Photo 7-1, as photographs on the date of the field program were not achievable due to weather conditions.

A 200 µm, 1 m wide, and 2 m long mesh net was used for the plankton survey. The boat travelled at approximately 1 knot to 1.5 knots in a straight line for a five-minute period. The net was deployed over the side of the boat, and the start of the tow was considered to be when the net drag was felt by the boat crew and the tow line became tight. The tow line was approximately eight m long, and a float was attached to the net ring with a two m line to confirm the net depth remained at two m from the water surface. GPS coordinates were taken at the start and stop of the tow, and a track (georeferenced using an iPad) was run during the tow to confirm the position during the tow. The tow duration was five minutes. Once the tow was terminated, the boat operator put the boat into neutral and slowly reversed as the net was pulled toward the boat. Once at the boat, the ring of the net was kept out of the water. One local assistant gently sprayed the outside part of the net with a pressurized water hose to rinse the plankton into the cod-end (bottom of the net). The second local assistant pulled the net into the boat as it was sprayed. The cod-end was then removed from the net and emptied into a 200 µm sieve. The cod-end was rinsed with water (from the outside). All of the plankton were concentrated into one end of the sieve with a water bottle (only spraying from underneath). A funnel was used to rinse the plankton into a 250 ml jar containing 95 % ethanol. Jars were filled to a maximum of 50 % plankton, and thus multiple jars were used as required.

Samples were packaged (lid sealed with electrical tape) and provided to the University of British Columbia (UBC) for analysis (visual and genetic identification, quantification of species composition and abundance, see Section 7.4.4). Two randomized tow samples were sub-sampled to estimate total abundance, and to visually identify species with light microscopy. The rest were sub-sampled for Deoxyribonucleic Acid (DNA) barcoding analysis (see Section 7.2.2).

Table 7-4: Plankton Tow Survey Times (29 August 2024)

Site No.	Replicate No.	Tow No.	Start		Time of Tow	Tide Height at time of Tow (m)
			Latitude (N)	Longitude (W)		
1	1	1	74° 41.228	94° 50.558	09:24	12.2
	2	7	74° 41.171	94° 50.508	12:53	14.6
2	1	4	74° 41.396	94° 50.884	10:31	10.1
	2	12	74° 41.385	94° 50.808	14:21	14.6
3	1	3	74° 41.478	94° 51.241	10:11	10.7
	2	9	74° 41.477	94° 51.285	13:36	15.9
4	1	2	74° 41.480	94° 51.761	09:52	16.8
	2	8	74° 41.283	94° 51.613	13:18	19.8
5	1	5	74° 41.151	94° 51.097	10:52	22.0
	2	11	74° 41.121	94° 50.897	14:06	22.6
6	1	6	74° 41.122	94° 51.862	11:11	25.6
	2	10	74° 41.114	94° 51.898	13:52	19.5

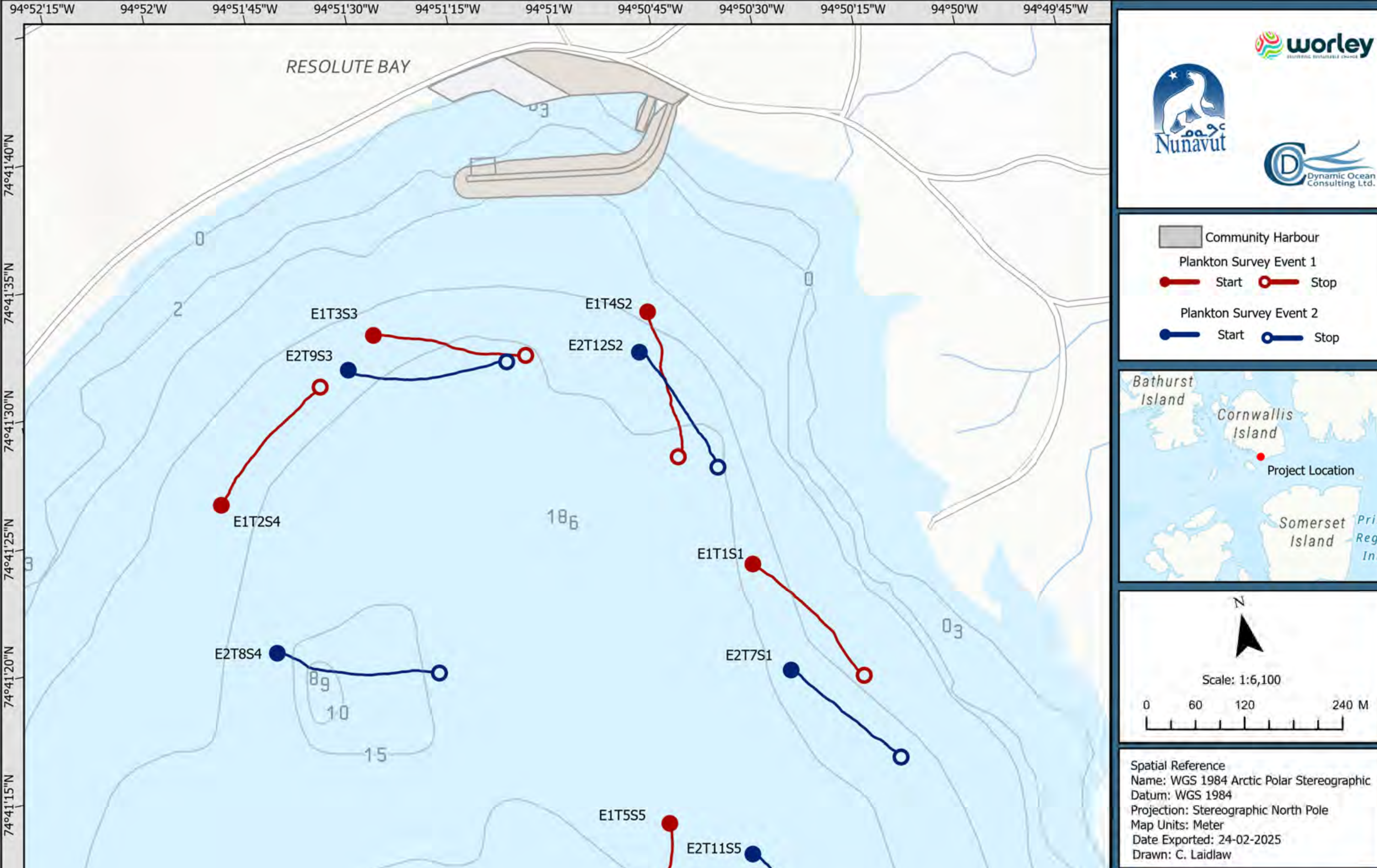


Figure 7-5

Plankton Tow Locations

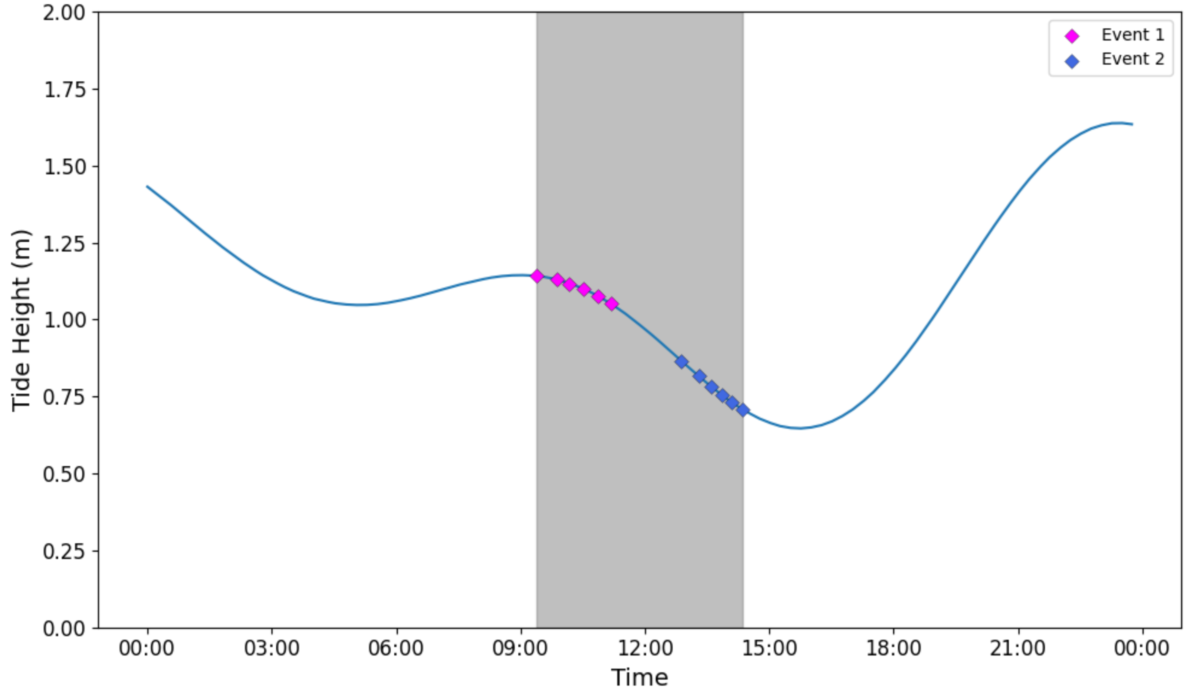


Figure 7-6: Plankton Tow Time and Tide Information on 29 August 2024

Source: Resolute Station (05560) - CHS (2024)
Note: Duration of plankton program represented by grey column, and squares represent the time of each tow with pink for Event 1 and blue Event 2

7.1.4.2 Physicochemical

Physicochemical analysis was undertaken in 2024 with a YSI Pro4 DSS probe and taken along side with plankton tow at each site. The YSI was lowered over the side of the vessel to document a vertical profile of the water column. The YSI was programmed to take a reading every half second, and recording was undertaken on the descent through the water column.

Photo 7-1: Representative Photo Panel from a Similar Plankton Tow Survey: a) Sample; b) Field Personnel Emptying Plankton Net; c) Sample Processing Close-up; d) Sample Processing

Source: Dynamic Ocean

7.1.5 Fresh Water Assessment

Potential freshwater 'interactions' were identified in advance of the field program with the use of Google Earth and KML's of the Project Study Area. An interaction is considered a freshwater course 'intersecting' a project component, such as one that would require culverts (or confirmation of functioning culverts) during use of the haul road, or the potential to require stream diversion for the community harbour.

During IQ and consultation, the potential for near by creeks and rivers to be fish-bearing watercourses was asked. During the field program, a qualitative assessment was undertaken on 28 August 2024, to assess freshwater habitat conditions at the 'target areas' identified. Photograph and GPS positions were documented. This assessment was further supported with a review of the Underhill drone data (described in Section 7.1.1.2). Freshwater sources (all non fish-bearing) in proximity to the Project components are summarized in Table 7-5 and depicted in Figure 7-11.

Table 7-5: Freshwater Sources in Proximity to Project Components

Water Source Name	Water Source Location (Foreshore)		Water Source Description	In Proximity to		Fish Bearing
	Latitude (N)	Longitude (W)		Project Component	Distance and Direction away	
Resolute River	74° 41.260	94° 50.101	Fed by Char Lake and Resolute Lake and drains into the westside of Resolute Bay.	Community Harbour	1.5 km south of the footprint	Yes
Culvert 1	74° 41.659	94° 50.996	Drainage path fed by surface runoffs upland and drains into the north side of the community harbour.	Community Harbour	Within the footprint	No
				Haul Road	Intersect north of community harbour	
Culvert 2	74° 41.541	94° 50.333	Drainage path fed by surface runoff and the slough adjacent to the community, drains into Resolute Bay northeast of the community harbour.	Community Harbour	0.3 km east of footprint	No
				Haul Road	Intersect east of community harbour	
Mecham River	74° 41.243	94° 50.191	Fed by small lakes northeast of the Project and drains into Resolute Bay southeast of the community harbour.	Community Harbour	0.8 km southeast of footprint	No
				Haul Road	Intersect southeast of the community harbour	
Creek 1 (unnamed)	74° 40.817	94° 48.160		Community Harbour	2 km southeast of footprint	No

Water Source Name	Water Source Location (Foreshore)		Water Source Description	In Proximity to		Fish Bearing
	Latitude (N)	Longitude (W)		Project Component	Distance and Direction away	
			Fed by small lakes east of the Project and drains into Resolute Bay southeast of the community harbour.	Haul Road	Intersect southeast of the community harbour	
				Quarry Northen Location	0.3 km southeast of the Quarry Location	

7.2 Laboratory and Office Methodology

7.2.1 Habitat Characterization

Substrate categories for both surveys were as defined by DFO (1990) (see Table 7-6). Marine plant observations were recorded as a percent areal cover (DFO, 1990, addition of 'infrequent' category specific to this program). Sessile and motile fauna observed abundance estimates are counts, percent cover, or relative estimates, depending on the organism being assessed. When using relative estimates, the categories defined in Table 7-7 are used. Habitat was categorized by the quality definitions defined in Table 7-8.

Table 7-6: Substrate Categories for the Marine Fish and Fish Habitat Field Assessment

Substrate	Definition	Size (mm)
Silt, clay, mud	Loose sedimentary deposit.	<0.0625
Sand	Loose granular material.	0.0625 - 2
Gravel	Loose fragments of rock.	2 - 64
Cobble	Loose stone larger than gravel, smaller than a boulder.	64 - 256
Boulder	Detached mass of rock.	>256
Bedrock	Solid rock underlying unconsolidated surface material.	
Shell hash	Shell fragments of various organisms.	

Source: DFO (1990)

Table 7-7: Categorizations of Marine Fauna when Enumerated with Estimates

Category	Definition	Quantified Area Estimate	
		Percent Cover (%)	Area (m^2) estimates
Abundant	Organisms distributed as the primary flora or fauna.	Distribution that covered an area >60 % of available suitable habitat.	20 to 50
Moderate	Organisms either clustered in groups or sporadic within the habitat zone.	Distribution covering 25 % to 50 % of available habitat.	10 to 20
Infrequent	Combination of moderate and trace, patchy and ephemeral in nature, occurring in more frequent clusters than trace.		

Category	Definition	Quantified Area Estimate	
		Percent Cover (%)	Area (m^2) estimates
Trace	Relatively small cluster of colonizing organisms.	(<10 % to 25 %) of assessed area.	5 to 10

Source: Adapted from percent cover estimates in DFO (1990)
Note: 'Infrequent' and area estimates are adapted by Dynamic Ocean based on Qualified Professional (QP) expertise

Table 7-8: Habitat Categories for Marine Seabed Classification

Category	Description
High	High value habitat that contributes to a critical life stage or function (e.g. feeding, nursery, reproductive, migratory route) of a marine species, or that are of high social or cultural significance. Additionally, loss of the habitat in question is limited or could result in decreased connectivity of a marine species or population.
Moderate	Habitat that may contribute to critical life stages or function of a marine species but is not limited.
Low	Habitat does not contribute to life stages and functions of marine species and is not limited. Habitat may be used for migratory purposes of marine species, but alternative migratory routes are available.

7.2.2 Species Identification and Morphometrics Methodology

Plankton species diversity and abundance were identified using a two-fold approach. Ten percent of the total volume of each preserved plankton tow sample was set aside for counting and microscopy. This allowed for estimating of the relative abundance of each plankton species per litre of seawater. Species identification through DNA metabarcoding was also performed. Samples were sent to the Canadian Centre for DNA Barcoding at the University of Guelph (UoG) in Ontario for sequencing of the cytochrome oxidase subunit 1 (CO1) gene, which is commonly used to identify animal species. Five sequencing primers targeted the CO1 gene in crustaceans, molluscs, annelids, and fish. Next-generation sequencing was conducted on a Torrent Ion S5 system. The combined higher taxonomic resolution from Barcode of Life Data (BOLD) and Silva databases was used to assign taxonomies.

7.3 Quality Assurance/Quality Control

7.3.1 Field

- Intertidal photographs and subtidal ROV footage (video, photographs) were recorded and backed up on field laptops and uploaded to company networks.
- The video feed was monitored throughout the survey to verify the camera was not obstructed and that the recording was of sufficient quality for later analysis.

7.3.2 Laboratory

The laboratory QA/QC measures for processing included procedures to reduce the risk of contamination, particularly in chemical reactions involved in the fatty acid and DNA metabarcoding analyses. The following QA/QC procedures were incorporated during laboratory processing to ensure the highest quality results:

- Prevention of cross-contamination by rinsing instruments with 95 % ethanol and wearing a new pair of nitrile gloves for each sample when handling samples and sampling equipment.
- Maintaining an organized work area by providing labels for each species.
- For drone survey post-processing, ground-truthing measurements were taken over the mapping flight mission area. The elevations for these measurements were compared to the generated 3D point cloud.

7.3.3 Plankton

The field QA/QC measures for the plankton survey included procedures to reduce the risk of cross-contamination. The following QA/QC procedures were incorporated during sampling to ensure the highest quality results:

- Using qualified environmental staff experienced in plankton sampling and field supervision of local assistants.
- Prevention of cross-contamination by washing down equipment and wearing a new pair of nitrile gloves for each sampling location when handling samples and sampling equipment.
- Storing samples in appropriately cleaned pre-treated and labelled sample containers.
- Maintaining a clean and organized work area.
- A regimented process for sample documentation was used, including:
    - Labelling all field sample containers and field data sheets with pencil/indelible ink and waterproof labels.
    - Backing up electronic data (i.e., positional data from GPS, photographs), in duplicate, at the end of each field day and labelling electronic files.
    - Keeping thorough notes, including photographs, GPS coordinates, tidal/weather conditions, and recording potential confounding factors observed during field days and at sites.

7.4 Results

Details from the fish habitat, freshwater, drone and plankton surveys and fish diet study are summarized as below:

- Intertidal Survey (Traditional)
    - Section 7.4.1, Appendix A (Table A-4, Table A-5) and Appendix B (Photo B-1, Photo B-2).

- Representative photo panel of the intertidal transects in the Community Harbour Study Area is provided in Photo 7-2 and Photo 7-3.

- Intertidal Survey (Drone)
  - Section 7.4.2
  - Orthomosaic drone imagery of the Community Harbour Study Area is provided in (Figure 7-8).

- Subtidal Survey
  - Section 7.4.3, Appendix A (Table A-6, Table A-7) and Appendix B (Photo B-3, Photo B-4).
  - A representative photo panel of the subtidal transects in the Community Harbour Study Area is provided in Photo 7-4 and Photo 7-5.

- Plankton
  - Section 7.4.4.
  - Representative photo panel of the plank species observed in the Community Harbour Study Area is provided in Photo 7-6.

- Freshwater
  - Section 7.4.5.

7.4.1 Intertidal (Transect, Traditional)

The tidal exchange on the date of the survey was 0.8 m in 2024 and 1.4 m in 2019 (see Table 1-4), where Resolute Bay can experience a maximum tide of 2.3 m (see Section 4.7, Table 4-2).

7.4.1.1 Transect Surveys – 2024

The exposed tidal area ranged from 5.5 m to 9.4 m in length (see Table 7-1), where just a single habitat band was observed. Substrate characteristics were homogenous consisting primarily of gravel and cobble with interspersed sand (see Figure 7-7, Panel a). Tide data on the day of the intertidal survey is represented in Figure 7-1, Panel a. There were no observations of marine vegetation, invertebrates, or fish.

7.4.1.2 Transect Survey – 2019

The exposed tidal area ranged from 7.5 m to 25 m in length (see Table 7-1), where just a single habitat band was observed. Substrate characteristics were homogenous consisting primarily of gravel and cobble with interspersed sand (see Figure 7-7, Panel b). Tide data on the day of the intertidal survey is represented in Figure 7-1, Panel b. There were no observations of marine vegetation, invertebrates, or fish.

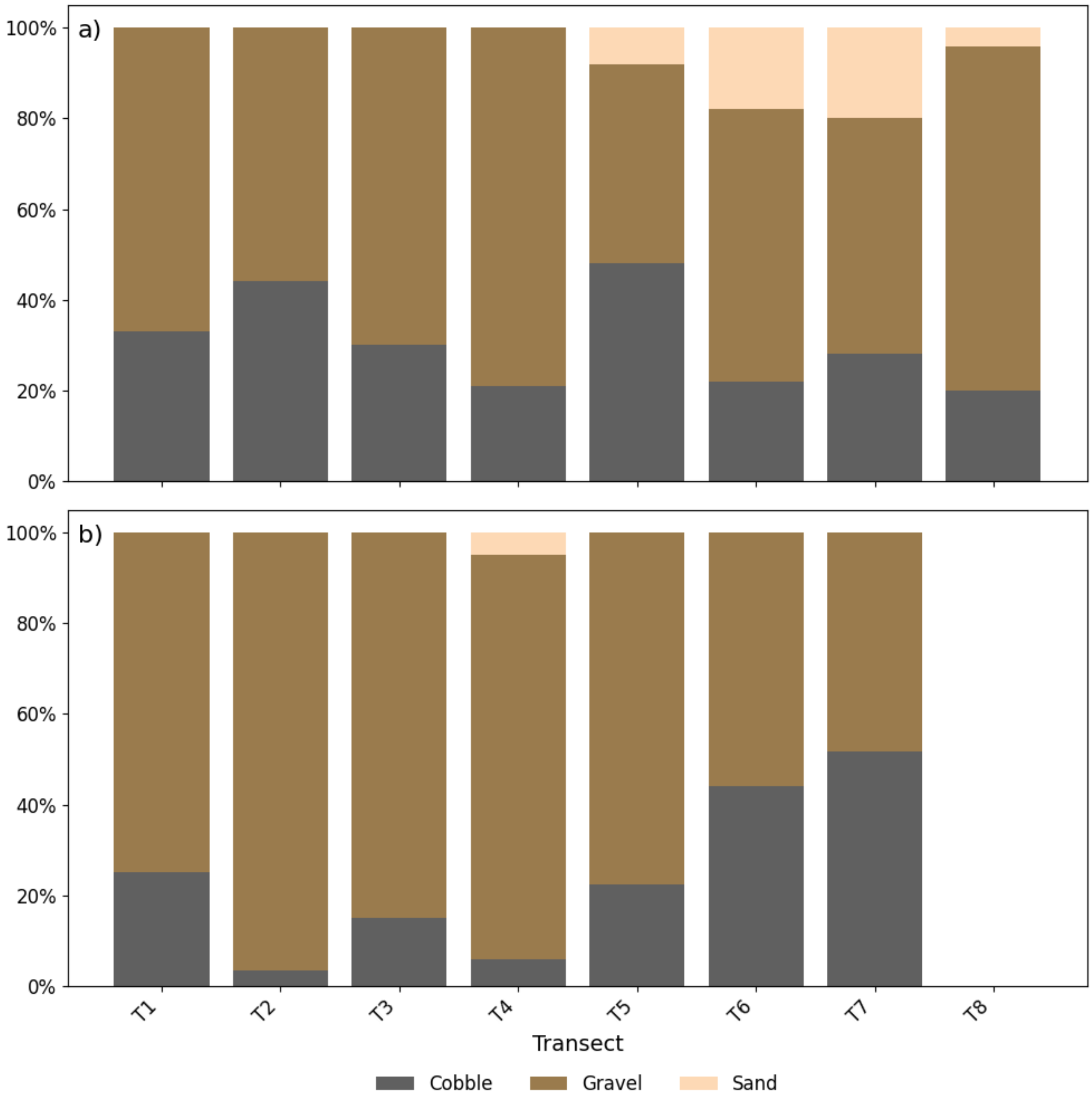


Figure 7-7: Substrate distribution of the Intertidal Survey Area from West to East: a) 2024; b) 2019

Note: See Figure 7-4 for transect location

Photo 7-2: Resolute Bay Intertidal Foreshore Transect Photo Panels (2024): a) Transect 1; b) Transect 3; c) Transect 6; d) Transect 8

Photo 7-3: Resolute Bay Intertidal Foreshore Transect Photo Panels (2019): a) Transect 1; b) Transect 3; c) Transect 4; d) Transect 7

7.4.2 Intertidal (Drone)

Based on drone imagery (Figure 7-8), the substrate within the Community Harbour Study Area intertidal zone was observed to be relatively uniform, primarily consisting of cobble or gravel, similar to observations from the intertidal survey. The substrate transitioned to be finer, such as sand, closer to LWM. Substrates are observable from drone imagery east of the breakwater, close to Transects 6, 7, and 8 from the intertidal survey.

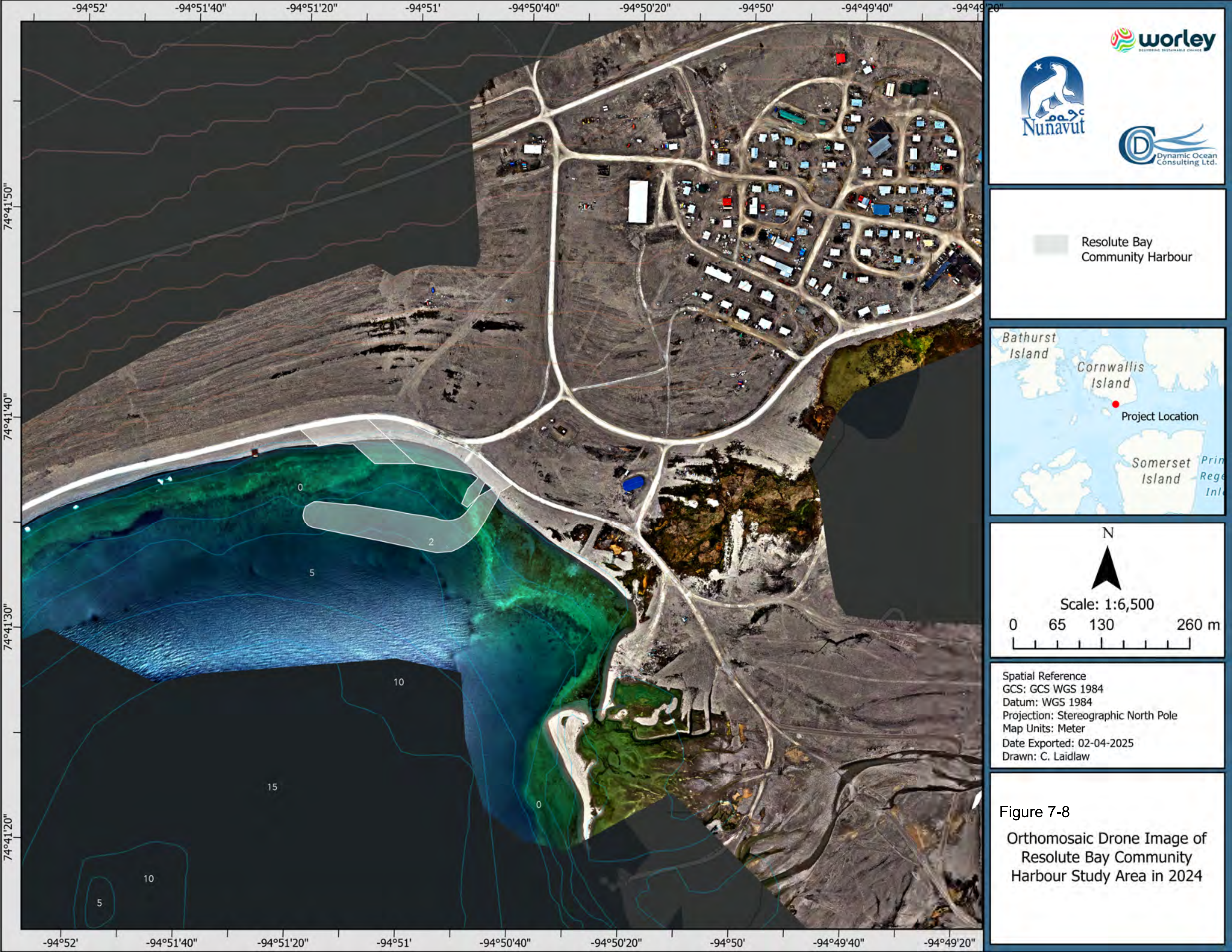


Figure 7-8

Orthomosaic Drone Image of Resolute Bay Community Harbour Study Area in 2024

7.4.3 Subtidal

Subtidal 2024 ROV survey data is provided in Appendix A (Table A-6); Appendix B (Photo B-3). 2019 ROV survey data is provided in Appendix A (Table A-6); Appendix B (Photo B-4). Demonstrative photo panels of the subtidal areas are provided in Photo 7-4 and Photo 7-5.

7.4.3.1 Remotely Operated Vehicle Transects – 2024

The substrate distribution is similar between community harbour and reference sites, with sand being the predominant substrate observed further from shore, and a higher cobble and boulders presence observed closer to shore (Transects 5-7, 17B, 18-20, 22, 31, 35, 36, see Figure 7-9). Shell hash was also occasionally observed in trace amounts. Vegetation species diversity did not vary based on substrate type. Kelp was the prominent vegetations observed, with sugar kelp (*Saccharina latissima*) being the most common species, which was presented on 33 transects in trace to abundant density. Winged kelp (*Alaria sp.*) was observed in trace density on Transect 33 and some unidentifiable kelps were observed in trace to infrequent density on five transects. Although there were six species of vegetation only observed in the proposed community harbour site, most of those species were presence in trace density and on only one transect. The only exceptions were dulse (*Palmaria sp.*) and an unidentified algae mat, which were present in trace density on four transects and exhibited moderate coverage on Transect 34 respectively. Additional vegetation observed included:

- Brown filamentous algae (present in infrequent to abundance density on 33 transects).
- Rockweed (*Fucus sp.*, present in trace to moderate density on 14 transects).
- Green filamentous algae (present in trace to moderate density on eight transects).
- Unidentified green algae (present in trace density on six transects).
- Bladed red algae (present in trace density on Transect 15).
- Encrusting coralline algae (present in trace density on Transect 17A).
- Sea lettuce (*Ulva sp.*, present in trace density on one Transect 19).
- Unidentified red algae (present in trace density on Transect 35).

Marine invertebrate species diversity generally differed with substrate types, with a higher presence of benthic species on sand-predominant substrates. Most species were present in trace to infrequent density, except for truncated soft-shell clam (*Mya truncata*), hydroid, brittle star, pelagic tunicate (*Oikopleura labradoriensis*), and tube-dwelling anemone (*Pachycerianthus borealis*), which present in moderate to abundant density on at least one transect. The predominant marine invertebrate species were truncated soft-shell clam, presenting in trace to abundant density in seven out of 14 transects at the reference site, and in trace to moderate density in 12 out of 26 transects within the community harbour. Additional marine invertebrates observed included:

- Comb jelly (present in trace density on 14 transects).
- Sea angel (*Clione limacine*, present in trace abundance on six transects).
- Helicid pteropod (*Limacina helicina*, present in trace density on six transects).

- Jelly (*Aglantha digitale*, present in trace density on four transects).
- Unidentified jelly (present in trace density on three transects).
- Rugose anemone (*Hormathia sp.*, present in trace density on Transect 33).
- Feather duster worms (*Chone sp.*, present in infrequent density on Transect 34).
- Hydromedusa jelly (present in trace density on Transect 36).
- Unidentified clam species (present in moderate density on Transect 38)
- Tube worm (*Echone papillosa*, present in infrequent density on Transect 39).

Several species of fish were present on four transects, including Arctic cod (*Boreogadus saida*), sculpin, and an unidentifiable fish species. A school of approximately 300 Arctic cod was observed on Transect 19, along with one deceased individual observed on Transect 21, within the community harbour.

7.4.3.2 Remotely Operated Vehicle Transects – 2019

The substrate distribution was similar between community harbour and reference sites, with soft substrates (silt and sand) predominantly observed, scattered with moderate density of gravel, and infrequent density of cobble and boulders. Hard substrate (cobbles and boulders) was presented in clusters, typically associated with marine vegetation. An unidentified filamentous green algae or diatoms were observed throughout the site. The most abundant marine vegetation was filamentous brown algae (possibly *Chordaria sp.*), which was observed in 29 transects in trace to abundant density. Additional vegetation observed included:

- Sugar kelp (*Saccharina latissimi*, present in moderate to abundant density on 26 transects).
- Rockweed (*Fucus sp.*, present in moderate density on 13 transects).

Most invertebrate species in the Community Harbour Study Area were present in trace to infrequent density, except for truncated soft-shell clam (*Mya truncata*). Truncate soft-shell clam, presented in trace to abundant density in two out of 12 transects at the reference site, and in trace to moderate density in three out of 15 transects within the community harbour. marine invertebrates observed included:

- Brittle stars (*Ophiocten* or *Ophiura sp.*, present in trace density on three transects).
- Tube worms (*Echone papillosa*, presented in trace density on one transect).

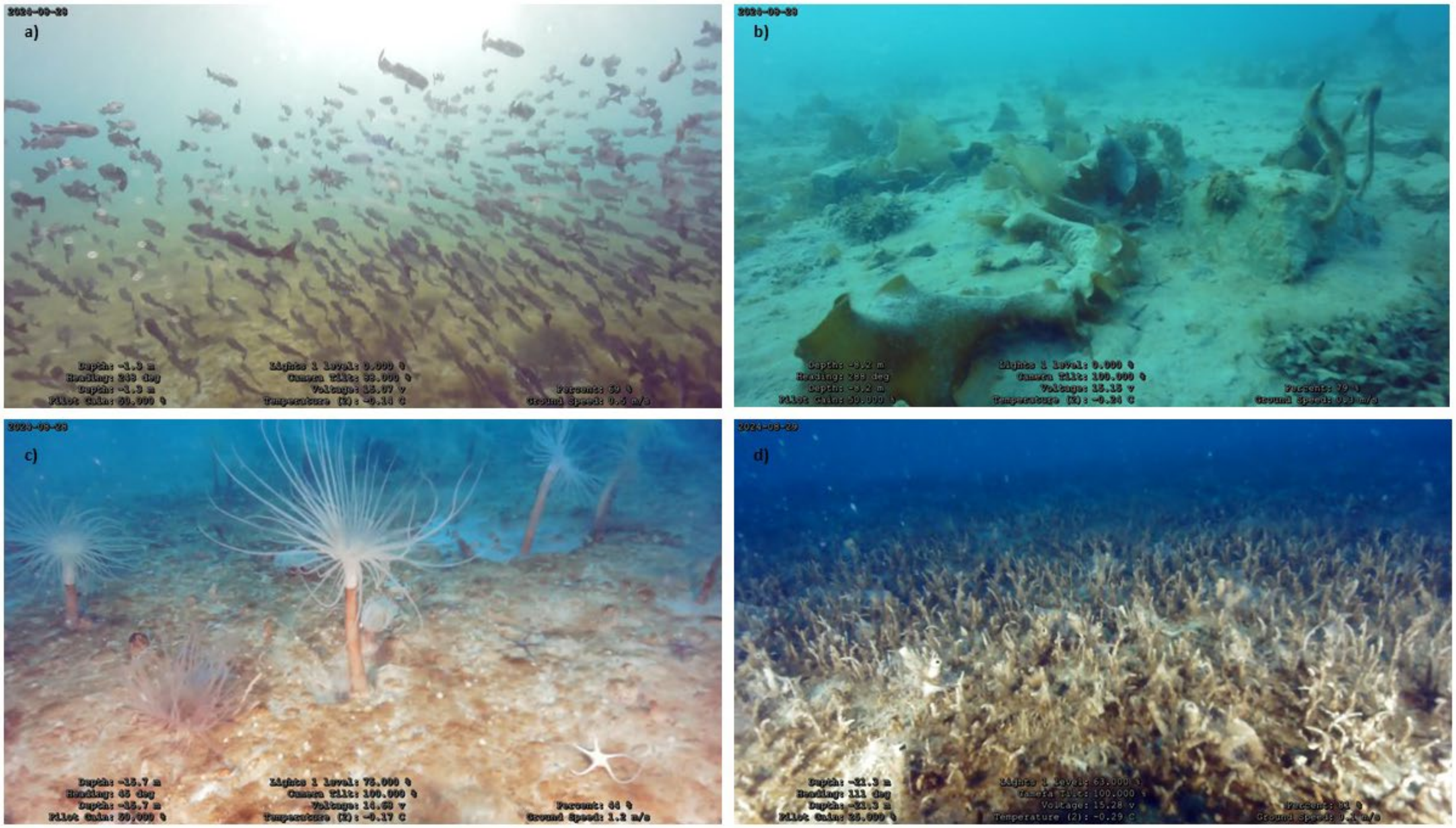
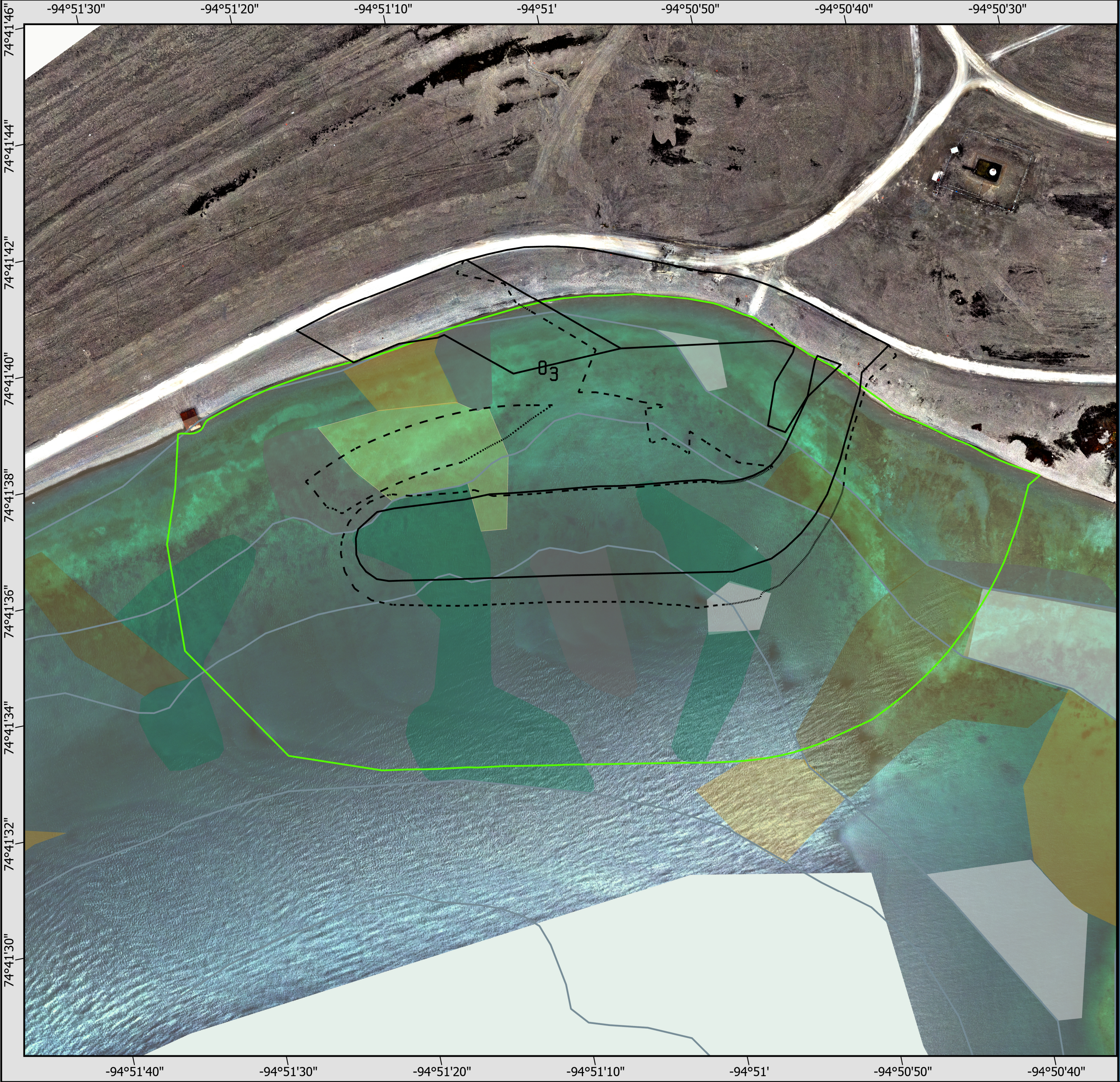


Photo 7-4: Representative Photo Panel of the Subtidal Community Harbour Study Area (2024): a) Transect 19, School of Arctic Cod (*Boreogadus saida*); b) Transect 18, Sugar Kelp (*Saccharina latissima*) and Rockweed (*Fucus sp.*); c) Transect 34, Tube-dwelling Anemone (*Pachycerianthus borealis*) and Brittle Stars; d) Transect 38, Hydroid and Clams

Photo 7-5: Representative Photo Panel of the Subtidal Community Harbour Study Area (2019): a) Transect 1, Sugar Kelp; b) Transect 6, Filamentous Brown Algae; c) Transect 8, Sugar Kelp; d) Transect 11, Rockweed



N

Scale: 1:5,000

0 25 50 100 m

Spatial Reference
Name: WGS 1984 Arctic Polar Stereographic
Datum: WGS 1984
Projection: Stereographic North Pole
Map Units: Meter
Date Exported: 27-02-2025
Drawn: C. Laidlaw

Figure 7-9

Resolute Bay Community Harbour Habitat Map

7.4.4 Plankton

7.4.4.1 Species ID (2024)

Throughout the 12 plankton tows, a total of 26 distinct taxonomic groups of plankton were identified using light microscopy (Photo 7-6). Identified species spanned across 10 phyla, including *Chromista, Cnidaria, Ctenophora, Polychaeta, Crustacea, Insecta, Gastropoda, Chaetognatha, Echinodermata and Tunicata*). Identified species included comb jellyfish, marine worms, free-swimming tunicates, along with multiple life stages of copepods, barnacles and jellyfish. Plankton observation and corresponding abundance are summarized Table 7-9.

Table 7-9: Summary of Plankton Relative Abundance and Broad Taxonomic Richness from Twelve Representative Tow Samples as Determined with Light Microscopy

Order	Taxon	Common name	Average Abundance per ml (n=12)
Chromista	*Arthroconidia*	Marine Protozoan	15.1
Cnidaria	*Aglantha digitale*	Hydrozoan	0.1*
	Aegina sp.	Jellyfish	0**
	Cnidaria (polyp)	Jellyfish (polyp stage)	3.2*
	Cnidaria A	Jellyfish	0*
Ctenophora	*Beroe cucumis*	Comb Jellyfish	4.7*
Polychaeta	*Autolytinae*		0*
	Spionidae		0.1*
	Polychaeta (larva)	Bristle worm	0*
Crustacea	*Philomedes sp.*		0*
	Calanoida	Calanoid Copepods	625.7
	Calanoida (Copepodite)	Calanoid Copepods (Juveniles)	294.3
	Calanoida (nauplii)	Calanoid Copepods (Nauplii)	1.4*
	Cyclopodia	Cyclopoid Copepods	0**
	Cirripedia (cyprid)	Barnacle	0.7*
	Cirripedia (nauplii)	Barnacle Nauplii	2.2*
	Apherusa sp.		0*
	Hyperia galba		0**
	Decapoda (zoea)		0**
	Crustacea A		0**
Insecta	*Diptera*		0**
Gastropoda	*Clione limacina*	Common clione	0**
	Limacina helicina	Swimming sea snail	0.6*

Order	Taxon	Common name	Average Abundance per ml (n=12)
Chaetognatha	*Chaetognatha*	Marine worm	1.6*
Echinodermata	*Ophiuroidea (larva)*	Brittle star (larva)	7.5
Tunicata	*Appendicularia*	Tunicates	201.9

Note:
* The average was obtained by dividing 50 to the number counted in 50mL subsample, due to their larger size. At least two individuals were counted in each 50mL sample
** The average across all twelve samples were zero for these species since only one individual was found in full 50mL. Notably *Beroe cucumi*s and *Chaetognatha* are physically larger species and therefore all were counted but are likely underestimated in subsampling

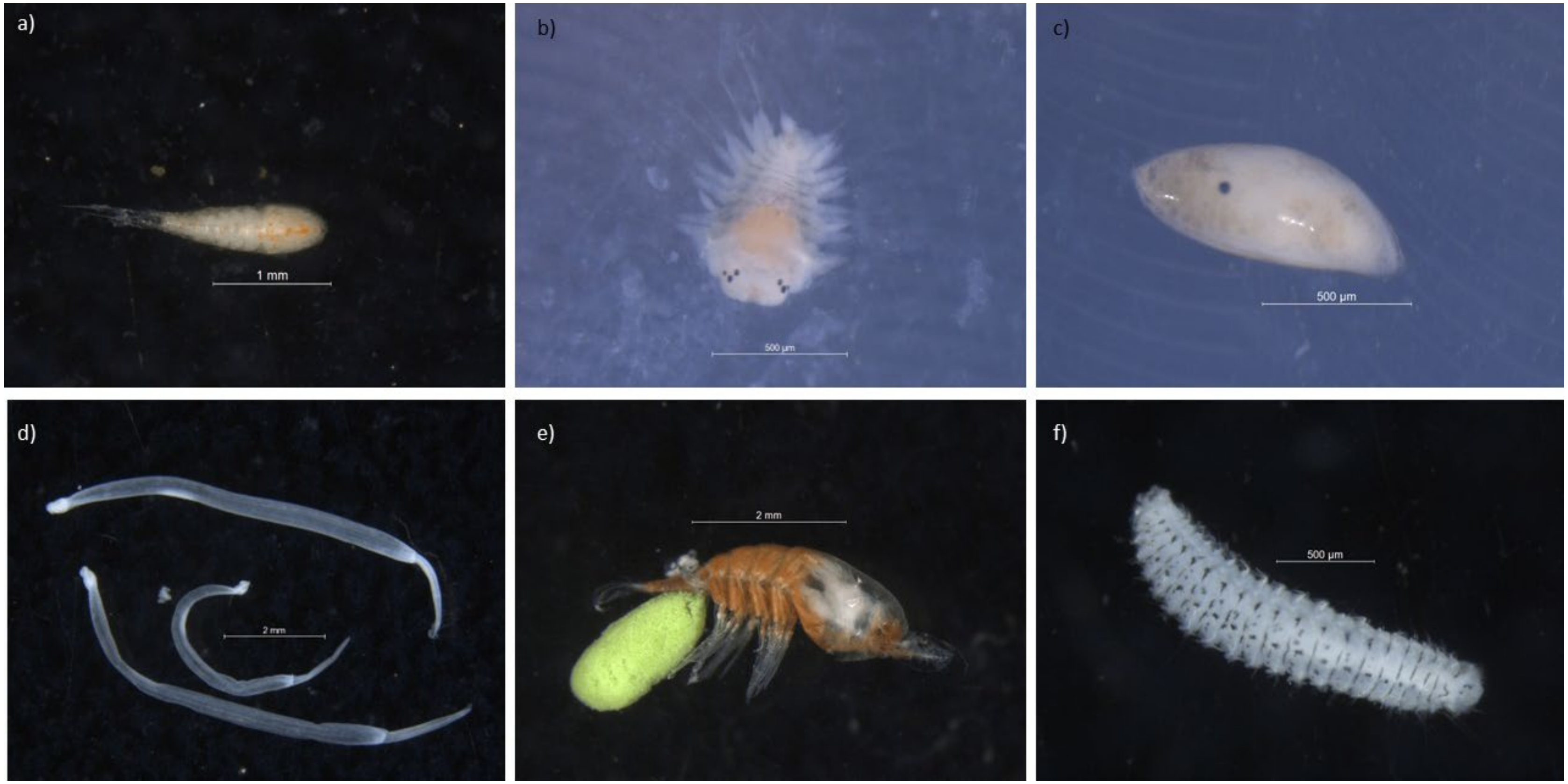


Photo 7-6: Light Microscopy Photos of Representative Individuals from Resolute Bay Plankton Tow: a) *Cyclopoida;* b) *Polychaeta;* c) *Cirripedia;* d) *Chaetognatha;* e) *Crustacea;* f) *Spionidae*

Source: UBC, 2024

7.4.4.2 Physico Chemical Water Quality

YSI vertical profile measurements were collected at each plankton tow survey sites across two events. 12 in-situ depth profiles were collected, with depths ranging from 8.2 m to 25.6 m, CD. Water temperature, pH, specific conductivity, and turbidity were recorded at each depth profile. Results are provided in Figure 7-10 and summarized below:

- Water temperature ranged from -0.80°C to 0.47°C, with higher temperatures generally occurring at the surface. Temperature remained relatively consistent with increasing depth.
- pH is slightly basic, ranging from 7.91 to 8.33, and was generally stable along the depth profile, with sharp clines generally occur at near-surface.
- Specific conductance ranged from 48,786 µS/cm to 50,567 µS/cm, with higher conductivity occurring in near-bottom than at the surface. Most locations showed gradual increase in conductivity throughout the measurement depth.
- Turbidity ranged from 0.37 NTU to 15 NTU, with turbidity at most sites not exceeding 1 NTU. Turbidity tended to be high on the surface, then rapidly declined between 0 m and 5 m.

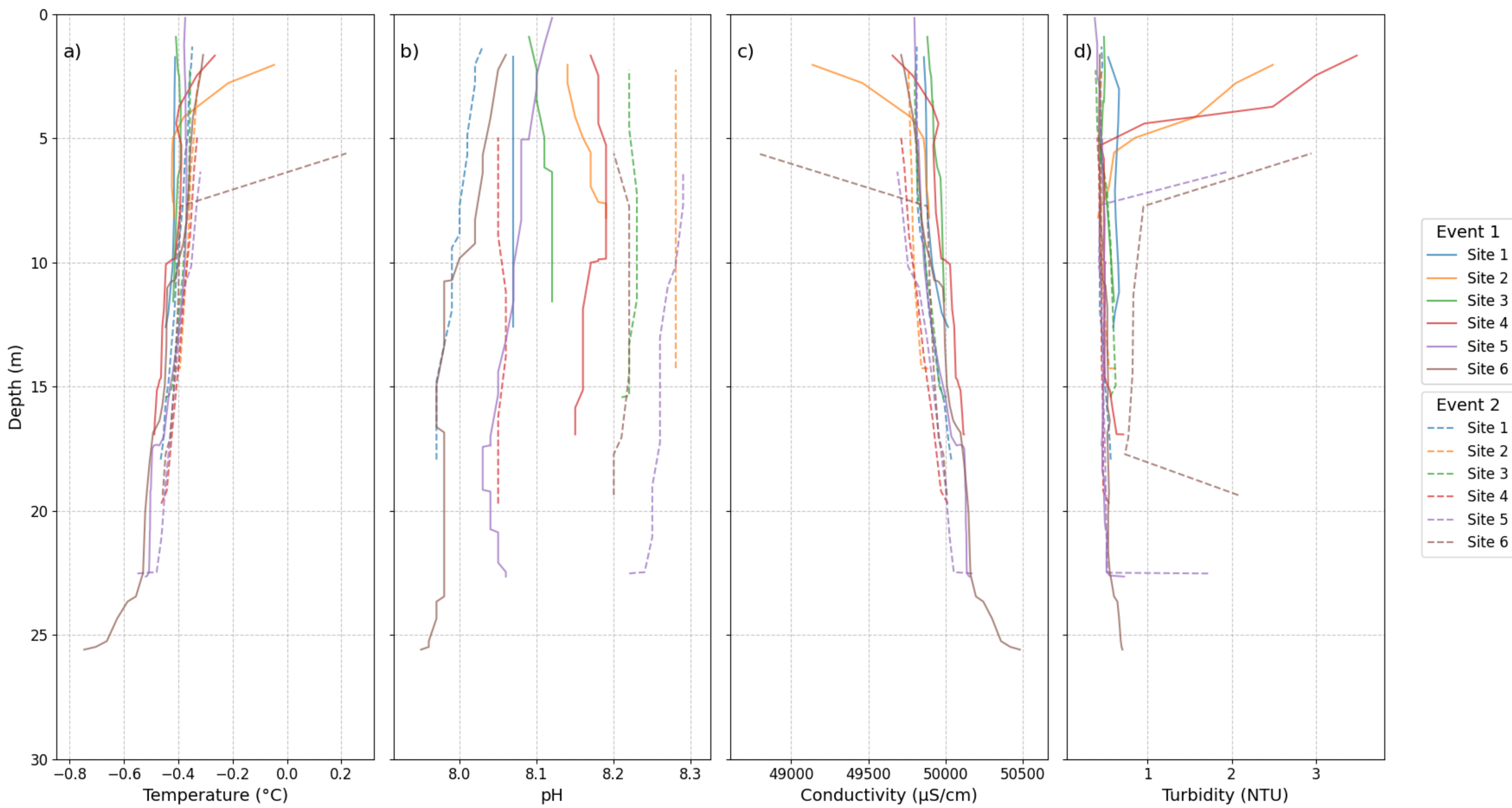


Figure 7-10: YSI In-Situ Depth Profiles: a) Temperature; b) pH; c) Specific Conductivity; d) Turbidity

7.4.5 Freshwater Assessment

In proximity of the community harbour, there are two lakes (Char Lake and Resolute Lake; see Figure 7-11) and three waterways (Creek No. 1 (unnamed), Mecham River and Resolute River; see Figure 1-1). Two waterway crossings, Creek No. 1 and Mecham River, intersect the haul road, and are non-fish bearing. Resolute River is on the opposite side of Resolute Bay to the community harbour and is fish bearing with potential for anadromous Arctic char (described in Section 4.4).

- Creek No. 1 (unnamed), located approximately 2 km southeast of the community harbour, and 0.3 km north of the northern quarry. An existing damaged set of culverts are present at the existing haul road crossing.
- Mecham River, located 0.8 km southeast of the community harbour footprint. There are no culverts present at the river near the existing haul road alignment; locals currently drive through the shallow river (see Photo 7-7, Panel b).
- Resolute River, located about 1.5 km northwest of the community harbour on the western shore of Resolute Bay, and is fed mainly by Resolute Lake and Char Lake (see Figure 2-1 for lake locations).
- Two drainage paths with culvert crossings are located in proximity to the community harbour (Culvert Nos. 1 and 2, see Figure 7-11 for culvert locations).
    - Culvert No. 1: on the foreshore of the community harbour. This culvert is damaged and discharges run-off from the adjacent slope (see Photo 7-7, Panel c).
    - Culvert No. 2: approximately 0.3 km east of the community harbour (see Figure 7-11).

See Table 7-10 for a summary of all freshwater crossing location along the haul road.

Table 7-10: Freshwater Crossing Location Impacted by Project Component

Watercourse	Crossing Location		Project Component in Proximity to	Existing Crossing Mechanism
	Latitude (N)	Longitude (W)		
Mecham River	74° 41.405	94° 49.684	Haul Road	Drive over river during low water
	74° 41.381	94° 49.550		
Unnamed Creek	74° 40.954	94° 47.761	Haul Road	Culvert (damaged)
Culvert 1	74° 41.674	94° 50.980	Haul Road, Community Harbour	Culvert (damaged)
Culvert 2	74° 41.581	94° 50.287	Haul Road, Community Harbour	Culvert

Photo 7-7: Demonstrative Photo Panels of Freshwater Crossings at the Haul Road: a) Unnamed Creek; b) Mecham River; c) Culvert 1

Source: Panel a: Dynamic Ocean, 2024; Panel b: Advisian, 2019; Panel c: Worley Consulting, 2024

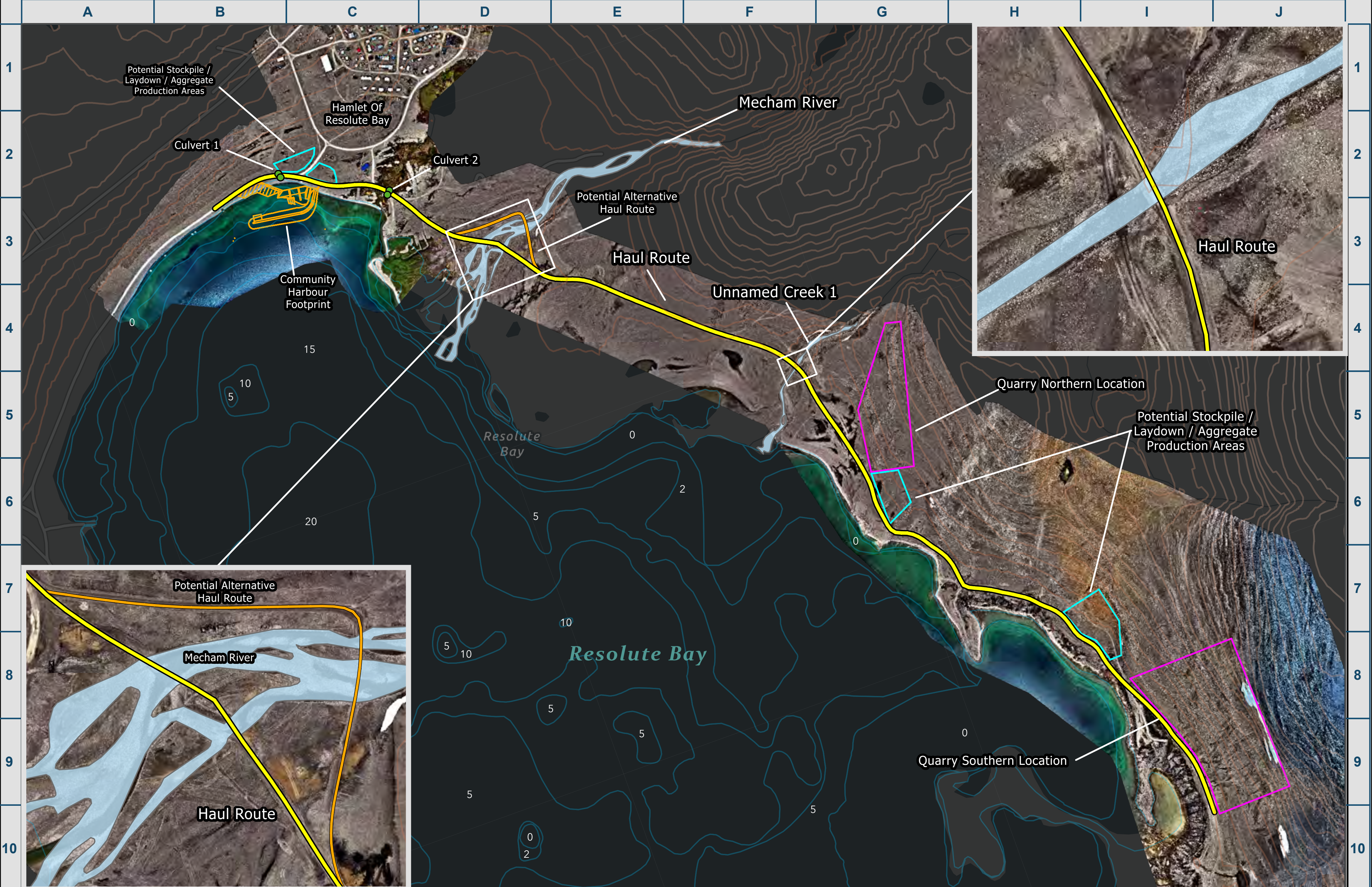


Figure 7-11

Water Courses In Proximity to Project Study Areas

N

Scale: 1:18,454

0 187.5 375 750 M

Spatial Reference
PCS: NAD 1983 CSRS UTM Zone 15N
Datum: North American 1983 CSRS
Projection: Transverse Mercator
Map Units: Meter

Date Saved: 2025-03-03 09:16

Drawn: C. Knight

Dynamic Ocean Consulting Ltd.

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7.5 Discussion

Marine and coastal habitat characteristics were comparable between the community harbour and the reference sites during the 2019 and 2024 surveys. Substrates within the Community Harbour Study Area were similar in both the intertidal and subtidal areas, which were predominantly gravel (intertidal) or sand/ silt (subtidal) with patchy areas of cobble and boulders scattered throughout.

Habitat quality within the community harbour was considered low quality in the intertidal and moderate quality in the subtidal areas. There were minimal observations of marine vegetation and no observations of marine invertebrates in the intertidal zone within the community harbour. The intertidal area smelled of sulphur and sewage and is likely heavily impacted by the wastewater outfall to the south. Habitat biomass and biodiversity was similar between the community harbour and the reference sites for 2019 and 2024. However, visual observation of the marine vegetation within the community harbour was noticeably less healthy than the surrounding reference sites. With consideration of the potential impact on contamination from the wastewater fallout, the habitat quality of the community harbour might be reclassified as low quality. Concerns for harvesting bottom dwelling invertebrates was also raised by (IQ Workshop 2019 - Peter Amarualik); however, the statement was in reference to all of Resolute Bay.

Fish observation was minimal in both years of surveys. The only significant fish observation was the school of Arctic cod observed in Transect 19 in 2024, which was observed at the end of transect close to shore. Copepods, which are a major prey for Arctic cod (Matley *et al.*, 2013), were the most frequently collected plankton during the 2024 plankton tow. Given the minimal tidal range (<3 m) in Resolute Bay, Arctic char and other marine fish may not use the intertidal area extensively. However, sea run Arctic char access rivers along the west shore of Allen Bay, located west of Resolute Bay, to migrate to lakes (IQ Workshop 2019 - Peter Amarualik). Further studies on the diets of Arctic char in the surrounding areas may offer deeper insights into the benthic invertebrates present in the region.

7.5.1 Intertidal/Subtidal

Habitat exposure during intertidal surveys ranged from 6.0 m to 9.6 m. Marine vegetation biodiversity was low in the intertidal areas, with no observation of vegetations at the 2024 survey, while only two species (rockweed, green algae) were observed in 2019, with a minimal coverage of rockweed. Similarly, invertebrate biodiversity and biomass was low, with no marine invertebrates observed during both 2019 and 2024 surveys. Intertidal habitat characterization as low quality was supported by the drone imagery taken during the survey periods (see Figure 7-8).

The depth range of the area observed during the subtidal Community Harbour Study Area field survey ranged from 2.5 m to 20.6 m CD, with a tidal range of 1.11 m (see Section 4.7). Species diversity across transects was generally low, with a maximum species richness of ten (observed on Transect 34 in the 2024 study). Marine vegetation compositions were similar in 2019 and 2024, with sugar kelp and brown filamentous algae being the predominant species, exhibiting moderate to abundant density on most transects. Similar to the 2019 survey, most vegetation in the 2024 study were observed to be heavily laden with sediment, indicating poor health. The high abundance of fast-growing species such as brown filamentous algae and algae mats could be an indicator for excess nutrient input (Probyn & Chapman, 1983) potentially caused by wastewater contamination. Marine vegetation observed at reference sites were grown in larger patches and did not have the same degree of siltation, indicating healthier habitat.

Results from the ROV surveys might not precisely reflect the habitat condition since it is not known how mobile species may react to the presence of the ROV, and some mobile species may take shelter behind rocks or under seaweed, avoiding detection. Most invertebrate species diversity occur in transects with higher depth and further offshore, including Transects 32, 34, 38, 39 in the 2024 study, which have depths greater than 14 m CD. The most observed species during both 2019 and 2024 field programs was the truncated soft-shell clam. Transect presence was 20 % in 2019 and 45 % in 2024 within the community harbour. Truncated soft-shell clam observations were similar between the community harbour and the reference sites. Clams were usually observed burrowed in soft sediments, with only the siphons exposed to the surface. Clams are known to be in Resolute Bay but are not harvested due to contamination concerns from the wastewater outfall. While clams were identified as the truncated soft-shell clam during the field program, the area is known to have other clam species. "*There are three kinds of clams in here*" (IQ Workshop 2019 - Peter Amarualik); therefore, undocumented species may be present. Other benthic invertebrates observed included brittle stars, anemones, tube worms, sea cucumbers and hydroid.

7.5.2 Plankton

Microscopy and DNA barcoding analysis of plankton tow samples detected at least 26 distinct zooplankton taxonomic groups in the water column near the community harbour, including protozoan, hydrozoan, jellyfish, copepods, barnacle, sea snails, marine worms, larval brittle stars, and tunicates. Copepod (in various life stages) were the most commonly observed plankton in Resolute Bay, followed by tunicate (*Appendicularia*), both taxa exhibited >100 individual observed per millilitre of sample.

Physicochemical parameters and trends in Resolute Bay were generally consistent across sampling locations, except for pH which showed variability at all sampling locations. Event 1 Site 2 and Event 1 Site 4 showed signs of stratification, with a gradual decrease in temperature and turbidity, and a gradual increase in specific conductivity, from 0 m to 5 m. After a depth of 5 m, both temperature and turbidity, and specific conductivity displayed sudden decreases and increases, respectively. Other sites also demonstrated the sudden increase in specific conductivity; however, the slower increase in shallower depths was not uniform across all sites.

7.5.3 Freshwater Assessment

Four freshwater courses were identified within the Project Study Area. All four of these watercourses intersect with the haul road and are considered non-fish bearing. Mecham River and Unnamed Creek 1 are fed by numerous small lakes, while Culvert Nos. 1 and 2 are drainage from upland areas. Mecham River is the only of these four watercourses without an existing culvert. Locals of the community cross Mecham River by driving through it during low flow. All haul road intersections with existing culverts will remain as mechanisms for freshwater crossing. As for Mecham River, potential ways of freshwater crossing include driving through during low flow, installing culverts, or constructing a bridge.

8 Terrestrial Vegetation

Program objectives for terrestrial vegetation are provided in Section 1.5 (Table 1-1). Vegetation studies focused on the terrestrial environment, within the HRQ Study Area (Figure 8-1).

8.1 Desktop Review

To support the assessment of the existing conditions of vegetation, a desktop review of existing literature and public databases was conducted to determine vegetation species with historical occurrences, or the potential to occur within the HRQ Study Area. Desktop information and IQ (see Section 2.3 for methodology details) was used to inform the field program, identify data deficiencies, and focus the information required to complete a baseline study of plant species and communities and SAR. For pre-mapping, aerial imagery was reviewed to identify and delineate potential distinct vegetation communities to be confirmed in the field. Prior to field programs, the SAR Public Registry (Government of Canada, 2024f) was searched for rare vascular and non-vascular plants with geographic ranges that encompass the HRQ Study Area. Available research on species distributions and habitats was evaluated to determine the likelihood of occurrence (see Table 3-2).

Most of Nunavut is located within the Tundra Biome and the Northern Arctic Ecozone (Ecological Stratification Working Group) (ESWG, 1995). This Ecozone incorporates the coldest and driest landscapes in Canada. In addition to the harsh climate, the high winds and shallow soils result in sparse and dwarfed plant life. Herb and lichen communities are the dominant vegetative cover. Lichen communities are associated with rock fields and hilly upland areas. Vegetation cover is greater on wetter sites, sheltered valleys and moist corridors along streams and rivers that typically are more nutrient rich. Specifically, the Project is located within Ecoregion 12 – Parry Islands Plateau, which incorporates southern Melville, Bathurst, and Cornwallis Islands. The High Arctic ecoclimate supports only a very sparse and discontinuous vegetative cover of moss and mixed low-growing herbs and shrubs. Permafrost is deep and continuous throughout the Ecoregion which is inhibitive to deep-rooted vegetation. The terrain is strongly ridged which are composed of gently curving folds of Palaeozoic carbonates, shales, and sandstones. The ridges are broad, flat-topped, and straight-sided. Typical species include purple mountain saxifrage (*Saxifraga oppositifolia* L.), avens (*Dryas* spp.), arctic willow (*Salix arctica* Pall.), bog sedges (*Kobresia* spp.), sedges (*Carex* spp.), and arctic poppy (*Papaver* spp.). Other species that may be present in the Northern Arctic Ecozone in no particular order include crustose lichens, cotton grasses (*Eriophorum* spp.), moss campion (*Silene acaulis* [L.] Jacq.), entireleaf daisy (*Hulteniella integrifolia* [Richardson] Tzvelev.), Maydell's oxytrope (*Oxytropis maydelliana* Trautv.), marsh fleabane (*Senecio congestus* [R. Br.] DC.), louseworts (*Pedicularis* spp.), pygmy buttercup (*Ranunculus pygmaeus* Wahlenb.), dwarf fireweed (*Chamerion latifolium* [L.] Holub), mouse-ear chickweed (*Cerastium arcticum* Lange), arctic white mountain heather (*Cassiope tetragona* [L.] D. Don), alpine mountainsorrel (*Oxyria digyna* [L.] Hill), and bog blueberry (*Vaccinium uliginosum* L.) (Aun *et al.*, 2002).

8.1.1 Vegetation Species at Risk

The review of the Species at Risk Public Registry (Government of Canada, 2024f) showed one rare plant species whose mapped range overlaps the HRQ Study Area:

- Porsild's bryum (*Haplodontium macrocarpum* [Hooker] Spence), listed as Threatened under COSEWIC and Schedule 1 under the SARA.

Porsild's bryum is a non-vascular bryophyte species. It has a broad, but disjunct distribution in Canada, including sites in Alberta, BC, the island of Newfoundland, and Nunavut (specifically Ellesmere Island). This species has been designated as threatened since 2003, because of its fragmented distribution and few confirmed population locations. There are 19 known populations in Canada, which accounts for about 40 % of known global occurrences. Three of the Canadian populations are located in proximity within Quttinirpaaq National Park, Ellesmere Island, Nunavut (2016a, 2016c). Porsild's bryum are found in the High Arctic but also in other treeless vegetation zones such as the sub-alpine and along barren coastlines. Microhabitats for most populations are associated with waterfalls or sheltered calcareous rock crevices or faces near water seepages. Narrow substrate (calcareous rock) and habitat requirements (waterfalls and seepages) limit this species distribution (ECCC, 2016a, 2016c; Government of Canada, 2019b).

No historical occurrences of Porsild's bryum have been recorded in the HRQ Study Area, and based on a review of aerial imagery, the HRQ Study Area appears not to contain microhabitats that could support Porsild's bryum. Therefore, the HRQ Study Area was predicted to have low potential to support populations of Porsild's bryum.

Legend

0 175 350 700 Meters

- Ground Plot
- Rare Plant Search
- Vegetation Study Area
- Quarry
- Alternate/Additional Haul Route
- Haul Road on Existing Road/Track
- Stockpile/Laydown Area

Locations approximate.

GOVERNMENT OF NUNAVUT
RESOLUTE BAY COMMUNITY
HARBOUR DEVELOPMENT

VEGETATION STUDY AREA

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		FIG No **Figure 8-1**	REV 0

Nunavut

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8.1.2 Harvesting

Twenty plant species have been identified as having traditional uses in the High Arctic ecoclimate (Baffinland Iron Mines Corporation, 2010). Traditional uses for these species include food, medicine, tools, and household items, and are identified in Table 8-1.

No specific areas for picking plants have been identified within or near the HRQ Study Area (IQ Workshop 2019 - Allie Salluviniq; IQ Workshop 2019 - Joadamee Amagoalik; IQ Workshop 2019 - Peter Amarualik; IQ Workshop 2019 - Simon Idlout). The area is very sparse and does not offer much for plant harvesting (IQ Workshop 2019 - Allie Salluviniq).

Table 8-1: Traditionally Used Vegetation Species

Latin Name and Authority	Common Name	Traditional Use
Shrubs		
Cassiope tetragona (L.) D. Don	white arctic mountain heather	mattresses, firewood
Empetrum nigrum L. ssp. *Nigrum*	black crowberry	edible
Ledum palustre L. ssp. decumbens (Aiton) Hultén	marsh Labrador tea	tea
Salix arctica Pall.	arctic willow	edible, firewood, tools
Salix richardsonii Hook.	Richardson's willow	edible
Saxifraga oppositifolia L.	purple mountain saxifrage	edible, tea
Saxifraga tricuspidata Rottb.	three toothed saxifrage	edible, tea
Vaccinium uliginosum L.	bog blueberry	edible
Graminoids		
Alopecurus alpinus Lam.	alpine meadow-foxtail	used to make whistling noises
Carex spp.	Sedges	not specified
Eriophorum spp.	arctic cotton grass	lamp wick
Forbs		
Oxytropis maydelliana Traitv.	Maydell's oxytrope	edible
Oxyria digyna (L.) Hill	alpine mountain sorrel	edible
Pedicularis lanata Cham. & Schltdl.	woolly lousewort	edible
Pedicularis sudetica Wild.	sudetic lousewort	not specified
Polygonum viviparum L.	alpine bistort	edible

Latin Name and Authority	Common Name	Traditional Use
Pyrola grandiflora Radius	large-flowered wintergreen	tea
Silene uralensis (Rupr.) Bocquet ssp. Uralensis	apetalous catchfly	not specified
Non-Vasculars		
Dicranum spp.	cushion mosses	used to treat pinworm infections
Racomitrium lanuginosum (Hedw.) Brid.	racomitrium moss	used to construct sleeping shelter

Source: Baffinland Iron Mines Corporation (2010); IQ Workshop 2022 - Johnny Kudluarok ; IQ Workshop 2022 - PIN013 (2022)

8.2 Field Program

8.2.1 Methodology

Field programs were conducted from 17 to 19 August 2019, by an experienced vegetation ecologist and a local Inuit field assistant. An ecological land classification survey (ELC) was completed to identify the vegetation communities in the HRQ Study Area. Field studies also focussed on identifying each species encountered to collect an inventory for the area.

8.2.1.1 Ecological Land Classification

During the ELC survey, quantitative data on ecosystems were collected to classify vegetation communities throughout the HRQ Study Area. As there was no official vegetation classification system used in Nunavut, vegetation communities were grouped based on similar characteristics such as species composition, topographical position, moisture regime, and percent cover of bedrock. Vegetation communities were identified using a combination of field verification and interpretation of desktop aerial imagery (Google Earth, 2022).

Within the HRQ Study Area, vegetation plots (0.5 m^2 x 0.5 m^2) were sited in each vegetation community identified during pre-mapping and in the field (Ground Plot; Figure 8-1). Plots were orientated so that they contained a homogeneous assemblage of plants representative of the typical vegetation community composition. Vegetation data collected at each plot included:

- General site characteristics such as slope, aspect, and surface substrate.
- Vegetation species identification and canopy percent cover.
- GPS coordinates.
- Photographs.

8.2.1.2 Terrestrial Vegetation Inventory and Rare Plant Assessment

A rare plant survey was completed within the HRQ Study Area between 17 to 19 August 2019. Surveys were targeted in areas where desktop pre-mapping had identified potentially unique habitats or vegetation communities. Each area identified was surveyed using a random meander technique, and all vascular and non-vascular species encountered were inventoried (or collected for identification). Figure 8-1 displays the data points collected along the random meander within the HRQ Study Area (Rare Plant Search). Given that no standards existed for Nunavut, the Alberta Native Plant Council (2012) standards were used as a guideline for survey methodology. The standard states that if rare plants are identified, a 50 m diameter buffer from the plant location is to be investigated to determine the extent and size of the population. Detailed habitat and population information, photographs, and GPS coordinates are further documented, as per the standards, if rare plants are observed.

The following guidebooks were used to identify vegetation species:

- Common Plants of Nunavut (Mallory & Aiken, 2013).
- Macrolichens of the Pacific Northwest (McCune & Geiser, 2000).
- Mosses and Liverworts of Britain and Ireland a Field Guide (Atherton *et al*., 2010).
- Mosses, Lichens and Ferns of Northwest North America (Vitt *et al*., 1988).
- Mosses, Liverworts, and Hornworts, a Field Guide to Common Bryophytes of the Northeast (Pope, 2016).
- The Arctic Guide: Wildlife of the Far North (Chester, 2016).
- Vascular Plants of Continental Northwest Territories (Porsild & Cody, 1980).

If a species could not be identified in the field, a voucher sample was collected for identification by an expert, following collection guidelines (Alberta Native Plant Council, 2012). A total of 16 bryophyte samples were collected and sent for identification to Terry McIntosh, Ph.D., and Steven Joya (bryologists) from the Department of Botany at the UBC. Nomenclature and authorities for each plant species recorded followed the United States Department of Agriculture Plants Database (USDA, 2019). Non-native and invasive species were defined according to (GN & ECCC, 2022).

8.2.2 Field Results

During the rare plant survey, 46 vegetation species were identified, including four shrub, six graminoid, 12 forb, 16 bryophyte, and eight lichen species. A total of 60 rare plant searches were conducted (Figure 8-1). A list of the species identified is provided in Table 8-2.

None of the species identified during the field program are listed as SAR or as invasive in Nunavut. Vegetation data collected in the field are provided in Appendix A, (Table A-8, Table A-9, Table A-10).

Five vegetation communities were identified and mapped within the HRQ Study Area (Figure 8-2) and five ELC ground plots were assessed to characterize these communities. Vegetation communities identified within the HRQ Study Area included:

- Upland Lichen Barren (ULB) – 160 hectares (ha) (71 % of the HRQ Study Area).
- Wetland Moss Lowland (WML) – 7 ha (3 % of the HRQ Study Area).
- Coastal Shoreline and Flats (CSF) – 23 ha (10 % of the HRQ Study Area).
- Disturbed Human-Caused (DHC) – 16 ha (7 % of the HRQ Study Area).
- Open Water (OW) – 20 ha (9 % of the HRQ Study Area).

The HRQ Study Area was covered predominantly by the ULB community, which was particularly dominant in the quarry area south of the hamlet. The ULB community mostly consisted of barren shales and talus slopes with crustose lichens on rock surfaces. The HRQ Study Area was interspersed with some lowland areas, which supported the WML community, particularly in areas closer to the coastal shoreline. The WML community had a diverse bryophyte (moss) population, which are common on rock and soil substrates in the Arctic. Descriptions for each community are provided below.

The CSF and DHC communities were mapped in the HRQ Study Area and are described below, but no vegetation data was collected in ELC plots. These communities were not surveyed in the field because they had high levels of disturbances (human [DHC] and marine intertidal [CSF]) and generally lacked terrestrial vegetation (Figure 8-2). General characteristics noted in the field are presented below and in Appendix A (Table A-8). The OW area was also not surveyed or described here as it is considered a marine environment and out of scope for the vegetation survey.

Legend

0 185 370 740 Meters

- Vegetation Study Area
- Coastal Shoreline and Flats
- Disturbed Human-Caused
- Open Water
- Upland Lichen Barren
- Wetland Moss Lowland

Locations approximate.

GOVERNMENT OF NUNAVUT
RESOLUTE BAY COMMUNITY
HARBOUR DEVELOPMENT

VEGETATION COMMUNITIES

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8.2.2.1 Upland Lichen Barren

The ULB community was characterized by barren, rocky areas with leprose and crustose lichens being the dominant vegetation type (Photo 8-1). In most cases, vegetation species (including lichens) were absent. Incidental species identified predominantly included trace amounts of pincushion plant (*Diapensia lapponica* L.), entireleaf mountain-avens, arctic willow, arctic poppy, tufted alpine saxifrage (*Saxifraga caespitosa* L.), purple mountain saxifrage (*Saxifraga oppositifolia* L.), broadsepal saxifrage (*Saxifraga platysepala* [Trautv.] Tolm.), northern woodrush (*Luzula confuse* Lindeberg), elegant orange wall lichen (*Xanthoria elegans* [Link] Th. Fr.), and lichen (*Cetraria tilesii* Ach.) (Table 8-2, Appendix A (Table A-8, Table A-9)).

Photo 8-1: Upland Lichen Barren Community at GD-17 (18 August 2019)

Source: Worley Consulting, 2019

8.2.2.2 Wetland Moss Drainage

The WGD community was characterized by saturated ground in drainage draws and lowland areas (Photo 8-2). Vegetation was predominantly mosses, wideleaf polargrass (*Arctagrostis latifolia* [R. Br.] Griseb.), and alpine meadow-foxtail (*Alopecurus magellanicus* Lam.). Some forbs were present and commonly included yellow marsh saxifrage (*Saxifraga hirculus* L.), and saltmarsh starwort (*Stellaria humifusa* Rottb.) (Table 8-2, Appendix A (Table A-9, Table A-10)).

Photo 8-2: Wetland Moss Drainage Community at GD-20 (18 August 2019)

Source: Worley Consulting, 2019

8.2.2.3 Coastal Shoreline and Flats

The CSF community was characterized by a mostly cobble and gravelly shoreline leading to the ocean. Extensive, open, areas with no vegetation cover were common (Photo 8-3). No vegetation was identified in this area and it was mapped based on topographical position, aspect, and disturbance type (water/ice disturbance) (Table 8-2, Appendix A (Table A-9,Table A-10)).

Photo 8-3: Coastal Shoreline and Flats Community at 445123 m E, 8290298 m N (19 August 2019)

Source: Worley Consulting, 2019

8.2.2.4 Disturbed Human-Caused

The DHC community was characterized by levelled and graded areas devoid of vegetation (Photo 8-4). DHC areas within the HRQ Study Area consisted of road networks, ditches, and buildings. No vegetation was identified in this area and it was mapped based on topographical position, aspect, and disturbance type (human disturbance) (Table 8-2, Appendix A (Table A-9, Table A-10)).

Photo 8-4: Disturbed Human-Caused Community at 444298 m E, 8289536 m N (10 August 2019)

Source: Worley Consulting, 2019

Table 8-2: List of Vegetation Species Identified During Field Program

Vegetation Species		Vegetation Community[1] Association & Richness	
Species Name	**Common Name**	**ULB**	**WML**
Shrubs		**4**	**1**
Diapensia lapponica L.	pincushion plant	Y	---
Dryas integrifolia Vahl	entireleaf mountain-avens	Y	---
Salix arctica Pall. *	arctic willow	Y	Y
Saxifraga oppositifolia L. *	purple mountain saxifrage	Y	---
Forbs		**10**	**5**
Cerastium arcticum Lange	mouse-ear chickweed	Y	---
Draba subcapitata Simmons	Ellesmereland whitlowgrass	Y	---
Minuartia rubella (Wahlenb.) Hiern.	beautiful sandwort	Y	---
Oxyria digyna (L.) Hill *	alpine mountainsorrel	Y	---
Papaver sp.	arctic poppy	Y	Y
Parrya arctica R. Br.	arctic false wallflower	Y	---
Saxifraga caespitosa L.	tufted alpine saxifrage	Y	---
Saxifraga cernua L.	nodding saxifrage	Y	Y
Saxifraga hirculus L.	yellow marsh saxifrage	---	Y
Saxifraga nivalis L.	alpine saxifrage	---	Y
Saxifraga platysepala (Trautv.) Tolm.	broadsepal saxifrage	Y	---
Stellaria humifusa Rottb.	saltmarsh starwort	Y	Y
Graminoids		**3**	**6**
Alopecurus magellanicus Lam. *	alpine meadow-foxtail	Y	Y
Arctagrostis latifolia (R. Br.) Griseb.	wideleaf polargrass	---	Y
Festuca brachyphylla Schult. ex Schult. & Schult. f.	alpine fescue	Y	Y
Juncus biglumis L.	twoflowered rush	---	Y
Luzula confusa Lindeberg	northern woodrush	Y	Y
Pleuropogon sabinei R. Br.	false semaphoregrass	---	Y
Bryophytes		**4**	**13**
Brachythecium sp.	Moss	---	Y
Catoscopium nigritum (Hedw.) Brid.	black golf club moss	---	Y

Vegetation Species		Vegetation Community[1] Association & Richness	
Species Name	**Common Name**	**ULB**	**WML**
Cinclidium arcticum Bruch & Schimp.	arctic cinclidium moss	---	Y
Cinclidium stygium Sw.	cinclidium moss	---	Y
Cratoneuron filicinum (Hedw.) Spruce	cratoneuron moss	---	Y
Cyrtomnium hymenophylloides (HÃ¼b.) Nyholm ex T. Kop.	cyrtomnium moss	---	Y
Didymodon rigidulus Hedw. var. gracilis (Schleich. ex Hook. & Grev.) R.H. Zander	rigid didymodon moss	---	Y
Distichium capillaceum (Hedw.) Bruch & Schimp.	distichium moss	Y	Y
Ditrichum flexicaule (SchwÃ¤gr.) Hampe	ditrichum moss	---	Y
Hypnum bambergeri Schimp.	Bamberger's hypnum moss	---	Y
Hypnum vaucheri Lesq.	Vaucher's hypnum moss	Y	---
Orthothecium chryseum (SchwÃ¤gr.) Schimp. var. cochlearifolium (Lindb.) Limpr.	orthothecium moss	---	Y
Racomitrium lanuginosum (Hedw.) Brid. *	racomitrium moss	Y	---
Schistidium rivulare (Brid.) Podp.	streamside schistidium moss	Y	---
Scorpidium scorpioides (Hedw.) Limpr.	scorpidium moss	---	Y
Timmia sp.	timmia moss	---	Y
Lichens		**8**	**0**
Cetraria tilesii Ach.	Lichen	Y	---
Flavocetraria cucullata (Bellardi) Karnefelt & A. Thell	snow lichen	Y	---
Flavocetraria nivalis (L.) Karnefelt & A. Thell	snow lichen	Y	---
Lecidea tessellata Flörke	lecidea lichen	Y	---
Lepraria neglecta (Nyl.) Erichsen	dust lichen	Y	---
Thamnolia subuliformis (Ehrh.) W.L. Culb.	whiteworm lichen	Y	---
Xanthoria elegans (Link) Th. Fr.	elegant orange wall lichen	Y	---

Note:
1 Vegetation communities surveyed included Upland Lichen Barren (ULB) and Wetland Moss Lowland (WML); no vegetation were identified in the other communities mapped.
'Y' denotes species was identified within vegetation community
--- denotes species was not identified within vegetation community
* denotes species has been identified as traditionally used

8.3 Discussion

Vegetation communities identified during field studies (i.e. ULB [71 %], CSF [10 %], DHC [7 %], and WML [3 %]) appear to be typical of the Parry Islands Plateau Ecoregion within the Northern Arctic Ecozone of the Tundra Biome (ESWG, 1995). Vegetation is overall devoid or sparse throughout the HRQ Study Area and dwarfed due to harsh climate conditions, exposure to wind, and frost damage. The WGD community had the highest percent cover of vegetation (mostly mosses) and the least amount of exposed rock.

Of the 20 traditionally used species identified during desktop review, five were identified within the HRQ Study Area during the field surveys. These species include arctic willow, purple mountain saxifrage, alpine mountainsorrel, alpine meadow-foxtail, and racomitrium moss (*Racomitrium lanuginosum* [Hedw.] Brid.) (Table 8-2 and Appendix A, Table A-9). The ULB community contained the most traditionally-used plants. Traditional use of these plants includes edibles, tea, whistle construction, firewood, tool construction, and sleeping shelter construction. Plucking leaves for tea still occurs as part of culture in the Arctic, though traditional plant use in the HRQ Study Area is likely mostly opportunistic and occurs during travel and when hunting (Baffinland Iron Mines Corporation, 2018).

As with any species inventory, some less abundant species may have been missed during the vegetation field survey. However, all species observed are common in the Northern Arctic Ecozone and enabled the characterization of vegetation communities, identification of traditional use plants, and assessment of rare plant habitat potential.

The only vegetation SAR potentially present in the HRQ Study Area was Porsild's bryum. however, no individuals or potential habitat (sheltered calcareous rock crevices or waterfall seepages) were identified during the field survey (2016a, 2016c). As such, Porsild's bryum has a low probability of occurring within the HRQ Study Area.

Overall, the HRQ Study Area was dominated by the ULB community, contains regionally common plant species, is not unique habitat, and has low rare plant habitat potential. In addition, the potential quarry locations are in areas dominated by the ULB community, which is largely an unvegetated rocky landscape. As a result, overall Project related disturbances to vegetation communities, traditionally-used plants, and vegetation SAR are considered low.

9 Terrestrial Wildlife

Program objectives for terrestrial wildlife are provided in Section 1.5 (Table 1-1).

Baseline information was determined through historical information gathered as part of a desktop review including a literature review and the IQ Workshop (see Section 2). This desktop review was then validated through a field-based habitat assessment and wildlife reconnaissance survey (referred hereafter as the field program) conducted in conjunction with the vegetation field program. These results enabled refinement of a list of species likely to inhabit the Project Study Area.

Migratory birds including marine birds are identified in Section 10. Considering polar bears spend most of their time on sea ice and rely heavily on marine habitats for food, they were considered under marine mammals in this document (see Section 6.4.9).

9.1 Desktop Review

The desktop review was conducted to determine species with historical occurrences near the Project Study Area. In addition to identifying historical occurrences, a list of species that could potentially occupy the HRQ Study Area was generated. This list was determined by examining available habitat using aerial imagery (Google Earth, 2022) and comparing it to habitat requirements for species whose ranges overlap with the Project. Range maps and habitat information were determined by field guides, peer-reviewed literature, and other reference sources.

Terrestrial wildlife occurrences were primarily based on the NWHS (Priest & Usher, 2004). Species identified as having potential to inhabit in the HRQ Study Area were further inferred from range maps, habitat requirements, aerial imagery, IQ (IQ Workshop 2019), and results of the vegetation review and community mapping.

There are eight terrestrial mammal species, ranging from Peary land collared lemmings (*Dicrostonyx groenlandicus*) to muskoxen (*Ovibos moschatus*) that have historical recorded presence or have the potential to occur within the HRQ Study Area (Table 9-1). Details on each species are provided in the following subsections. For information on SAR, refer to Section 3.1 (Table 3-2).

Table 9-1: Terrestrial Wildlife that have the Potential to Inhabit the Haul Road Quarry Study Area

Common Name	Scientific Name	Habitat[1]
Small Mammals (Rodents and Lagomorphs)		
Peary Land collared lemming	*Dicrostonyx groenlandicus*	• Dry (xeric), rocky tundra
Arctic hare	*Lepus arcticus*	• Typically willow-dominated tundra but also rocks and broken terrain for cover
Medium Mammals (Canids and Mustelids)		
Arctic fox	*Alopex lagopus*	• Likely determined more by prey availability (i.e. small mammals and geese) than vegetation

Common Name	Scientific Name	Habitat[1]
		• Dens are large, complex burrow systems with multiple entrances
Arctic wolf	*Canis lupus arctos*	• Likely determined more by prey availability (e.g. caribou) than vegetation • Dens typically located along eskers
Wolverine[2]	*Gulo gulo*	• Wide ranging species whose habitat is likely determined more by prey availability (i.e. carcasses and small mammals) than vegetation • Den within snow or under snow-covered rocks
Ermine	*Mustela ermine*	• Habitat generalist likely determined more by prey availability than vegetation • Uses subnivean grass nests, rock piles and burrows often commandeered from prey
Large Mammals		
Muskoxen	*Ovibos moschatus*	• Low-lying areas like river valleys and tussock graminoid tundra • Wet sedge areas and wind-swept areas that provide efficient foraging during snow-covered seasons.
Peary caribou[3]	*Rangifer tarandus pearyi*	• Mesic to xeric tundra with snow-free or shallow snow-covered ridges with sparse-moderate vegetation cover at intermediate-high elevations

Note:

1 Habitat information from: (Anderson & Ferguson, 2016; Chesemore, 1969; Chester, 2016; COSEWIC, 2011, 2014a, 2015; Duchesne *et al.*, 2011; Garrott *et al.*, 1983; Gray, 1993; King, 1983; King & Powell, 2007; Klein & Bay, 1994; McLoughlin *et al.*, 2004; Parker, 1977; Sale, 2006; Sittler, 1995)

2 Wolverine are listed as Vulnerable by the GN, listed by Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as Special Concern, and are listed on Schedule 1 as Special Concern under the SARA (CESCC, 2022; Government of Canada, 2024f)

3 Peary caribou are listed as Apparently Secure by the GN, by the COSEWIC as Threatened, and are listed under the SARA as Endangered (CESCC, 2022; Government of Canada, 2024f)

9.1.1 Small Mammals (Rodents and Lagomorphs)

Small mammals are defined in this report as those species belonging to the following mammalian orders: Rodentia (rodents) and Lagomorpha (hares and rabbits). Peary Land collared lemmings are considered a keystone species and are a crucial component within trophic dynamics (Laing, 2008). They are also a primary consumer of vegetation in the Arctic. Populations of lemmings typically fluctuate in low-high oscillations (Gruyer, 2010), and they are the primary prey of species such as arctic fox (*Alopex lagopus*), ermine (*Mustela ermine*), snowy owl (*Bubo scandiacus*), and long-tailed jaegers (*Stercorarius longicaudus*) (McLennan, 2012).

According to the Nunavut Wildlife Harvest Study (Priest & Usher, 2004), arctic hare (*Lepus arcticus*) is the only small mammal reported to be harvested by hunters from the Hamlet, and mean annual harvest was 4 individuals per year (Priest & Usher, 2004). Arctic hares are uncommon near the HRQ Study Area (IQ Workshop 2019 - Simon Idlout).

9.1.2 Medium Mammals (Canids and Mustelids)

For this Project, medium-sized mammals have been identified as those species belonging to the following mammalian orders: Canidae (dog family) and Mustelidae (weasel family). The NWHS (Priest & Usher, 2004) identified that arctic wolf (*Canis lupus arctos*) and arctic fox have been harvested by hunters in the Hamlet. However, location data for these species have not been collected. Therefore, it cannot be determined whether these species were distributed and harvested near the HRQ Study Area. Wolves have also been incidentally observed in the region during aerial estimates for large mammals (Anderson, 2014). On average, 31 arctic fox and 1 arctic wolf were harvested each year by hunters from the Hamlet (Priest & Usher, 2004).

In addition to foxes and wolves, ermine, and wolverine could potentially be present in or near the HRQ Study Area. Locals do not trap for these species in or around the Hamlet and wolf tracks have been seen but are rare (IQ Workshop 2019 - Joadamee Amagoalik; IQ Workshop 2019 - Peter Amarualik). Although no surveys have been conducted near the Hamlet, ermine can be common in coastal lowlands where prey is available (Miller, 1955). Though the mapped distribution for wolverine overlaps with the HRQ Study Area, wolverine have a low probability of occurrence as observations are rare in the region and not documented locally (Mallory, 2001).

9.1.3 Large Mammals (Caribou)

Peary caribou are a main source of country food, and between 1996 and 2001, the mean annual harvest of caribou was 17 individuals per year (Priest & Usher, 2004). Location data collected as part of the survey revealed that caribou were historically hunted largely on the northern end of Cornwallis Island, about 60 kilometres from the Hamlet (Figure 9-1). Most harvests have focussed on the Bathurst Island Complex, which is an important harvesting area for the Hamlet community (Jenkins *et al.*, 2012). Specifically, Peary caribou in the region are often concentrated around Bracebridge Inlet and on Massey and Alexander Islands (Anderson, 2014). This population of caribou is recognized as the Western Queen Elizabeth subpopulation and icing events causing freezing ground and difficult forage in 1996 resulted in approximately 5,400 die-offs of a population estimated to be 22,000 mature individuals (COSEWIC, 2015). Resolute Bay elders recall similar starvation die-offs in the 1930s (COSEWIC, 2015). Recent estimates of the subpopulation are approximately 8,000 (COSEWIC, 2015). The herds on Cornwallis Island are considered part of the Bathurst Island Group of Peary caribou which exhibit regular, inter-island seasonal movements among a group of five island complexes that make up the greater Western Queen Elizabeth subpopulation (COSEWIC, 2015; Jenkins *et al.*, 2012). Recent estimates of caribou on Bathurst and its satellite islands are approximately 1,482 (±387) (Anderson, 2014). In general, caribou have apparently never been numerous on Cornwallis Island and surrounding smaller islands. The islands in this area are mostly calcareous rock with very little vegetation cover to support foraging (COSEWIC, 2016).

Muskoxen are vitally important to the Hamlet community and have been hunted in the area since the government ban on muskoxen hunting was lifted in 1969. Tags are currently set aside for domestic/commercial use and sport hunts (Anderson & Kingsley, 2015). Between 1996 and 2001, the mean annual harvest of muskoxen was 7 (Priest & Usher, 2004). Location data collected as part of the survey revealed that muskoxen were historically hunted largely near the southwest portion of Cornwallis Island, northeast of the Hamlet (Figure 9-2). Muskoxen typically concentrate on the northwest portion of Cornwallis Island and on central Bathurst Island. Recent estimates of the overall population on Bathurst Island and Cornwallis Island are approximately 1,888 (±979) muskoxen and increasing (Anderson, 2014; Anderson & Ferguson, 2016; Cuyler *et al.*, 2019). In addition, between 2001 and 2013, residents of Resolute Bay reported higher populations of muskoxen (Anderson, 2014). Muskoxen are commonly seen eight kilometers from the Hamlet (IQ Workshop 2019 - Joadamee Amagoalik). A summary of species harvested is provided in Section 6.2 (Table 6-2).

Legend

Animal Species

Peary Caribou

0 10 20 40 Kilometers

Locations approximate.

GOVERNMENT OF NUNAVUT
RESOLUTE BAY COMMUNITY
HARBOUR DEVELOPMENT

HARVESTED CARIBOU LOCATIONS (1996-2001)

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FIG No **Figure 9-1**

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USER NAME: lucas.pittman
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Legend

Animal Species

Muskox

0 12.5 25 50 Kilometers

Locations approximate.

GOVERNMENT OF NUNAVUT
RESOLUTE BAY COMMUNITY
HARBOUR DEVELOPMENT

HARVESTED MUSKOX LOCATIONS (1996-2001)

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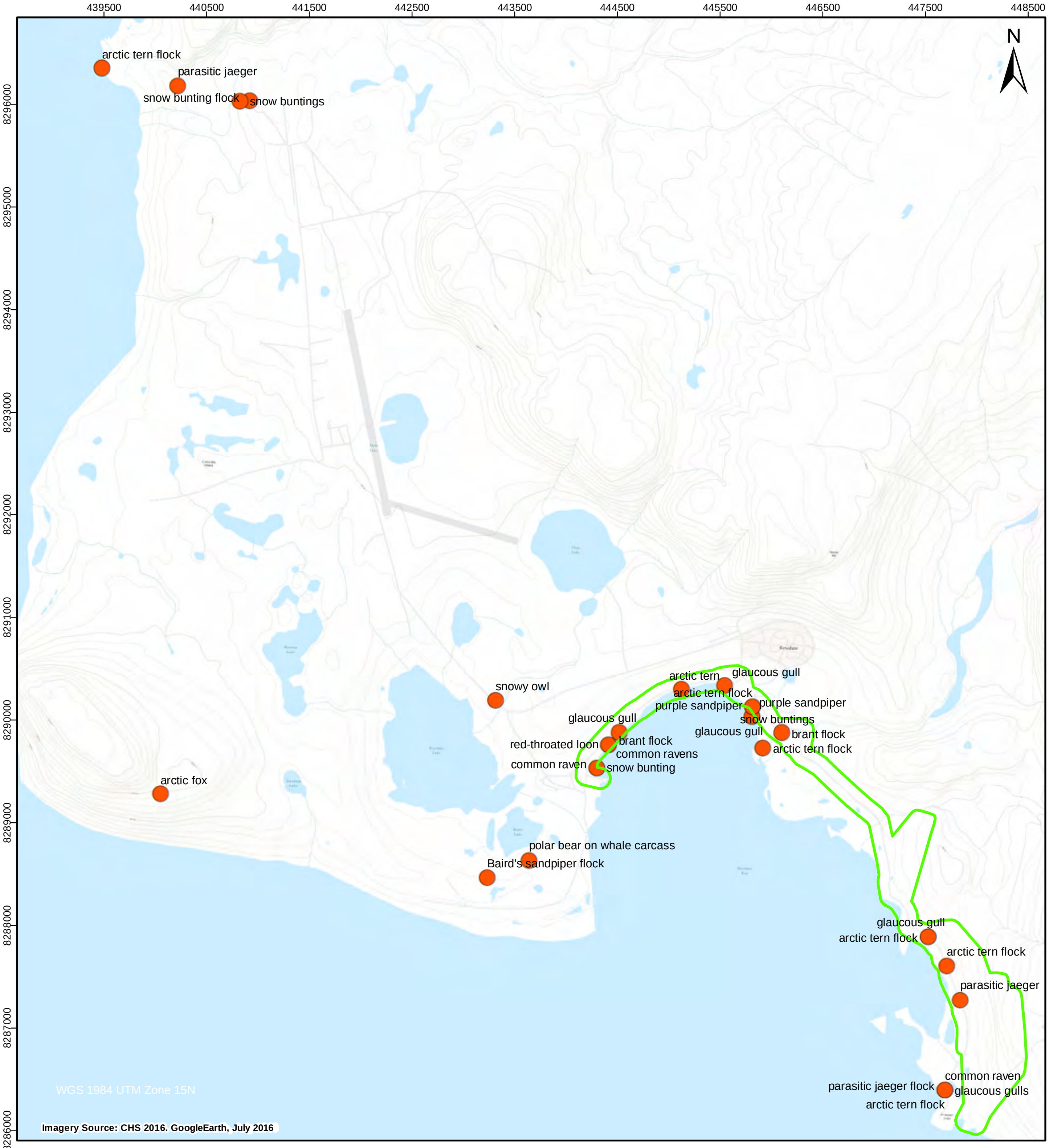
9.2 Field Program

9.2.1 Methodology

Fieldwork was conducted in conjunction with the vegetation survey from 17 to 19 August 2019. All wildlife species observed or detected by sign (scat, pellets, tracks, etc.) were identified, photographed (if possible), and georeferenced using a handheld GPS. In addition to individual wildlife, all wildlife features (e.g. dens, burrows, diggings) were similarly photographed and georeferenced. The focus of the field program included the quarry and haul route plus a 100 m buffer, but incidental observations were also recorded outside this area. It should be noted that some terrestrial wildlife are migratory or nomadic and travel long distances and have large home ranges. Moreover, terrestrial wildlife can be cryptic and difficult to detect without repeat visits and targeted surveys. As such, a lack of observations does not preclude the potential for species occurrence within the HRQ Study Area. It should also be noted that cryptic species are often naturally difficult to detect without repeat visits and targeted surveys. Given logistical constraints, repeat visits and targeted surveys were not conducted. A general reconnaissance survey was the focus of the wildlife fieldwork and information collected during the vegetation survey were used to further refine the list of species with potential to inhabit the HRQ Study Area. Weather conditions during the field programs are provided in Section 1.5.2 (Table 1-5).

9.2.2 Results

Terrestrial wildlife species identified or detected included arctic fox and polar bear (*Ursus maritimus*) (Figure 9-3). For a discussion of bird species observed, see Section 10. All wildlife data collected, including coordinate locations are provided in Appendix A (Table A-11, Table A-12). Locations of wildlife species observed or detected are also shown in Figure 9-3.



Legend

Wildlife Study Area

Incidental Wildlife Observation or Detection

0 500 1,000 2,000 Meters

Locations approximate.

GOVERNMENT OF NUNAVUT
RESOLUTE BAY COMMUNITY
HARBOUR DEVELOPMENT

WILDLIFE AND WILDLIFE FEATURES OBSERVED OR DETECTED DURING FIELD SURVEY

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		FIG No **Figure 9-3**	REV 0

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9.3 Discussion

9.3.1 Habitat Value

In general, habitat near the Community Harbour Study Area is of limited value for terrestrial wildlife. Human development in the Hamlet extends to the edge of the ocean. Much of the beach is developed and has structures, roads, and boats along its length. Dogs were also tied up along the shoreline and likely deter wildlife. The buildings along the beach and Hamlet area may provide cover for small mammals and weasels. At low tide, the intertidal zone likely provides foraging opportunities. However, the value of these areas for habitat is low given the amount of disturbance and frequent human activity.

Habitat available for wildlife in proximity to the haul road and quarry areas are similarly of low quality for terrestrial wildlife. Most of the terrain is comprised of barren rock with very little vegetation cover. When present, vegetation predominately consists of crustose lichens. Some graminoids were identified in small lowland, moss dominant areas and likely provide little value to terrestrial wildlife. Security, escape, and thermal cover for small mammals is also limited throughout the HRQ Study Area. More information about vegetation community descriptions and land cover types are provided in Section 0.

9.3.2 Small Mammals

9.3.2.1 Arctic Hare Presence in the Haul Road Quarry Study Area

Arctic hare typically inhabit willow-dominated communities in winter and summer (Klein & Bay, 1994) where they typically forage on twigs, bark, and other plant material (Sale, 2006) such as willow, graminoids, and forbs (Parker, 1977). Willow-dominated communities were not identified in the HRQ Study Area, and very few willow plants were present. Parker (1977) suggests that arctic hare also commonly inhabit elevated, dry gravel slopes, which support a sparse but diverse vegetation community. In addition, arctic hare commonly seek shelter behind rocks during winter (Gray, 1993). It is believed that this type of broken terrain provides appropriate escape cover and sheltering habitat. This type of habitat was limited or not existent throughout much of the HRQ Study Area and IQ confirm that they are uncommon. Therefore, the HRQ Study Area unlikely supports arctic hare.

9.3.2.2 Lemming Presence in the Haul Road Quarry Study Area

Peary Land collared lemmings occupy a variety of tundra types and den in complex micro-habitat with an abundance of deciduous shrubs and mosses, which provide opportunities for deep snow cover and thermal protection (Sale, 2006) (Duchesne *et al.*, 2011). Much of the HRQ Study Area is dry and composed of upland, open, and barren areas with very little vegetation. Portions of the HRQ Study Area may support a low density of lemmings, but overall, likely provide little value for this species.

9.3.3 Medium Mammals

9.3.3.1 Ermine Presence in the Haul Road Quarry Study Area

Ermine are considered to be habitat generalists (King, 1983; King & Powell, 2007). Like many other mustelids, habitat is likely determined primarily by prey availability rather than vegetation associations

(Klemola *et al.*, 1999). In the Arctic, ermine eat lemmings primarily. When lemming populations are low, ermine use other food sources such as ptarmigan (*Lagopus spp*.) and their eggs (King & Powell, 2007). Therefore, their likelihood of inhabiting the HRQ Study Area depends on the availability of prey. Ermine are known to occupy lemming nests during winter in tundra environments (Sittler, 1995), and they also nest in rock piles and burrows (King, 1983). Given the barren, rocky areas in the HRQ Study Area, there is suitable cover and escape habitat available for ermine. Home ranges of ermine in the tundra span from 35 to 66 ha for females and 121 to 207 ha for males (King & Powell, 2007). Consequently, only one or two pairs (male and female) of weasels would be likely to inhabit the HRQ Study Area, if any.

9.3.3.2 Wolverine Presence in the Haul Road Quarry Study Area

Although federally-listed as Special Concern in Canada, wolverine populations appear to be increasing in Nunavut (COSEWIC, 2014a). No wolverines were reported to have been harvested on Cornwallis Island between 1996 and 2001 (Priest & Usher, 2004). Mapped wolverine range historically did not overlap with the HRQ Study Area: currently they have an increased presence in the region (COSEWIC, 2014a). Wolverine habitat use in the Arctic is likely determined more by prey availability (rodents, hare, and ungulate carcasses) rather than vegetation (COSEWIC, 2014a). Wolverines are a wide-ranging, generally nomadic species, found in low densities in remote areas away from human disturbance (COSEWIC, 2014a; Sale, 2006). As such, wolverine occurrence within the HRQ Study Area is unlikely and would only be transient if present.

9.3.3.3 Fox Presence in the Haul Road Quarry Study Area

Similar to weasels, arctic fox appears to be less closely tied to vegetation associations than to other factors such as prey availability. Cycles in arctic fox populations are closely tied with lemming abundance (Gauthier & Berteaux, 2011). Arctic fox home range and movements also increase during periods (or in territories) of low food abundance (Gauthier & Berteaux, 2011). There are likely few places for fox to den within the HRQ Study Area, but abandoned buildings near the Hamlet could support denning habitat and one individual was identified about 4 kilometres west of the HRQ Study Area. Arctic fox home ranges are large and studies in other coastal areas indicated that they may be around 10 km^2 (males) and 4 km^2 (females) (Anthony, 1997). As such, based upon expected home range sizes, the HRQ Study Area might only partially support one pair or family group of foxes.

9.3.3.4 Arctic Wolf Presence in the Haul Road Quarry Study Area

Although it is possible that arctic wolves could pass through the HRQ Study Area, it is unlikely. Arctic wolves have large home ranges, and as is with the other carnivores discussed, base their habitat utilization upon prey availability. In the case of arctic wolves on Cornwallis Island, their primary prey are caribou and muskoxen (Anderson & Kingsley, 2015; McLoughlin *et al.*, 2004). Given that it is expected that wolves follow caribou herds (Krizan, 2006), and muskoxen infrequent the Hamlet, it is unlikely that wolves would frequent the HRQ Study Area.

9.3.4 Large Mammals

9.3.4.1 Peary Caribou Presence in the Haul Road Quarry Study Area

Given that the current Peary caribou range does not overlap with the Hamlet area, caribou are not likely to occupy the HRQ Study Area. The quarry area, south of the Community Harbour Study Area has less human activity but is overall of low value to caribou.

9.3.4.2 Muskoxen Presence in the Haul Road Quarry Study Area

With the identification of muskoxen harvests near and northwest of the Hamlet, as well as IQ indicating that they are often present within 8 kilometres of the Hamlet (IQ Workshop 2019 - Joadamee Amagoalik), it is possible that muskoxen may occupy the HRQ Study Area for short periods of time. The Location 2 quarry area, south of the Community Harbour Study Area has less human activity but is overall of low value to muskoxen.

10 Migratory Birds (Including Marine Birds)

Program objectives for migratory birds are provided in Section 1.5 (Table 1-1).

Many marine birds are pelagic and spend most of their life at sea, but marine birds have been considered together here with migratory birds given that they nest terrestrially (a critical life history stage), and most are also migratory. The field program focused on the Project Study Area, but incidental observations were also recorded outside this area.

10.1 Desktop Review

To support assessment of the existing condition of migratory and marine birds, existing literature, IQ (IQ Workshop 2019 - Allie Salluviniq; IQ Workshop 2019 - Joadamee Amagoalik; IQ Workshop 2019 - Peter Amarualik; IQ Workshop 2019 - Simon Idlout), and databases were reviewed to determine species with historical occurrences near the Project. Protected areas or known high-value habitats (e.g. wildlife sanctuaries) were identified. In addition to identifying historical occurrences, a list of species that could potentially occupy the Project Study Area was generated. This list was determined by examining available habitat using aerial imagery (Google Earth, 2022) and comparing it with habitat requirements for species whose ranges overlaps with the Project. Range maps and habitat information were determined by field guides, peer-reviewed literature, and other reference sources.

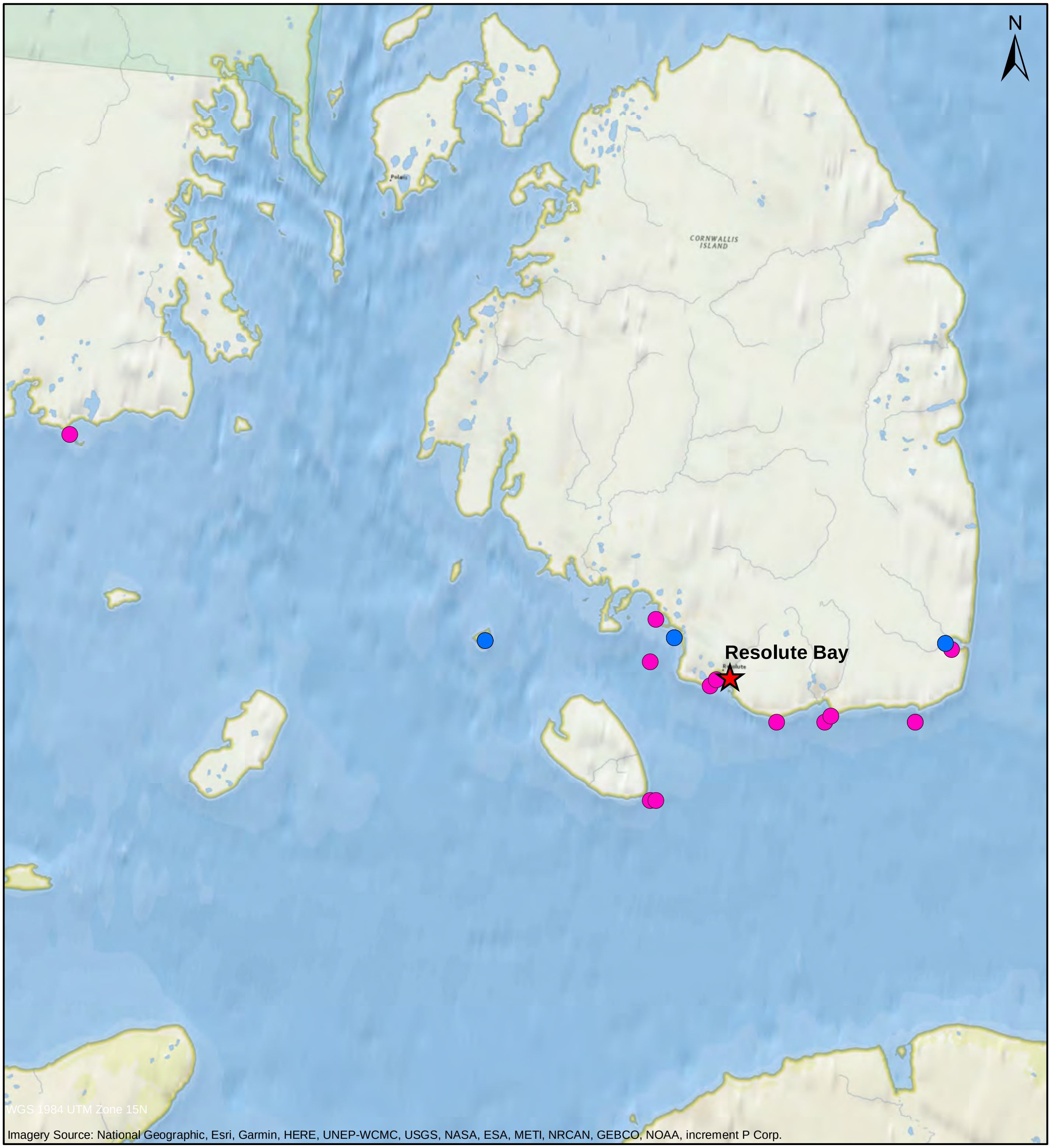
10.1.1 Migratory, Marine, and Other Birds Likely to be Present

A review of the Nunavut Wildlife Harvest Study (Priest & Usher, 2004), revealed that several bird species are harvested by hunters in the Hamlet, suggesting their presence and breeding in the surrounding area (Table 6-2). The species most harvested are ptarmigan (*Lagopus muta*), eider ducks (*Somateria* spp.), duck eggs, gull eggs, snow goose (*Chen caerulescens*), arctic tern eggs (*Sterna paradisaea*), and brant (*Branta bernicla*), respectively. Location data for harvested birds were not collected for most species. Hunters in the Hamlet hunt both common eiders (*S. mollissima*) and king eiders (*S. spectabilis*), and information on the location of harvests for these species was collected. Although no bird harvests have been recorded within the Project Study Area, nearby areas including Resolute Passage, Somerville Island, Griffith Island, Allen Bay, Assistance Bay, and Barlow Inlet have historically been areas for hunting eiders (Figure 10-1). There are at least 56 bird species who have potential to be present in the region, but 35 were considered unlikely to nest within or near the Project Study Area (Figure 10-1). Ten were considered likely to nest, based on habitat, during the breeding season. These include: American golden plover (*Pluvialis dominica*), arctic tern (*Sterna paradisaea*), Baird's sandpiper (*Calidris bairdii*), common raven (*Corvus corax*), horned lark (*Eremophila alpestris*), northern wheatear (*Oenanthe oenanthe*), purple sandpiper (*Calidris maritima*), red knot (*Calidris canutus*), red phalarope (*Phalaropus fulicarius*), and snow bunting (*Plectrophenax nivalis*) (Appendix C, Table C-3). The likelihood of nesting for the remaining potential species is either low or moderate.

IQ indicates that migratory birds, including arctic terns, nest in the south quarry location and within about 15 m of the shoreline (Figure 2-1). Other species that are active in the area during August and September include eider ducks, gulls, sandpipers, and northern fulmars (*Fulmarus glacialis*) (IQ

Workshop 2019 - Joadamee Amagoalik). Ptarmigan are usually found more near ponds and lakes (IQ Workshop 2019 - Joadamee Amagoalik).

Bird SAR that have potential to be present include ivory gull (*Pagophila eburnean*), buff-breasted sandpiper (*Tryngites subruficollis*), peregrine falcon (Falco peregrinus), red knot, red-necked phalarope (Phalaropus lobatus), and Ross's gull (Rhodostethia rosea) (See Appendix C (Table C-3), Table 3-2). Ivory gull and Ross's gull are not likely to nest within or near Project Study Area though they may forage near these areas. The likelihood of buff-breasted sandpiper, peregrine falcon, and red-necked phalarope to nest in the area is low. It is likely that red knot could nest in the HRQ Study Area. The territorial and federal status of these SAR are provided in Appendix C (Table C-3), Table 3-2. These species are discussed further in Section 10.3.4.



Legend

Animal Species

- Common Eider
- Common Eider Eggs

0 5 10 20 Kilometers

Locations approximate.

GOVERNMENT OF NUNAVUT
RESOLUTE BAY COMMUNITY
HARBOUR DEVELOPMENT

HARVESTED COMMON EIDER DUCK AND COMMON EIDER EGG LOCATIONS (1996-2001)

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10.1.2 Important Bird Areas and Key Bird and Habitat Sites

Important Bird Areas are described in Section 3.2.8, with their relevance to migratory and marine birds described below.

10.1.2.1 Cape Liddon

Towering limestone cliffs characterize the Cape Liddon and support an estimated 10,000 or less breeding pairs (range of 1,000 to 10,000) of northern fulmars. Northern fulmars occupy the area from about mid-April to early-October and feed in Barrow Strait and Lancaster Sound during this time. The shoreline near Caswell Tower, a high rock stack about 9 kilometres north of Cape Liddon, is occupied by common eiders (*Somateria mollissima*) and black guillemots (*Cepphus grylle*) during the breading season. Other species documented in the area include black-legged kittiwakes (*Rissa tridactyla*) (Mallory & Fontaine, 2004). This IBA is identified as a Key Migratory Bird Terrestrial Habitat site and was recognized as a significant site by the International Biological Programme (Bird Studies Canada, 2024).

10.1.2.2 Prince Leopold Island

Prince Leopold Island consists of cliffs surrounding the shoreline that support the second largest breeding congregation of northern fulmars in Canada. There are an estimated 20 % of the Canadian northern fulmar population and as much as 11 % of the western Atlantic black-legged kittiwake population nest there (Bird Studies Canada, 2024). Other species that have been documented on the Island include thick-billed murres (*Uria lomvia*), black guillemots, brant, dovekie (*Alle alle*), common raven, common eider, king eider, sandhill crane (*Grus canadensis*), purple sandpiper, Baird's sandpiper, parasitic jaeger (*Stercorarius parasiticus*), long-tailed jaeger (*Stercorarius longicaudus*), Iceland gull (*Larus glaucoides*), glaucous gulls (*Larus hyperboreus*), gyrfalcon (*Falco rusticolus*), peregrine falcon, horned lark (*Eremophila alpestris*), common redpoll (*Acanthis flammea*), Lapland longspur (*Calcarius lapponicus*), and snow bunting. The combined total number of pairs of seabirds that nest on the IBA are about 200,000 (Bird Studies Canada, 2024). Major current interactions around Prince Leopold Island create local enrichment of nutrients and results in highly suitable conditions for foraging seabirds (Mallory & Fontaine, 2004). The entire island is included within the Prince Leopold Island Migratory Bird Sanctuary (described below). It is considered a Key Migratory Bird Terrestrial Habitat site, was identified as a significant site in the International Biological Programme, and is a UNESCO World Heritage Site (Bird Studies Canada, 2024; Mallory & Fontaine, 2004).

10.1.2.3 Washington Point, Baillie-Hamilton Island (and Cheyne Islands)

The breeding population of Ross's gull on the Cheyne Islands ranges from 0 to 10 pairs per year (COSEWIC, 2007c). Washington Point lies at the southeastern corner of Baillie-Hamilton Island. Steep cliffs with flat tops characterize Washington Point and a polynya develops north of the island in January and continues until ice breakup. Historical records indicate that the area supports an estimate of 3,000 pairs of black-legged kittiwakes which occupy the area from mid-May to early-October (Bird Studies Canada, 2024). Other species known to breed on the cliffs include glaucous gulls and black guillemots. Black guillemots are known to overwinter north of the island (Mallory & Fontaine, 2004). Common eiders and king eiders are also documented in the area (Mallory & Fontaine, 2004). The site has been designated as an International Biological Programme site which does not afford it any protection but stresses its significance (Bird Studies Canada, 2024).

10.1.3 Migratory Bird Sanctuaries

Migratory Bird Sanctuaries are described in Section 3.2.9 and below.

10.1.3.1.1 Prince Leopold Island

The combined total number of pairs of seabirds that nest in Prince Leopold Island are about 200,000 (Bird Studies Canada, 2024). The area is also designated as an IBA. See Important Bird Areas in Section 10.1.2 for documented species presence within the MBS.

10.1.4 Ecologically or Biologically Significant Marine Areas

Ecologically and Biologically Significant Area's are described in Section 3.2.4 with their relevance to migratory birds described below.

10.1.4.1 Resolute Passage (and Browne Island)

Historical estimates suggest that Browne Island supports 500 to 2,000 pairs of black-legged kittiwakes depending on ice breakup timing in Barrow Strait. Thayer's gull and glaucous gulls have also been documented on Browne Island. Resolute Passage and Barrow Strait are used for foraging by these seabirds (Alexander *et al.*, 1991; Mallory & Fontaine, 2004).

10.1.4.2 Prince Leopold Island

Prince Leopold Island was designated as an EBSA primarily because it is the largest multi-species aggregation of breeding seabirds in the Canadian Arctic. See Important Bird Area section above for species documented in Prince Leopold Island.

10.1.4.3 Wellington Channel (Penny Strait)

Ross's gull is listed as Threatened on the SARA. They occupy the area from about late-May to August. The species nests on the small Cheyne Islands located within Penny Strait and the EBSA encompasses the Dundas Island polynya which supports seabird foraging.

10.2 Field Program

10.2.1 Methodology

Fieldwork was conducted in conjunction with the vegetation survey from 17 to 19 August 2019. Given logistical constraints (i.e. ice break-up), this timing was largely outside the breeding season for migratory and marine birds, which is from approximately 5 June to 25 July in the Arctic. Birds could nest past this period, up until around 15 August in the Arctic, although likelihood is lower (ECCC, 2018). As such, fieldwork focused on gathering habitat data that could be used to generate a list of species with potential to inhabit the HRQ and Community Harbour Study Area. All birds observed and features that were detected (e.g. whitewash, pellets, nests, perches) were identified, photographed, and georeferenced using a handheld GPS unit.

In addition, a visual survey with a series of five-minute point counts spaced approximately 400 m apart were conducted by following transects along the shoreline near the Community Harbour Study Area (Figure 10-2). This distance spacing was used to minimize counting the same individual twice. This survey methodology followed a combination of the BC Coastal Waterbird Survey Protocol (Bird Studies Canada, 2013) and Alberta Sensitive Species Inventory Guidelines (Government of Alberta, 2013) because no government-recommended protocols exist in Nunavut for migratory or marine bird inventories. Each point count included a wait period of two minutes and listening and observing period of five minutes. Point counts were started no more than 30 minutes before sunrise and were completed before 10:00, when possible (in some cases this was not possible because of poor weather or logistical constraints). All birds observed or heard were identified and recorded. Because of schedule and weather constraints, visual surveys were conducted on different days to maximize survey opportunities and species detections. Weather conditions during the field programs are provided in Table 1-5.

10.2.2 Results

Eleven bird species were identified during the field program from 17 to 19 August 2019 (Table 10-1). No nesting or breeding behaviour was identified. Considering the survey was conducted at the end of the breeding bird season, the lack of breeding behaviour does not preclude the potential for birds to nest in the area.

Flocks of arctic terns, brants, glaucous gulls, parasitic jaegers, and snow buntings were observed (Figure 10-2; and Appendix A (Table A-11, Table A-12)). In addition, a flock of snow geese were observed approximately 500 metres offshore from the northern quarry location and a flock of Baird's sandpiper were identified southwest and outside the Project Study Area. Field-collected data for migratory and marine birds are included in Appendix A (Table A-11, Table A-12), with other wildlife observations and detections.

Legend

- Point Count Location
- Community Harbour Study Area

0 95 190 380 Meters

Locations approximate.

GOVERNMENT OF NUNAVUT
RESOLUTE BAY COMMUNITY
HARBOUR DEVELOPMENT

BIRD POINT COUNT LOCATIONS DURING FIELD SURVEY

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Table 10-1: Bird Species Observed during Point Counts and Field Program

Common Name	Species Name
Point Count Observations	
Arctic tern	*Sterna paradisaea*
Common raven	*Corvus corax*
Glaucous gull	*Larus hyperboreus*
Purple sandpiper	*Calidris maritima*
Snow bunting	*Plectrophenax nivalis*
Other Incidental Observations	
Baird's sandpiper	*Calidris bairdii*
Brant	*Branta bernicla*
Parasitic jaeger	*Stercorarius parasiticus*
Red-throated loon	*Gavia stellate*
Snow goose	*Chen caerulescens*
Snowy owl	*Bubo scandiacus*

10.3 Discussion

10.3.1 Habitat Value

In general, habitat in the Community Harbour Study Area is of limited value to migratory and marine birds. Human development dominates the community harbour with structures and boats along its length. Moreover, teams of dogs were tied up along its length. Species breeding in the Community Harbour Study Area are likely those that nest on bare ground and gravelly areas (e.g. snow buntings) and are relatively tolerant of human disturbance (e.g. common raven). However, human use and dogs likely discourage birds from nesting. At low tide, the intertidal zone provides foraging opportunities, but only for those species tolerant of human activity (e.g. gulls and ravens). Consequently, the value of these habitats is likely low given disturbance and human activity. The HRQ Study Area offers more natural habitat including sporadic wet or moist areas, dry and barren areas, and limited to barren vegetated areas. Therefore, the HRQ Study Area offers some value for nesting birds. More information about vegetation community descriptions and land cover types are provided in Section 0.

10.3.2 Migratory Birds

The upland lichen barren and wetland moss lowland areas identified in the HRQ Study Area (see Section 0) potentially offer nesting and foraging habitat for American golden plover, arctic tern, Baird's sandpiper, horned lark, northern wheatear, purple sandpiper, red knot, red phalarope, and snow bunting. There is also moderate nesting potential for hoary redpoll, parasitic jaeger, sandhill crane, and snowy owl (Appendix C, Table C-3).

According to ECCC, the general nesting season for the region (N10: Arctic Plains and Mountains, Bird Conservation Region 3) is between late-May and mid-August, and the primary season (61-100 % of birds nesting) is from early-June to late-July (ECCC, 2018). It should be noted these are estimated breeding dates and that the exact timing can vary according to the species occurrence, climate, elevation, and habitat type. Timing could also vary according to micro-sites or factors such as early or late spring. Because of natural variability in nesting, the timing could vary by up to ten days; moreover, the period above does not include a nest building phase which typically is initiated two weeks prior to the general nesting season (ECCC, 2018).

10.3.3 Marine Birds

The majority of marine birds that have historical occurrences or whose range overlaps with the HRQ Study Area are unlikely to nest here. Most of these birds nest in large colonies on remote, precipitous cliffs and remote islands that are inaccessible to (Cornell Lab of Ornithology, 2015, 2019). Although not breeding, 27 species of marine birds could potentially use inter-tidal, marine coast, and nearshore habitats in the Community Harbour Study Area and Resolute Bay area for foraging and staging. The use of this habitat likely peaks between mid-July and October during ice free periods in the bay (Mallory & Fontaine, 2004).

10.3.4 Species at Risk

Bird SAR status and designations are shown in Table 3-2.

10.3.4.1 Ivory Gull

Ivory gulls breed where the ocean is free (or partly free) of ice in late-May and early June. The Project Study Area does not support breeding and nesting habitat (COSEWIC, 2006). However, given the proximity to ice edge and availability of food for scavenging, including historical observations, there is potential that ivory gulls forage near the Hamlet or in Resolute Passage. The timing and extent of sea ice likely plays a large role in ivory gull distribution and migratory timing (Spencer *et al.*, 2014).

10.3.4.2 Buff-breasted Sandpiper

Buff-breasted sandpiper occur in tundra regions, primarily in wet/lowland habitat, often near a wetland, pond, or lake with sedge-dominated vegetation (COSEWIC, 2012). Habitat use varies depending on breeding stage. In spring, males often display on barren ridges, but as the snow melts, they may display in moister areas. Nests have been documented on the drier parts of the tundra, including slopes with sedge tussocks and moss-willow-varied grass areas, and in sedge-graminoid meadows close to streams or open-water wetlands (COSEWIC, 2012). This type of habitat was identified within the HRQ Study Area although Cornwallis Island is outside the mapped breeding range. Therefore, the likelihood is low that buff-breasted sandpipers occupy and nest in the HRQ and Community Harbour Study Area during the breeding season.

10.3.4.3 Peregrine Falcon

The likelihood of peregrine falcon being within the Project Study Area is low. Habitat capable of supporting this species (cliffs with open gulfs of air) are not present within the Project Study Area. Peregrine falcons also breed in a wide variety of habitats and use coastal areas for hunting avian prey. Peregrine falcons have been known to nest on human-made structures such as buildings, bridges, and other tall structures, but typically do not nest lower than 50 m (Cornell Lab of Ornithology, 2015, 2019; COSEWIC, 2017b).

10.3.4.4 Red Knot

Three subspecies of red knot (*Calidris canutus*) are considered at-risk in Canada: *rufa* (Endangered), *roselaari* (Threatened), and *islandica* (Special Concern). The *islandica* subspecies is the most likely to overlap the Project Study Area (ECCC, 2016d). Red knots breed on windswept ridges, slopes, and plateaus with sparse (<5 %) vegetation cover, often on south-facing sites in proximity to freshwater such as wetlands and lakes (COSEWIC, 2007a). This habitat was identified within the HRQ Study Area; therefore, it is likely that this species occupies and nests in the HRQ Study Area during the breeding season.

10.3.4.5 Red-necked Phalarope

Red-necked phalarope typically breed in low-Arctic tundra near freshwater (e.g. ponds, lakes, and streams) in vegetation dominated by graminoids (COSEWIC, 2014b). The Hamlet is not within the mapped breeding range and this species is considered an accidental visitor to the region (LePage *et al.*, 1998). Although nesting habitat within the HRQ and Community Harbour Study Area may be present, particularly in the wetland areas identified in Section 0, the likelihood of red-necked phalarope being present is low.

10.3.4.6 Ross's Gull

Ross's gulls are distributed across the Arctic, but breed primarily in Siberia and overwinter in the Bering Sea (COSEWIC, 2007c). Some small colonies have been documented on the Cheyne Islands, approximately 190 km to the north so they may stage and forage in the open-water far offshore from the Project Study Area. They can nest in a wide variety of habitats including marshy tundra and gravel reefs, but always close to water (COSEWIC, 2007c). The Project Study Area does not support their preferred nesting habitat, and therefore they are unlikely to nest there.

11 Socio-Economic Environment

This section provides an overview of the existing socio-economic environment of the Hamlet of Resolute Bay including demographics; housing and accommodation; labour force and economic activity; community infrastructure and services; local businesses; and land and resource use. Its main objective is to describe the socio-economic conditions that may interact with the construction of the community harbour. Program objectives for the socio-economic study are outlined in Table 1-1.

11.1 Methodology

Data collection for this socio-economic baseline survey was obtained through a combination of field research (primary data) and desktop research (secondary data). Field research involved interviews and meetings with community leaders and key stakeholders including Mayor and Council, the local Senior Administrative Officer (SAO), local outfitters, business owners, and health centre personnel. A local interpreter was hired to facilitate discussions as required.

Desktop research consisted of the review and analysis of data provided by relevant government and industry reports and websites, including but not limited to:

- Statistics Canada (Statistics Canada, 2023b).
- Nunavut Bureau of Statistics (Nunavut Bureau of Statistics, 2024b).
- The Hamlet of Resolute Bay ICSP Vol.1 and Vol. 2 (GN, 2011).
- The Hamlet of Resolute 2024/2025 Infrastructure Plan (GN, 2024a).
- Review of the Nunavut Adult Learning Strategy (GN, 2019b).
- The NPC's Public Hearings Report on the 2021 Draft Nunavut Land Use Plan; (NPC, 2023a).
- Nunavut Tourism (GN, 2025).
- Nunavut Housing Corporation's (NHC) 2023-24 Annual Report (NHC, 2024).

11.2 Socio-Economic Profile

The Hamlet of Resolute or Resolute Bay, also known locally as Quaasuittuq meaning "the place with no dawn" in Inuktitut, is located on the southern coast of Cornwallis Island. It is the second most northern community in Nunavut, after Grise Fiord. The bay is the waterway into Parry Channel, located in the middle of the Northwest Passage and is part of the Qikiqtaaluk Region. Due to its northern location, Resolute Bay is a gateway for expeditions to the North Pole and Quttinirpaaq (Ellesmere Island) National Park. The nearest communities are Grise Fiord, Arctic Bay, and Pond Inlet.

Resolute Bay was at first a weather station and then an air force base shortly after World War II. It became an Inuit community during the High Arctic Relocation when the Federal government moved several families from Pond Inlet and Northern Quebec to Resolute Bay and Grise Fiord from 1953 to 1955.

Resolute Bay is home to Natural Resources Canada's (NRCan) Polar Continental Shelf Program's (PCSP) Arctic logistics hub. The PCSP facility, located about seven kilometers northwest of the Hamlet, operates from February to September and includes accommodations for up to 237 people, dining, field equipment, storage, office and working space, and a non-specialised laboratory (NRCan, 2016). The PCSP facility also accommodates the Canadian Armed Forces Arctic Training Centre (CAF ATC), that conducts operations and exercises in the Arctic to preserve and enhance the military's ability to operate in the region (National Defence and the Canadian Armed Forces, 2018). The CAF ATC has been operating since 2013 and can accommodate up to 140 military personnel with 1,100 m^2 of storage space for military equipment and vehicles (National Defence and the Canadian Armed Forces, 2018). The PCSP facility's total footprint is approximately 7,500 m^2 of buildings on almost 26,000 m^2 of leased land (NRCan, 2016).

11.2.1 Demographics

11.2.1.1 Population

According to 2021 census data from Statistics Canada, the total population of Resolute Bay is 183, representing a decrease of 7.6 % since 2016. The population is young, with children aged 0-14 years representing just under a third of the total population (60 individuals) and a median age of 25.8 years for the total population. A breakdown of key population statistics provided by Statistics Canada for Resolute Bay is presented in Table 11-1. The Nunavut Bureau of Statistics estimated the population of Resolute Bay to be 202 as of 1 July 2023 (Nunavut Bureau of Statistics, 2020).

11.2.1.2 Indigenous Identity

The total self-declared Inuit population is 165 or 91.7 % of the total population according to Statistics Canada 2021 census data (Table 11-1).

11.2.1.3 Educational Attainment and Language

Table 11-1 shows that in 2021, of the total population 15 years old and over in Resolute Bay: 20 % (25 individuals) held a secondary school diploma (or equivalent) as their highest educational attainment and an additional 25 individuals held a postsecondary certificate, diploma or degree. Of the 25 individuals with postsecondary accreditations, 10 individuals (40 %) held apprenticeship or trades certificates; and 15 individuals (60 %) graduated with a College, Collège d'enseignement général et professionnel (English translation - General and Vocational College (CEGEP) or other non-university certificate or diploma. Of the total population 15 years old and over, 70 individuals (61.5 %) held no certificate, diploma or degree.

Low levels of literacy and numeracy present a challenge to labour force development in the community and across Nunavut (GN & NTI, 2022).

> "…*the largest group of adult learners in Nunavut needs programming that focuses on literacy, life skills,completion of high school or high school equivalency, adult basic education, and personal empowerment,"* (GN & NTI, 2022).

Individuals with low levels of literacy are prevented from gaining meaningful employment, *"while others are dead-ended in positions from which they can't progress without additional education and training*" (GN & NTI, 2022).

Often, the lack of childcare in the community also becomes a barrier to employment and schooling. Many parents in Resolute Bay find it hard to find care for their young children during work hours because the community lack a licensed daycare.

> *"A daycare in the community could potentially increase employment in Resolute Bay and/or offer training opportunities for stay-at-home parents to further improve the chances of their employability in the ever-changing labour market,"* Ian Dudla, Senior Administrative Officer for the Hamlet of Resolute Bay (Nunatsiaq News, 2022).

According to the 2021 census, 47.2 % of respondents identified English as their mother tongue, 38.9 % identified Inuktitut, and 13.9 % reported both languages. This reflects the community's bilingual nature, with English and Inuktitut as the primary languages spoken. Among employed residents in Resolute Bay, English was reported as the language most often used in work settings.

11.2.2 Housing and Accommodation

The 2021 census reported Resolute Bay having a total of 65 occupied private dwellings of which 60 dwellings were rented. Of the 60 rented dwellings, 83.3 % were public (subsidized) housing. Over half (53.8 %) of occupied dwellings were also in need of major repairs (Statistics Canada, 2023b).

The Nunavut Housing Corporation's Annual report for 2023-2024 listed Resolute Bay's housing stock at 34.0 %, indicating a high need for housing as compared to other communities in Nunavut (NHC, 2018).

Accommodation in Resolute Bay is currently provided by the ATCO Frontec Ltd. (ATCO) South Camp Inn with 28 rooms and a total capacity for 52 guests and the Airport Hotel with 21 rooms and a total capacity for 32 guests (ATCO hotel manager. pers. comm. Nov 2024).

11.2.3 Labour Force and Economic Activity

Table 11-1 presents the participation, employment and unemployment rates of the total population in Resolute Bay according to the 2021 Census. Resolute Bay has a higher participation rate and a lower unemployment rate compared to Nunavut as a whole. The participation rate in Resolute Bay was reported as 64.0 % compared to 58.6 % for Nunavut and the unemployment rate was reported as 12.5 % in Resolute Bay compared to 16.8 % for Nunavut (Statistics Canada, 2017). The employment rate was 56 % for Resolute Bay vs. 48.7 % for the territory (Statistics Canada, 2017).

At the territorial level, according to Nunavut's Bureau of Statistics' 2023 Annual Labour Force Update, both Inuit and non-Inuit employment in Nunavut increased between 2022 and 2023. Although Inuit accounted for about 80.0 % of the working-age population in Nunavut, on average, they accounted for only 66.0 % of the total employed individuals in the territory that year. This disparity is also represented with an employment rate of 44.7 % for Inuit compared to 89.6 % for non-Inuit in 2023 (Nunavut Bureau of Statistics, 2024a).

Given the size of the community, income data for Resolute Bay for the 2021 Census have been suppressed to meet the confidentiality requirements of the Statistics Act.

The economy in Resolute Bay can be characterized as a combination of traditional subsistence activities (including hunting, fishing, trapping and gathering) and wage based economic activities. The main employers in Resolute Bay are the Hamlet, GN, ATCO, the Tudjaat Co-op and the airport. Many residents continue to rely heavily on fish, seal and whale hunting, both for subsistence and as a cultural activity, including customary resource sharing practices.

Residents participate in a variety of occupations including construction, education, and retail trade. Public administration accounted for the largest industry, occupying 40% of the total labour force activity in Resolute Bay (Statistics Canada, 2017).

Table 11-1: Resolute Bay Demographics

Census Data	Total
Population	
Population in 2021	183
Population in 2016	198
Median age of the population	25.8
% of the population < 15 years of age	32.4
Percent population change (2016 to 2021)	-7.6
Indigenous Population	
Inuit	165
First Nations	0
Metis	0
Highest Educational Attainment	
Total population 15 years and over	125
No certificate, diploma or degree	70
Secondary (high) school diploma or equivalency certificate	25
Postsecondary certificate, diploma or degree	25
Apprenticeship or trades certificate or diploma	10
College; CEGEP or other non-university certificate or diploma	15

Census Data	Total
University certificate or diploma below the bachelor level	0
University certificate or degree at bachelor level or above	0
Labour force activity	
Total population 15 years and over	125
In the labour force	80
Employed	70
Unemployed	10
Not in the labour force	50
Participation rate	64.0 %
Employment rate	56.0 %
Unemployment rate	12.5 %

Source: Statistics Canada (2023a)

Please note that in order to ensure the confidentiality of an individual's census response, Statistics Canada rounds values up or down, including totals, to a multiple of '5' or '10'. As stated by Statistics Canada, "*as a result, when these data are summed or grouped, the total value may not match the individual values since totals and sub-totals are independently rounded*" (Statistics Canada, 2025). Any discrepancy noted in the totals for various data categories is due to random rounding and does not affect the accuracy of the data set in a significant way. Similarly, percentages may not necessarily add up to 100 % because they are calculated on rounded data.

At the territorial level, according to Nunavut's Bureau of Statistics' 2023 Annual Labour Force Update, both Inuit and non-Inuit employment in Nunavut increased between 2022 and 2023. Although Inuit accounted for about 80.0 % of the working-age population in Nunavut, on average, they accounted for only 66.0 % of the total employed individuals in the territory that year. This disparity is also represented with an employment rate of 44.7 % for Inuit compared to 89.6 % for non-Inuit in 2023 (Nunavut Bureau of Statistics, 2024a).

11.2.4 Community Infrastructure and Services

11.2.4.1 Hamlet-Owned Infrastructure

According to the GN-CGS, the Hamlet of Resolute Bay currently owns the following infrastructure:

- Hamlet Office.
- Fire Hall.
- Arena.
- Two-bay maintenance garage.
- Hamlet Utilidor System.
- Gymnasium / Community Hall.
- Workshop.
- Resolute Dump Road Bridge.

11.2.4.2 Hamlet Equipment and Vehicle Inventory

The following equipment and vehicles are currently owned by the Hamlet (Ian Dudla, SAO. pers. comm. Dec 2024):

- 3 loaders-950/936 of varying ages.
- Old grader.
- A new D5 dozer.
- One Compactor (drum style).
- A Freightline dump truck-in need of major repair.
- 2 garbage trucks. One brand new, one old and unreliable.
- 2 F150 trucks (2023 and 20220).
- 1 old F150 truck in need of major repair.

The equipment listed above is required for the day-to-day operations of the Hamlet and therefore has no availability for any additional project support.

According to the Hamlet's 2024-2025 infrastructure plan, a 4-bay extension to the current 2-bay Hamlet garage is in the design phase. Several pieces of heavy equipment and municipal vehicles remain parked outside during the winter due to lack of proper storage which increases the risk of vandalism and decreases their service life. The plans include a covered parking lot and heated storage space for municipal vehicles such as water and sewage service trucks.

11.2.4.3 Utilities and Communications

The GN contracts ATCO Frontec Ltd. to maintain the water and wastewater services in Resolute Bay, supplied through the Utilidor System. The Utilidor System, constructed in the 1970s, was originally designed for an anticipated population of 1500; however, the expected growth was not realized, and the current population is just under 200 (Dillon, 1999). As the system was designed for 1500 people, there was insufficient flow, leading to numerous freeze-ups and failures within the system (GN, 2003). Significant upgrades to the system including a new intake system, pump station and water treatment plant have recently been completed. The upgrades include a new 720 L/min pump station with three intakes, three boilers and a backup power generator.

11.2.4.3.1 Water

Water is supplied to the treatment plant from Char Lake via 2.7 km of electrically heat-traced insulated high density polyethylene pipe. The new treatment plant houses first-stage multi-media filters (gravel, sand and anthracite), second-stage cartridge filters, UV disinfection and new chlorination equipment. The water supply is integrated with the Hamlet's sewage collection system through the utilidor. Water in the utilidor is continuously supplied, circulated, and heated to prevent pipes from freezing. The Hamlet is served entirely by the Utilidor system with the exception of the Royal Canadian Mountain Police (RCMP) building, the airport site and the PCSP, which rely on water truck delivery (Ian Dudla, SAO. pers. comm. Nov 2024).

11.2.4.3.2 Sewage

Sewage and municipal wastewater are collected through the Utilidor system, macerated and discharged to the ocean. The system uses bleed water from the water mains to provide freeze protection to the sewer mains, which also serves to dilute the wastewater prior to discharge. The effluent discharge occurs just above the low tide mark. The effluent is discharged continually into the ocean at high tide and on land at low tide. The airport site has a separate sewage lagoon system. The GN is expected to build a new sewage treatment plant for the community in the near future.

11.2.4.3.3 Solid Waste Management

The municipal waste facilities include a domestic waste site located 4 km south-west of the Hamlet, on the shoreline of the Arctic Ocean and a metal wastes and hazardous goods site within the Hamlet. The domestic waste site is not lined or contained, and the facility is managed by the burn and cover procedure. The metal waste and hazardous goods site is located within the Hamlet. This site receives all the metal wastes without any segregation. The hazardous waste is segregated in a berm-like structure that is at maximum capacity. The current landfill is nearing capacity and requires new double fencing.

The Hamlet has proposed to construct a new municipal waste site at a location approximately 75 m north of the existing bulk metals disposal site. The proposed site was originally built in 2001 as a waste disposal site but was never licenced or used (GN, 2016c). The site has an existing perimeter fence with an entrance gate and an approximate area of 50,000 m² (GN, 2016c). Funding for the solid waste site upgrades was approved by Infrastructure Canada in 2017 with an expected completion by 2027 (Government of Canada, 2024d).

The Hamlet operates one garbage truck for collection of solid waste within the community and transfer to the solid waste facility. A front-end loader is used to haul metal objects such as old automobiles and fridges to the metal dump. An access road, approximately 7 km long, from the community connects the solid waste site and bulky metal site. The road is adequately maintained for all types of vehicles throughout the year.

11.2.4.4 Electricity and Fuel

Electricity is provided via diesel generators that are owned and operated by the Qulliq Energy Corporation, a territorial corporation 100 % owned by the GN. Qulliq Energy is the only generator, transmitter and distributor of electrical energy in Nunavut. Both power and heat in Nunavut are entirely derived from an estimated 55 million litres of diesel shipped annually to each of the 25 remote communities during the summer months (open-water season). Each community relies entirely on their own Qulliq Energy Corporation (QEC) operated diesel plant.

Currently, Nunavut is the sole territory or province in Canada lacking a regional power grid with no substantial source of renewable energy. In contrast, over two thirds of the energy (on average) in Canada is derived from renewable sources such as hydro, wind, solar, and geothermal/biomass (NTI, 2020).

Fuel in Resolute Bay is stored at a tank farm located in the industrial area approximately 3 km south-west of the centre of town with some volume stored at the airport for jet fuel (See Table 11-2). There have been no significant issues with fuel delivery or storage capacity in the community in recent years, except for a jet fuel shortage in 2022. The current fuel storage capacity adequately meets the community's needs, and no shortages have been reported since (Ian Dudla, SAO. pers. comm. Dec 2024).

Table 11-2: Bulk Fuel Storage Capacity for Resolute Bay

Total Diesel (L)	Total Gasoline (L)	Total Jet A-1 (L)
13,663,313 L	4,049,707 L	12,949,287 L

Source: Nunavut Maligaliurvia (2023)

11.2.4.5 Communications

Landline and mobile phone services are provided by NorthwesTel / Bell Mobility. Historically, internet services were provided by Qiniq. However, as of 2019, a new open-access network by Northwestel and Bell called Tamarmik Nunaliit now services Resolute Bay and delivers 15 megabits per second (Mbps) internet and LTE wireless service to the community. Operating on Telesat ka-Band satellite technology, the network provides up to 20 times more internet capacity than previously available, making high-speed internet and wireless service possible in the community.

11.2.4.6 Education Services

Education services in Resolute Bay are provided through Qarmartalik School and Nunavut Arctic College (NAC).

Qarmartalik School offers kindergarten to Grade 12 education, following the Nunavut curriculum with a strong emphasis on bilingual instruction in Inuktitut and English, as well as the integration of IQ alongside standard academic subjects.

Across Nunavut, a variety of organizations currently offer adult education and training programs. However, the delivery of programs and courses is fragmented and inconsistently applied, leading to frustration and lack of engagement by adult learners. As a result, course and program completion rates are low and the system often falls short of meeting its stated objectives (GN & NTI, 2022).

NAC offers programs in communities across the territory through its 5 regional campuses and Community Learning Centres in each of the 25 communities. The programs and services offered by NAC aim to respond to local demands, including courses that provide the work force with the skills required to respond to local employment opportunities. Not all programs are offered every year, and they vary according to need and demand. According to NAC, many applicants require academic upgrading to be eligible to participate in their programs and although NAC offers preparatory programs, funding constraints means these programs are only able to be offered in a few communities. As a result, many adult learners would have to leave their communities to access these programs.

11.2.4.7 Transportation

Resolute Bay is serviced daily by scheduled commercial flights provided by Canadian North via Iqaluit. The ATCO South Camp Inn and airport hotel offer free airport shuttles.

As the hub for Arctic research (PCSP) and military training operations (CAF ATC), Resolute Bay has a much more extensive road system compared to other communities in Nunavut. The roads in Resolute Bay are gravel surface with no walkways. Pedestrians, all-terrain vehicles, snow machines, cars and trucks all share the road. The Hamlet is responsible for snow clearing and dust suppression on roads; however, maintaining Resolute Bay's extensive road network remains challenging with the current resources. Spring runoff, which frequently washes out sections of the roads, poses a significant issue (Ian Dudla, SAO. pers. comm. Dec 2024).

Sealift is a vital link for all communities in Nunavut that supply residents with their annual cargo of goods and materials. Sealift ships travel from several southern Canadian ports with a variety of goods ranging from housewares, non-perishable items, construction materials, vehicles, and heavy equipment. Nunavut Sealink and Supply Inc. (NSSI) and Nunavut Eastern Arctic Shipping Inc. (NEAS) are the current providers of sealift carriage and associated services. Sealift ships usually arrive in Resolute Bay at the end of August or beginning of September, with the last boat of the year leaving sometime around middle to late September.

11.2.4.8 Emergency and Protection Services

Fire protection is the responsibility of the Hamlet and currently relies on 8 volunteer firefighters. The Hamlet has a pumper firetruck, and firefighters are trained to hook up to the fire hydrants for fire suppression. Although the Hamlet reports that no fires have occurred over the past year, it is a constant struggle for the community to ensure that enough firefighters are in town at any given time to respond should one occur.

The RCMP detachment office is staffed with two full time officers.

11.2.4.9 Public Health

The Resolute Bay Health Centre is nearly 50 years old and in need of major structural repairs. The 2024-2025 Infrastructure Plan for Resolute Bay indicates that the Health Centre needs to be replaced.

The Health Centre is staffed by two to three nurses: a supervising nurse and support nurse(s). It has limited laboratory facilities and can provide basic X-rays (Supervising nurse. pers. comm. Dec 2024). The nurses are equipped to provide plaster casts and splints but not circumferential casts. They deal with basic infections and are authorized to prescribe and dispense medications. The Health Centre is not equipped to allow overnight stays and patients are stabilized and then evacuated by medevac services to hospital in Iqaluit. Resolute Bay also uses tele-med services.

The Health Centre delivers community health programs that include Pre-natal and Post-natal Care, Well Adult, Well Child and Chronic Disease Clinics.

There are visiting specialists who fly into the community, as follows:

- Family physicians: once every three months.
- Dentists: a few times a year for 10 to 14 days per visit.
- Physiotherapists, speech therapists, occupational therapists: once a year.
- Mental health clinician: available on a casual basis in the community and by telephone if the clinician is not in Resolute Bay.

According to the most recent data available, the Resolute Bay Health Centre had a total of 2,279 visits in 2016 and 10.9 visits per capita (GN, 2018c).

The nursing team reported that the Health Centre is adequately staffed and equipped to address the community's current health care needs. They noted that the clinic accepts workers from the south requiring medical attention beyond the capabilities of ATCO or other companies working in the community. The nurses have the capacity to address these medical needs effectively. Based on prior experience with ATCO, the team indicated that the expected construction workforce for the community harbour should not place significant strain on the Health Centre, provided that workers are fit-for-work and in good health. However, they advised that workers requiring prescriptions bring sufficient medication with them, as Resolute Bay does not maintain a fully stocked pharmacy.

11.2.5 Local Businesses

The following businesses are registered with the Hamlet for the current financial year (Jeffrey Amarualik, Community Economic Development Officer. pers. comm. Feb 2025).

Table 11-3: Registered Businesses for the Current Financial 11-3

Last Name	First Name	Name of Business	Type
Nungaq	Randy	Polar Outfitting	Tourism and Outfitting
		Tudjaat Co-operative Ltd.	General Retail
Salluviniq	Susan	Salluviniq Translating Services	Translation
Idlout	Randy	Quvvariavik Mamisarvik	Healing
		Atco Frontec Ltd.	General Contractor
			Narwhale Hotel
			Fuel Distribution
			South Camp Inn
			Restaurant (South Camp Inn)
			Restaurant (Narwhale Hotel)
			Apartment Block 3
			Taxi / Ambulance
			Vehicle and Equipment Rental
			Repair and Service Shop
			Hall for Public Rental
		Kenn Borek Air Ltd.	Aircraft management & operations

11.2.6 Land and Resource Use

11.2.6.1 Harvesting and Food Security

Food security, as defined by the United Nation's Food and Agriculture Organization (FAO), exists "*when all people, at all times, have physical, social and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life*" (FAO, 2023). Inuit in Canada face the highest documented prevalence of food insecurity of any Indigenous people living in a developed country (ITK, 2021). In 2021, 46.1 % of people in Nunavut lived in food-insecure households (Statistics Canada, 2023b).

Hunting remains essential to life in Resolute Bay. Harvesting of ringed seal, Arctic char, narwhal, and caribou are of particular importance. The availability of traditionally harvested foods in Resolute Bay is crucial because it lowers the demand for imported food which is expensive and most often less nutritious. Additionally, the harvesting, preparation, and sharing of meat and skins offers important opportunities for community members to maintain Inuit cultural practices. Residents also buy food at the Co-Op and order food via the sealift. However, "*Low incomes and high food prices mean most Inuit households can afford less than half the cost of a healthy food basket, while very low-income households can afford only 6–13 % of the cost of a healthy food basket*" (ITK, 2021).

Harvesting locations identified during the IQ program have been provided in the Land Use and Occupancy map Figure 2-1.

Apart from the occasional marine mammal, harvesting does not occur in Resolute Bay due to the wastewater outfall (IQ Workshops 2019 and 2024). There is no harvesting for clams or other bivalves, kelp or seaweed, and there is no fishing in Resolute Bay (IQ workshops 2019 and 2024).

Although belugas are occasionally harvested in the bay during the open-water season, the practice is discouraged by the HTA due to community safety concerns (IQ Workshop 2019 - Joadamee Amagoalik). Seals are also occasionally harvested in the bay between July and August (IQ Workshop 2019 - Allie Salluviniq) and in the winter from freeze up to about March along cracks in the ice (IQ Workshop 2019 - Simon Idlout) (Figure 2-1).

> *"The seal (ice) cracks have sustained this community since we got here"* (IQ Workshop 2019 - Joadamee Amagoalik)

Fishing with gillnets occurs at Allen Bay (Figure 2-1) but there is no fishing in Resolute Bay (IQ workshop 2019 and 2024). Clams and other shellfish, although present in Resolute Bay, are also not harvested due to the outfall.

> *"Sea urchins, whelks and clams are all over, we know they're there from research that's been done here, and from some people harvesting many years ago, but we don't harvest anything in the bay anymore due to the outfall"* (IQ Workshop 2019 - Peter Amarualik).

Clams occur at Allen Bay and were harvested in the past by one resident who no longer harvests them (IQ Workshop 2019). Trapping for Arctic fox or any other land animals does not occur anywhere in or around the community (IQ Workshops 2019 and 2024).

Knowledge holders stated that there was no sense in marking polar bear sightings in the area because *"they are everywhere*" and *"unlike other communities, we (Resolute Bay residents) see bears here consistently 365 days a year"* (IQ Workshop 2019 - Joadamee Amagoalik). Polar bear tracks are a common sighting all over town and especially at the dump and near any food left out (IQ Workshop 2019 and 2024). Harvesting of plants or berries does not occur in or around the Study Area. Plants in the area are considered too sparse for picking (IQ Workshops 2019 and 2024). Additionally, seaweed and kelp, although present in Resolute Bay, are not harvested anywhere near the community due to the outfall (IQ workshops 2019 and 2024).

11.2.6.2 Travel Routes and Access

Boats and skidoos are critical for subsistence harvesting in the Arctic. The majority of hunting and fishing activities are conducted far from Resolute Bay and require boats and skidoos for access.

The community does not currently have a protected boat harbour, and the only existing marine infrastructure consists of bollards for the fuel vessel. There have been previous attempts to construct breakwaters and dredge the bay, however, these efforts were unsuccessful. Most boats are pulled up on the beach in the northeast corner of the bay, which is closest to the townsite, although some boats are also stored in the industrial area on the west side of the bay.

Dry cargo from the sealift is lightered to shore in the conventional manner, that is, using small tugs and barges that are carried on board the arriving ship. The barges are brought into the western beach adjacent the industrial part of the community. Sealift is therefore segregated from boat activities that occur on the eastern shore nearest the community.

11.2.6.3 Nauttiqsuqtiit Inuit Steward program

In July 2018, QIA launched the Tallurutiup Imanga Nauttiqsuqtiit pilot program (otherwise known as the pilot Guardian Program) in Arctic Bay as an early benefit from the IIBA required to establish the TI NMCA (IIBA, 2019). The program is made possible through funding from Parks Canada and has now expanded to other communities, including Resolute Bay. The Resolute Bay Nauttiqsuqtit provide local stewardship of the TI NMCA to monitor the ecological health of the region and maintain cultural sites. Six Inuit from Resolute Bay have been hired as Nauttiqsuqtit to be the stewards of the marine areas in and around the community.

Their activities include the following:

- Monitor sea ice, snow conditions, wildlife and ship traffic.
- Assist with search and rescue efforts.
- Harvesting to provide country food for the community.
- Contribute to land and marine planning and management.
- Promote intergenerational sharing of Inuit knowledge (IQ) by taking youth out on the land and sea.
- Engage with community members and act as a bridge between Elders and youth.
- Act as cultural liaisons and interpreters for the TI NMCA.
- Gather IQ.

11.2.6.4 Recreation and Tourism

11.2.6.4.1 Recreation

The Hamlet offers community residents the following recreational facilities:

- Community gymnasium/C-hall.
- Arena.
- Playground.
- Baseball diamond.

Resolute Bay hosts annual events, including but not limited to:

- Hamlet Day.
- Nunavut Day.
- Canada Day.
- Community Clean-ups.
- Traditional Games and Barbeque.
- Christmas and New Year’s celebrations.

11.2.6.4.2 Tourism

Resolute Bay offers a unique tourist destination. It is a place of historic interest because it served as a crucial junction along the infamous Northwest Passage in the 18th and 19th centuries. Resolute Bay was named after the British ship, HMS Resolute, which was abandoned in 1850 while searching for the Northwest Passage and the lost Franklin expedition. Resolute Bay has since become the major stopover point for extreme adventure expeditions to the North Pole and to Ellesmere Island (Quttinirtaaq) National Park.

Tourist experiences in and near Resolute Bay include:

- Wildlife viewing: Polar bears, beluga whales, seals, walruses, and migratory birds.
- Historic sites: Cold War era buildings and plane wrecks.
- Tupirvik Territorial Park: Hiking through the park’s ancient seabed rich with fossils dating back 400 million years.

The main outfitters in town are Polar Ice Adventures and Outfitting run by Randy Nungaq and Devon Manik providing dog sledding expeditions. The HTA can also arrange for local Inuit guides for various trips in the region.

The 2024-2025 Infrastructure Plan for Resolute Bay indicates the need to build a Heritage Centre to showcase the culture and heritage of the community for visitors as tourism to the community is increasing.

Cruise ship visitation to the community has increased steadily in the last couple of years since the 2-year ban on cruising during the global pandemic. According to the SAO, at least 20 cruise ships visited in 2024, and an even higher number of cruise ship visits are expected in 2025. Currently, small boats or tender boats carry passengers from the anchored cruise ships to shore on Dynamite Beach (see Figure 2-1) (HTA member. pers. comm. Nov 2018). Alternate landing locations for tender boats are also provided in Figure 2-1 (HTA members. pers. comms. June 2019 and Aug 2024). According to the HTA, there has also been an increase in sail boats and pleasure craft (including very large yachts) visiting the community in recent years.

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