

Title: Understanding the impacts of climate change on Arctic nesting geese – a key towards Inuit food sovereignty in Arviat, Nunavut
Applicant: Aqqiumavvik Society, Box 444, Arviat, NU, X0C0E0 Kukik Baker, Executive Director, arviatwellness@gmail.com ; 867-857-2037
People to be covered under the permit: Frank Baldwin, ECCC (CWS) Dominique Henri, ECCC Jennifer Provencher, ECCC Johannes Berhane, CFI Aqqiumavvik Ujjiqsuinig Young Hunters Program

The Aqqiumavvik Society has brought together a team of experts to investigate the dynamics of climate-food-health from a food sovereignty perspective based on the experiences of Arviarmiut in relation to light goose harvesting and consumption. Our research builds on insights gained from the Kangut Project (2016-2020) that identified Arviarmiut priorities related to light goose management and research. The goal of our project is to assess the viability of an increased harvest of geese and eggs in a changing climate, to contribute to food security in Arviat. Our work contributes to community efforts to restore Inuit relationships with geese, address food sovereignty issues, promote climate change awareness and action in Arviat, and restore nutritionally rich diet options within the community and across Nunavut. As part of these goals, we propose to gather information on geese with the nearby Kuugaajuk Migratory Bird Sanctuary. Proposed work that will take place within the sanctuary includes:

1. Mapping current goose nesting locations and estimating abundance through systematic nest plot surveys (a grid of sample plots where numbers of nests inside a 30 m radius are counted, and eggs are measured to determine species; details provided below).
2. Goose population health monitoring: collect a sample of 50 adult snow and 50 adult Ross's geese to assess cotemporary pathogens, plastic pollution, contaminant, and pre-breeding nutrient levels (note: some of these birds may be collected outside the MBS).
3. Banding a representative sample of snow and Ross's geese to determine current harvest and survival rates, which will guide local harvesting thresholds (note: some banding may occur outside the MBS).

Project location All activities will take place within the Kuugaajuk Sanctuary and within a 25-mile radius of Arviat with specific focus on goose nesting areas to the northwest of the community.

Dates and duration of the project: Activity in the Kuugaajuk Sanctuary will take place in April-September of each year from 2022-2026. Depending on the research activity to be undertaken, visits will be: daily from mid-late May to harvest up to 50 snow and 50 Ross's geese for contaminants, microplastics, nutrient reserve analysis. Daily from late May-end of June to visits to map nesting areas, measure and monitor eggs and take nest vicinity soil samples. Daily for approx. 1 week between early-mid July, for capturing and banding a sample of lesser snow and Ross's geese.

Method of transportation and frequency: We will use ATVs to enter and traverse the MBS for field work. ATVs will be used to transport crew to the edge of the nesting colony, but the colony itself will be accessed on foot during the nesting period. When using ATVs, we intend to stay on established routes in the intertidal zone, and avoid sensitive habitats where ATVs may cause damage. During the approximate 1 week of banding, we will establish a mobile base camp in, or within close proximity to the nesting area (perhaps on an esker). At the end of the banding process all evidence of the camp will be removed.

Summary of activities and rationale:

1. Assessing goose abundance and distribution around Arviat (monitoring colony location, size and changes over time) - a biotic determinant of health. There is currently a need to further monitor goose abundance and distribution around Arviat in the context of changing climatic conditions.
2. Establishing a goose banding program to monitor goose population dynamics - a social determinant of health. Banding is the main monitoring program for Snow and Ross' Geese across North America and is conducted annually across Nunavut by Environment and Climate Change Canada (ECCC). Banding is an important program for continental harvest management, and for understanding the status of the population, but

has not been conducted in the Arviat area for several years. 3. Assessing pathogens, emerging diseases and contaminants in geese - a biotic determinant of health- Our main interest is in the zoonosis pathogens and diseases that could pose a risk from the consumption of geese. However, we are also interested in understanding the incidence of other pathogens (e.g., influenza A, avian paramyxoviruses, coronaviruses, avian metapneumovirus and other emerging viruses as well), as indicators of goose health. Understanding both legacy contaminants (i.e. those that have been detected and tracked over many years), and contaminants that are of emerging concern is critical information for Inuit communities to holistically consider the benefits and risks to eating in a healthy way. 4. Assessing of plastic pollution in geese and their habitats - an abiotic determinant of health - Plastic pollution ingestion has been recorded in several bird species in northern Canada, but to date, light geese have not been examined. 5. Studying Canada geese genomics and hybridization of Canada and Cackling geese at the McConnell River - A Canada-Cackling Goose hybrid zone occurs between northern Manitoba and southern Nunavut, and there is interest in determining if there is a relationship between egg size and genomics, so other hybrid areas can be identified, and so we can gain an understanding of the northward movement of nesting Canada Geese. 6. Examining Pre-nesting nutrient reserves- The demand for protein by millions of geese concentrated in a narrow-band coastal habitat has driven habitat alteration in the sub-Arctic and southern Arctic. Protein reserves in individuals have been in long-term decline in both species (Ross et al. 2017) and may be related to declining habitat quality and per-capita availability in the North. 7. A climate change analysis activity – looking potentially on impacts for goose abundance and health as climate conditions change resulting in drying of marshlands and ponds. 8. Analysis of the implications of data for goose and human health – nutritional profiles of goose samples collected; analysis of climatic indicators that might impact harvest sustainability and future health implications so that annual harvest information emerges. 9. Community selection of goose health metrics for community-based monitoring- a prioritization exercise of the most important health metrics to continue to monitor beyond the scope of this funding to track goose population health for human use in relation to climate change.

Operations Phase: from 2022-04-28 to 2026-08-27

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Kuugaarjuq Migratory Bird Sanctuary	Researching	Crown	Kuugaarjuq Migratory Bird Sanctuary is co-managed under the Nivvialik Co-management Committee.	N/A	Arviat is the closest community. Our project will work within a 25 miles radius from Arviat and also within the Kuugaarjuq Migratory Bird Sanctuary

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ᖅᓴᖅ	Peter Alareak	Nivvialik Co-management Committee	2022-01-28
ᖅᓴᖅ	Sam Muckpah	Arviat Hunters and Trappers Organization	2022-01-28
ᖅᓴᖅ	Gordy Kidlapik	Hamlet of Arviat	2022-01-28
ᓴᓱᓱᓂᓂᓶ	Kono Tattuinee	Kivalliq Inuit Association	2022-01-28
ᓴᓱᓱᓂᓂᓶ	Burt Dean	Nunavut Tunngavik	2022-01-28

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Kivalliq

$\epsilon \Delta t^{\alpha} j^c$ $\Lambda J^{\alpha} e D \dot{N}$ $d^{\alpha} r^{\beta} C D P L \dot{\chi}^c$

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Nunavut Tunngavik Inc	Application for a community research certificate	Applied, Decision Pending		
ᓴᓴᓄᓚ ᓴᓴᓄᓚ ᓴᓴᓄᓚ	The project actively partners with CWS which has committed in-kind funding and training support.	Active	2021-10-08	2026-03-31
Environment and Climate Change Canada	The project actively partners with ECCC which has committed in-kind funding and training support.	Active	2021-10-08	2026-03-31
ᓴᓴᓄᓚ ᓴᓴᓄᓚ, ᓴᓴᓄᓚ ᓴᓴᓄᓚ	The project actively partners with DoE which has committed in-kind funding and training support.	Active	2021-10-08	2026-03-31
Hamlets and Municipalities	The project has received a letter of support from the Hamlet of Arviat	Active	2022-02-09	2026-03-31
Hunters and Trappers Associations/Organizations	The project has received a letter of support from the Arviat HTO	Active	2022-02-09	2026-03-31
ᓴᓴᓄᓚ	The project has received a letter of support from the Canada Food Inspection Agency	Active	2021-10-09	2026-03-31
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ATV	8	4x4	We will use ATVs to enter and traverse the MBS for field work. ATVs will be used to transport crew to the edge of the nesting colony, but the colony itself will be accessed on foot during the nesting period. When using ATVs, we intend to stay on established routes in the intertidal zone, and avoid sensitive habitats where ATVs may cause damage.During the approximate 1 week of banding, we will establish a mobile base camp in, or within close proximity to the nesting area (perhaps on an esker?).
Sled and tent frame	1	8x10	temporary camp
ATV/skidoo	8	4x4	Access to data collection sites

[illegible][illegible]

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0	10 l water container.	Wold Creek or McConnell River

$$\Delta^b C d \leq \rho \sigma \Delta^a \sigma^b$$
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Our work is poised to make significant impacts by addressing Arviarmiut priorities, advancing light goose research in Inuit Nunangat, connecting climate and human health research, and examining migratory bird policies and regulations in the context of Inuit rights and governance. There is not expected to be significant environmental impact from this work. However, overall research impacts included • Migratory bird management/policy (regional, territorial, national, international scales) –i) improving population monitoring and assessment of goose abundance and health informs evidence-based policy- and decision-making; ii) developing safe goose consumption guidelines contributes to northern health policy; iii) refining policies relating to sustainable harvest and food sharing in Nunavut; and, iv) understanding impacts of colonial wildlife management is essential to improve cross-jurisdictional management practices and policies across light goose migratory ranges.

Additional Information

SECTION A1: Project Info

SECTION A2: Allweather Road

SECTION A3: Winter Road

SECTION B1: Project Info

SECTION B2: Exploration Activity

SECTION B3: Geosciences

SECTION B4: Drilling

SECTION B5: Stripping

SECTION B6: Underground Activity

SECTION B7: Waste Rock

SECTION B8: Stockpiles

SECTION B9: Mine Development

SECTION B10: Geology

SECTION B11: Mine

SECTION B12: Mill

SECTION C1: Pits

SECTION D1: Facility

SECTION D2: Facility Construction

SECTION D3: Facility Operation

SECTION D4: Vessel Use

SECTION E1: Offshore Survey

SECTION E2: Nearshore Survey

SECTION E3: Vessel Use

SECTION F1: Site Cleanup

SECTION G1: Well Authorization

SECTION G2: Onland Exploration

SECTION G3: Offshore Exploration

SECTION G4: Rig

SECTION H1: Vessel Use

SECTION H2: Disposal At Sea

SECTION 11: Municipal Development

[illegible]

Kuugaarjuk Migratory Bird Sanctuary is an area extending inland from the deep tidal flats of western Hudson Bay. It is nesting groups for a rich variety of shore birds and various goose species. The area is low marshland and includes several eskers and shallow lakes.

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Much of the Kuugaarjuk Migratory Bird Sanctuary has been stripped of vegetation in recent years. Climate conditions are causing a drying of shallow ponds. It remains a key nesting area for geese and shore birds.

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Kuugaarjuk Migratory Bird Sanctuary has been a rich harvesting area for geese in the past. It continues to be used by Inuit but reportedly to a lesser degree given the habitat degradation that has occurred due to goose over population.

Miscellaneous Project Information

$a \rightarrow a \Delta^{fb} C D \sigma^{ab} r^c$ $d b) ^{fb} C D P L \downarrow^c$ ${}^{fb} m \Delta^c) \sigma^{ab} r^c$ $\langle c D \Gamma' \downarrow \downarrow P^{fb} C D \sigma d^f \sigma^{ab} r^c \rangle$

Our research will have little impact on the area. We will be using plotting surveys which should cause as little disruption as possible. Sampling of nests will be limited and nest assessment will take place after goslings have hatched.

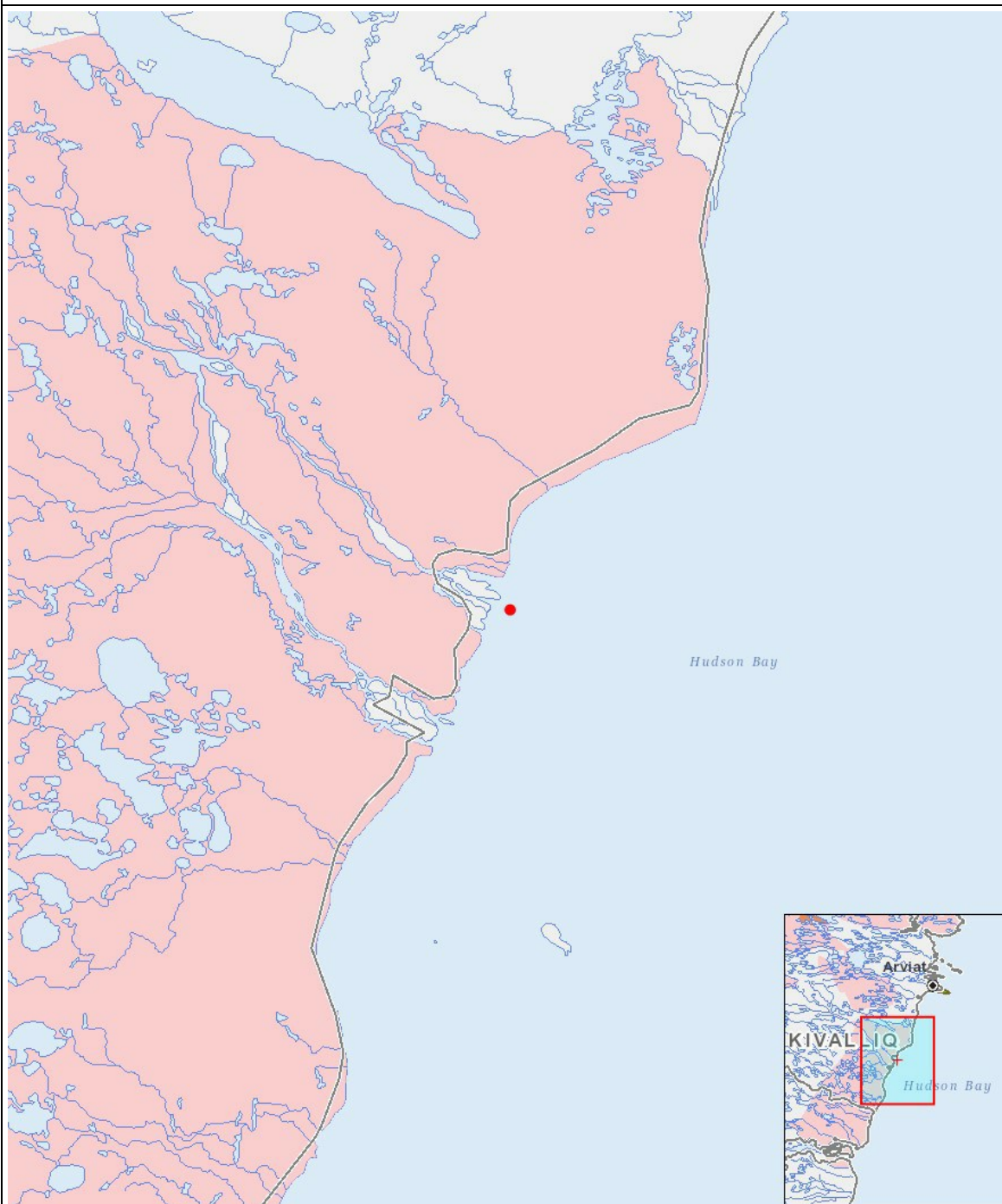
Cumulative Effects

None anticipated.

Impacts

$\mathbb{A}^1_{\mathbb{C}} \times \mathbb{A}^1_{\mathbb{C}} \rightarrow \mathbb{A}^1_{\mathbb{C}}$

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$$(P = \mathbb{A}b\mathbb{A}p\mathbb{N}r^a q^{sb})^c, N = \mathbb{A}b\mathbb{A}r^s \mathbb{A}c\mathbb{A}r^a q^{sb})^c \mathbb{A}c\mathbb{A}r^s \mathbb{A}r^{sb})^{sb} \mathbb{A}c\mathbb{A}r^a q^{sf})^c \mathbb{A}, M = \mathbb{A}b\mathbb{A}r^s \mathbb{A}c\mathbb{A}r^a q^{sb})^c \mathbb{A}c\mathbb{A}r^s \mathbb{A}r^{sb})^{sb} \mathbb{A}c\mathbb{A}r^a q^{sb})^c \mathbb{A}, U = {}^{sb}\mathbb{A}p\mathbb{A}r^a q^{sf})^{sb})$$



List of Project Geometries

1	point	Kuugaarjuq Migratory Bird Sanctuary
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