

NIRB Application for Screening #125077

Canadian Arctic Tidal Transect Research and Information Network - Ice Covered Ecosystem (CAT-TRAIN-ICE): Amendment to NRI#04 002 17R-M

Application Type: New
Project Type: Research
Application Date: 2/21/2017 11:28:27 AM
Period of Operation: From 2017-04-15 to 2017-05-31
Proposed Authorization: From 2017-04-15 to 2017-05-31
Project proponent: CJ Mundy
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 Winnipeg Manitoba R3T 2N2
 Canada
 Tel: 204-272-1571, fax:

DETAILS

Non-technical project proposal description

English: Climate warming has induced rapid change in the ice-covered marine ecosystem of the high Arctic. This application is for an amendment to our current multiyear NRI licence (NRI#04 002 17R-M; NIRB 10YN014). The amendment will be to expand the region of study to Bathurst Inlet under the auspices of the same objectives in our original NRI licence, which are to investigate: (1) physical and biological processes controlling the timing of marine primary production, which has been hypothesized as an indicator of potential change in the ecosystem, (2) the influence of rivers and sea ice melt on the freshwater budget and organic carbon cycle in coastal bays near Cambridge Bay, and (3) microbial diversity in sea ice and seawater as it relates to in situ biogeochemical cycling and the potential microbial response to increased industrial activity, e.g., oil spills. A core collaborator in this work is the Arctic Research Foundation (ARF), a private not-for-profit organization, who's main objective is to support long-term Arctic sustainability through in part interdisciplinary research within the Kitikmeot Region. ARF recently developed self-sustaining portable research laboratories, called Mobile Marine-Archeology-Geology Network (M-MAG-N) labs. These labs were designed to run specifically on green energy, which includes wind and solar panel power. The CAT-TRAIN-ICE project seeks to support a specific investigation of the role of tidal straits on biological production in the region. Tidal straits are waterways that constrict tidal current flow, causing currents to increase. The result is often a thinner ice cover, yet enhanced biological production within the strait. In fact, these sites are potentially the driving force for much of the primary production within this region and can serve as critical location for other higher order trophic levels, such as fish and other marine organisms. Our oceanographic investigation will make use of a cat-train and M-MAG-N labs to access tidal straits within Dease Strait and Bathurst Inlet. This unique opportunity will allow us to expand our current marine ecosystem monitoring and enable the study of spatial variability in tidal strait processes. A map with targeted sampling transects CT1 to CT8 is located below. We note the cat-train will follow a path on the sea ice, but close to shore for safety purposes to deploy the M-MAG-N labs (See separate application NPC# 148438). To access the tidal strait sampling transects, snowmobiles (5-6) will be used including komatiks/sleds to carry sampling gear. Oceanographic sampling will occur over approximately 3 weeks between 15 April and 31 May 2017 (final dates to be determined). The following sample variables will be collected over the course of the expedition from ice cores and water samples: physical oceanic variables (temperature, salinity currents), nutrient concentration, chemical variables associated with ocean acidification (pH, dissolve inorganic carbon (DOC), total alkalinity, etc.) and algal photo-physiology and production.

French: n/a

Inuktitut:

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 (NRI#04 002 17R-M; NIRB 10YN014).

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 Geology Network (M-MAG-N) .

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CT1 CT8 . ,
M-
MAG-N . (NPC# 148438).
(5-6)
15- 31, 2017- ().
: (,),
, (pH, dissolve inorganic carbon (DOC), total alkalinity,)
algal photo-physiology .

Personnel

Personnel on site: 16

Days on site: 21

Total Person days: 336

Period of operation: from 2017-04-15 to 2017-05-31

Proposed term of operation: from 2017-04-15 to 2017-05-31

ACTIVITIES

Project Activities

Location	Activity Type	Land Status	Site History	Site Archaeological or Palentological Value	Proximity to the nearest communities and any protected areas
Transect 3 (CT3)	Researching	Marine	Last year we collected some oceanographic data within Bathurst Inlet under the assumption that it fit within the latitude-longitude bounds of our original NRI license. We reported on this and learnt our assumption was incorrect. We apologize for this and seek approval for future data collection through this application.	N/A	The proposed CAT-TRAIN-ICE project will occur within the governing areas of Cambridge Bay, NU. Sampling is proposed to occur along tidal straits within Dease Strait and Bathurst Inlet, accessed via snowmobile from a cat-train that will follow a path on the sea ice yet close to the shore.
Transect 2 (CT2)	Researching	Marine	Last year we collected some oceanographic data within Bathurst Inlet under the assumption that it fit within the latitude-longitude bounds of our original NRI license. We reported on this and learnt our assumption was incorrect. We apologize for this and seek approval for future data collection through this application.	N/A	The proposed CAT-TRAIN-ICE project will occur within the governing areas of Cambridge Bay, NU. Sampling is proposed to occur along tidal straits within Dease Strait and Bathurst Inlet, accessed via snowmobile from a cat-train that will follow a path on the sea ice yet close to the shore.
Transect 4 (CT4)	Researching	Marine	Last year we collected some oceanographic data within Bathurst Inlet under the assumption that it fit within the latitude-longitude bounds of our original NRI license. We reported on this and learnt our assumption was incorrect. We apologize for this and seek approval for future data collection through this application.	N/A	The proposed CAT-TRAIN-ICE project will occur within the governing areas of Cambridge Bay, NU. Sampling is proposed to occur along tidal straits within Dease Strait and Bathurst Inlet, accessed via snowmobile from a cat-train that will follow a path on the sea ice yet close to the shore.
Transect 5 (CT5)	Researching	Marine	Last year we collected some oceanographic data within Bathurst Inlet under the assumption	N/A	The proposed CAT-TRAIN-ICE project will occur within the governing areas of Cambridge Bay, NU.

			that it fit within the latitude-longitude bounds of our original NRI license. We reported on this and learnt our assumption was incorrect. We apologize for this and seek approval for future data collection through this application.		Sampling is proposed to occur along tidal straits within Dease Strait and Bathurst Inlet, accessed via snowmobile from a cat-train that will follow a path on the sea ice yet close to the shore.
Transect 6 (CT6)	Researching	Marine	Last year we collected some oceanographic data within Bathurst Inlet under the assumption that it fit within the latitude-longitude bounds of our original NRI license. We reported on this and learnt our assumption was incorrect. We apologize for this and seek approval for future data collection through this application.	N/A	The proposed CAT-TRAIN-ICE project will occur within the governing areas of Cambridge Bay, NU. Sampling is proposed to occur along tidal straits within Dease Strait and Bathurst Inlet, accessed via snowmobile from a cat-train that will follow a path on the sea ice yet close to the shore.
Transect 7 (CT7)	Researching	Marine	Last year we collected some oceanographic data within Bathurst Inlet under the assumption that it fit within the latitude-longitude bounds of our original NRI license. We reported on this and learnt our assumption was incorrect. We apologize for this and seek approval for future data collection through this application.	N/A	The proposed CAT-TRAIN-ICE project will occur within the governing areas of Cambridge Bay, NU. Sampling is proposed to occur along tidal straits within Dease Strait and Bathurst Inlet, accessed via snowmobile from a cat-train that will follow a path on the sea ice yet close to the shore.
Transect 8 (CT8)	Researching	Marine	Last year we collected some oceanographic data within Bathurst Inlet under the assumption that it fit within the latitude-longitude bounds of our original NRI license. We reported on this and learnt our assumption was incorrect. We apologize for this and seek approval for future data collection through this application.	N/A	The proposed CAT-TRAIN-ICE project will occur within the governing areas of Cambridge Bay, NU. Sampling is proposed to occur along tidal straits within Dease Strait and Bathurst Inlet, accessed via snowmobile from a cat-train that will follow a path on the sea ice yet close to the shore.
Transect 1 (CT1)	Researching	Marine	Last year we collected some	N/A	The proposed CAT-TRAIN-ICE project

			oceanographic data within Bathurst Inlet under the assumption that it fit within the latitude-longitude bounds of our original NRI license. We reported on this and learnt our assumption was incorrect. We apologize for this and seek approval for future data collection through this application.		will occur within the governing areas of Cambridge Bay, NU. Sampling is proposed to occur along tidal straits within Dease Strait and Bathurst Inlet, accessed via snowmobile from a cat-train that will follow a path on the sea ice yet close to the shore.
Tentative Cat-train path (There & Back)	Marine Based Activities	Marine	Last year we collected some oceanographic data within Bathurst Inlet under the assumption that it fit within the latitude-longitude bounds of our original NRI license. We reported on this and learnt our assumption was incorrect. We apologize for this and seek approval for future data collection through this application.	N/A	The proposed CAT-TRAIN-ICE project will occur within the governing areas of Cambridge Bay, NU. Sampling is proposed to occur along tidal straits within Dease Strait and Bathurst Inlet, accessed via snowmobile from a cat-train that will follow a path on the sea ice yet close to the shore.

Community Involvement and Regional Benefits

Community	Name	Organization	Date Contacted
Kugluktuk	Larry Adjun	Kugluktuk Hunters & Trappers Organization (HTO)	2017-01-30
Cambridge Bay	Bobby Greenley	Ekaluktutiak HTO	2017-01-31

AUTHORIZATIONS

Project Locations

Kitikmeot

Project Authorization

Authorizing Agency	Authorization Description	Current Status	Date Issued / Applied	Expiry Date
Fisheries and Oceans Canada	license to fish for scientific purposes	Not Yet Applied		
Government of Nunavut, Nunavut Research Institute	NRI# 04 002 17R-M	Active	2016-12-19	2017-12-31
Other	Ekaluktutiak Hunters & Trappers Organization	Active	2017-04-01	2017-12-01
Other	Kugluktuk Hunters & Trappers Organization	Applied, Decision Pending		
Other	NIRB# 10YN014: Winter to Summer Transitions in the Arctic-Ice Covered Ecosystem (Arctic-ICE)-Multiyear Project	Active		

MATERIAL USE

Equipment to be used (including drills, pumps, aircraft, vehicles etc.)

Equipment Type	Quantity	Size - Dimensions	Proposed Use
Mobile Shipping Container Laboratories	1	6m x 2.5m x 2.5m	Temporary structures, which will serve as a research space. Fueled by wind, solar panel and back-up diesel generator. These will be distributed at different site locations along the track, which are part of a separate CAT-TRAIN land use NPC application
Snow-Cat Tractor/ Bulldozer	1	4.5m x 4.5m x 4.5m	Tracked vehicle to pull cat-train across the sea ice – owned and operated by Kitnuna Corporation
Snowmobiles	4-6	4.5-6ft	Transportation of personnel and carrying equipment to and from sites
Niskin Bottles	4	5L	Collect water samples
Ice Auger	2	18 cm diameter	Drilling holes through sea ice
Core Barrels	2	9cm diameter	Collect ice cores
Kemmerer bottle	1	5L	Water sample collection

Detail Fuel and Hazardous Material Use

Fuel / Material	Type	Number of Containers	Container Capacity	Total Amount	Units	Proposed Use
Diesel	fuel	6	200	1200	Liters	Fuel cat-train
Gasoline	fuel	2	200	400	Liters	Fuel for snowmobiles and ice augers
Other	fuel	1	1	1	Liters	Coleman Fuel: Used for heating
Glutaraldehyde	hazardous	1	0.06	0.06	Liters	Used for algae sample preservation
Lugol's Acid	hazardous	1	0.01	0.01	Liters	Used for algae sample preservation
Hydrochloric Acid (HCl)	hazardous	1	0.8	0.8	Liters	Used to clean sampling syringes and filter holders
Mercuric Chloride	hazardous	1	0.015	0.015	Liters	Used for preserving sea water samples

Project Water Consumption

Daily Amount (m3)	Proposed Water Retrieval Methods	Proposed Water Retrieval Location
1	Storage Tank and/or RO system	Drinking water will be brought from Cambridge Bay or produced from sea water using an RO system on board the cat-train

WASTE

Waste Management

Project Activity	Type of Waste	Projected Amount	Method of Disposal	Additional Treatment
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		Generated		Procedures
Researching	Combustible wastes	Engine Oil	Stored and brought to Kitnuna Corporation in Cambridge Bay to dispose of the oil waste	n/a
Researching	Non-Combustible wastes	Garbage	Disposed of in Cambridge Bay land fill	n/a
Researching	Non-Combustible wastes	Recyclables	Taken to Cambridge recycling facility	n/a
Researching	Sewage (human waste)	0-5kg/day	Placed in holding tank and brought back to Cambridge Bay for proper treatment	Portable labs have composting toilets. We will bag waste and remove from the site and dispose of it in Cambridge Bay

Environmental Impacts

We expect this project to have a very minimal environmental impact, as waste products and all other foreign items/objects (excluding portable labs) will be taken back with us to Cambridge Bay for proper disposal. For example, solid waste materials such as human waste, garbage and recyclables will be stored on the cat-train and brought back to Cambridge Bay to the appropriate treatment facility. Support fuel for the snowmobiles and ice augers (gasoline, diesel and Naphtha (Coleman) fuel) will be stored on the cat-train. To mitigate any further environmental impacts, an emergency spill response plan has been set in place with research personnel being trained in spill response prior to leaving Cambridge Bay.

DETAILS PART 2

Project General Information

Climate warming has induced rapid change in the ice-covered marine ecosystem of the high Arctic. This application is for an amendment to our current multiyear NRI licence (NRI#04 002 17R-M; NIRB 10YN014). The amendment will be to expand the region of study to Bathurst Inlet under the auspices of the same objectives in our original NRI licence, which are to investigate: (1) physical and biological processes controlling the timing of marine primary production, which has been hypothesized as an indicator of potential change in the ecosystem, (2) the influence of rivers and sea ice melt on the freshwater budget and organic carbon cycle in coastal bays near Cambridge Bay, and (3) microbial diversity in sea ice and seawater as it relates to in situ biogeochemical cycling and the potential microbial response to increased industrial activity, e.g., oil spills. A core collaborator in this work is the Arctic Research Foundation (ARF), a private not-for-profit organization, who's main objective is to support long-term Arctic sustainability through in part interdisciplinary research within the Kitikmeot Region. ARF recently developed self-sustaining portable research laboratories, called Mobile Marine-Archeology-Geology Network (M-MAG-N) labs. These labs were designed to run specifically on green energy, which includes wind and solar panel power. The CAT-TRAIN-ICE project seeks to support a specific investigation of the role of tidal straits on biological production in the region. Tidal straits are waterways that constrict tidal current flow, causing currents to increase. The result is often a thinner ice cover, yet enhanced biological production within the strait. In fact, these sites are potentially the driving force for much of the primary production within this region and can serve as critical location for other higher order trophic levels, such as fish and other marine organisms. Our oceanographic investigation will make use of a cat-train and M-MAG-N labs to access tidal straits within Dease Strait and Bathurst Inlet. This unique opportunity will allow us to expand our current marine ecosystem monitoring and enable the study of spatial variability in tidal strait processes. A map with targeted sampling transects CT1 to CT8 is located in the file titled "Cat_Train_tracks_Labeled_Feb 21 2017". We note the cat-train will follow a path on the sea ice, but close to shore for safety purposes to deploy the M-MAG-N labs (See separate application NPC# 148438). To access the tidal strait sampling transects, snowmobiles (5-6) will be used including komatiks/sleds to carry sampling gear. Oceanographic sampling will occur over approximately 3 weeks between 15 April and 31 May 2017 (final dates to be determined). The following sample variables will be collected over the course of the expedition from ice cores and water samples: physical oceanic variables (temperature, salinity currents), nutrient concentration, chemical variables associated with ocean acidification (pH, dissolve inorganic carbon (DOC), total alkalinity, etc.) and algal photo-physiology and production. We have contacted both the Kugluktuk and Ekaluktutiak Hunters and Trappers Organization and have recieved approval from Ekaluktutiak HTO (Kugluktuk HTO approval is pending). We are in the process of contacting the Department of Fisheries and Oceans Canada for a licence to conduct fish based research. We have also submitted an amendment to our original NRI application #04 002 17R-M and have a multi-year licence from NRIB #10YN014

DFO Operational Statement of Conformity

With the proposed research project, we do not see any impacts on any aquatic organisms including fish and other marine mammals. Our samples which include ice cores are geared towards sampling primary producers (algae) and taking environmental measurements. Therefore, there are no foreseen impacts associated with this project.

Transportation

A snow-cat (cat-train) will tow and transport three Mobile Marine-Archeology-Geology Network (M-MAG-N) portable labs, one accommodation trailer and one kitchen trailer. The three M-MAG-N portable labs will be transported and deposited to designated sampling sites and remain there for an extended period of time (part of a separate application called CAT-TRAIN; NPC# 148438). Snowmobiles will also be used to transport personnel from one site to the next and survey ice thickness ahead of cat-train. The tentative cat-train path, which stays close to land and starts at Cambridge Bay, and proposed sampling transects can be seen in the Project Map section of this application and in the Supporting Documents tab (Cat_Train_tracks_Labeled_Feb 21 2017; red lines are transects, blue dots portable lab locations and the blue line is the proposed cat-train transportation path).

Camp Site

The cat-train will have an accommodation and kitchen trailer (approximately 6m x 2.5m x 2.5m) that will be used as a mobile camp. Diesel will be used to fuel the snow-cat and power the cat-train accommodation and kitchen trailer. The 3 M-MAG-N labs will be used for processing ocean samples. They have solar panels and wind electrical generation with a back-up diesel generator. Coleman fuel will be used to heat temporary sampling tents (fishing pop-up tent set-up while on site for < 1 day). Sixteen Personnel will be on site for a 21 day period between the tentative dates of April 15 and May 31, in which they will be housed in the cat-train accommodation trailer.

Equipment

(1) Cat-train (1 Snowcat + 5 trailer): Mobile Marine-Archaeological-Geological Network (M-MAG-N) portable labs (x3; 6m x 2.5m x 2.5m): Temporary structure, which will serve as a research space. Fueled by wind, solar panel and back-up diesel generator. These will be distributed at different locations along the track, which are part of a separate CAT-TRAIN land use NPC Application (#148438). Will also consist of one accommodation trailer and one kitchen trailer. (2) Snowmobiles (x5-6): Transportation of personnel and equipment (3) Ice Auger (x2): Used for drilling holes in the ice (4) Core Barrel (x2): Used for sampling sea ice (5) CTD (x1): Used to take conductivity, temperature, and depth measurements and coupled with a light and fluorescence sensor attached (6) Niskin Bottles (x4): water sample collection (7) Kemmerer bottle (x1): water sample collection

Water

Water will be brought from Cambridge Bay and stored in a holding tank or a RO system on the cat-train will be used to make freshwater from seawater. Roughly 1 m³/day for a total 16 people will be used. Grey water will be stored in a separate holding tank and taken back to Cambridge Bay.

Waste Water (Grey water, Sewage, Other)

All waste water such as grey/sewage will be stored and taken back to Cambridge Bay for proper disposal. The estimated amount of grey/sewage is 0-5kg per day for 16 people. Solid waste, such as recyclables and garbage will also be stored on the cat-train and taken back to Cambridge Bay Recycling Centre and landfill, respectively.

Fuel

-Gasoline: 2x 200L (400L total), Supply for snowmobiles and ice augers. -Diesel: 6x 200L (1200 total), Supply for cat-train -Naphtha (Coleman fuel): 1x 1L (1L), Supply for Coleman heater for sampling tent Support fuel for the snowmobiles, ice augers and heating (gasoline, diesel and Naphtha (Coleman) fuel) will be stored on the cat-train (See Cat_Train_tracks_Labeled_Feb 21 2017; blue line for cat-train path). Spill kits, with absorbent materials will be kept in close proximity to the stored fuel in the event of an emergency spill. Appropriate MSDS sheets, will be kept in a visible and known location to all personnel. Personnel will also be trained in the proper handling (pouring and storing) of fuel and emergency spill response protocols prior to leaving Cambridge Bay (see "CAT-TRAIN-ICE_Spill_Plan_Feb 21 2017" file for spill response). Fuel will be transported to sites in barrels on the cat-train and will remain on the cat-train at all times. Fuel transfer between barrels and machines (i.e. snowmobiles and ice augers) will be performed by either a jerrycan or by fuel pump (directly from barrel).

Chemical and Hazardous Material

-Glutaraldehyde 1x 60 ml, preservation of algal samples -Lugol's Acid 1x 60 ml, preservation of algal samples -Hydrochloric Acid (HCl) 1x 800 ml, used to clean sampling equipment (i.e. water sampling syringes) -Mercuric Chloride 1x 15 ml, used for preserving seawater samples -Engine oil (both 4-cycle and 2-cycle), antifreeze, and batteries will be used in minor quantities to operate the snowmobiles, Snow cat tracked vehicle and generators. Should a spill occur, we will contain and clean up the spilling following protocols of our spill plan. All chemicals will be properly stored and labeled on the cat-train and in the portable labs in designated containers (see Cat_Train_tracks_Labeled_Feb 21 2017; blue line for cat-train path) and will not be used outside of the cat-train or labs. MSDS sheets will be kept in a visible and known location. Only personnel who have been properly trained in WHMIS and chemical handling will be in contact with these chemicals. Chemicals will be transferred, via pipette into sample containers, where samples containers will be securely stored in the cat-train for transport back to Cambridge Bay. If a spill does occur it will be isolated within the portable labs or cat-train. Spills will be promptly cleaned up, using the methods and protocols listed within the MSDS sheets. All spill waste will be taken back to Cambridge Bay for proper disposal.

Workforce and Human Resources / Socio-Economic Impacts

The cat-train project will employ community members, including both the Ekaluktutiak Hunters and Trappers Organization (E-HTO) as field guides, as well as the Northern Rangers to assist with the expedition. Field guides and rangers will work for about a 6 to 8 hour period daily (rough total 21 days) and assist us with things like watching for polar bears, guiding the cat-train using the snowmobiles, and helping with some aspects of the scientific research. Field guides and rangers will be accommodated on the cat-train mobile camp accommodation trailer.

Public Involvement / Traditional Knowledge

Cambridge Bay has been our main point of contact through the Ekaluktutiak Hunters and Trappers Organization, where we presented the project plan at a board meeting in January. We have addressed the contamination concerns of the E-HTO by setting in place a spill prevention plan (see "CAT-TRAIN-ICE_Spill_Plan_Feb 21 2017") to alleviate those concerns. We are now in the process of contacting and getting approval from the Kugluktuk HTO and alleviating any concerns. We will also be sharing and communicating our research directly with the HTO's and the community, upon completion. Though there is no direct application of traditional knowledge and resources being used for the current project. We are communicating with HTO's regarding tidal straits and the proposed area that the project encompasses for a safe expedition, which can lead to traditional knowledge about the area. However, a parallel research project that is more directly linked to traditional knowledge is being conducted by a PhD student under the same research licence, but focussed on Cambridge Bay specifically. She is working to understand marine ecosystem services with respect to the traditional knowledge provided by the Cambridge Bay community.

SECTION H: Marine Based Activities: Disposal at Sea

n/a

Description of Existing Environment: Physical Environment

According to the NPC land use designation, a portion of Bathurst Inlet is a marine protected area. Bathurst Inlet is also a well-used recreational area for local residents. Transportation in support of this project will be restricted to the snow-covered sea ice surface as well as spatial sampling of the sea ice and water column. Our sampling will target tidal straits as it is these areas we hypothesize support greater marine production. However, noted by locals, these areas are also dangerous in terms of thin ice cover in the winter. Our work will take care to avoid thin ice using measurements well in advance of visiting the regions of interest.

Description of Existing Environment: Biological Environment

The region mainly supports fish production as evidenced by the active commercial fisheries based out of Cambridge Bay. It has been noted from conversations with the HTO that marine mammals scarcely frequent the area, but can be observed closer to tidal straits. These conversations have helped formulate our hypotheses and focus of our proposed research program. We also note that the sea ice is a migration corridor of caribou and other mainland animals. Efforts will be made to avoid migrating land animals if encountered.

Description of Existing Environment: Socioeconomic Environment

The closest community to our proposed study region is Cambridge Bay and the next closest is Kugluktuk, although a small settlement does exist at Umingmaktok within Bathurst Inlet. The marine system is utilized for recreational purposes, subsistence gathering and cultural activities. In particular, Bathurst Inlet is used for weekend get-aways and extended stays for locals in cabins and camps along its coasts. From Cambridge Bay, local residents typically travel via snowmobile along a well-driven path across Dease Strait towards Elu Inlet. We are unaware of any archaeological sites along the marine system we will travel.

Identification of Impacts and Proposed Mitigation Measures

Both the Research and Marine Based application of this project will have very minimal effects on the physical environment. We note that the project will have a positive effect on the designated environmental areas and water quality as the project hopes to find applications in protecting these delicate areas more efficiently. We, however, are unsure of the impacts on air quality and noise level. We will mitigate these impacts by minimizing travel, and try to reduce the amount of noise being produced during the operation by having scheduled operation times. For both the Research and Marine Based application of this project, we believe that this project will have very minimal effects on the biological environment. We note that there will be potentially positive effects from our research in that we hope to gain a better understanding of the processes that control marine production across the region. This research can help us predict bloom time events and thus, help us predict aquatic species migration and spawning events that coincide with the algal bloom, as well as understanding their habitat in order to minimize future impacts. We are uncertain of any possible impacts on wildlife. Again for both application of this project, we believe that this project will have positive effects on the socio-economic environment. This is because we are hiring local guides from the Hunters and Trappers Organization and/or the Canadian Rangers. We are also placing the portable labs not only for research purposes, but also to be used as safe havens for local residents.

Cumulative Effects

With the present study, we believe that most of the impacts will be positive. As explained above we have listed very minimal impacts to both the physical and biological environments in terms of negative interactions, versus that of positive impacts to these environments as well as the socio-economic environment.

IMPACTS

TABLE 1 - IDENTIFICATION OF ENVIRONMENTAL IMPACTS

CONSTRUCTION																								
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OPERATION																								
Researching		P	-	-	-	P	-	-	-	-	-	U	U		P	U	-	P	-		P	-	-	-
Marine Based Activities		P	-	-	-	P	-	-	-	-	-	U	U		P	U	-	P	-		P	-	-	-
DECOMMISSIONING																								
-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

(P = Positive, N = Negative and non-mitigatable, M = Negative and mitigatable, U = Unknown)