REPORT

2019 Milne Ore Dock Fish Offset Monitoring Report

Fisheries Act Authorization 14-HCAA-00525

Submitted to:

Fisheries and Oceans Canada

Fisheries Protection Program
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Distribution List

Fisheries and Oceans Canada

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ACRONYMS AND ABBREVIATIONS

Acronym or Abbreviations	Definition
Baffinland	Baffinland Iron Mines Corporation
Biologica	Biologica Environmental Services Ltd
CRA Fishery	Commercial, Recreational or Aboriginal Fishery
DFO	Fisheries and Oceans Canada
ERP	Early Revenue Phase
FAA	*Fisheries Act* Authorization
GPS	Global Positioning System
Indet.	Indeterminate
m^2	Square metres
MEEMP	Marine Environmental Effects Monitoring Program
Mtpa	Million Tonnes per Annum
NIRB	Nunavut Impact Review Board
ROV	Remotely Operated Vehicle
SEM	Sikumiut Environmental Management Limited
sp.	Species
The Project	Mary River Project
The Proponent	Baffinland Iron Mines Corporation
UTM	Universal Transverse Mercator

1.0 INTRODUCTION

Baffinland Iron Mines Corporation (Baffinland, the Proponent) is currently operating in the Early Revenue Phase (ERP) of the Mary River Project (the Project), an iron ore mine located in the Qikiqtani Region of Nunavut, Canada. Project Certificate No. 005, amended by the Nunavut Impact Review Board (NIRB) on 30 October 2018, authorizes the Company to mine up to 22.2 million tonnes per annum (Mtpa) of iron ore from Deposit No. 1. Of the 22.2 Mtpa, Baffinland is authorized to transport 18 Mtpa of ore by rail to Steensby Port for year-round shipping through the Southern Shipping Route (via Foxe Basin and Hudson Strait; rail and port have yet to be constructed), and 6.0 Mtpa of ore by truck to Milne Port for open water shipping through the Northern Shipping Route during the open water season (July – October) using chartered ore carrier vessels.

During the environmental assessment for the Project, the proposed infilling of the marine environment resulting from construction of the Ore Dock at Milne Port was predicted to result in the permanent loss of 24,847 m^2 of marine fish habitat, or 6,003 Habitat Equivalent Units. It was subsequently determined by Fisheries and Oceans Canada (DFO) that the habitat loss associated with the ore dock placement would result in serious harm to fish that are considered part of a commercial, recreational or Aboriginal (CRA) fishery, or a permanent change to ecosystem productivity that supports such a fishery and as such, offsetting measures would be required.

Baffinland submitted to DFO an application for an authorization under paragraph 35(2)(b) of the *Fisheries Act* for installation of the ore dock. DFO issued the *Fisheries Act* Authorization (FAA) (#14-HCAA-00525) for the ore dock on 30 June 2014 (Appendix A). The FAA also required Baffinland to undertake monitoring and reporting of the structural stability and biological utilization of offsetting measures at the Milne Port ore dock, in accordance with Section 7 of the FAA, which states the following:

- 7.1 - The Proponent shall conduct monitoring of the habitat offsetting measures according to the approved schedule and criteria below:
  - 7.1.1 - During Year 1, 3 and 5, the integrity of the coarse rock substrate will be monitored using video surveys (drop camera). All information will be geo-referenced and any slumping or other deteriorations will be documented and repaired as necessary.
  - 7.1.2 - During Year 2, 4 and 6, video surveys (drop camera) of the coarse rock substrate will be used to document the types and percent coverage of the aquatic vegetation colonizing the substrate. Benthic invertebrates and fish recorded in the video will be identified and quantified.
  - 7.1.3 - The production of benthic invertebrates and the occurrence of fish larva will be monitored by setting artificial and natural substrate collection baskets in the vicinity of the coarse substrate.
  - 7.1.4 - Continuous video monitoring of the rock substrate shall be undertaken to demonstrate the association of fish with the rock substrate.
- 7.2 - The Proponent shall report to DFO that the offsetting works were conducted according to the conditions of this Authorization by providing the following:
  - 7.2.1 - Monitoring report shall be submitted to the DFO-Yellowknife Office by December 31 of each year monitoring is carried out.

Monitoring the effectiveness of the Milne Port Ore Dock offset habitat began in 2015 and continued annually in accordance with monitoring requirements outlined in FAA #14-HCAA-00525. Additionally, marine biophysical monitoring has been conducted annually at Milne Port since 2014 as part of Baffinland's Marine Environmental Effects Monitoring Program (MEEMP). A summary of the habitat offset monitoring surveys performed since 2015 is presented in Table 1. Sikumiut Environmental Management Limited (SEM) conducted Year 1 (2015) and Year 2 (2016) of habitat offset monitoring on behalf of Baffinland, with results presented in Baffinland's annual fish offset monitoring reports (SEM 2015; 2017a). Golder Associates Ltd. (Golder) completed Year 3 and Year 4 of habitat offset monitoring on behalf of Baffinland (Golder 2017; Golder 2018). This report presents the results of Year 5 of habitat offset monitoring undertaken by Golder in Milne Port during the open-water season of 2019. Habitat offset monitoring in Year 5 meets the conditions prescribed in the FAA, and includes additional information related to observations of fish association with the rock substrate to demonstrate biological functionality of the existing offset habitat as well as to inform future offset monitoring initiatives in Milne Port. More detailed information on fish presence and abundance in Milne Port will be presented in the 2019 MEEMP technical data report, scheduled for delivery in March 2020. A more extensive overview of the regulatory context for the FAA is provided in SEM's 2016 habitat offset monitoring report (SEM 2017a).

Table 1: Summary of Offset Habitat Monitoring Activities Presented by Survey Year

Sampling Method	FAA Condition	Monitoring Year				
		1 (2015)	2 (2016)	3 (2017)	4 (2018)	5 (2019)
Video Survey						
Structural Integrity	7.1.1	√		√		√
Vegetation (Presence)	7.1.2		√	√	√	√
Vegetation (Type, Coverage)	7.1.2		√		√	
Benthic Invertebrate (Presence)	7.1.2		√	√	√	√
Benthic Invertebrate (Identification, Quantification)	7.1.2		√		√	
Fish (Identification, Quantification)	7.1.2		√		√	√
Fish (Association with Habitat)	7.1.4	√	√	√	√	√
Artificial Substrate						
Benthic Invertebrate (Production)	7.1.3	*	*	*	√	√
Fish Larvae (Production)	7.1.3	*	*	*	√	√
Other Sampling Methods to Inform Productivity						
Active Fish Sampling (Identification, Quantification)	7.1.2		√	√	√	√**
Zooplankton Tows (Fish Larvae)	7.1.3		√		√	

* In 2015, offset monitoring was performed 34 days after completion of construction. Settlement baskets were deployed at this time to meet future monitoring requirements. Settlement basket monitoring was not completed in Years 2 or 3 due to insufficient colonization and loss of settlement baskets deployed in Year 1 (SEM 2016).
** Although active fish sampling is not a required activity for Year 5 of offset monitoring, it provides key information on fish association with existing rock substrate and also serves to inform future habitat offset initiatives in Milne Port. Detailed results from the fish sampling program will be presented in the 2019 MEEMP report, scheduled for delivery in March 2020.

2.0 OBJECTIVE

In accordance with FAA #14-HCAA-00525, the objective of the 2019 Milne Port Ore Dock Fish Offset Monitoring Program was to complete Year 5 of habitat offset monitoring as prescribed by DFO, which included the following tasks:

- monitoring the integrity of the coarse rock substrate using georeferenced video surveys including identification of any slumping or other deterioration of the offset habitat (FAA Condition 7.1.1).
- monitoring the production of benthic invertebrates and the occurrence of fish larvae by setting artificial and natural substrate collection baskets in the vicinity of the coarse substrate (FAA Condition 7.1.3).
- undertaking continuous video monitoring of the rock substrate to demonstrate the association of fish with the rock substrate (FAA Condition 7.1.4).

3.0 METHODS

Habitat offset monitoring was conducted from 26 July 2019 to 6 October 2019. The monitoring team consisted of two Golder biologists and a local boat operator and field technician from Pond Inlet. Field sampling was conducted from a 28-foot aluminum vessel based out of the Milne Port facility. The following scientific data collection permits were obtained from the Nunavut and federal governments prior to the start of the monitoring program:

- DFO Licence to Fish for Scientific Purposes Permit #: S-19/20-1033-NU
- DFO Animal Use Protocol Permit # FWI-ACC-2019-42
- Nunavut Research Institute Scientific Research Licence # 02 010 19R-M

3.1 Structural Integrity of Offset Habitat

Underwater video was collected along shore-parallel transects adjacent to the ore dock to assess the structural integrity of the offset habitat and identify any slumping or deterioration of materials in accordance with Condition 7.1.1 of the FAA. For consistency, sampling methods used during the 2015, 2016 and 2017 video surveys were replicated to the extent possible, including monitoring along the same transects and depth ranges monitored in previous years. Survey methodology changed in 2018 to include the use of a remotely operated vehicle (ROV) for collection of underwater video rather than a simple drop camera. Underwater video methodology remained the same in 2019. An ROV is a maneuverable, propulsion-powered tool that allows for greater control and collection of higher quality video footage during a video survey.

The underwater video system used for the survey consisted of two high resolution video cameras (NTSC standard definition with 3x optical zoom) mounted on a lightweight Seamor Chinook 300F industrial-grade inspection ROV equipped with spotlights, integrated pressure/depth sensor and a magnetic compass (Figure 2, Appendix B, Photos 1 and 2). The video camera on the ROV was connected via umbilical to a video monitor set-up on the deck of the 28 ft aluminum field vessel, where video data was recorded on an external hard drive. The ROV was operated by a subcontracted ROV technician (Andy Clark - Ocean Dynamics Inc.) using manual and automatic thruster, tilt, pitch and heading controls built into a top-side deck-mounted control box. The video transects were georeferenced using a handheld GPS that recorded a track throughout the full duration of the video survey as part of Condition 7.1.1 in the FAA.

Figure 1: Photograph showing set-up of Seamor Chinook 300F ROV on deck of field vessel used to undertake underwater video surveys of offset habitat along Milne Port Ore Dock (August 2019).

Between 24 and 26 August 2019, ROV video surveys were conducted along three transects on the west side of the ore dock and four transects on the east side of the ore dock (Table 2; Figure 2). Multiple shallow and deep video transects on each side of the ore dock were conducted to:

- Evaluate the structural integrity of the offset habitat including any potential slumping or deterioration of the coarse rock substrate along the rock face and at the interface of the nearby habitat.
- Characterize habitat conditions of the coarse rock substrate and areas immediately adjacent to the offset habitat.

Table 2: Ore Dock ROV Video Transect Locations

Location	Transect Name	Start / End	UTM Coordinates (Zone 17W)		Depth Range† (m)	Length of Video Recording (mm:ss)
			Easting	Northing		
West Side of Ore Dock	T1	start	503216	7976624	-0.7 to -16.7	26:09
		end	503215	7976543		
	T2	start	503214	7976542	-0.1 to -0.9	13:59
		end	503138	7976491		
	T3	start	503135	7976498	-0.7 to -16.4	15:40
		end	503210	7976620		
East Side of Ore Dock	T4	start	503367	7976683	-0.4 to -1.5	13:46
		end	503428	7976630		
	T5	start	503420	7976632	-0.1 to -1.0	22:46
		end	503489	7976594		
	T6	start	503492	7976594	-0.1 to -0.8	14:09
		end	503302	7976512		
	T7	start	503308	7976511	-0.1 to -16.2	69:54
		end	503371	7976677		

†Depths are recorded to chart datum.

LEGEND

- SETTLEMENT BASKET SAMPLE LOCATION
- TOWED VIDEO PATH

0 50 100

1:2,500 METRES

REFERENCE(S)

SATELLITE IMAGERY BY DIGITALGLOBE (AUGUST, 2016), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017.
HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT – MILNE ORE DOCK HABITAT OFFSET MONITORING PROGRAM

TITLE **UNDERWATER VIDEO TRANSECT AND SETTLEMENT BASKET LOCATIONS FOR FISH HABITAT OFFSET MONITORING IN 2019 AT MILNE PORT ORE DOCK**

CONSULTANT
GOLDER

YYYY-MM-DD	2019-12-19
DESIGNED	CB
PREPARED	AA
REVIEWED	PR
APPROVED	SR

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	24000-04	0	2

3.2 Settlement Baskets and Plates

In accordance with Condition 7.1.3 of the FAA, settlement baskets were initially deployed by SEM in August 2016 on the west and east sides of the ore dock adjacent to the caisson. Settlement baskets were deployed in sets of three at each of the two locations. Each basket was filled with rocks similar to the type used on the offset habitat. The baskets were retrieved by Golder in September 2017 and immediately redeployed due to the limited amount of colonization present. In addition, five settlement plates were attached to the baskets to provide additional surface area for colonization. The settlement baskets and plates were subsequently recovered in August 2018 and processed for taxonomic analysis prior to being redeployed for the winter. On 29 August 2019, Golder recovered the settlement baskets and plates deployed on the east side of the ore dock (total deployment period of ~12 months) and these were processed for subsequent taxonomic analysis (Figure 2; Table 3, Appendix B, Photo 3-5). The settlement basket and plates on the west side of the ore dock were not recoverable in 2019 as the deployment rope was severed by winter ice break-up and the settlement plates and basket were lost (Appendix B, Photo 6).

In 2018, the recovered settlement baskets and plates exhibited low levels of colonization. Following consultation, the taxonomist recommended to submit the unprocessed settlement baskets (whole rocks) and settlement plates directly to the laboratory rather than the scraped epifaunal samples in order to improve the taxonomic identification. In 2019, epifaunal colonization on the settlement baskets and plates was again limited, similar to 2018. In line with the recommendation, the sediment plates and all rocks in the settlement baskets were preserved in 10% formalin as a single composite sample to preserve sample integrity. The composite sample was submitted to Biologica Environmental Services Ltd. (Biologica) for taxonomic identification and enumeration (Table 3).

Table 3: Settlement Basket Recovery Locations

Location	Sample Name	UTM Coordinates (Zone 17W)		Deployment Date	Retrieval Date	Deployment Period
		Easting	Northing			
East Ore Dock	SBEO-1	503229	7976590	13 August 2018	29 August 2019	12 months
West Ore Dock	SBWO-1	503346	7976648	13 August 2018	29 August 2019*	Settlement baskets and plates lost over winter

* Attempted retrieval date of SBWO-1

3.3 Fish and Invertebrates Associated with the Offset Habitat

The underwater video collected as part of FAA Condition 7.1.1 was also used to identify and enumerate marine fish utilizing and interacting with the offset habitat in accordance with Condition 7.1.4. In addition, during the review of the underwater video, incidental observations of aquatic vegetation and invertebrates associated with the coarse rock substrate were documented. Methodology for collection of the underwater video is provided in Section 3.1.

The ROV video surveys were conducted along three transects on the west side of the ore dock and four transects on the east side of the ore dock (Table 2; Figure 2). In addition to the survey objectives outlined in Section 3.1, multiple shallow and deep video transects on each side of the ore dock were conducted to:

1) Identify and enumerate marine fish utilizing the offset habitat area, and to evaluate the structural integrity of the offset habitat including any potential slumping or deterioration of the coarse rock substrate.

2) Document incidental observations of aquatic vegetation and invertebrates in the offset area.

Video data from the ROV transects were post-processed by an experienced Golder marine biologist to provide a general overview of fish utilization of the offset habitat. The following information was recorded from the underwater video analysis:

- Benthic fish identified to the lowest practical taxonomic level
- Incidental observations of invertebrates associated with the coarse rock habitat, identified to the lowest practical taxonomic level
- Representative photographs of the coarse rock substrate, aquatic vegetation, benthic invertebrates, and fish - captured from the video footage.

3.3.1 Fish Sampling

Consistent with previous years, fish sampling was also undertaken in 2019 to identify fish presence in the offset habitat area. Although fish sampling is not a specific monitoring requirement outlined in FAA #14-HCAA-00525, it provides key information on fish association with the rock substrate (FAA Condition 7.1.4) and serves to inform future habitat offset initiatives in Milne Port. Fish and fish larvae were sampled in the Milne Port area from 26 July 2019 to 3 September 2019 using both active (gill netting, angling, beach seine) and passive (Fukui traps, fyke nets) capture methods as part of the 2019 MEEMP. Fish sampling locations and sampling methodology were consistent with previous years (2015-2018). Due to the delayed sampling program in 2019, taxonomic data from the zooplankton tows were not available at the time of writing this report (in previous annual habitat offset monitoring reports, ichthyoplankton from zooplankton tows were included to characterize juvenile fish presence). This information will however be included in the 2019 MEEMP technical data report, scheduled for delivery in March 2020.

4.0 RESULTS

4.1 Structural Integrity of the Offset Habitat

Georeferenced underwater video collected along the ore dock transects was analyzed to identify potential changes in the structural integrity of the coarse rock apron placed around the ore dock as offset habitat. No evidence of movement or slumping of the coarse rock was observed in the 2019 video surveys. The placement of the coarse rock appeared to be unaltered and functioning as when constructed. Transects surveyed along the seafloor adjacent to the ore dock showed no evidence of loose or stray rocks. Similar to observations in 2018, there was generally a large amount of algal growth and epifaunal colonization on the rocks along the east and

west sides of the ore dock. Macroalgae was dominated by green and brown algae and included perennial species such as laminarian kelp (Appendix B, Photos 19 and 20). Generally, the western extent of the ore dock habitat was dominated by thick mossy green and brown algae species, with large patches of bladed kelp observed in deeper locations along the transects. The eastern transects were similar with heavy cover of mossy and filamentous brown and green algae, as well as clusters of longer ropy brown algae, and small patches of bladed kelp on the northeastern portion of the coarse rock habitat, although overall cover was generally lower than the western transects. The presence of thick cover of macroalgae and perennial species further confirms the stability of the coarse rock habitat. In general, patterns of biological growth and sediment deposition associated with the coarse rock apron suggest that the offset habitat has been in a relatively stable position since its initial placement.

4.2 Production of Benthic Invertebrates and Occurrence of Larval Fish

4.2.1 Settlement Baskets and Plates

The settlement basket and settlement plates on the west side of the ore dock were not analyzed in 2019 as the tether that attached the settlement baskets to the ore dock was severed just below the water line, presumably due to interactions with the sea ice during the winter break-up period. The settlement baskets were lost and the settlement plates were found washed up on shore and were therefore unusable (Appendix B, Photo 6). The settlement basket and plates on the eastern ore dock were recovered on 29 August 2019. Colonization on the settlement plates and settlement basket rocks was apparently low. The full contents of the baskets, as well as whole settlement plates were sent to Biologica for identification.

A total of 2,317 encrusting epifauna from 22 distinct taxa were identified on substrate (rocks) in the settlement baskets and plates recovered in 2019 from the eastern ore dock (Table 4). The majority of encrusting epifauna collected were bryozoans of the order Cyclostomatida which included a total of 1,570 adults unidentifiable to the species level. An additional 264 adult Cyclostomatidan bryozoans were identified to be the species *Patinella verrucaria*. Other bryozoans identified included unknown species from the genera *Alcyonidium* and *Bowerbankia*, and a single unidentifiable individual from the suborder Ascophora.

The next most abundant taxa were barnacles of the arthropodan suborder Balanomorpha (species indeterminate) of which a total of 302 juveniles were observed. Other arthropods included copepods of the order Harpacticoida (n=3) and unidentified amphipods (Amphipoda, n=2).

In previous settlement substrate analyses, only two individual annelid specimens were identified, both of the *Circeis* genus. In contrast, in 2019, a variety of annelid worms were identified on the settlement substrates, including specimens from various life stages of species *Nereimyra aphroditoides*, *Pholoe minuta*, *Harmothoe imbricata*, *Circeis armoricana*, and *Leaena ebranchiata*. The most abundant annelid species present on the settlement baskets and plates in all life stages was *C. armoricana*.

Newly observed taxa on the settlement plates and baskets (e.g. not identified in previous sample years) included individuals from the phyla Cnidaria and Chordata, in addition to a single individual from the phylum Nemertea. Hydrozoan cnidarians of the genus *Gonothyraea* and the family Tubulariidae were identified in low numbers on the settlement substrates. Chordata representatives included individual juvenile tunicates from the order Stolidobranchia and the class Ascidiacea. One immature larval invertebrate was unable to be identified to phylum, due to the lack of distinguishing features. As in previous years, no larval fish were identified on the settlement substrate.

Known distribution and range was determined through literature review for each species to confirm Arctic origin or presence in North Atlantic or Canadian Arctic waters. For taxa not identifiable to species level, confirmation was made that at least one species within the taxa had a known range that included the North Atlantic, Arctic or Canadian Arctic waters. The range for each identified taxa is summarized in Table 4.

Despite a shorter total deployment period and the recovery of only one set of settlement baskets in 2019, total encrusting organisms and total unique taxa counts were higher in 2019 than 2018. Deployments of each of the settlement baskets and plates in 2018 extended over a period of 24 months and 12 months, respectively. A total of 1,733 encrusting epifauna from 8 unique taxa were identified in 2018. Epifauna counts in 2019 represent a 34% increase in total organisms and a 125% increase in unique taxa. The observed increase in both total settlement and diversity potentially suggests the presence of nearby source populations that were not present in previous survey years. This would indicate the offset habitat is functioning as intended and that colonization of the coarse rock has established and increased to the point where it is capable of seeding new populations of hard substrate-associated epifauna.

Table 4: Epifauna Taxa Identified from Settlement Baskets and Plates in Milne Port (2019)

Taxa	Total Abundance				Description
	A	I	J	L	
Annelida					
*Nereimyra aphroditoides**	2	2			Polychaete worm, known to be distributed in the Canadian and Greenlandic part of the Arctic Ocean, including Baffin Island.
*Pholoe minuta**	1	2			Small bristle worm, known to be distributed in the Arctic Ocean, including Baffin Island.
*Harmothoe imbricata**	2	1			Scale worm, widely distributed in the northern hemisphere, including the Canadian Arctic.
Polynoinae indet.			2		Polychaete subfamily, with representative species in the Arctic Ocean, including Baffin Island.
*Circeis armoricana**	88	8	5		Calcareous tube dwelling sabellid worm, known to be distributed in the Arctic Ocean.
*Leaena ebranchiata**	2	2			Terebellid worm, known to be distributed in the Arctic Ocean, including Baffin Island.
Terebellidae indet.			1		Polychaete family, with representative species in the Arctic Ocean, including Baffin Island.
Arthropoda					
Harpacticoida indet.*	3				Order of copepods; global distribution.
Balanomorpha indet.*			302		Unidentified barnacles; global distribution.
Amphipoda indet.*	2				Unidentified amphipods; global distribution.
Bryozoa					
Ascophora indet.*	1				Suborder of bryozoan species; global distribution
Alcyonidium sp.*	4				Genus of colonial bryozoan species; known to be distributed in the North Atlantic and Arctic Oceans.
Bowerbankia sp.*	1				Genus of colonial bryozoan species; known to be distributed in the North Atlantic and Arctic Oceans.
*Patinella verrucaria**	264				Colonial bryozoan, known to be distributed in the Arctic Ocean, including Baffin Island.
Cyclostomatida indet.	1,570				Order of colonial bryozoan species; globally distributed.

Taxa	Total Abundance				Description
	A	I	J	L	
Mollusca					
*Hiatella arctica**			23		Common name: wrinkled rock-borer; species of saltwater clam known to be distributed in the Arctic Ocean; adult specimens previously observed in Milne Port.
*Mya truncata**			2		Common name: truncate softshell; species of saltwater clam known to be distributed in the Arctic Ocean; adult specimens observed around Baffin Island.
Musculus sp.*			2		Genus of mussels, globally distributed.
Mytilidae indet.			1		Mussel family; globally distributed
Propeamussiidae indet.*			1		Scallop family; globally distributed
Bivalvia indet.			5		Mollusc class; globally distributed
Gastropoda indet.*		1	3		Mollusc class; globally distributed
Cnidaria					
Tubulariidae indet. *	1				Hydrozoan family; globally distributed
Gonothyraea sp.*	9				Genus of hydrozoans, globally distributed
Other					
Stolidobranchia indet.*			1		Unidentified Ascidian tunicate; global distribution
Ascidiacea indet.*			1		Unidentified Ascidian tunicate; global distribution
Nemertea indet.*			1		Unidentified Nemertean worm; global distribution
Invertebrate indet.				1	Unknown immature invertebrate larvae

*= Unique taxa

A= adult; I= intermediate (has adult features but not of typical reproductive size); J= juvenile, L= Larvae.

Taxa information sources: WoRMS 2019, ETI 2019, Degan and Faulwetter 2019, Golder 2018, DFO 2016

Table 5: Incidental Observations of Benthic Invertebrates Recorded on ROV Video Transect Surveys of Milne Ore Dock Offset Habitat

Taxa	Common Name	Presence/ Absence						
		West Ore Dock			East Ore Dock			
		T1	T2	T3	T4	T5	T6	T7
Mysida	Opossum shrimp	☒	☒	☒	☒	☒	☒	☒
Euphausiacea	Krill	☒	☒	☒	☒	☒	☒	☒
Balanomorpha	Barnacles	☒	☒	☒	☒	☒	☐	☒
Pandalidae	Shrimp	☒	☐	☐	☐	☐	☐	☒
Amphipoda	Amphipods	☐	☐	☒	☐	☒	☒	☒
Ophiuroidea	Brittle star	☒	☐	☐	☐	☐	☐	☒
Echinoidea	Sea urchin	☒	☒	☒	☒	☒	☐	☒
Crinoidea	Crinoid	☒	☐	☐	☐	☐	☐	☐
Pectinidae	Scallops	☒	☐	☒	☒	☐	☐	☒
Hiatella arctica	Wrinkled rock-borer	☒	☐	☒	☐	☐	☐	☒
Gastropoda	Whelk	☐	☐	☐	☐	☐	☐	☒
Limacina helicina	Sea butterfly	☒	☐	☐	☒	☒	☒	☒
Clione sp.	Sea angel	☒	☒	☒	☒	☒	☒	☒
Polyplacophora	Chiton	☒	☐	☐	☐	☐	☐	☒
Ctenophora	Ctenophore	☒	☒	☒	☒	☒	☐	☒
Cnidaria	Jellyfish	☒	☒	☒	☒	☒	☒	☒
Cnidaria	Hydroids	☒	☒	☒	☒	☒	☐	☒
Polychaeta	Tube worm	☒	☐	☐	☐	☐	☐	☒

4.2.2 Association of Invertebrates with Offset Habitat

Underwater video collected along transects on the east and west side of the ore dock included incidental observations of benthic invertebrates. Overall, 12 different taxa of invertebrate were identified (Table 5). The most abundant taxa observed on the seven transect surveys were opossum shrimp (Mysida) and amphipods (Amphipoda). Opossum shrimp were observed in large numbers on Transects T7 and T4 along the North-east side of the ore dock (Appendix B; Photo 16). Amphipods were observed in large numbers on Transects T7 and T5, east of the ore dock in close proximity to the coarse rock offset habitat. Sea angels (*Clione* sp.) were observed in lower numbers on the transect surveys, although were present on all seven transects. The highest individual species numbers counted on the transects occurred for jellyfish (Cnidaria) and ctenophores (Ctenophora). Three types of jellyfish were recorded, this included unidentified species as well as four tentacled jellies (*Aegina citrea*) (Appendix B; Photo 17). Three types of ctenophores were also identified (Appendix B; Photo 18), with sea gooseberry (*Pleurobrachia* sp.) being the most common. Other invertebrates recorded on the video transects included the wrinkled rock borer, *Hiatella arctica* (Appendix B, Photo 21), scallops (Appendix B, Photo 22) and crinoids (Appendix B, Photo 23). Invertebrate observations were incidental to the program and no apparent differences were noted from the more detailed surveys in 2018.

4.3 Association of Fish with Offset Habitat

4.3.1 Continuous Video Monitoring

Underwater video collected along transects on the east and west sides of the ore dock was reviewed to document the association of fish with the coarse rock substrate. Overall, a total of 41 fish were documented on the transect surveys (Table 6), comprising three families: cod (Gadidae), prickleback (Stichaeidae) and sculpin (Cottidae). Eight fish were identified to species level; four fourhorn sculpin (*Myoxocephalus quadricornis*) and four shorthorn sculpin (*Myoxocephalus scorpius*, Appendix B, Photo 24). An additional thirteen sculpin were not identifiable to species level. Sculpin were the most abundant fish observed and were more common on the west side of the ore dock and were observed using the offset habitat for cover. One sculpin was recorded seeking cover, potentially due to the presence of the ROV (Appendix B; Photo 13 &14). Cod were observed using coarse rock as habitat and were observed in similar numbers on both sides of the ore dock (Appendix B; Photo 15). Prickleback were only observed on Transect T7 on the east side of the ore dock. Thirteen of the recorded fish could not be taxonomically identified due to a combination of factors such as camera angle, camera movement, fish behaviour (using cover), and poor visibility due to high zooplankton and suspended sediment.

Notably more fish (n = 41) were observed in 2019 video surveys compared 2018 (n = 8). Survey effort between years (2017-2019) was similar. Fish presence in 2019 represents over a four-fold increase in the number of fish using the offset habitat compared to 2018, suggesting that fish are attracted to and using the offset habitat as intended. This will be validated during Year 6 of monitoring in accordance with the FAA. Cod and sculpin were recorded on the transect surveys during all three survey years (2017-2019). Prickleback were recorded on the transect surveys for the first time in 2019.

Table 6: Fish Taxa Observed on ROV Video Transect Surveys of Milne Ore Dock Offset Habitat

Taxa	Common Name	Abundance (# of fish)							
		West Ore Dock			East Ore Dock				Total
		T1	T2	T3	T4	T5	T6	T7	
Gadidae indet.	Unidentified cod	1	2	-	-	-	1	1	5
Stichaeidae indet.	Unidentified prickleback	-	-	-	-	-	-	2	2
Cottidae indet.	Unidentified sculpin	4	5	-	-	3	-	1	13
Myoxocephalus quadricornis	Fourhorn sculpin	2	1	-	-	-	-	1	4
Myoxocephalus scorpius	Shorthorn sculpin	-	3	1	-	-	-	-	4
	Unidentified species	-	9	-	-	1	1	2	13
Total Count									**41**

In previous years, stationary and transect video were both used to satisfy the continuous video monitoring requirement outlined in Section 7.1.4 of the FAA. In 2018, longer-term continuous video surveillance of the coarse rock substrate was tested as an alternative method for video monitoring to document the association of fish with the offset habitat and found to be sufficient and therefore stationary video monitoring was not included as part of the 2019 program. Based on the number of fish observed during the 2019 offset monitoring program and during previous monitoring years, the ROV video transect survey methodology is deemed sufficient to satisfy the continuous monitoring requirement outlined in Section 7.1.4 of the FAA.

4.3.2 Active Fish Sampling

A total of 279 fish belonging to five Arctic species groups were captured during active fish sampling undertaken in 2019. Fish counts (by species) are presented in Table 7 for all different sampling methods. As in previous survey years, Arctic char (*Salvelinus alpinus*) (n=106), fourhorn sculpin (*Myoxocephalus quadricornis*) (n=105) and shorthorn sculpin (*M. scorpius*) (n=66) were the most common species caught, comprising 99% of the total catch. A single northern sandlance (*Ammodytes dubius*) and a single ninespine stickleback (*Pungitius pungitius*) made up the remainder of identified species, each representing approximately 0.36% of all fish caught (Appendix B, Photos 8-12).

Table 7 also provides a detailed summary of fish recorded during active fish sampling undertaken at Milne Port between 2010 and 2019. Greater gill net effort in 2018 and 2019 has led to an increase in total catch in comparison to previous sample years. Since 2010, fourteen distinct fish species have been identified in surveys. Ninespine stickleback was identified in 2019 fish surveys, and has not previously been captured in the Milne Port area fish surveys. Ninespine stickleback can be found in calm habitats within marine, brackish and freshwater environments along Arctic, Atlantic and Pacific drainages. They may act as a major prey source in areas where they are common (Gotthardt and Booz 2005).

Table 7: Total Number of Fish Recorded per Year During Fish Sampling in Milne Port (2010 to 2019) (Uncorrected for Effort)

Common Name	Taxonomic ID	2010	2013	2014	2015	2016	2017	2018	2019
Arctic Char	*Salvelinus alpinus*	11	6	3	67	157	23	169	105
Arctic Sculpin	*Myoxocephalus scorpioides*	0	0	4	1	0	9	3	0
Shorthorn Sculpin	*Myoxocephalus scorpius*	50	4	9	8	18	45	78	66
Fourhorn Sculpin	*Myoxocephalus quadricornis*	7	3	39	13	18	40	147	106
Arctic Staghorn Sculpin	*Gymnocanthus tricuspis*	3	0	0	2	0	0	0	0
Longhorn Sculpin	*Myoxocephalus octodecemspinosus*	0	2	4	2	2	0	0	0
Arctic Hookear Sculpin	*Artediellus atlanticus*	0	0	5	1	0	0	0	0
Unidentified Sculpin	Cottidae	0	0	0	12	0	0	3	0
Greenland Cod	*Gadus ogac*	4	0	1	0	0	0	0	0
Common Lumpfish	*Cyclopterus lumpus*	0	0	1	0	0	0	0	0
Fishdoctor	*Gymnelis viridis*	0	1	0	3	0	0	0	0
Fourline Snakeblenny	*Eumesogrammus parecisus*	0	0	1	2	2	0	0	0
Sandlance	*Ammodytes spp.*	0	0	0	0	0	1	1	1
Arctic Cod	*Arctogadus glacialis*	0	0	0	0	0	0	1	0
Ninespine Stickleback	*Pungitius pungitius*	0	0	0	0	0	0	0	1
Unidentified Species	-	0	0	0	0	0	0	1	0
Total		**75**	**16**	**67**	**111**	**197**	**118**	**403**	**279**

5.0 SUMMARY

The 2019 habitat offset monitoring program was designed to fulfill Year 5 monitoring requirements under Sections 7.1 and 7.2 of FAA# 14-HCAA-00525, including assessing the structural integrity of the coarse rock substrate, evaluating the biological productivity of encrusting epifauna in the offset habitat, and documenting the types and numbers of fish observed in the vicinity of the ore dock offset habitat, including association of fish with the coarse rock substrate. A summary of monitoring requirements under FAA# 14-HCAA-00525 in relation to offset habitat monitoring completed to date is provided in Table 8.

Table 8: Monitoring Requirements under FAA# 14-HCAA-00525 Relative to Monitoring Completed to Date

FAA Requirement	Year 1 (2015)	Year 2 (2016)	Year 3 (2017)	Year 4 (2018)	Year 5 (2019)	Monitoring Requirement Met (Y/N)
During Year 1, 3 and 5 the integrity of the coarse rock substrate will be monitored using video surveys.	√	N/A	√	N/A	√	Y – Year 1, Year 3 and Year 5 monitoring completed.
During Year 2, 4 and 6, video surveys of the coarse rock substrate will be used to document the types and percent coverage of aquatic vegetation colonizing the substrate. Benthic invertebrates and fish will be identified and quantified.	N/A	√	N/A	√	N/A	Y – Year 2 and Year 4 monitoring completed. Year 6 monitoring will occur in 2020.
The production of benthic invertebrates and the occurrence of fish larva will be monitored by setting artificial and natural substrate collection baskets in the vicinity of the coarse substrate.	x	x	x	√	√	Y – Year 4 and Year 5 monitoring completed[†]
Continuous video monitoring of the rock substrate shall be undertaken to demonstrate the association of fish with the rock substrate.	√	√	√	√	√	Y – Monitoring completed in all years[††]

Notes: √=completed; x=not completed; N/A=condition not required during monitoring year; Y=Monitoring requirement met; N= Monitoring requirement not met. [†]Settlement basket monitoring was not completed in Years 1, 2 or 3 due to insufficient colonization and loss of settlement baskets deployed in Year 1 (SEM 2016). A settlement basket was lost in 2019; therefore, results are only available for half of the deployed substrate. [††] Continuous video monitoring was completed via stationary and transect video recordings at multiple locations around the ore dock following the methods initially developed by SEM.

Underwater video surveys confirmed that biological utilization of the offset habitat is occurring and that the offset habitat is stable and serving as functional habitat for benthic invertebrates and fish. Aquatic vegetation in the offset habitat area appears comparable to observations made in 2018, and the continued presence of kelp on the coarse rock substrate suggests the coarse rock is stable enough to provide sufficient habitat for the colonization and growth of larger perennial aquatic vegetation species, which in turn is providing greater cover and habitat complexity for fish and benthic invertebrates utilizing the habitat. The diversity and abundance of benthic invertebrates on the coarse rock substrate also appears comparable to the 2018 surveys.

A notable increase in the number of adult fish associated with the coarse rock substrate was observed in 2019 compared to 2018. The fish identified from continuous video monitoring included several unidentified species of cod, two resident species of sculpin, and a prickleback, all of which were observed utilizing the coarse rock for cover and foraging. The increase in the number of observed fish associated with the habitat is a reliable indicator that the coarse rock is acting as functional habitat and is attracting and recruiting targeted species.

A variety of fish were also captured during active fish sampling in Milne Port, including Arctic char, fourhorn sculpin, shorthorn sculpin, sandlance and ninespine stickleback. Results of the Year 5 monitoring program suggest that fish from a number of different taxa groups are utilizing the offset habitat. Overall, species occurrence and relative abundance was comparable to previous survey years.

Biological colonization and productivity was monitored through the use of settlement baskets and settlement plates. Samples collected from settlement baskets and plates showed that colonization is generally low following a 12-month deployment, as seen in previous years. Colonization of the rocks and settlement plates was mostly by juveniles of the same taxa observed in the offset habitat and throughout Milne Port. Despite the relatively low colonization, there was a significant increase in the number of taxa and individuals on the rock substrate and settlement plates. All epifauna taxa observed are known to have ranges that include Arctic, north Atlantic or Canadian Arctic waters. None of the epifauna taxa identified from settlement baskets or plates in 2019 are globally recognized invasive species or considered invasive species in Canada.

Occurrence of fish larvae was not noted to be associated with the settlement substrates. Zooplankton samples were collected within Milne Port that may contain larval or juvenile fish, however, results were not available at the time of reporting. Ichthyoplankton identified in these samples will be reported on in the upcoming Marine Environmental Effects Monitoring Report, available 2020.

Results of Year 5 habitat offset monitoring indicate that the objectives of the offset habitat measures are being achieved and contingency measures are not required at this time. The coarse rock substrate is stable and no repairs or modifications to the offset habitat are presently required. Based on monitoring results collected to date, the coarse rock substrate placed around the perimeter of the Milne Port Ore Dock is functioning in accordance to conditions set out in FAA #14-HCAA-00525 and as designed in the Fish Offset Plan.

6.0 CLOSURE

We trust this information is sufficient for your needs at this time. Should you have any questions or concerns, please do not hesitate to contact the undersigned at 250-881-7372.

Golder Associates Ltd.

Christine Bylenga, PhD
Biologist

Kaitlin Broadhurst
Environmental Scientist

Reviewed by:

Philippe Rouget, BSc, MSc, RPBio
Marine Biologist

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CB/KB/PR/asd

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7.0 REFERENCES

Beuchel, F. and B. Gulliksen, 2008. Temporal patterns of benthic community development in an Arctic fjord (Kongsfjorden, Svalbard): results of a 24-year manipulation study. Polar Biology. July 2008. Volume 31 (8), p.913-924

Casas-Monroy O., Linley R.D., Adams J.K., Chan F.T., Drake D.A.R., and S.A. Bailey, 2014. National risk assessment for introduction of aquatic nonindigenous species to Canada by ballast water. DFO. Can. Sci. Advis. Sec. Res. Doc. 2013/128. Vi + 73 p.

Dayton PK. 1985. Ecology of kelp communities. Annu. Rev. Ecol. Syst. Vol 16, p.215–245.

Degan R, Faulwetter S. 2019. The Arctic Traits Database – a repository of Arctic benthic invertebrate traits. Earth System Science Data 11:301-322.

DFO (Fisheries and Oceans Canada). 2016. Central and Arctic Multi-Species Stock Assessment Surveys, Version 6. In OBIS Canada Digital Collections. Bedford Institute of Oceanography, Dartmouth, NS, Canada. Published by OBIS. [Accessed December 2019] http://www.iobis.org/.

ETI (ETI Bioinformatics). 2019. Marine Species Identification Portal. [Accessed December 2019]. http://species-identification.org/index.php

Golder (Golder Associates Ltd.). 2017. 2017 Milne Ore Dock Fish Offset Monitoring Report, *Fisheries Act* Authorization 14-HCAA-00525. 29 December 2017. Prepared for Baffinland Iron Mines Corporation Report 1663724-040-R-Rev0.

Golder (Golder Associates Ltd.). 2018. 2018 Milne Ore Dock Fish Offset Monitoring Report, *Fisheries Act* Authorization 14-HCAA-00525. 21 December 2018. Prepared for Baffinland Iron Mines Corporation Report 1663724-084-R-Rev0.

Gotthardt TA, Booz M. 2005. Ninespine Stickleback. In: Hammerson G, Author. Global Element Ecology and Life History. Alaska Department of Fish and Game Species Information Database. Available at: https://www.adfg.alaska.gov/static/species/speciesinfo/_aknhp/ninespine_stickleback.pdf

Kain J.M., 1975. The biology of *Laminaria hyperborea* VII. Reproduction of the sporophyte. J. Mar. Biol. Assoc. U.K. Vol 55, p.567–582.

Molnar, J.L, Gamboa R.L., Revenga C., and M.D. Spalding, 2008. Assessing the global threat of invasive species to marine biodiversity. Frontiers in Ecology and the Environment. [accessed December 2019] http://www.conservationgateway.org/ConservationPractices/Marine/Pages/marineinvasives.aspx.

Orberg, S.B., Krause-Jensen, D., Meire, L., and M. K. Sejr, 2018. Subtidal benthic recruitment in a sub-Arctic glacial fjord system: Temporal and spatial variability and potential drivers. Polar Biology. December 2018. Volume 41 (12), p.2627-2634.

Parke M., 1948. Studies on British Laminariaceae. I. Growth in *Laminaria Saccharina* (L.) Lamour. J. Mar. Biol. Assoc. U.K. Vol. 3, p.651–709.

SEM (Sikumiut Environmental Management Ltd.). 2017a. 2016 Milne Ore Dock Fish Offset Monitoring. Prepared for Baffinland Iron Mines Corporation, Oakville, Ontario.

SEM, 2017b. 2016 Marine Environmental Effects Monitoring Program (MEEMP) and Aquatic Invasive Species Monitoring Milne Inlet Marine Ecosystem. Prepared for Baffinland Iron Mines Corporation, Oakville, Ontario.

Steneck R.S., Graham M.H., Bourque B.J., Corbett D., Erlandson J.M., and J.A. Estes, 2002. Kelp forest ecosystems: biodiversity, stability, resilience and future. Environ. Conserv. Vol. 29, p.436–459.

Wernberg T., Kendrick G.A., and B.D. Toohey, 2005. Modification of the physical environment by an *Ecklonia radiata* (Laminariales) canopy and its implications to associated foliose algae. Aquat. Ecol. Vol. 39, p.419–430.

WoRMS (WoRMS Editorial Board). 2019. World Register of Marine Species. [Accessed December 2019]. http://www.marinespecies.org/index.php

APPENDIX A

Fisheries Act Authorization

Fisheries and Oceans Canada | Pêches et Océans Canada

DFO File No.: 14-HCAA-00525
Authorization No.:1

FISHERIES ACT 35 (2)(b)AUTHORIZATION

Authorization issued to:

Baffinland Iron Mines Corporation (hereafter referred to as the "Proponent")
Attention: Oliver Curran
2275 Upper Middle Road East Suite 300
Oakville, ON
L6H 0C3

Location of Proposed Project

Nearest community : Pond Inlet
Territory: Nunavut
Name of waterbody: Milne Inlet
UTM Coordinates: NAD 83 UTM 17 503250E 7976508N

Description of Proposed Project

The proposed project of which the work, undertaking or activity authorized is a part involves:

The Early Revenue Phase of the Mary River Project will involve the mining and shipment of up to 4.2 million tonnes per annum of iron ore via the Tote Road to the port at Milne Inlet, for shipment to European markets during the open water season.

Description of Authorized work(s), undertaking(s) or activity(ies) likely to result in serious harm to Fish

The works, undertakings, or activities associated with the proposed project described above, that are likely to result in serious harm to fish, are:

The infilling of fish habitat in Milne Inlet resulting from the construction of the ore dock and mooring structures.

The serious harm to fish likely to result from the proposed work, undertaking, or activity, and covered by this authorization includes:

Permanent destruction of 24, 847 m^2 (6015 Habitat Equivalent Units) of fish habitat.

Conditions of Authorization

The above described work, undertaking or activity that is likely to result in serious harm to fish must be carried on in accordance with the following conditions.

1. **Conditions that relate to the period during which the work, undertaking or activity that will result in serious harm to fish can be carried on:**

The work, undertaking or activity that results in serious harm to fish is authorized to be carried on during the following period:

From	To
Date of Issuance	December 31, 2020

If the Proponent cannot complete the work, undertaking or activity during this period, Fisheries and Oceans Canada (DFO) must be notified. DFO may, where it considers appropriate, provide in writing notice that the period to carry on the work, undertaking or activity has been extended.

The period during which other conditions of this authorization must be complied with are provided in their respective sections below.

2. **Conditions that relate to measures and standards to avoid and mitigate serious harm to fish resulting from the ore dock construction:**

2.1 Sediment and erosion control measures must be in place and shall be upgraded and maintained, such that release of sediment is avoided at the location of the authorized work, undertaking, or activity.

2.2 Measures and standards to avoid and mitigate serious harm to fish resulting from the construction of the ore dock shall be implemented prior to the commencement of in-water works.

2.3 While conducting vibratory pile driving, dredging and infilling a marine mammal exclusion zone of 200m radius will be established. Field measurements will be undertaken to verify that underwater noise levels are below the 100db threshold.

2.4 The marine mammal exclusion zone will be monitored for marine mammal presence starting 30 minutes prior to the commencement of vibratory pile driving, dredging or infilling activities. All activities shall cease if marine mammals are observed within or approaching the exclusion zone and only recommence when the marine mammals have left the area.

2.5 If measured underwater noise levels exceed the 100db threshold the following contingency measures shall be considered for implementation: expansion of the marine mammal exclusion zone and the installation of bubble curtains.

2.6 Turbidity levels shall be monitored in waters adjacent to the work zone during vibratory pile driving, infilling and dredging activities. If turbidity levels exceed Canadian Council of Ministers of the Environment (CCME) guidelines the following contingency measures shall be considered for implementation: installation of additional turbidity curtains, changes in grain size gradation of infill material, altered methods of infilling and the suspension of in-water works until turbidity levels are within the CCME guidelines.

3. Conditions that relate to measures and standards to avoid and mitigate serious harm to fish resulting from project related shipping activity (Terms and Conditions (T&C) adapted from Nunavut Impact Review Board's Project Certificate No 5 May 28, 2014):

3.1 The Proponent shall develop and implement a monitoring program to evaluate changes to marine fish, fish habitat and aquatic organisms as well as to monitor for non-native species introductions resulting from ballast water discharges. Baseline data collection shall commence prior to any ballast water discharge into Milne Inlet and monitoring shall continue for the life of the project. (NIRB T&C 87).

3.2 The Proponent shall develop and implement a monitoring program to confirm the predictions made in the Final Environmental Impact Statement – Addendum, with respect to disturbance impacts of shipping noise on the distribution of marine mammals. The survey shall be designed to monitor effects during the shipping season and include locations in Milne Inlet, Eclipse Sound and Pond Inlet. The survey shall continue over a sufficiently lengthy period of time to determine the extent to which habituation occurs for Narwhal and Bowhead whales. (NIRB T&C 109)

3.3 The Proponent shall develop and implement a monitoring protocol that includes but is not limited to acoustic monitoring, to assess the potential short term, long term and cumulative effects of vessel noise on marine mammals and marine mammal populations.(NIRB T&C 110)

3.4 The Proponent shall provide sufficient marine mammal observer coverage on project vessels to monitor marine mammal interactions with project vessels and report any accidental contact of marine mammals. (NIRB T&C 121)

3.5 The Proponent shall identify and implement measures to reduce the potential for interactions with marine mammals throughout the life of the project. These measures may include; a) changes in frequency and timing (including periodic shipping suspensions) when the likelihood of negative interactions with marine mammals are greatest or during sensitive life stages b) reduced shipping speeds where ship-marine mammal interactions are most likely to occur. (NIRB T&C 105)

4. Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate serious harm to fish from the ore dock construction:

4.1 The Proponent shall undertake monitoring and report to DFO annually by December 31st whether measures and standards to avoid and mitigate serious harm to fish were conducted according to the conditions of this Authorization, by:

4.1.1 Providing dated photographs and inspection reports to demonstrate effective

implementation and functioning of mitigation measures and standards described above to limit the serious harm to what is covered by this authorization.

4.1.2 Providing details of any contingency measures that were followed, to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.

5. Conditions that relate to monitoring and reporting of measures and standards to avoid and mitigate serious harm to fish from project related shipping:

5.1 The Proponent shall undertake monitoring and report to DFO annually. The submission of monitoring reports shall coincide with the Proponent's submission of their Annual Monitoring Report to the Nunavut Impact Review Board.

6. Conditions that relate to the offsetting for the serious harm to fish likely to result from the authorized work, undertaking or activity:

6.1 Course rock substrate will be placed around the perimeter of the ore dock and moorings at Milne Inlet to provide 6003 HEU of fish habitat.

6.2 All fish habitat offsetting measures shall be completed and functioning according to the criteria below by December 31, 2020.

6.2.1 Coarse rock substrate will provide additional habitat for benthic invertebrates and fish species in Milne Inlet.

6.2.2 Colonization of the rock substrate by algae and aquatic vegetation to provide a food source for benthic invertebrates and fish.

6.3 If the results of monitoring as required in condition 7 indicate that the offsetting measures are not completed by the date specified in condition 6.2, the Proponent shall give written notice to DFO and put in place contingency measures specified in condition 6.5 and associated monitoring measures, as contained within their approved offsetting plan, to ensure the offsetting is completed and functioning as required by this authorization.

6.4 If monitoring identifies deterioration in the structure, plans will be developed to repair and reinforce these areas. Annual monitoring (drop camera) will be adjusted to include repaired locations and will continue for a period of three years following any repairs.

6.5 If no quantifiable increase in use of the rock substrate by fish, benthic invertebrates or aquatic vegetation is detected by year 6 the following contingency measures will be undertaken.

6.5.1 The Proponent will create an additional 6005 HEU of artificial reefs outside the zone of influence of the ore dock within Milne Inlet.

6.6 To ensure that the above offsetting contingency measures are functioning as intended the monitoring program described in Condition 7 shall be carried out.

6.7 Offsetting measures shall be left undisturbed, and the Proponent shall not carry on any work, undertaking or activity that will adversely disturb or impact the offsetting measures.

6.8 DFO may draw upon funds set aside by the Proponent through the letter of credit provided as

part of the application for this authorization, in order to ensure conditions of this authorization related to offsetting measures, including monitoring and reporting, are met.

7. **Conditions that relate to monitoring and reporting of offsetting measures (described above in section 6:**

7.1 The Proponent shall conduct monitoring of the offsetting measures according to the approved schedule and criteria below:

7.1.1 During Year 1, 3 and 5 the integrity of the coarse rock substrate will be monitored using video surveys (drop camera). All information will be geo-referenced and any slumping or other deterioration will be documented and repaired as necessary.

7.1.2 During Year 2, 4 and 6 video surveys (drop camera) of the coarse rock substrate will be used to document the types and percent coverage of the aquatic vegetation colonizing the substrate. Benthic invertebrates and fish recoded in the video will be identified and quantified.

7.1.3 The production of benthic invertebrates and the occurrence of fish larva will be monitored by setting artificial and natural substrate collection baskets in the vicinity of the coarse substrate.

7.1.4 Continuous video monitoring of the rock substrate shall be undertaken to demonstrate the association of fish with the rock substrate.

7.2 The Proponent shall report to DFO that the offsetting works were conducted according to the conditions of this Authorization by providing the following:

7.2.1 Monitoring report shall be submitted to the DFO-Yellowknife Office by December 31 of each year monitoring is carried out.

DFO File No. : 14-HCAA-00525
Authorization No. :1

Authorization Limitations and Application Conditions

The Proponent is solely responsible for plans and specifications relating to this Authorization and for all design, safety and workmanship aspects of all the works associated with this Authorization.

The holder of this authorization is hereby authorized under the authority of paragraph 35(2)(b) of the Fisheries Act. R.S.C., 1985, c.F. 14 to carry on the works, undertakings and/or activities that are likely to result in serious harm to fish as described herein. This authorization does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

This Authorization does ***not*** permit the deposit of a deleterious substance in water frequented by fish. Subsection 36(3) of the *Fisheries Act* prohibits the deposit of any deleterious substances into waters frequented by fish unless authorized by regulations made by Governor in Council.

At the date of issuance of this Authorization, no individuals of aquatic species listed under the *Species at Risk Act* (SARA) were identified in the vicinity of the authorized works, undertakings or activities. In the event that any such individuals are identified in this area, or in the event that an aquatic species found in this same area is listed under the SARA after this Authorization is issued, this Authorization does not permit the killing, harming, capture or taking of individuals of any such species (section 32 of the SARA), or the damage or destruction of residence of individuals of such species (s. 33 of the SARA) or the destruction of the critical habitat of any such species (s. 58 of the SARA).]

The failure to comply with any condition of this authorization constitutes an offence under paragraph 40(3)(a) of the *Fisheries Act* and may result in charges being laid under the *Fisheries Act*.

This authorization must be held on site and work crews must be made familiar with the conditions attached.

This authorization cannot be transferred or assigned to another party. If the work(s), undertaking(s) or activity(ies) authorized to be conducted pursuant to this authorization are expected to be sold or transferred, or other circumstances arise that are expected to result in a new Proponent taking over the work(s), undertaking(s) or activity(ies), the Proponent named in this authorization shall advise DFO in advance.

Date of Issuance: JUN 3 0 2014

Approved by:

Dave Burden
Regional Director General
Central and Arctic Region
Fisheries and Oceans Canada

APPENDIX B

Photos

Photo 1: Seamor Chinook 300F ROV video system used to undertake underwater video surveys of offset habitat along Milne Port Ore Dock in August 2019

Photo 2: Topside view of underwater video survey of offset habitat along Transect 7 (T7) on east side of Milne Port Ore Dock in August 2019

Photo 3: Settlement basket and plates (SBEO-1) retrieved from eastern side of Milne Port Ore Dock in August 2019

Photo 4: Encrusting epifaunal growth on settlement plates and settlement basket (SBEO-1) retrieved from eastern side of Milne Port Ore Dock in August 2019

Photo 5: Settlement basket (SBEO-1) retrieved from eastern side of the Milne Port Ore Dock in August 2019

Photo 6: Settlement plates from western side of Milne Port Ore Dock (SBWO-1) found washed up on shore in August 2019

Photo 7: Fyke net (FN-02) deployed near Milne Port Ore Dock in August 2019

Photo 8: Sandlance captured in Fukui traps during fish sampling at Milne Port Ore Dock in August 2019

Photo 9: Shorthorn sculpin caught in gill nets as part of fish sampling at Milne Port in August 2019

Photo 10: Fourhorn sculpin captured during gill net sampling at Milne Port in July 2019

Photo 11: Arctic char captured during gill net sampling at Milne Port in July 2019

Photo 12: Ninespine stickleback captured during seine net sampling at Milne Port in August 2019

Photo 13: Sculpin observed resting on offset habitat during video surveys on East Side (T7) of Milne Port Ore Dock in August 2019

Photo 14: Same sculpin observed moving to cover during video surveys on East Side (T7) of Milne Port Ore Dock in August 2019

Photo 15: Cod observed resting on offset habitat during video surveys on East Side (T7) of Milne Port Ore Dock in August 2019

Photo 16: Opossum shrimp observed along North East Side (T7) of Milne Port Ore Dock in August 2019

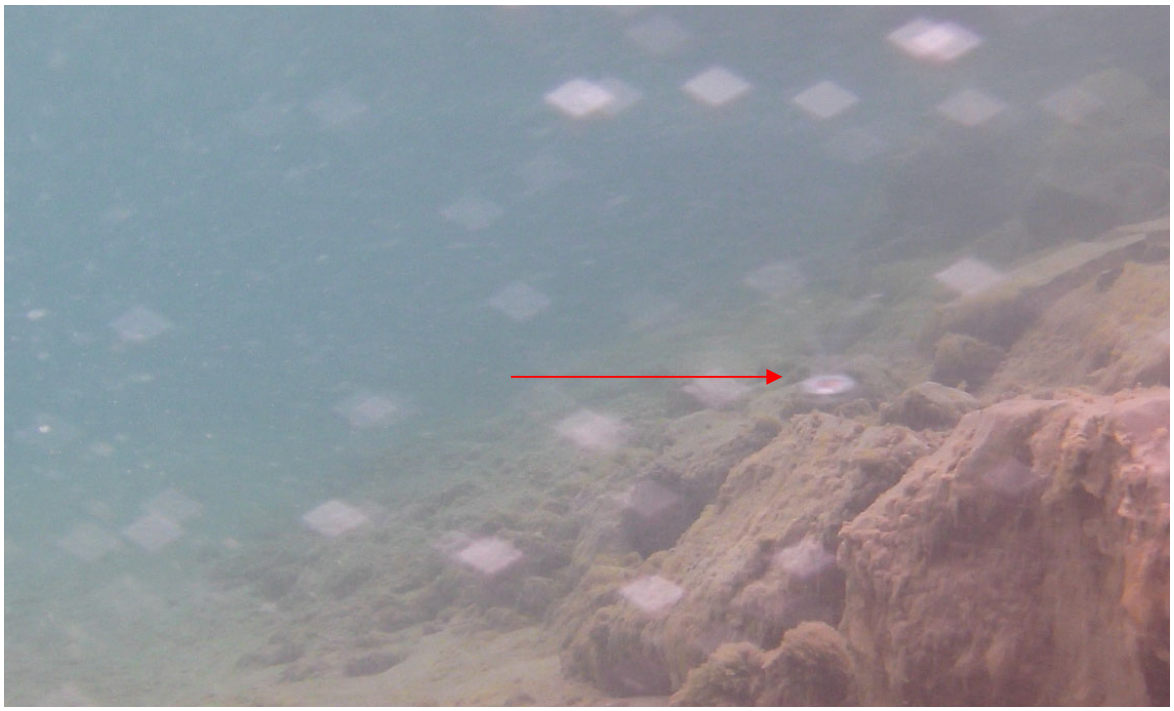

Photo 17: Four tentacled jelly observed along west of Milne Port Ore Dock (T3) in August 2019

Photo 18: Ctenophore observed along coarse rock habitat on west side of Milne Port Ore Dock (T2) in August 2019

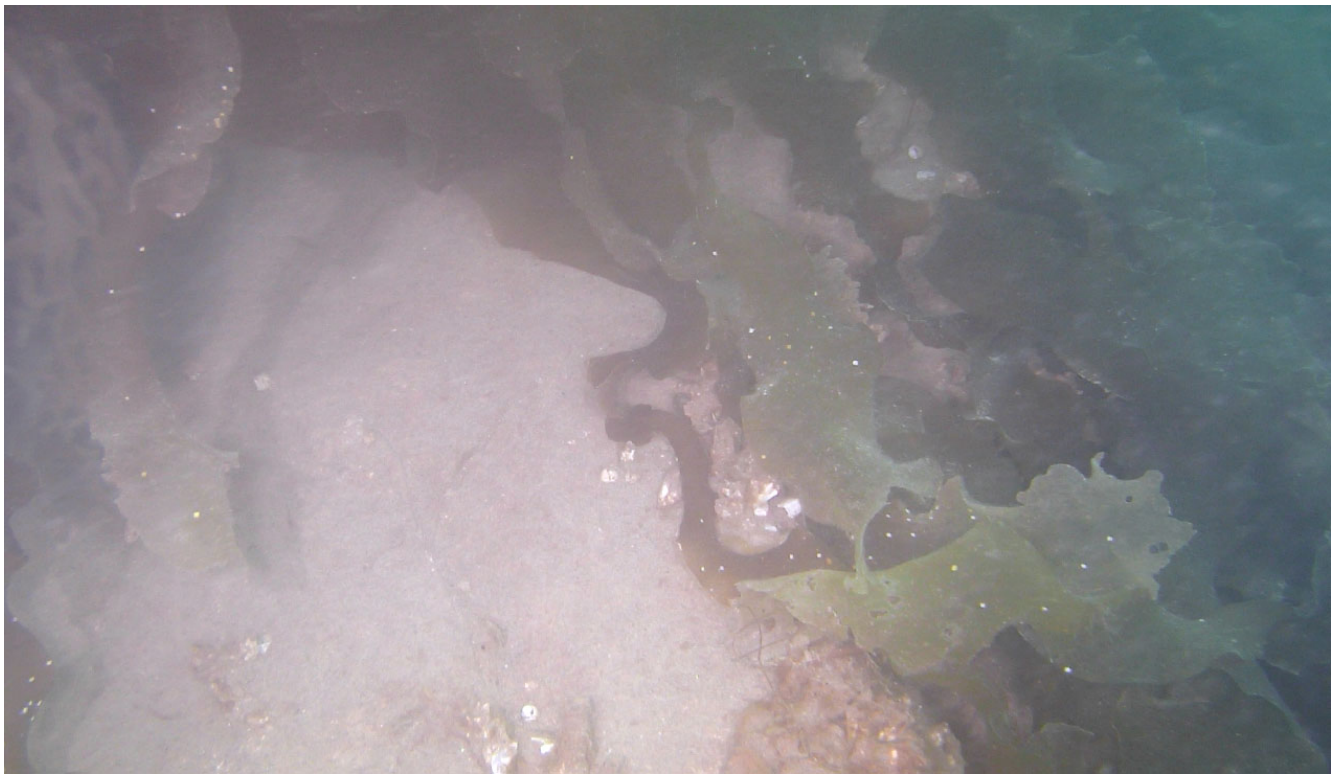

Photo 19: Bladed kelp observed on west side of Milne Port Ore Dock (T1) in August 2019

Photo 20: Thick algal cover on coarse rock on west side of Milne Port Ore Dock (T2) in August 2019

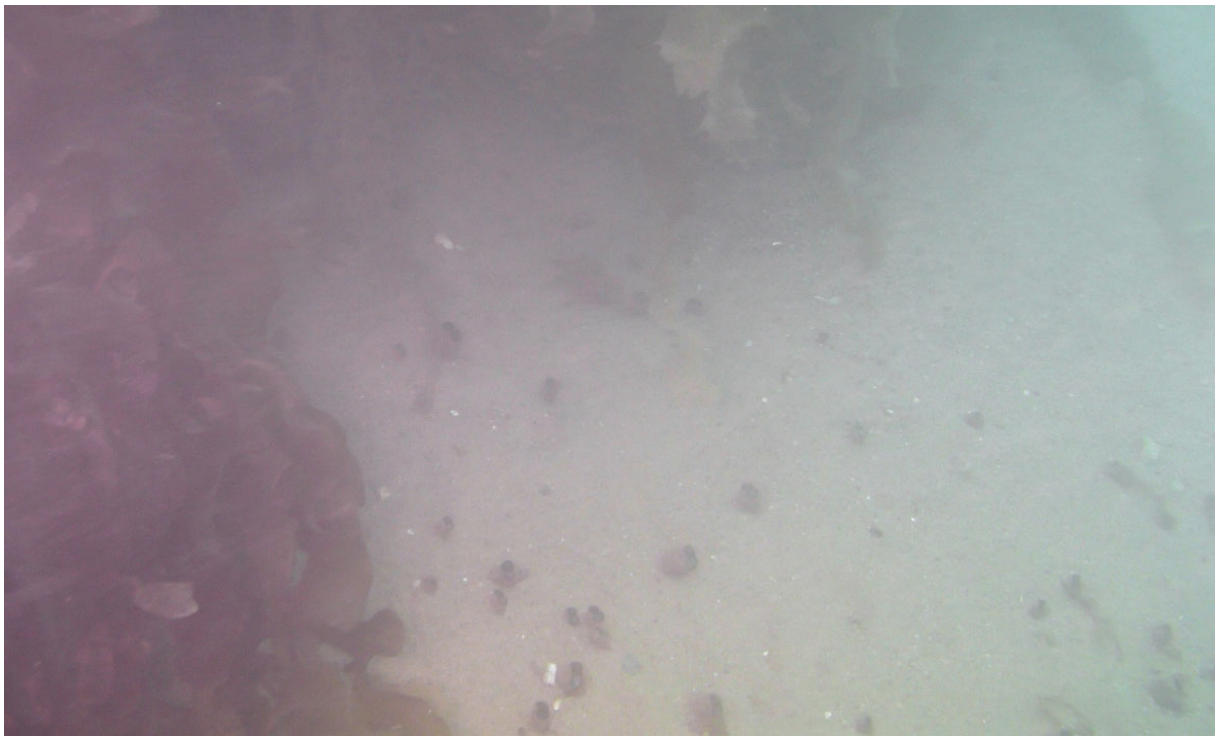

Photo 21: Siphons of *Hiatella arctica* observed in sand next to bladed kelp covered offset habitat on west side of Milne Port Ore dock (T1) in August 2019

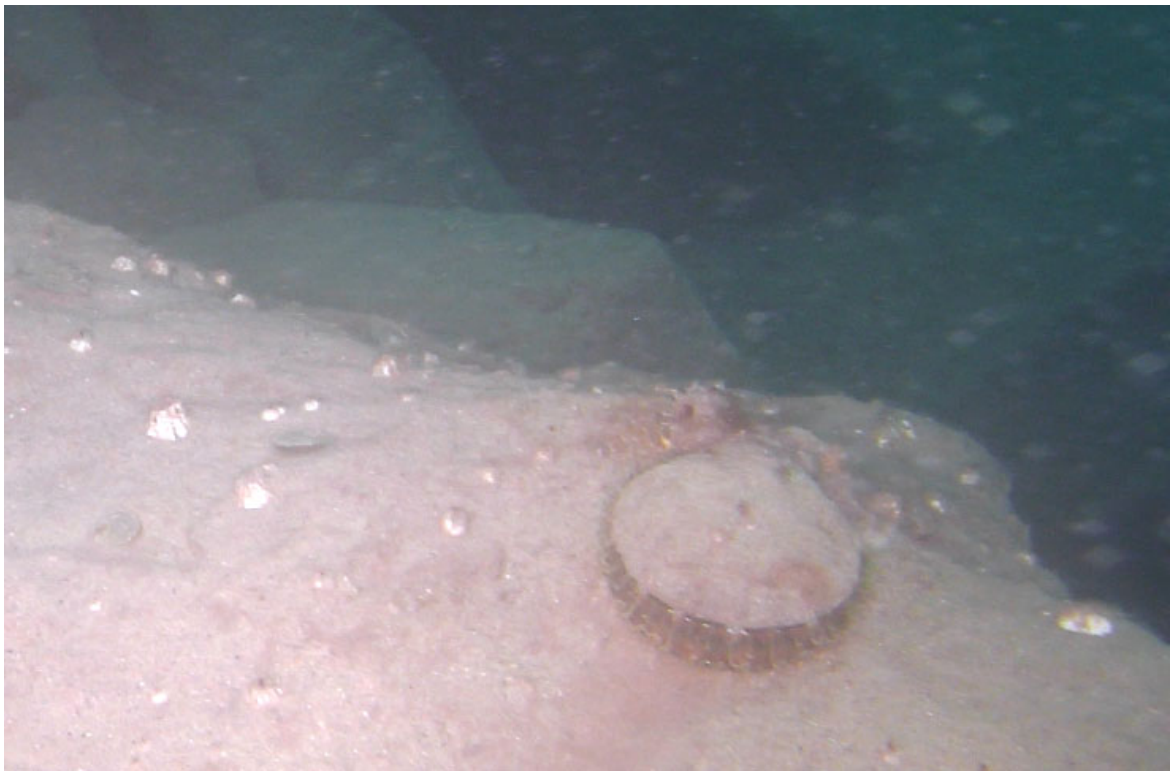

Photo 22: Scallop observed on coarse rock habitat on west side of Milne Port Ore Dock (T1) in August 2019

Photo 23: Crinoid observed on coarse rock on west side of Milne Port Ore Dock (T1) in August 2019

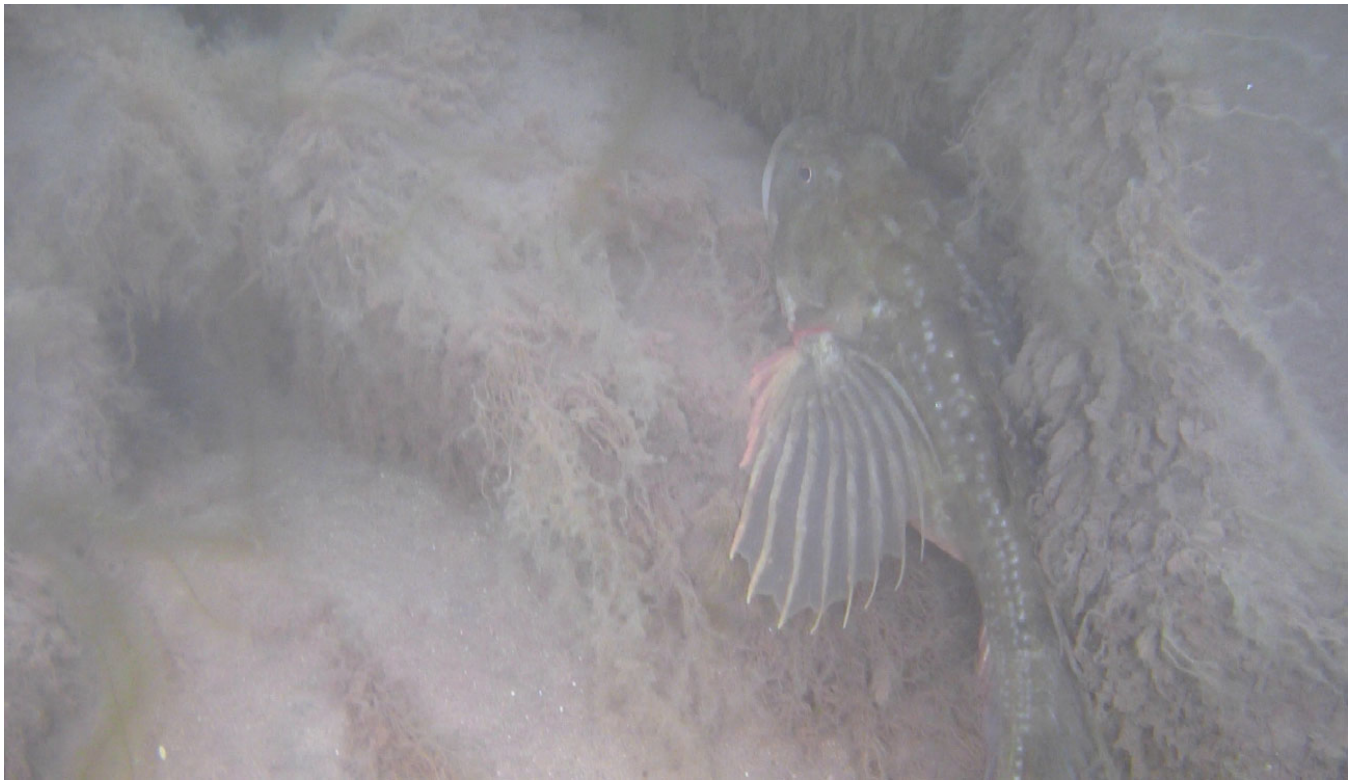

Photo 24: Fourhorn sculpin observed hiding in between boulders on coarse rock habitat on west side of Milne Port Ore Dock (T1) in August 2019

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