Appendix V5-6D

2009 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project

Hope Bay Mining Limited

2009 Freshwater Fish and Fish Habitat Baseline Report, Hope Bay Belt Project

Rescan Engineers & Scientists

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2009 FRESHWATER FISH AND FISH HABITAT BASELINE REPORT, HOPE BAY BELT PROJECT

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Prepared for:

Hope Bay Mining Limited

Prepared by:

Rescan™ Environmental Services Ltd.
Kamloops, British Columbia

Executive Summary

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Executive Summary

Environmental baseline studies were conducted by Rescan Environmental Services Ltd. (Rescan) on behalf of Hope Bay Mining Ltd. (HBML) at the Hope Bay Belt Project in 2009. The Hope Bay Belt property is located approximately 125 km southwest of Cambridge Bay, Nunavut, on the southern shore of Melville Sound.

The purpose of the 2009 environmental baseline program was to collect additional information to support the design and permitting of a future expanded Hope Bay Belt Project. The objective of the 2009 freshwater fish baseline work was to characterize fish habitat and fish communities in lakes, ponds, rivers and streams of the Project area. Fish communities were characterized in terms of species richness, relative abundance (i.e., catch-per-unit-effort), absolute abundance (only in Doris and Patch lakes which were surveyed by hydroacoustic gear) and biological features (e.g., length, weight, age). Lake trout diet and tissue metal concentrations were sampled from five lakes. Historical information on fish and fish habitat from 1995 to 2007 was summarized to assist Project planning, permitting and future environmental monitoring.

Studies of fish habitat found that lakes supplied the greatest amount of perennial fish habitat in the Project area. Fines were the predominant substrate at potential receiving environment lakes, while bedrock and boulder substrates were most prevalent at reference lakes. Large rivers and lake outlet streams supplied good quality habitat for fish. Ninespine stickleback, juvenile Arctic char and lake trout were the predominant species captured from streams. Ponds and small, ephemeral streams assessed were generally non-fish-bearing and rated as poor habitat quality.

The fish communities of lake, river, stream and pond habitats were also assessed. The fish communities of lakes were assessed using gillnets and/or hydroacoustic gear. Large river sites were assessed with a combination of gillnets, minnow traps and electrofishing gear. The fish community of stream sites was primarily assessed using backpack electrofishing gear. Fish communities displayed very low species richness. A total of seven species were identified in freshwater environments, including Arctic char, Arctic grayling, cisco, lake trout, lake whitefish, ninespine stickleback and slimy sculpin. Cisco, lake whitefish and lake trout represented the majority of fish captured. Hydroacoustic gear was used to estimate fish absolute abundance at Doris and Patch lakes. The total number of fish was estimated as 55,806 and 33,619, respectively. Hydroacoustic and gillnetting data both showed that fish abundance generally increased with depth in Doris and Patch lakes. Taxonomic analysis of stomach contents was conducted on lake trout and lake whitefish stomachs. These analyses found several food sources derived from marine and freshwater environments. Lake trout muscle and liver tissue samples were analysed for total metal concentrations from five lakes in the Project area. All lake trout samples, both muscle and liver, had concentrations below the Health Canada guideline for mercury.

Acknowledgements

Acknowledgements

This report was prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd. The 2009 freshwater fish and fish habitat fieldwork was conducted by Kevin Esseltine (M.Sc.), Kirsten MacKenzie (M.Sc., R.P.Bio.), Erika Genrich (B.Sc.), Michael Stamford (M.Sc.) and François Landry (M.Sc., R.P.Bio.). Hydroacoustic assessments were conducted by Brock Stables (M.Sc.) with the assistance of K. Esseltine and K. MacKenzie. The report was prepared by K. Esseltine with support from E. Genrich, David Fauquier (B.Sc.) and Carolyn Duckham (B.Sc.), and reviewed by Michael McGurk (Ph.D., R.P.Bio.). The Hope Bay Belt Project was managed by Deborah Muggli (Ph.D., R.P.Bio.).

Rescan staff were assisted in the field by Tannis Bolt, Aaron Halushka, Janet Kadlun, Darcy Kanayok, Clarence Klengenberg, Stephen Kuhoktak, Wynter Kuliktana and Irvin Kuptana.

Field-related support was provided by the Newmont Environment and Social Responsibility (ESR) Department, Health, Safety and Loss Prevention (HSLP) Department, Great Slave Helicopters, Braden Burry Expediting and Nuna Logistics.

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2009 FRESHWATER FISH AND FISH HABITAT BASELINE REPORT, HOPE BAY BELT PROJECT

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1. Introduction

1. Introduction

The Hope Bay Belt Property is located approximately 125 km southwest of Cambridge Bay, Nunavut, on the south shore of Melville Sound (Figure 1-1). The nearest communities are Omingmaktok (75 km to the southwest of the property), Cambridge Bay, and Kingaok (Bathurst Inlet; 160 km to the southwest of the property).

The property consists of a greenstone belt running in a north/south direction, approximately 80 km long, with three main gold deposit areas. The Doris and Madrid deposits are located in the northern portion of the belt and the Boston deposit is located in the southern end. The northern portion of the property consists of several watershed systems that drain into Roberts Bay and a large river (Koignuk River) that drains into Hope Bay. Watersheds in the southern portion of the belt ultimately drain into the upper Koignuk, which drains into Hope Bay.

Newmont Mining Corporation (Newmont) acquired the property in 2008, and initially decided to consider the property as a whole to evaluate various options for responsible, long-term development of the belt. However, as of the fall of 2009, Hope Bay Mining Ltd. (HBML), a fully owned subsidiary of Newmont, has decided to proceed with developing the already-permitted Doris North Project, which consists of a two year underground gold mine in the north end of the belt.

The environmental baseline program conducted in 2009 was based on the plan to develop multiple deposits in the belt, as illustrated in Figure 1-2. The 2009 program was also based on Newmont's priorities as of early 2009, which included regulatory compliance with the existing Doris North Project permits and licences. Baseline programs for ecosystem mapping, vegetation, soils and socio-community were deferred to 2010. Baseline work was primarily focused on the north end of the belt in 2009.

Results from the 2009 environmental baseline program are being reported in a series of reports, as follows:

- 2009 Hydrology Baseline Report;
- 2009 Meteorology Baseline Report;
- 2009 Freshwater Baseline Report;
- 2009 Freshwater Fish and Fish Habitat Baseline Report;
- 2009 Marine Baseline Report; and
- 2009 Marine Fish and Fish Habitat Baseline Report.

In addition, baseline information obtained during 2009 was used to generate various compliance reports as specified in the Doris North Project Certificate (e.g., the Wildlife Monitoring & Mitigation Program Report), the Doris North Type A Water Licence and the Doris North Roberts Bay Jetty Fisheries Authorization. Archaeology work was also conducted in 2009 and is being reported separately.

This report presents the results from the freshwater fish and fish habitat portion of the 2009 environmental baseline program.

PROJECT # 1009-002-01 ILLUSTRATION # a23708w May 21 2009

Figure 1-1

Hope Bay Belt Project Location

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PROJECT # 1009-002-01 GIS # HB-15-009 May 26 2009

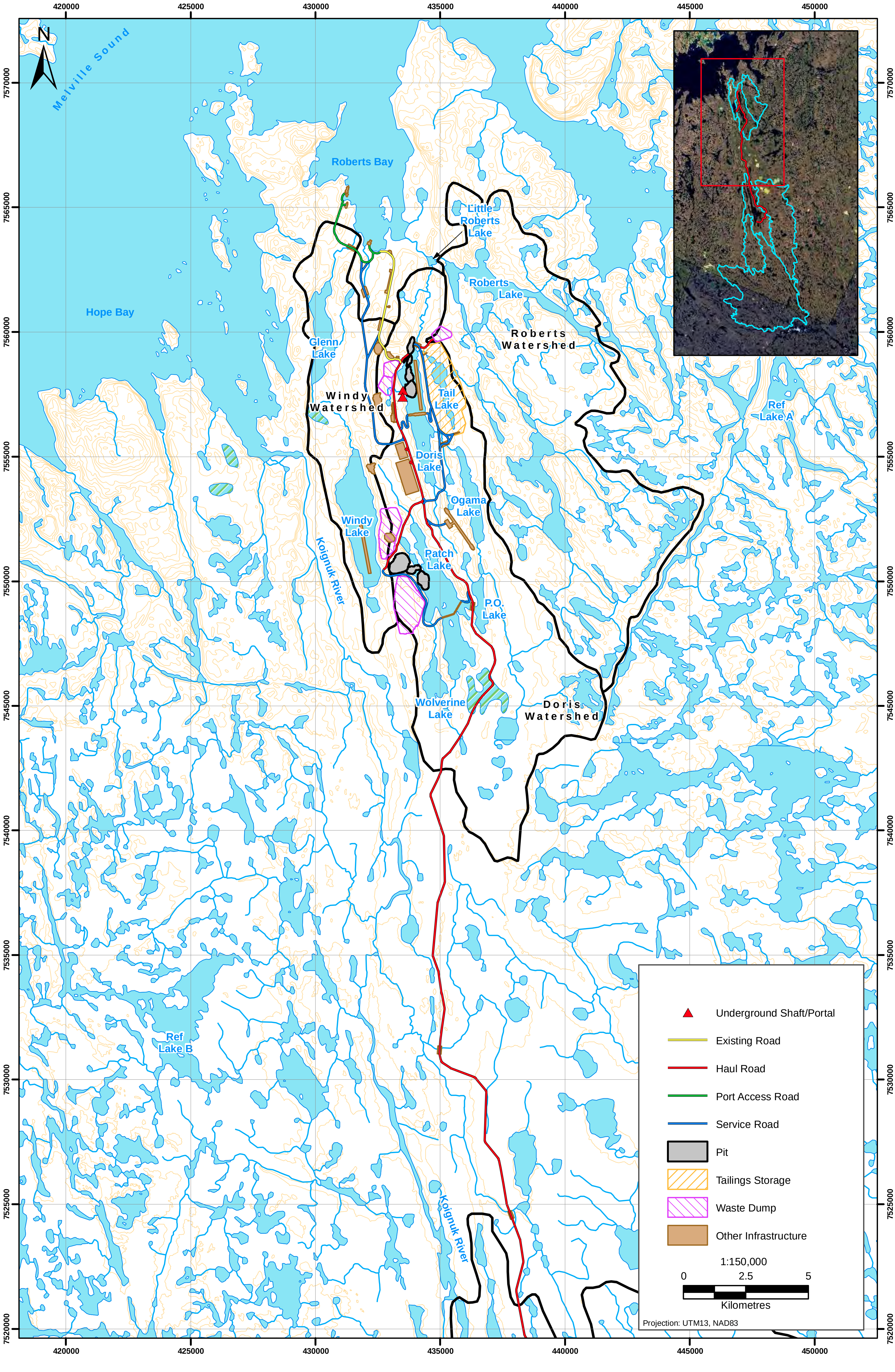

Figure 1-2

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Site Layout Options Considered for 2009 Baseline Program

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The primary objective of the 2009 freshwater fish and fish habitat baseline work was to characterize fish habitat and fish communities in the Project area. Fish habitat was defined as those environmental components that are required either directly or indirectly by fish to carry out their life processes, including spawning and rearing areas, food production areas, migration routes and over-wintering areas. These areas included lakes, ponds, large rivers and streams. The fish communities were defined in terms of total number and number-by-species at each sampling location, total catch-per-unit-effort (CPUE) and species-specific CPUE for each type of assessment gear. Biological features of fish such as length, weight, condition, age and diet were also measured. Lake trout (*Salvelinus namaycush*) tissue metal concentrations were evaluated at three lakes in the potential receiving environment and at two reference lakes. Hydroacoustic methods were also used to estimate absolute fish abundance and evaluate fish habitat in Doris and Patch lakes, respectively.

The secondary objective of this report was to summarize historical data on freshwater fish and fish habitat in the Hope Bay Belt study area to provide context to the results of the 2009 work.

2. Materials and Methods

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2. Materials and Methods

2.1 FISH HABITAT

2.1.1 Lake Habitat

2.1.1.1 Visual

Fish habitat surveys were conducted at four lakes (Little Roberts, Glenn, Windy and Reference A) in the Project area in 2009 (Figure 2.1-1 and Table 2.1-1). Other water bodies in the Project area including Doris, Patch, P.O., Ogama and Tail lakes, and the Koignuk River were assessed using similar methods in previous studies conducted in 2005 to 2007. Surveys were conducted by walking or slowly boating along the shoreline and delineating habitat units based on the substrate composition of the littoral zone. Substrate composition was recorded as a percent coverage (e.g., 70% cobble and 30% boulder) within delineated zones. The habitat types were classified as bedrock, boulder, cobble, gravel, sand, silt and organic material. Patches of emergent and submergent vegetation were noted and recorded on a field map. Photographs were taken to illustrate various habitat types.

Table 2.1-1. Lakes Assessed for Littoral Zone Fish Habitat, Hope Bay Belt Project, 2009

			UTM	
Lake	**Watershed**	**Date Assessed**	**Easting**	**Northing**
Little Roberts	Doris/Roberts	28-Jul-2009	434600	7562800
Glenn	Windy	4-Aug-2009	430500	7560000
Windy	Windy	29-Jul-2009	432000	7552500
Reference A	Reference A	26-Jul-2009	449000	7558000

2.1.1.2 Hydroacoustics and Underwater Video

<u>Substrate Classification</u>

Data Collection

The site infrastructure options considered for 2009 included the construction of dykes at the central portion of Doris and Patch lakes, in order to develop open pits at the northern end of each lake. The development of these open pits would require de-watering of a portion of each lake, which would result in the loss of fish habitat. Thus, hydroacoustic methods were used to quantify fish habitat in Doris and Patch lakes, in order to obtain information on lake productive capacity and habitat quality for fish habitat compensation purposes.

Hydroacoustics were used for substrate classification (or bottom typing) at Doris and Patch lakes on August 22 and 27, 2009, respectively. Data were collected from a 4.3 m-long aluminum boat with a low-horsepower outboard motor (Plate 2.1-1). The echo sounding system consisted of a dual-transducer, 200 kHz, BioSonics DT-X split-beam scientific echo sounder linked to a Garmin model 182 differential GPS. The transducers were mounted on a metal pole that was attached to the port side of the boat, with one transducer aimed downward (down-looking) and the other aimed sideways (side-looking) perpendicular to the direction of travel, tilted slightly downward. The down-looking transducer was aimed 1° to 3° sternward to aid in the identification of bubbles. The side-looking transducer was tilted 5° down from horizontal to reduce echoes from the lake surface as described by Yule (2000). The system was controlled by a laptop computer that displayed electronic echograms for monitoring sounder performance during data collection. Hydroacoustic data merged with geographic coordinates from the GPS were logged to the computer hard drive. Other system specifications appear in Table 2.1-2. Only data from the down-looking transducer was used for bottom typing.

Plate 2.1-1. Hydroacoustics system used to conduct substrate classification and fish abundance estimates at Doris and Patch lakes, Hope Bay Belt Project, 2009.

Table 2.1-2. Hydroacoustic System Specifications for Surveys of Doris and Patch Lakes, Hope Bay Belt Project, 2009

Project Phase	Category	Variable	Value
Data Collection	Transducers	Type	Split-beam[1]
		Sound frequency	201 kHz down-looking
			199 kHz side-looking
		Nominal beam angle	6.7°down-looking
			6.5 side-looking
		Depth of transducer face	0.55 m
	Settings (both transducers)	Pulse width	0.4 msec
		Transmit power level	low (-10.3 dB)
		Data collection threshold	-60 dB
		Minimum data range[2]	0.5 m
		Time varied threshold	40 log R
		Ping rate	8 pps/transducer
	DGPS	Type	WAAS-differential[3]
		Datum	NAD83
	Other	Transecting speed	1.4 to 1.9 m/sec

(continued)

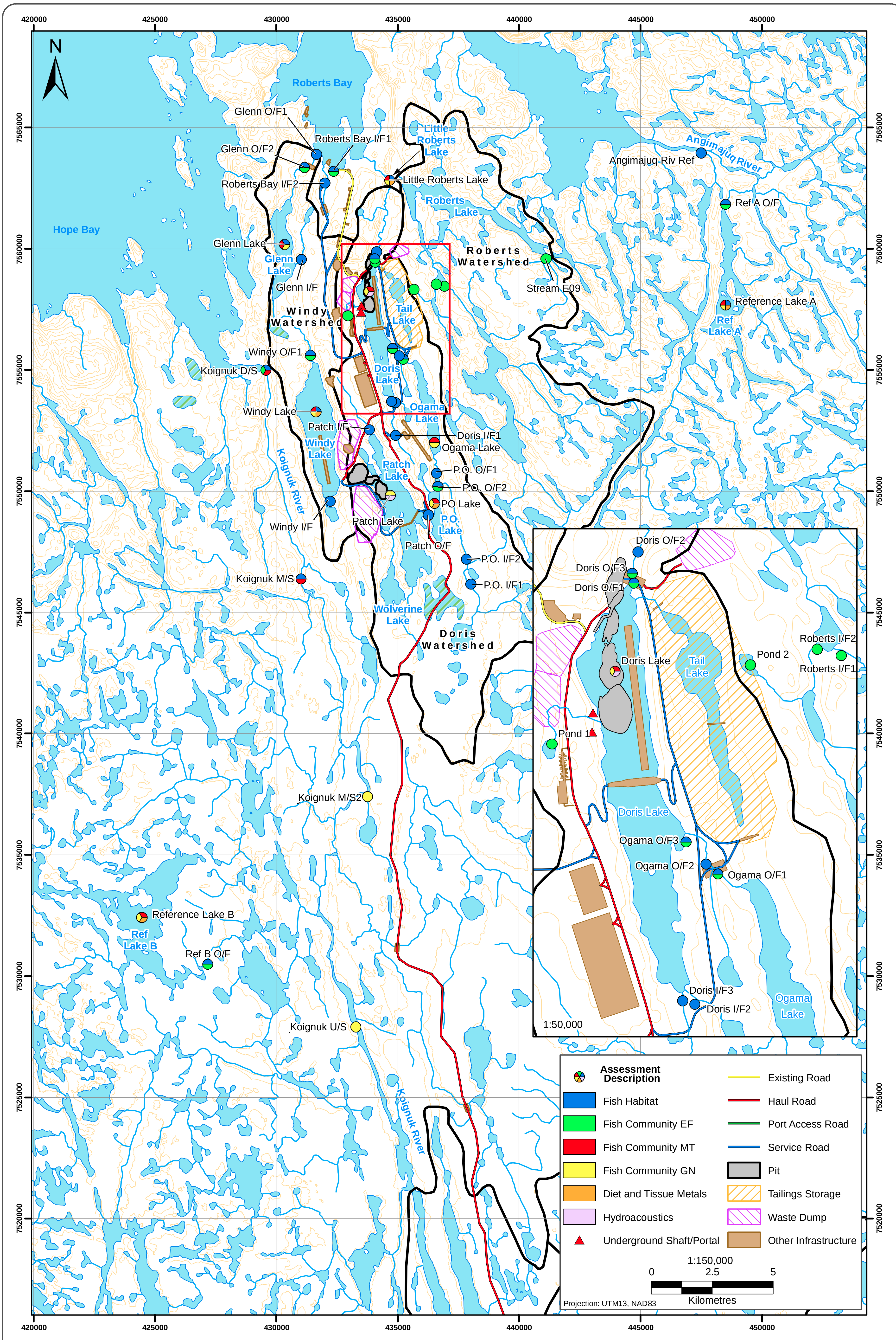

Figure 2.1-1

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Fish Habitat and Fish Community Assessment Locations, Hope Bay Belt Project, 2009

Figure 2.1-1

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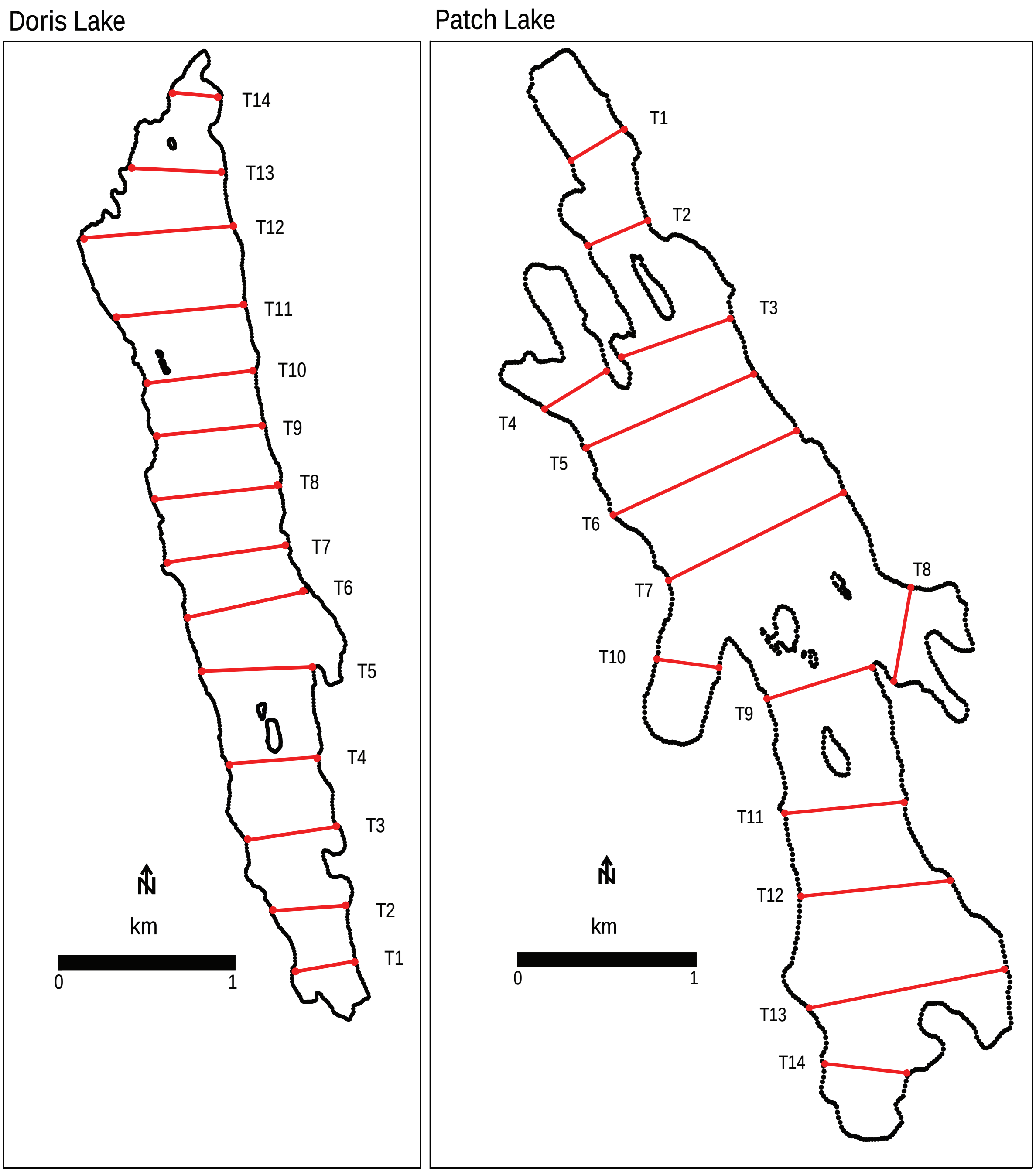
Table 2.1-2. Hydroacoustic System Specifications for Surveys of Doris and Patch Lakes, Hope Bay Belt Project, 2009 (completed)

Project Phase	Category	Variable	Value
Data Analysis	General	Calibration offset	-0.7 dB down-looking
			-0.5 dB side-looking
		Time varied gain	40 log R
		Minimum threshold[4]	-60 dB
		Maximum threshold[4]	none
		Beam pattern threshold	-6 dB
		Beam full angle	6.7° down-looking
			6.5° side-looking
		Single target filters	0.8 to 1.5 @ -6 dB
		Range processed[2]	2 to 20 m down-looking
			10 to 30 m side-looking
	Fish tracking, per fish	Minimum number echoes	1 down-looking
			2 side-looking
		Maximum range change	0.2 m
		Maximum ping gap	1

[1] *BioSonics DT-X split-beam digital scientific echo sounder.*
[2] *Range from transducer.*
[3] *A WAAS satellite signal was received during sampling with typical nominal position accuracy 2 to 3 m.*
[4] *Processing threshold after application of calibration offset.*

Sampling was performed by piloting the boat with the hydroacoustics system along pre-mapped transects (Figure 2.1-2) at a speed of 1.4 to 1.9 m/s. A total of 14 transects on each lake were performed. Supplemental transects (between pre-mapped transects) were performed to capture additional data in key habitat areas. Transects 6, 10, 11 and 13 were selected as reference transects. These transects were also surveyed using underwater video to obtain a continuous record of substrate types and to verify hydroacoustic classification of bottom type at the same locations.

Video recordings of the lake bottom were conducted on August 29, 2009, using the same boat and motor used for hydroacoustic surveys. Images were collected with a Deltavision Splashcam recording to a Sony VRD-VC20 DVD recorder (Plate 2.1-2). The camera was suspended from a rope held over the side of the boat with the lens aimed straight down about 50 to 100 cm above bottom. Transects were performed at 0.27 to 0.54 m/s. Occasionally, the boat was stopped to obtain a clear stationary image. Parallel lasers 10 cm apart were used as a reference for the distance that the camera was above bottom and as a scale for substrate size estimates. Time and boat positions (latitude and longitude), provided by a Garmin GPSmap 182 differential GPS, were continuously recorded to the video image by way of a video overlay device. Nominal position accuracy of the GPS (indicated by the instrument) was 2 to 3 m during the survey. GPS tracks from both the video and hydroacoustic transect lines showed nearly perfect overlap. Thus, the calibration of the video and hydroacoustics substrate data were deemed highly accurate.



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Pre-mapped Transects used for Hydroacoustic Surveys of Substrate Classification and Fish Abundance Estimates at Doris and Patch Lakes, Hope Bay Belt Project, 2009

Figure 2.1-2

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Plate 2.1-2. Underwater video system used to observe substrate at Patch Lake, Hope Bay Belt Project, 2009.

Data Processing and Analysis

Substrate composition was determined from hydroacoustic data using the RoxAnn method (Chivers et. al. 1990), which was implemented through BioSonics Visual Bottom Typing (VBT) version 1.12 software (Burczynski 2007). This method uses the ratio of first and second bottom echo energy levels to distinguish bottom types. Energy from the first echo (E1) represents substrate roughness, while energy from the second echo (E2) represents hardness. Scatter plots of these variables are used to characterize substrate types through a form of cluster analysis. Because E1 and E2 can vary from ping to ping, even at a single location with a homogeneous bottom type, VBT estimates bottom type by averaging values from groups of contiguous pings (or reports). In this study, VBT reports were 20 pings long (equivalent to 4 to 5 m along a transect at a speed of 1.4 to 1.9 m/s). Other processing settings appear in Table 2.1-3.

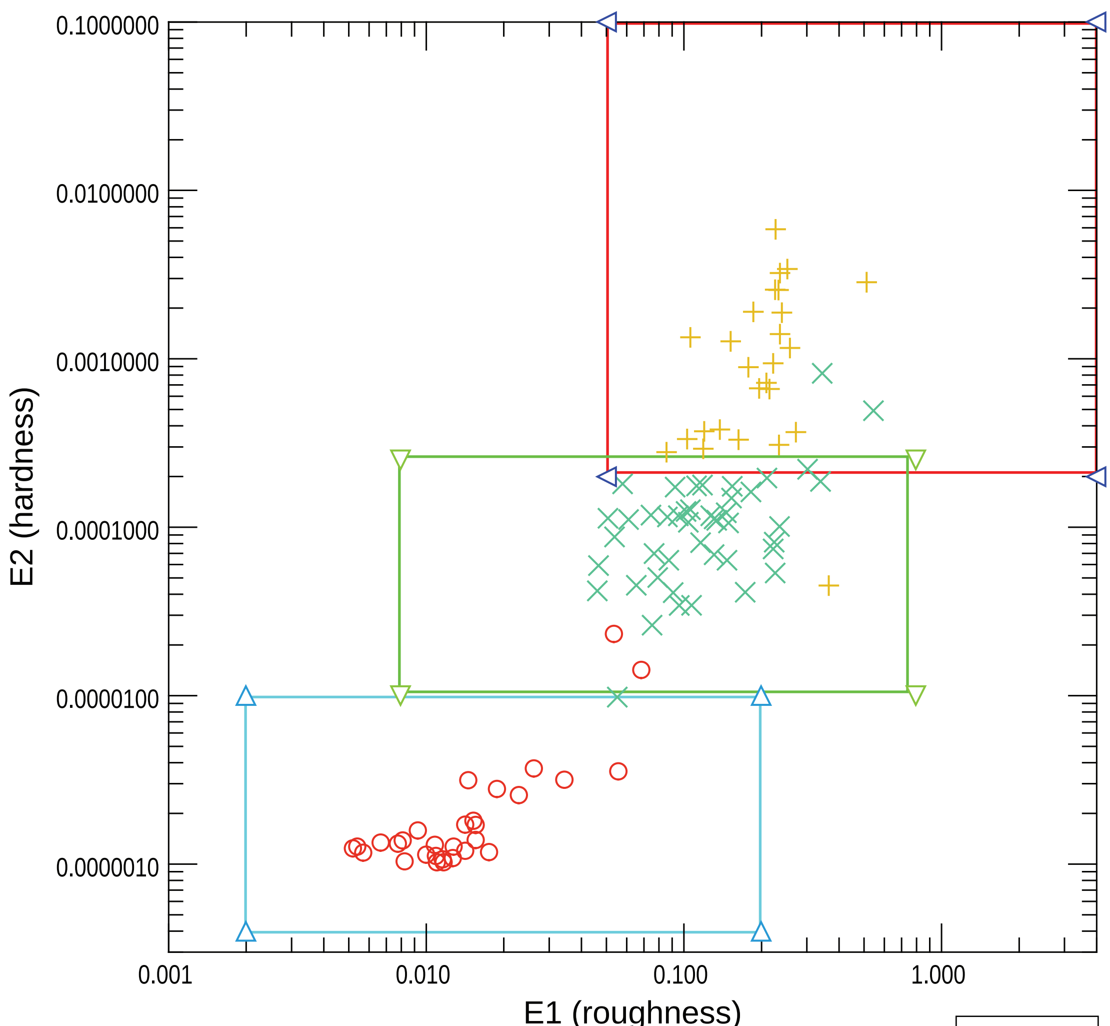
The substrate classification scheme used for Patch and Doris Lakes was developed using data from Patch Lake reference transects (6, 10, 11 and 13). Echograms from these transects were examined with Echoview software (settings 20 log R, -80 dB threshold) to identify distinct bottom echo patterns that might represent different types of substrate. Three main types were recognized: strong, moderate and weak second bottom echo. One or more data segments representing each pattern were then chosen from Transect 6 and processed in VBT. Plots of the resulting E1 and E2 values showed three main data clusters, suggesting three main substrate types on Transect 6, and boundaries were developed for these clusters (Figure 2.1-3).

Table 2.1-3. Visual Bottom Typing (VBT) Processing Settings used to Distinguish Bottom Types of Doris and Patch Lakes, Hope Bay Belt Project, 2009

Item	Setting
Data processing threshold	-80 dB
TVG	30 log R
Bottom Sampling Windows	
First bottom, first part	16 samples
First bottom, second part	40 samples
Second bottom	100 samples
Sediment layer	16 samples
Bottom Tracker Settings	
Peak threshold	-45 to -30 dB (typically -40 dB)
Peak width	5 samples
Bottom detection threshold	-60 dB
Above bottom blanking	1 samples
Alarm limit	8 samples
Tracking window	25 samples
Tracking domain	20 log R
Bottom typing method	B2 (E1/E2)
Depth normalization	none
Pings per report	20
Energy filter	75%

Video recordings were analyzed in the lab by playing them back on a computer using Windows Media Player and visually observing the substrate type and degree of plant coverage. For each minute of each transect, all substrate size classes observed and an overall estimate of plant coverage were recorded on a data form. At a boat speed of 0.27 to 0.54 m/s (or 1 to 2 km/hr), a 1 minute segment would be 17 to 33 m long. Substrate size classes followed the modified Wentworth scale for particle size (<2 mm = fines, 2 to 64 mm = gravel, 64 to 256 mm = cobble, >256 mm = boulder; Orth 1983) and plant coverage was classed as sparse (0 to 25% of the bottom covered), intermediate (25 to 50% covered), or extensive (75 to 100% covered). A screen-capture that included sampling time and geo-coordinates was taken at the end of each segment.

The physical composition of these hydroacoustic categories (e.g., mud or rock) was mainly determined by comparing them to the video classifications within several reference transect segments where video indicated that the substrate type was uniform for some distance. Hydroacoustic categories 1 and 2 (moderate and weak second bottom echoes) were soft, fine sediments that could not be distinguished from each other with the video (Figures 2.1-3 and 2.1-4). However, in a later test at Lake Whatcom, Washington (B. Stables, unpublished data), hydroacoustic data from mud matched category 2, suggesting that category 2 also represented mud in Patch Lake. Hydroacoustic category 3, with a strong second bottom echo, represented rocky substrates. Video data from the reference transects indicated little gravel, and that gravel, cobble and boulder were mixed or in patches smaller than 45 m, the length of VBT reports. Therefore, hydroacoustic category 3 corresponds to a mix of mainly cobble and boulder, occasionally interspersed with gravel or fines.



Note: Plot of E1 versus E2 from selected data segments representing the three bottom echo patterns that were identified on reference transects, showing classification boundaries of the three sediment type categories that were developed from them. Boundaries were developed from individual pings, whereas points plotted are means of 20 ping reports.

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Plot of Substrate Hardness on Roughness from Hydroacoustic Ecotype Data used to Determine Substrate Categories, Hope Bay Belt Project, 2009

Figure 2.1-3

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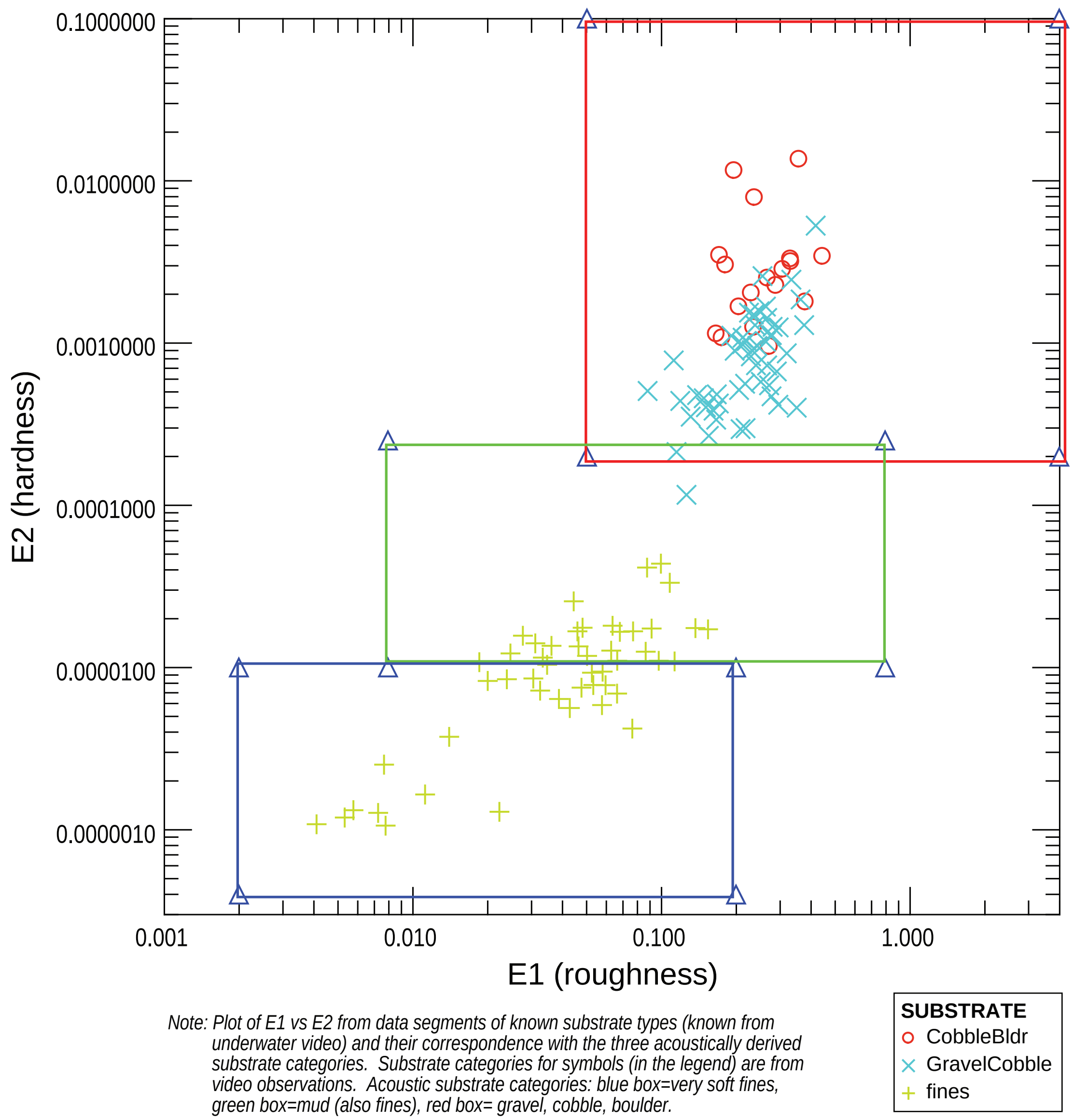

Note: Plot of E1 vs E2 from data segments of known substrate types (known from underwater video) and their correspondence with the three acoustically derived substrate categories. Substrate categories for symbols (in the legend) are from video observations. Acoustic substrate categories: blue box=very soft fines, green box=mud (also fines), red box= gravel, cobble, boulder.

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Plot of Substrate Hardness on Roughness from Underwater Video Data used to Calibrate Substrate Categories at Patch Lake, Hope Bay Belt Project, 2009

Figure 2.1-4

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A comparison of video and hydroacoustic substrate categories along the reference transects showed a close correspondence between results of the two methods (Figure 2.1-5 and Table 2.1-4). With video results used as a standard, classification accuracy exceeded 95% when additional data from over 235 m of reference transects 11 and 13 were used to test the hydroacoustic classification model.

Table 2.1-4. Tests of the Substrate Classification Model using Data from Reference Transects at Patch Lake, Hope Bay Belt Project, 2009

			Acoustic Classification from E1/E2					
			Number of Reports			Percentage of Reports		
Transect	Video Classification	Total Number of VBT Reports	Very Soft Fines (1)	Mud (2)	Gravel, Cobble, Boulder (3)	Very Soft Fines (1)	Mud (2)	Gravel, Cobble, Boulder (3)
11	fines	9	9	0	0	100	0	0
11	cobble and boulders	18	0	0	18	0	0	100
13	fines	40	19	21	0	48	53	0
13	gravel and cobble	51	0	2	49	0	4	96

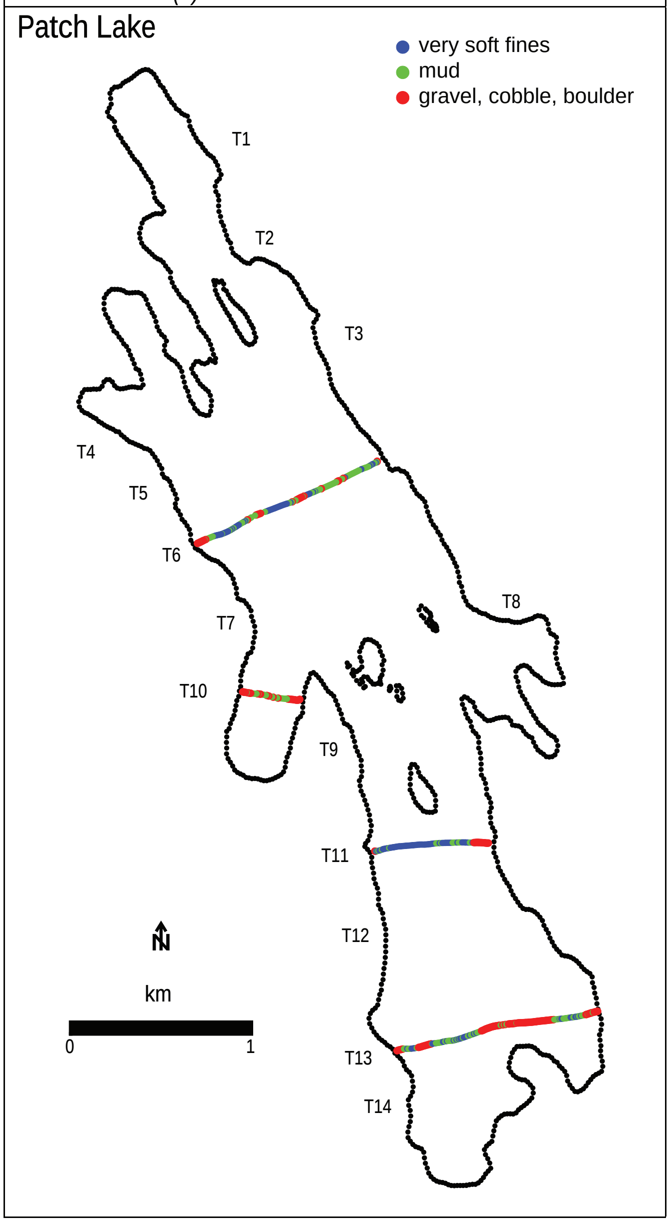
2.1.2 Stream Habitat

A total of 26 stream sites were surveyed in the Project area (Table 2.1-5 and Figure 2.1-1). The inflows (I/F) and outflows (O/F) of the lakes and ponds sampled in the Project area were surveyed to identify which streams provided fish habitat and allowed fish passage between lakes. Streams that had clearly defined channels were split into units defined by habitat type and underwent an assessment that followed the protocol originally developed by Johnston and Slaney (1996) for the BC Watershed Restoration Program. A field data sheet template is shown in Appendix 2.1-1. The following habitat types were identified: pool, glide, riffle, and cascade. Within each habitat unit, the physical features (e.g., gradient, mean depth, mean width, substrate composition, water velocity, availability of cover for fish, potential barriers, bank stability and bank height) were measured. Data were collected with a measuring tape, meter stick, clinometer (for gradient), and by visual inspection.

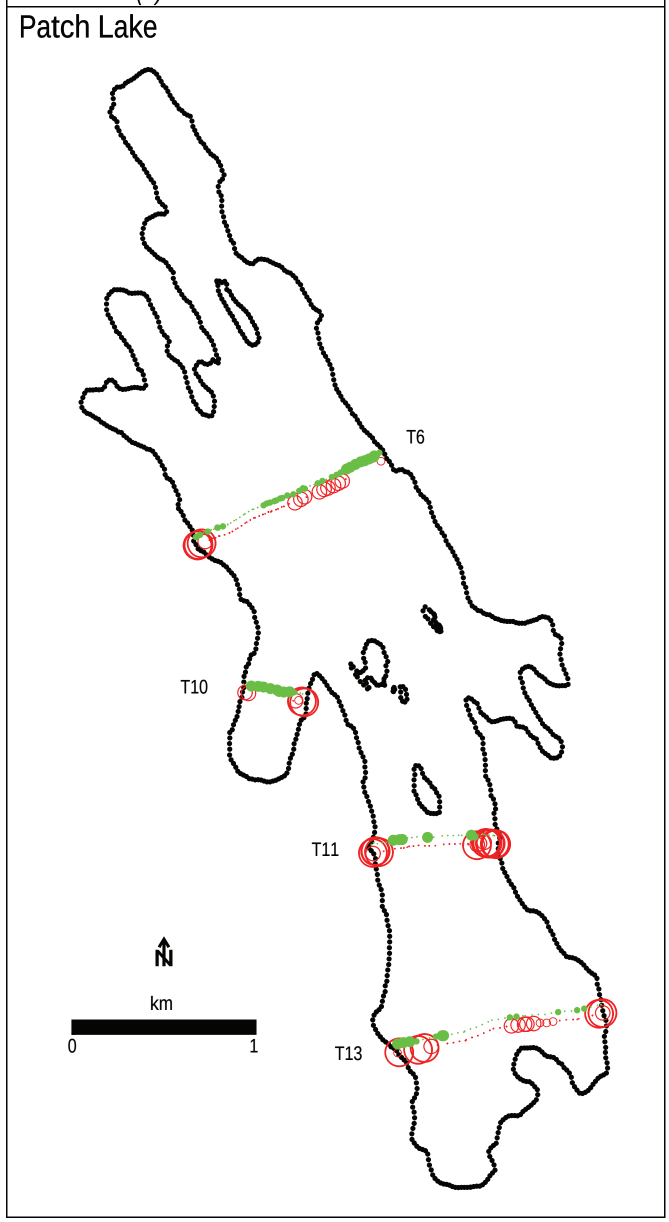
Some streams in the Project area had no clearly defined channel, with water flowing among boulder gardens and tundra vegetation. In these circumstances, a description of the flow characteristics and potential fish habitat was provided, but a detailed breakdown into different habitat types was not conducted.

Data collected on the habitat variables listed above were used to evaluate the overall quality of fish habitat at sites within the Project area. Fish habitat quality was evaluated for all fish life-stages (e.g., spawning, rearing, adult feeding, and overwintering) and categorized as none, poor, fair or good. These observations of fish habitat and fish catch data were used to determine if a stream site is fish bearing, and to classify fish habitat as none, marginal, important or critical on a watershed scale. Based on the fish-bearing status of each site and the streams wetted width, streams were classified as shown in Table 2.1-6.

From acoustics (a)



From video (b)



Note: Map (b) - green dots indicate degree of algae coverage (small=0-25%, medium=25-75%, large=75-100%) and red circles indicate the largest substrate particle size observed per 1 minute segment of transect.

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Comparison of Substrate Maps using Hydroacoustics and Video Data at Four Reference Transects at Patch Lake, Hope Bay Belt Project, 2009

Figure 2.1-5

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Table 2.1-5. Steam and River Fish Habitat Assessment Locations, Hope Bay Belt Project, 2009

		UTM	
Site	**Watershed**	**Easting**	**Northing**
Doris O/F1	Doris	434067	7559440
Doris O/F2	Doris	434124	7559869
Doris O/F3	Doris	434044	7559575
Doris I/F1	Doris	434901	7552300
Doris I/F2	Doris	434906	7553648
Doris I/F3	Doris	434738	7553696
P.O. O/F1	Doris	436591	7550740
P.O. O/F2	Doris	436649	7550190
P.O. I/F1	Doris	438010	7546164
P.O. I/F2	Doris	437821	7547195
Ogama O/F1	Doris	435223	7555438
Ogama O/F2	Doris	435059	7555575
Ogama O/F3	Doris	434784	7555878
Patch O/F	Doris	436255	7549016
Patch I/F	Doris	433821	7552530
Roberts Bay I/F1	Roberts Bay	431028	7559547
Roberts Bay I/F2	Roberts Bay	432218	7549585
Glenn O/F1	Windy	433745	7537391
Glenn O/F2	Windy	433263	7527897
Glenn I/F	Windy	431657	7563884
Windy O/F1	Windy	431154	7563342
Windy I/F	Windy	431405	7555594
Ref A O/F	Reference	436914	7558445
Ref B O/F	Reference	436584	7558531
Koignuk D/S	Koignuk	429569	7554988
Koignuk M/S	Koignuk	431015	7546380
Angimajuq Riv Ref	Reference	441106	7559574

Table 2.1-6. Classification System for Streams, Hope Bay Belt Project, 2009

Stream Class	Channel Width (m)	Fish-Bearing Status
S1 - Large River	> 100	Fish
S1	> 20	Fish
S2	20 to 5	Fish
S3	5 to 1.5	Fish
S4	< 1.5	Fish
S5	> 3.0	No Fish
S6	< 3.0	No Fish

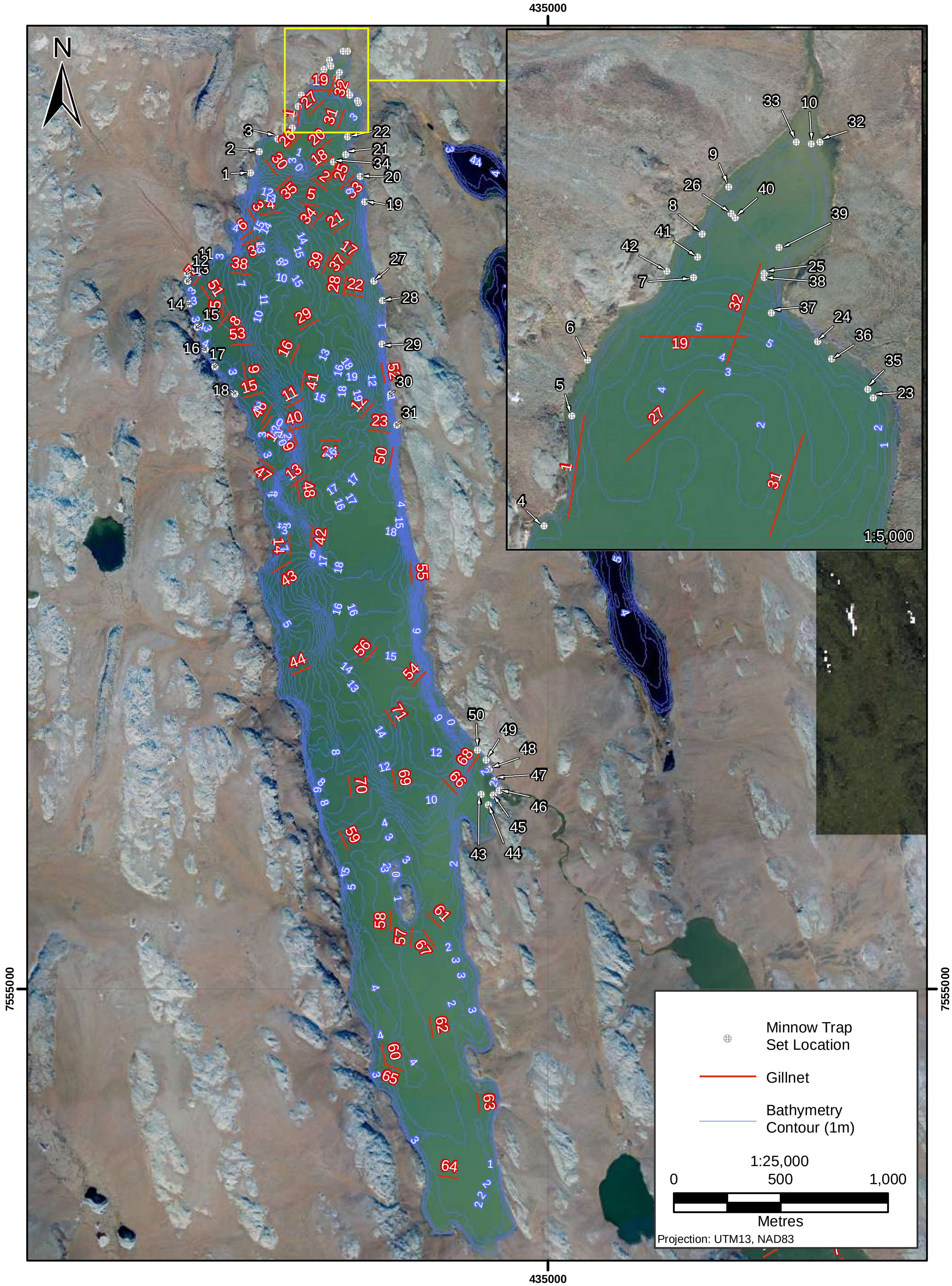
2.2 FISH COMMUNITY

2.2.1 Field Sample Collection and Processing

The fish communities of seven lakes, two large river sites, 13 stream sites and two ponds were sampled in July and August 2009 (Figure 2.2-1). These sites were sampled using a combination of sinking and floating gillnets (Plate 2.2-1), seine nets, minnow traps and backpack electrofishing (Plate 2.2-2). Gillnets and minnow traps were set in lakes that could accommodate a boat, while minnow traps and electrofishing were used at the lake inflows and outflows, or along the shoreline areas. Fishing effort with gillnets and minnow traps was spread over the entirety of each lake to ensure that all habitat types were sampled and to capture fish of different ages and species with varying habitat preferences. For lakes where the fish community was known (from past studies), the fish community studies were conducted for one of three purposes: 1) to estimate relative fish abundance and species-specific population sizes in Doris and Patch lakes; or 2) to collect lake trout tissue metals samples from Little Roberts Lake, P.O. Lake, Windy Lake, Reference Lake A and Reference Lake B; or 3) to collect general fish community data (i.e., community composition and fish biological data) for baseline reporting.

Site layout options considered in 2009 included the construction of dykes at the central portion of Doris and Patch lakes. Gillnetting and hydroacoustic methods were used to estimate fish abundance and populations, and to determine fish distribution (vertical and horizontal) in Doris and Patch lakes to document information that would be required to develop a compensation plan for the resulting loss of fish habitat.

Plate 2.2-1. Gillnetting at Doris Lake, Hope Bay Belt Project, 2009.



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Gillnet and Minnow Trap Set Locations on Doris Lake, Hope Bay Belt Project, 2009

Figure 2.2-1

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Plate 2.2-2. Backpack electrofishing gear used to assess the fish communities in streams, Hope Bay Belt Project, 2009.

Table 2.2-1 shows the lakes sampled for fish community and tissue metals in the Project area in 2009. Figures 2.2-1 to 2.2-10 show the location of gillnets and minnow traps. Appendices 2.2-1 and 2.2-2 present the set and retrieval times, and locations for gillnets and minnow traps, respectively.

Table 2.2-1. Fish Community and Tissue Metals Sampling Locations, Hope Bay Belt Project, 2009

		UTM		Community				
Site	**Watershed**	**Easting**	**Northing**	**AG**	**EF**	**GN**	**MT**	**Tissue Metals**
Lakes								
Doris Lake	Doris	433819	7558230	X	X	X	X	-
Ogama Lake	Doris	436553	7552003	-	-	X	X	-
P.O. Lake	Doris	436489	7549473	X	-	X	X	LKTR, LKWH
Patch Lake	Doris	434660	7549739	X	-	X	X	-
Little Roberts Lake	Doris/Roberts	434660	7562817	X	-	X	X	LKTR
Glenn Lake	Windy	430110	7560232	-	-	X	X	-
Windy Lake	Windy	431631	7553268	X	-	X	X	LKTR
Reference Lake A	Reference A	448583	7557621	-	-	X	X	LKTR
Reference Lake B	Reference B	425613	7534367	-	-	X	X	LKTR
Rivers and Streams								
Doris Outflow	Doris	434056	7559407	-	X	-	X	-
Ogama Outflow	Doris	435250	7555393	-	X	-	X	-

(continued)

Table 2.2-1. Fish Community and Tissue Metals Sampling Locations, Hope Bay Belt Project, 2009 (completed)

Site	Watershed	UTM		Community				Tissue Metals
		Easting	Easting	AG	EF	GN	MT	
Patch Outflow	Doris	436305	7548985	-	-	-	-	-
P.O. Outflow	Doris	436652	7550175	-	X	-	X	-
Tail Lake Outflow	Doris	434507	7558925	-	X	-	X	-
Koignuk U/S	Koignuk	431940	7545536	-	X	X	X	-
Koignuk M/S	Koignuk	436490	7549055	-	X	X	X	-
Koignuk D/S	Koignuk	429580	7554915	-	X	X	X	-
Stream E09	Roberts	441123	7559626	-	X	-	X	-
Glenn Outflow	Windy	431548	7563357	-	X	-	X	-
Windy Lake Outflow	Windy	431410	7555417	-	X	-	X	-
Reference Lake A Outflow	Reference A	448502	7561748	-	X	-	X	-
Reference Lake B Outflow	Reference B	427083	7530373	-	X	-	X	-

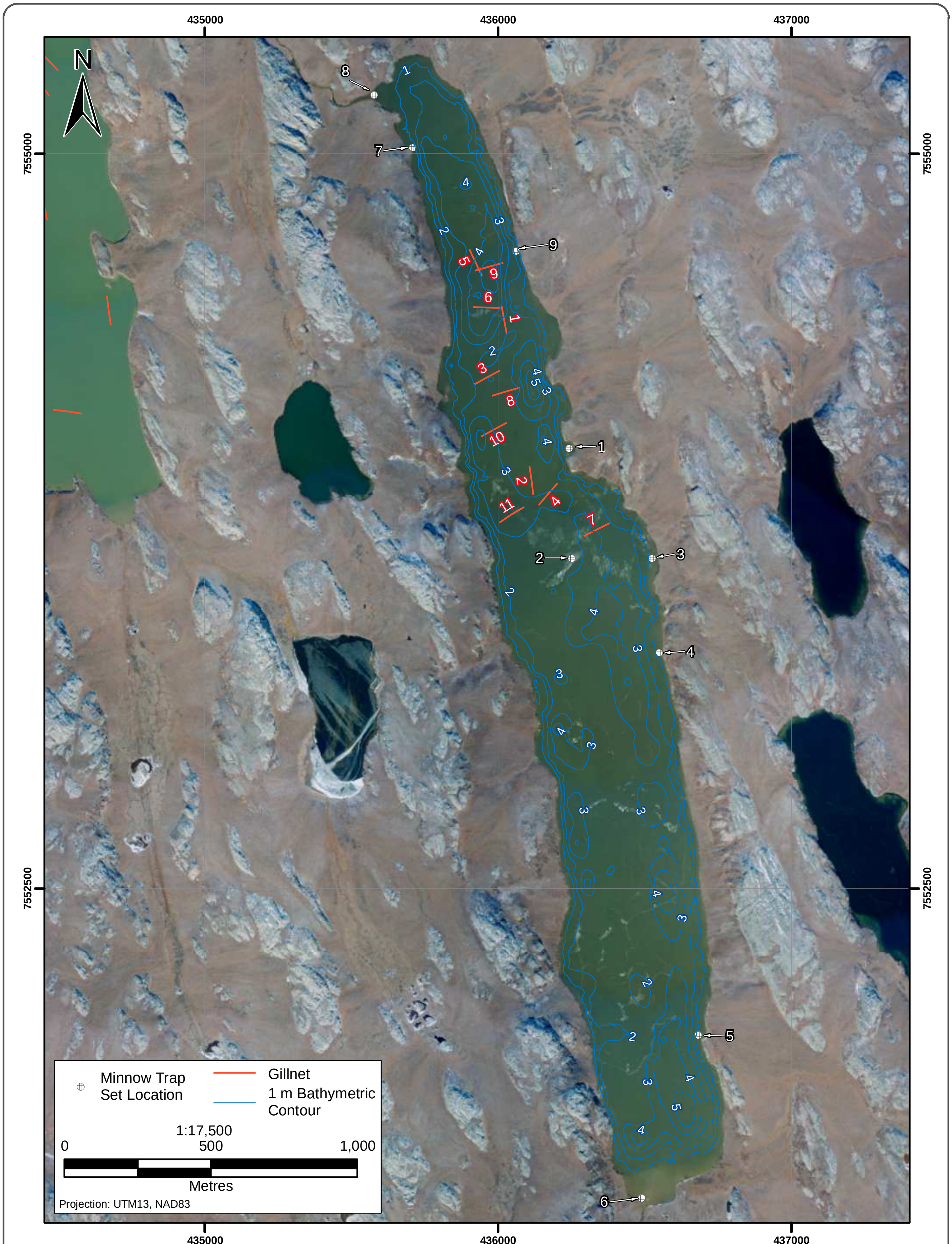
Community Assessment Codes: AG = angling, EF = electrofishing, GN = gillnet, MT = minnow trap.
Fish Species Codes: LKTR = lake trout; LKWH = lake whitefish.
Stream sampling locations: U/S = upstream, D/S = downstream
Dashes indicate no sampling.

The lakes were sampled using monofilament index gillnet gangs. Standard RISC gillnet gangs consisted of six panels, ranging from 25 to 89 mm stretched mesh. Each RISC gillnet gang was tied in the following order: Panel 1 – 25 mm; Panel 2 – 76 mm; Panel 3 – 51 mm; Panel 4 – 89 mm; Panel 5 – 38 mm; and Panel 6 – 64 mm. Each panel measured 15.2 m long by 2.4 m deep for an area of 36.48 m^2 and a total area of 218.88 m^2 per gang. A short, small mesh sinking gillnet was also used to target juvenile or small-bodied fish at Doris and Patch lakes to augment hydroacoustic assessments. This gillnet consisted of three panels of 19 mm stretched mesh. Each panel measured 15.2 m long by 2.4 m deep for an area of 36.48 m^2, with a total area of 109.44 m^2. All gillnets consisted of a lead line at the bottom and a floating line at the top of the net. Sinking nets were designed to fish at the bottom of the lake, while floating nets were designed to fish at the lake surface.

Data (geographic coordinates, depths, catch-per-unit-effort or CPUE; see Section 2.4) for individual RISC gillnets set at Doris and Patch lakes were examined graphically to show general trends in fish distribution patterns. Maps using a graduated colour scale were produced to represent areas of relatively high (red) to low (purple) CPUE. Gillnet CPUE patterns were compared with estimates of absolute fish abundance (fish/m^3 or fish/ha) generated from hydroacoustic surveys.

Minnow traps consisted of two wire mesh cylinders that were locked together using a clip attached to a rope and marker buoy. Each minnow trap was baited with a small amount of dry crab bait. Minnow traps were then placed on the streambed or along the shore of lakes or ponds so that the trap was resting on the substrate.

Captured fish were identified to species, measured for fork length to the nearest 1 mm, weighed to the nearest 0.1 g and sampled for various structures (scales, fin rays and otoliths) used to determine the age of the fish. Otoliths were only collected from incidental mortalities or from fish lethally sampled for tissues (e.g., muscle and liver). Scales were collected with a knife below the posterior margin of the dorsal fin on the left side of the fish. Two to three rays of the left pelvic fin were collected with scissors or pliers (Plate 2.2-3). Aging structures were placed in envelopes (Plate 2.2-4) labelled with the site, date, species and sample number.



NEWMONT NORTH AMERICA

Figure 2.2-2

Gillnet and Minnow Trap Set Locations on Ogama Lake, Hope Bay Belt Project, 2009

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