Table 5.2. Summary statistics for invertebrate community variables for the exposure and reference areas

Endpoints	Seep Creek Ponds 1 & 2 (Exposure)						Fingers Lake (Reference)					
	Mean	Median	SD	SE	Min	Max	Mean	Median	SD	SE	Min	Max
Total Invertebrate Density (orgs/m^2)	3710	3045	2507.3	1121	387	6604	5107	1634	8612.5	3851.6	430	20459
Richness[a]	5	5	1.1	0.5	3	6	5	5	2.3	1	3	9
Evenness	0.17	0.191	0.087	0.019	0.064	0.291	0.308	0.344	0.102	0.023	0.158	0.422
SDI	0.104	0.086	0.069	0.015	0.032	0.21	0.226	0.238	0.101	0.023	0.097	0.323
BCI	0.498	0.593	0.155	0.069	0.307	0.64	0.417	[illegible]51	0.315	0.141	0.069	0.867
Ceratopogonidae Density (orgs/m^2)	96	0	215.4	96.3	0	482	2	[illegible]	3.8	1.7	0	9
Chironomidae Density (orgs/m^2)	3478	2839	2307.2	1031.8	370	5847	4747	1419	8227.3	3679.4	353	19427
Enchytraeidae Density (orgs/m^2)	14	0	30.8	13.8	0	69	138	9	249	111.4	0	576
Lumbriculidae Density (orgs/m^2)	62	43	68.1	30.5	0	172	46	26	48.5	21.7	0	120

Note: [a]Family level richness; SD = standard deviation; SE = standard error; Min = minimum; Max = Maximum; samples size was five for all endpoints; orgs/m^2=organisms per square metre

Figure 5.4. Benthic invertebrate densities of major invertebrate families at each replicate station

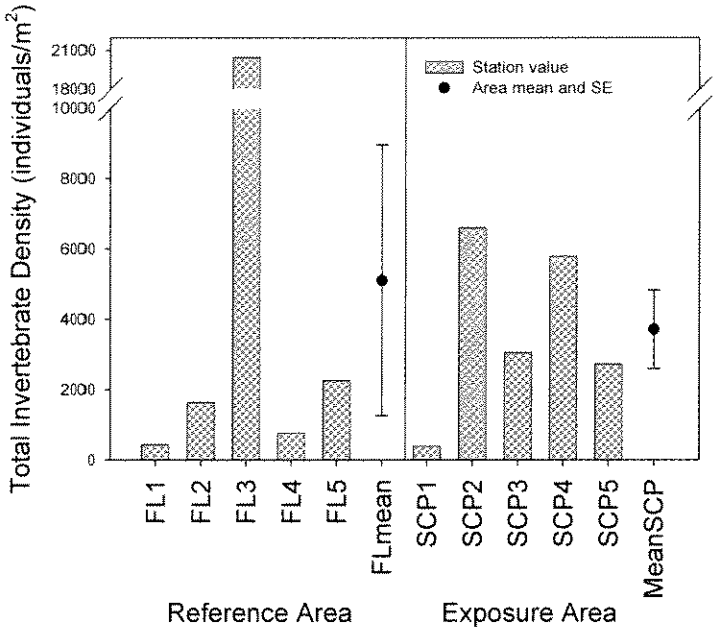


Figure 5.5. Benthic invertebrate richness of invertebrate families at each replicate station

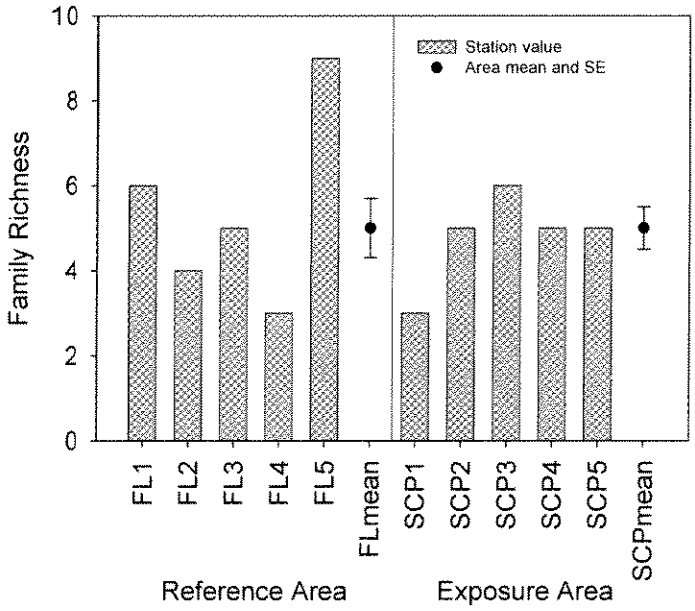


Figure 5.6. Evenness indices at each replicate station

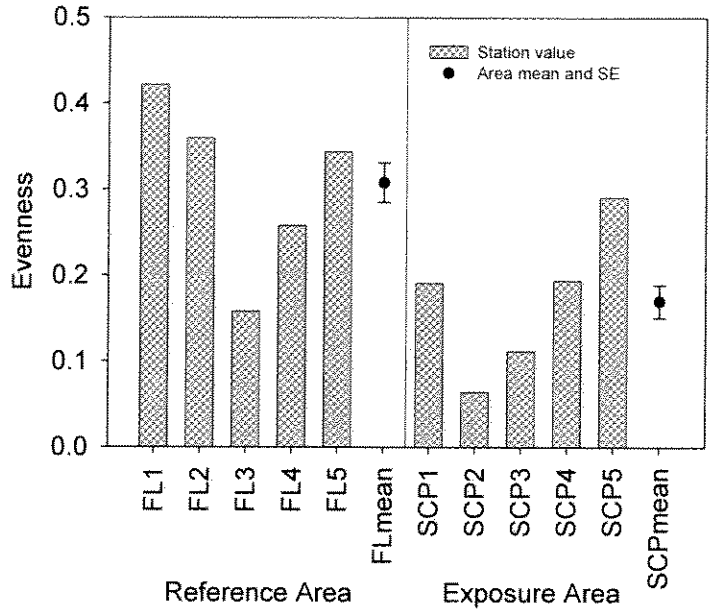


Figure 5.7. Simpson's diversity indices at each replicate station

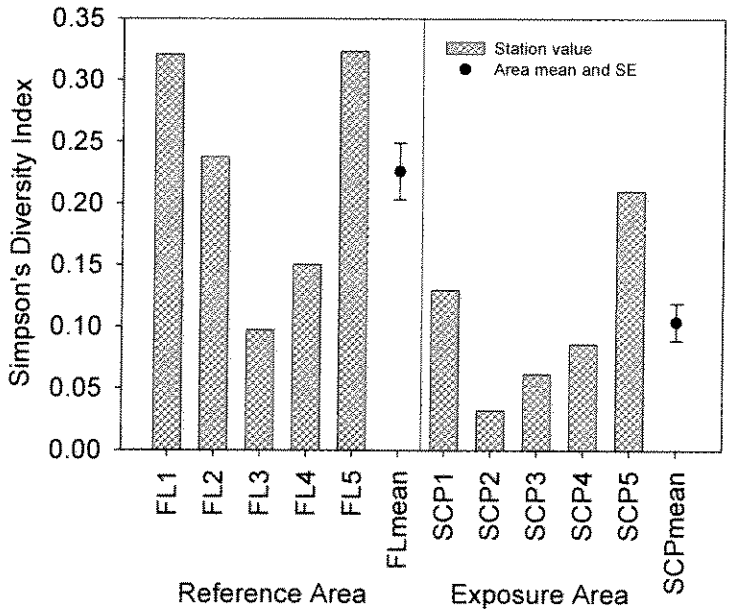
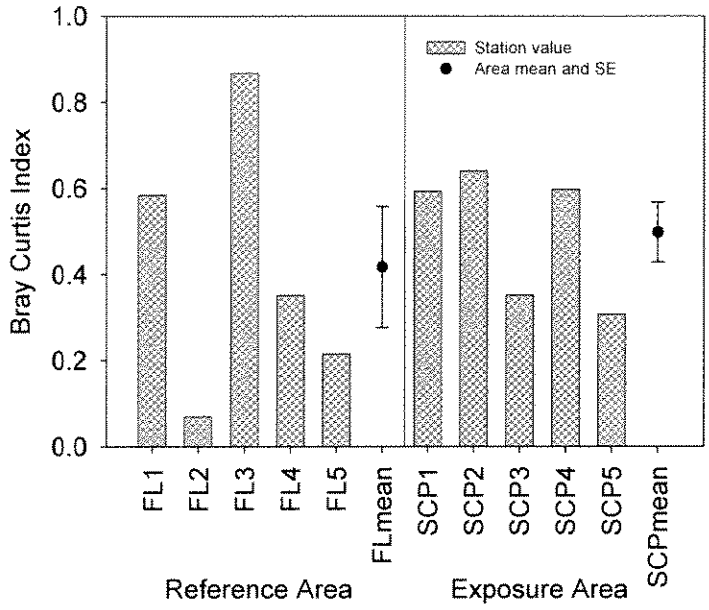


Figure 5.8. Bray-Curtis indices at each replicate station



5.2.3.6 Power Analysis

Power of the statistical tests comparing invertebrate community variables between the two sampling areas ranged from 0.93 to 0.99 for α=0.1, and 0.85 to 0.96 for α=0.05 (Table 5.3). These results suggest that the statistical tests met or exceeded the recommended EEM guideline of 90% power. To increase the power to 95%, seven replicates per area would be required.

Table 5.3. Statistical results summary for invertebrate community endpoints

Endpoint	*P*	Significant Difference Between Areas[a]	Estimated Power for T-test	
			α=β=0.1	α=β=0.05
Total Invertebrate Density	0.709	No	0.95	0.88
Family Richness	0.467	No	0.98	0.95
Simpson Diversity Index	0.047	Yes	0.96	0.91
Evenness Index	0.076	Yes	0.99	0.96
Bray-Curtis Index	0.347	No	0.93	0.85

Note: [a] Significant at $P \leq 0.1$

5.2.4 Community Analysis

5.2.4.1 Family Presence/Absence

In total, 10 benthic invertebrate families were encountered in the exposure area, whereas 11benthic invertebrate families were encountered in the reference area (Table 5.4). Families Aeolosomatidae and Heptageniidae were observed in the exposure area, but were not observed in the reference area. Ostracoda, and the families Sphaeriidae and Limnephilidae, were collected in the reference area, but not in the exposure area.

Table 5.4. Presence/Absence of each invertebrate family in the reference and exposure areas

Major Taxon	Family (Subfamily/Tribe)	Reference Area	Exposure Area
Oligochaeta	Aeolosomatidae		✓
	Enchytraeidae	✓	✓
	Lumbriculidae	✓	✓
Acari	Hydrachnidia	✓	✓
Pelecypoda	Sphaeriidae	✓	
Ostracoda	-	✓	
Ephemeroptera	Heptageniidae		✓
Tricoptera	Leptoceridae	✓	✓
	Limnephilidae	✓	
Diptera	Chironomidae	✓	✓
	**Chironomini	✓	✓
	**Tanytarsini	✓	✓
	*Orthocladiinae	✓	✓
	*Tanypodinae	✓	✓
	Ceratopogonidae	✓	✓
	Empididae	✓	✓
	Tipulidae	✓	✓

Note: ✓ = family present; * = Subfamily; ** = Tribe

5.2.4.2 Percent Composition

Community composition was summarized based on five groups: Chironomidae, Ceratopogonidae, Enchytraeidae, Lumbriculidae and others, representing the remaining groups (Figure 5.9). Both the reference and exposure stations were dominated by dipterans, primarily Chironomidae. The mean proportion of Chironomidae in the reference and exposure areas was 91% and 93%, respectively. None of the remaining 19 groups comprised more than 2% of the total density. The remaining groups varied in presence and proportion across all stations, with Enchytraeidae being the second most

Nitrate concentration [redacted] as slightly higher in the BIC exposure area than in the area. With the exception [redacted] n of selenium and mercury, concentrations of total me to be higher in the ex[redacted] osure area compared to the reference area. In the BIC area, cadmium, copper [redacted] lead, nickel and zinc concentrations exceeded the CW protection of aquatic l[redacted] e.

The substrate of the e[redacted] posure area was composed primarily of silt and sand, w substrate of the refere[redacted] ce area was composed primarily of sand. Relative to the station, substrate parti[redacted] e size was more variable within the exposure area, with contributions. The hi[redacted] her TOC observed in the exposure stations may be differences in basin m[redacted] phologies (i.e., fingers Lake is larger than the Seep Cre

Sediments collected [redacted] within the exposure area had elevated metal conc compared to the refe[redacted] nce area. Arsenic concentrations were above the IS exposure stations, as [redacted] well as at Station FL1 within the reference area. C concentrations were [redacted] ove the ISQG sediment guidelines for two stations exposure area.

Although BIC densit[redacted] was greater in the reference area than in the expo differences were not [redacted] tistically significant. Family richness was similar in b and was not significan[redacted] y different. BCI was more variable in the reference are not significantly diffe[redacted] nt from the exposure area. SDI and evenness were sig lower in the exposure [redacted] rea than the reference area. The differences in SDI and may be linked to the e[redacted] vated arsenic and chromium concentrations in the exp sediments, and the el[redacted] ated metal concentrations in the water column of the area.

Based on the informat[redacted] n collected during the BIC survey, mine effluent has l impact on the BIC wit[redacted] in the aquatic receiving environment (Seep Creek Pon relative to the refere[redacted] e area (Fingers Lake). The mine did not significan invertebrate density, [redacted] mily richness or BCI, but did significantly affect evenness.

6.0 FISH SURVEY

6.1 Survey Objectives

The fish community in Fingers Creek and Fingers Lake (reference area) and the Seep Creek system (exposure area) were surveyed in 2005 to meet MMER EEM requirements. The objective of the EEM fish population survey was to determine if mine effluent discharged into the aquatic environment had a significant effect on the growth, reproduction, survival, condition or usability of fish relative to fish populations in a reference area. Supporting environmental variables (limnology and water quality) were collected in each area.

6.2 Methods

As part of the revised TAP-approved study design, juvenile Arctic grayling (*Thymalus arcticus*) and slimy sculpin (*Cottus cognatus*) were selected as the primary target sentinel species for a lethal sampling program. Ninespine stickleback (*Pungitius pungitius*) was to be a contingent target species, under a non-lethal sampling program. Target sample sizes for each area were 40 juvenile Arctic grayling, and 60 slimy sculpin (20 adult males, 20 adult females, and 20 juveniles).

The field sampling schedule included a two-day reconnaissance survey in each of the reference and exposure areas to assess the presence of fish and spawning condition. However, seven days (including the two-day reconnaissance) of intensive fishing efforts in each of the study areas resulted in the capture of only two slimy sculpin from the reference area and none in the exposure area. Similarly, although several ninespine sticklebacks were captured in the exposure area, only one was captured in the reference area. Thus, due to the low numbers of slimy sculpin and ninespine stickleback, the fish study design was modified during the field survey, in consultation with the AO, to focus the EEM study on juvenile (age 1 or younger) Arctic grayling. Carcass and liver tissue from these juvenile Arctic grayling were frozen for copper analysis. In addition, ninespine stickleback from the exposure area were measured for length and weight, and a sub-sample was examined for parasites, as directed by the AO.

6.2.1 Field Methods

6.2.1.1 Fish Collection

Fish sampling was conducted in the Fingers Creek system (reference) and (Seep Creek system (exposure) from 19 August to 4 September 2005, using a variety of gear types

(Tables 6.1 and 6.2; Figures 6.1 and 6.2). To maximize fish capture, fish sampling was conducted in different habitat types and at different times of the day.

Table 6.1. Gill net, hoop net and fyke net locations

Method	Treatment	Station	UTM (Zone 12W NAD 83)		Latitude	Longitude
			easting	northing		
Gill net	Exposure	C1	479104	7292537	65° 45' 13.45" N	111° 27' 21.64" W
		SCD1	485723	7289663	65° 43' 41.95" N	111° 18' 40.50" W
		SCD1	485903	7289729	65° 43' 44.08" N	111° 18' 26.42" W
		SCD1	485716	7289665	65° 43' 41.99" N	111° 18' 41.04" W
		SCD1	485632	7289683	65° 43' 42.56" N	111° 18' 47.66" W
		SCP2	481268	7290730	65° 44' 15.58" N	111° 24' 30.71" W
	Reference	FL1	494153	7288557	65° 43' 07.14" N	111° 07' 38.71" W
Fyke net	Exposure	SC3	484061	7289912	65° 43' 49.69" N	111° 20' 51.11" W
Hoop net	Reference	FC3	494622	7288989	65° 43' 21.14" N	111° 07' 01.92" W

The fishing gear consisted of five minnow traps, two fyke nets, one hoop net, a set of six 1.8 × 15 m gill nets of different mesh sizes (19, 25, 38, 50, 64, and 76 mm stretch mesh), and a Smith-Root Type XII POW (Programmable Output Waveform) backpack electrofisher (settings of 400-500 V, 50 Hz, and 6 ms). Gill nets were set for 4 to 12 h periods, whereas minnow traps, hoop, and fyke nets were set for a minimum of 24 h. The following information was recorded for each sampling station:

- date and time set and retrieved (traps and gill nets);
- whether the trap was baited or unbaited;
- mesh and panel size (gill nets);
- date and time started and ended (electrofishing);
- electrofisher setting;
- the number and species of fish captured;
- water depth; and,
- UTM coordinates.

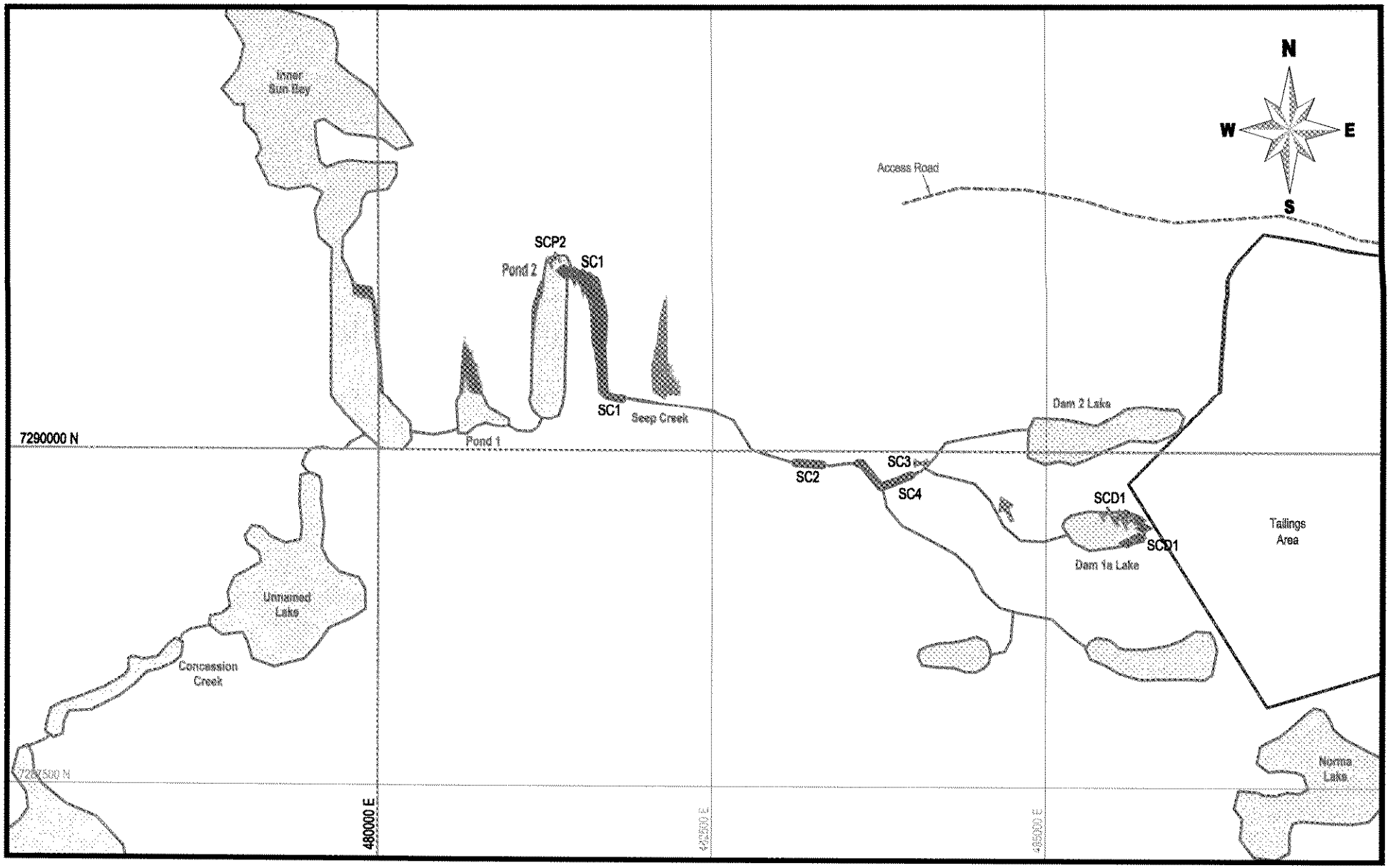
6.2.1.2 Field Data Collection

Length (fork length for Arctic grayling and total length for ninespine stickleback) and weight were recorded for all sentinel and non-target fish. Length was measured using a measuring board, marked by metric graduations with an accuracy of 1 mm. Total body weight was measured using an Acculab® VIC-123 electronic scale with an accuracy of 0.001 g.

Table 6.2. Backpack electrofishing and baited minnow trap locations

Method	Treatment	Station	UTM (Zone 12W NAD 83)							
			Start point		End point		Start point		End point	
			easting	northing	easting	northing	Latitude	Longitude	Latitude	Longitude
Backpack electrofishing	Exposure	SC2	483135	7289994	483325	7289999	65° 43' 52.18" N	111° 22' 03.83" W	65° 43' 52.32" N	111° 22' 00.70" W
		SC1	481838	7290521	481654	7290539	65° 44' 08.95" N	111° 23' 45.82" W	65° 44' 09.46" N	111° 24' 00.32" W
		SC4	483918	7289949	483592	7289894	65° 43' 50.84" N	111° 21' 02.34" W	65° 43' 49.01" N	111° 21' 27.86" W
	Reference	FC3	494608	7288867	494617	7288953	65° 43' 17.22" N	111° 07' 03.00" W	65° 43' 19.96" N	111° 07' 02.42" W
		FC3	494680	7289068	494681	7289068	65° 43' 23.70" N	111° 06' 57.42" W	65° 43' 23.70" N	111° 06' 57.35" W
		FC3	496327	7290999	496123	7290579	65° 44' 12.59" N	111° 05' 04.31" W	65° 44' 26.16" N	111° 04' 48.36" W
		FC3	495303	7289841	494619	7288840	65° 43' 16.36" N	111° 07' 02.17" W	65° 43' 48.72" N	111° 06' 08.64" W
Baited minnow trap	Exposure	SCD1	485594	7289539	n/a	n/a	65° 43' 37.90" N	111° 18' 50.60" W	n/a	n/a
		SCD1	485685	7289495	n/a	n/a	65° 43' 36.50" N	111° 18' 43.44" W	n/a	n/a
		SCD1	485730	7289436	n/a	n/a	65° 43' 34.60" N	111° 18' 39.89" W	n/a	n/a
		SCD1	485689	7289366	n/a	n/a	65° 43' 32.33" N	111° 18' 43.08" W	n/a	n/a
		SCD1	485603	7289325	n/a	n/a	65° 43' 30.99" N	111° 18' 49.81" W	n/a	n/a
		SC1	481432	7290659	n/a	n/a	65° 44' 13.31" N	111° 24' 11.66" W	n/a	n/a
		SC1	481510	7290643	n/a	n/a	65° 44' 12.80" N	111° 24' 17.86" W	n/a	n/a
		SC1	481570	7290632	n/a	n/a	65° 44' 12.48" N	111° 24' 06.95" W	n/a	n/a
		SC1	481618	7290570	n/a	n/a	65° 44' 10.46" N	111° 24' 03.13" W	n/a	n/a
		SC1	481704	7290530	n/a	n/a	65° 44' 09.17" N	111° 23' 56.40" W	n/a	n/a
	Reference	FL2	492298	7286271	n/a	n/a	65° 41' 53.16" N	111° 10' 03.83" W	n/a	n/a
		FL2	492321	7286266	n/a	n/a	65° 41' 53.02" N	111° 10' 01.96" W	n/a	n/a
		FL2	492332	7286225	n/a	n/a	65° 41' 51.72" N	111° 10' 01.06" W	n/a	n/a
		FL2	492349	7286217	n/a	n/a	65° 41' 51.47" N	111° 09' 59.72" W	n/a	n/a
		FC3	494616	7288879	n/a	n/a	65° 43' 17.58" N	111° 07' 02.46" W	n/a	n/a

Notes: n/a=not applicable



LEGEND

- Direction of flow
- Watercourse
- Backpack electrofishing
- Baited Minnow trap
- Gill net

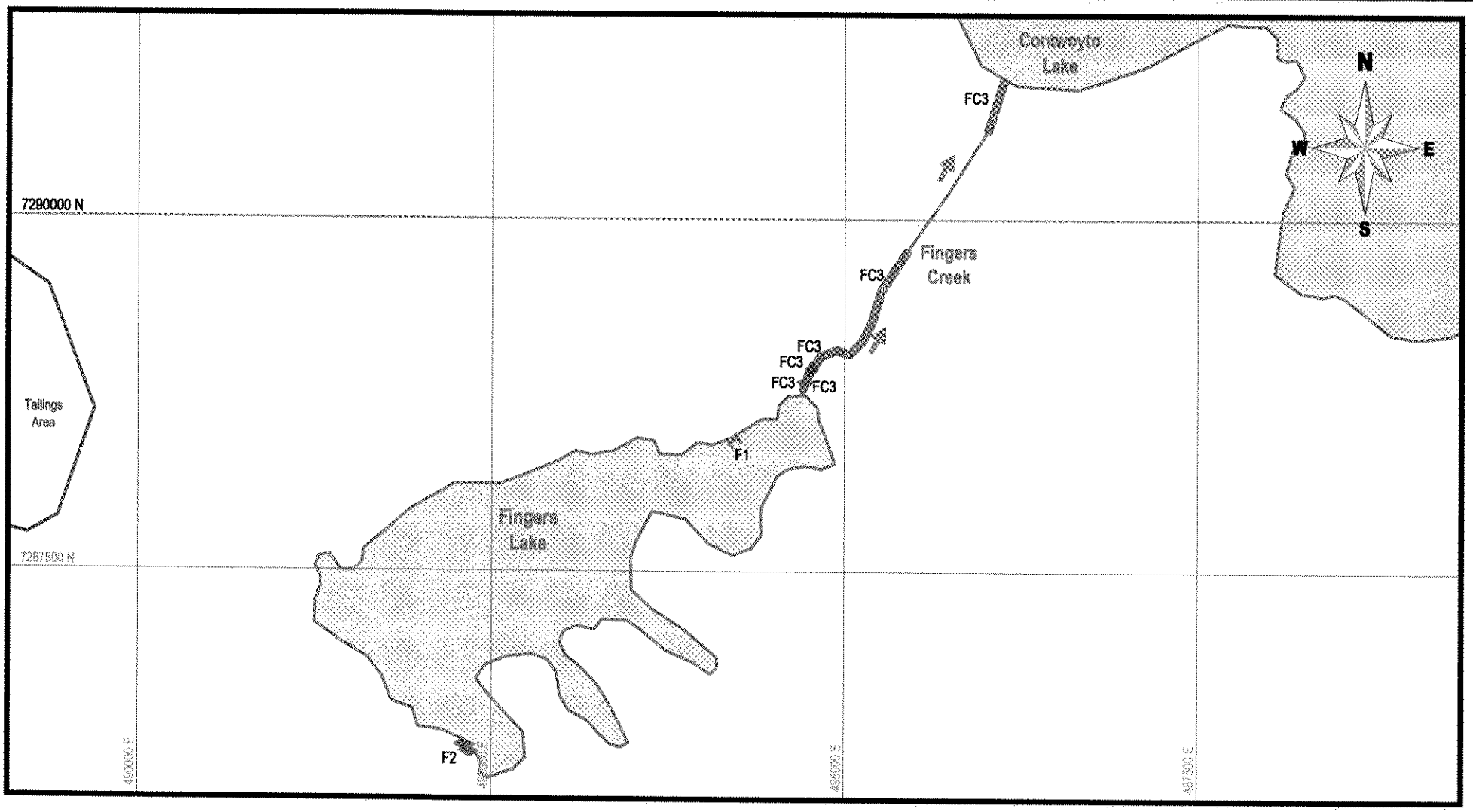
PROJECT

Kinross Gold Corporation
Environmental Effects Monitoring Interpretive Report,
Lupin Gold Mine

TITLE

Fish Sampling Locations in the Exposure Area

Drawing path and name: R:\CAD\2005\1370-Extraction\1373-05\05-1373-0106.2 - 1730639_fishSamples.dwg Jun. 2, 2006 (2:49 PM)



LEGEND

- Direction of flow
- Watercourse
- Backpack electrofishing
- Baited Minnow trap
- Gill net
- Hoop net

800 0 800

Scale Metres

PROJECT

Kinross Gold Corporation
Environmental Effects Monitoring Interpretive Report,
Lupin Gold Mine

TITLE

Fish Sampling Locations in the Reference Area

Golder Associates
Edmonton, Alberta

PROJECT No.		05-1373-019	FILE No.		1730639
DESIGN	AH	23/06/06	SCALE	As shown	REV. 0
CADD	RW	23/06/06			
CHECK					
REVIEW					

Figure: 6.2

Scales were collected from Arctic grayling for fish ageing. Ageing structures from Arctic grayling were removed in the field and placed into individual sealed envelopes with the appropriate information for identification (i.e., fish number, area, length, weight).

6.2.1.3 Supporting Environmental Variables

Field water quality parameters were measured at each sampling station within the exposure area (Seep Creek and Dam 1a Lake) and the reference area (Fingers Creek and Fingers Lake). One water quality grab sample was collected from Fingers Creek and one in Dam 1a Lake. A composite water quality sample was collected from Fingers Lake and one from the Seep Creek ponds.

Water samples in the exposure and reference areas were collected according to the methods outlined in the MMER TGD (EC 2002). Samples were analysed for metals, deleterious substances, major ions and nutrients. Detailed methods and results are provided in section 4.0 of this report. A summary of the results is provided in section 6.0 to provide information regarding the water quality associated with the fish habitat.

6.2.2 Laboratory Measurements

6.2.2.1 External Examination

An external examination was conducted on all sentinel fish sampled during the fish survey. Detailed observations were made on any features of the fish that did not appear normal (i.e., wounds, tumors, parasites, fin fraying, gill parasites or lesions). External examinations were completed following the recommendations outlined in the MMER TGD (EC 2002).

6.2.2.2 Internal Examination

A complete internal health examination was conducted on all collected Arctic grayling, following the recommendations outlined in the MMER TGD (EC 2002). Thirty ninespine stickleback were examined for internal abnormalities and parasites. The internal examination included the following:

- sex;
- life stage;
- internal pathology;
- liver weight;
- stomach contents; and,
- state-of-maturity.

In both species, all organ systems were examined for the presence of any abnormalities, such as tumors, necrosis, or parasites. The livers were carefully excised from the intestines. Liver weight was determined using an Acculab® VIC-123 electronic scale with an accuracy of 0.001g. Stomach fullness was noted, along with a general description of gut contents. When possible, maturity and sex were recorded for Arctic grayling. Gonad weight was not recorded due to the focus on juvenile Arctic grayling for the EEM study.

6.2.2.3 Fish Tissue Collection

The TAP requested that the Mine conduct copper analysis for muscle fillets and liver tissues as part of the fish survey if significant results were found in the effect endpoints. Due to the small size of the juvenile Arctic grayling captured in the fish survey, muscle fillets could not be removed without contamination of the sample. In consultation with the AO, whole carcasses (head removed) were preserved for copper analysis. In total, 35 carcasses were preserved from the reference area and 40 from the exposure area.

A minimum 2.0 g sample is required for liver tissue analysis. To meet this requirement, liver tissues were combined into composite samples. The number of individual liver tissues required to meet the required 2.0 g sample weight varied in each composite sample (Appendix F). Two composite samples were collected in the exposure area, and three composite samples were collected in the reference area. The small sample size would likely preclude statistical analyses of liver tissue copper concentration.

Liver tissues and carcasses of Arctic grayling were frozen separately. These samples were placed in long-term storage (-20°C) at the Alberta Research Council Laboratory pending copper analysis as directed by the TAP. The results of the tissue analysis will be reported separately when the data are available.

6.2.2.4 Quality Assurance/Quality Control

Specific work instructions outlining the fish survey tasks in detail were provided to field personnel by the task manager prior to the field program. Samples were collected by experienced personnel, and were labeled, preserved, and shipped to the Edmonton Golder office. Detailed field notes were recorded on pre-printed waterproof field data sheets.

Data collected during the fish survey underwent a variety of individual quality assurance checks. Field data sheets were checked at the end of each day for completeness and accuracy. Data entered into Golder Associates database underwent a 10% check for accuracy by a second person not involved in the initial entry process. All tables and data sets generated by the database underwent a 10% check for completeness and accuracy.

6.2.3 Laboratory

6.2.3.1 Fish Ageing

Ages of the Arctic grayling collected during the fish survey were determined following the methods outlined in Mackay et al. (1990). Scales were viewed using a compound microscope, and annuli were counted on the distal side from the focus to the edge of the dorsal tip. QA/QC results are presented in Appendix F.

6.2.3.2 Quality Assurance/Quality Control Procedures

A proportion (10%) of the age data was randomly selected and re-analyzed by Golder Associates personel in Edmonton. A greater than 10% difference would have resulted in all of the scale samples being reanalyzed. Age of all selected samples were consistent with the original ageing.

6.2.4 Data Analysis

Catch-per-unit-effort (CPUE) was calculated for each species captured, and was summarized by area and sampling method to document the effort expended in collecting the required number of fish. This calculation also provided a measure of relative abundance among sampling areas by standardizing the catch data for the exposure and reference areas.

The biological variables that were analyzed in the summary and/or statistical analyses included the following:

- physical abnormalities (e.g., tumors, lesions, obvious parasites);
- total body weight (g);
- fork length (mm);
- age (years); and,
- liver weight (g).

Summary statistics for each biological variable (i.e., sample size, arithmetic mean, median, minimum, maximum, standard deviation, and standard error) were calculated for mature fish, and summarized by area, and species. The biological variables were used to estimate energy storage and energy use in fish populations from the reference and exposure areas.

Age determinations indicated that all juvenile Arctic graylings captured from the exposure area were age 1 or young-of-the-year, whereas the catch in the reference area consisted of both ages 1 and 2 fish, as well as a few young-of-the-year. Because some of the endpoints, such as length-weight relationships and condition factor, vary with fish size and age, only fish of the same age and within similar size ranges (age 1 fish) were used for comparisons between the reference and exposure areas. Survival and size-at-age, which are EEM effect endpoints, could not be examined for the Lupin EEM study due to the limited age range.

Energy Use is a measure of the ability of the fish population to utilize resources in their environment to grow and reproduce. It is also a measure of hindrances that can deter fish from growing and reproducing normally and successfully (EC 2002, Gray et al. 2002).

Energy Storage is a measure of the current condition of the fish population. A healthy fish will demonstrate a greater body weight to length ratio. Stressors from the environment, whether they are natural or anthropogenic, can affect the condition of fish populations (EC 2002, Gray et al. 2002).

Two types of analyses were conducted on the data: effect analyses and supporting analyses (Table 6.3). An effect is defined as a statistically significant difference between fish population measurements taken in an exposure and reference area (EC 2002). Effect analyses are used to determine effects on the fish population. Supporting analyses are used for informational purposes only, and a significant difference between exposure and reference areas are not necessarily used to designate an effect (EC 2002).

The magnitude of the effect was calculated as the percent difference between the reference and exposure area means according to the following equation:

$$[(\text{exposure mean} - \text{reference mean})/ \text{reference mean}] \times 100$$

For ANCOVA analyses, the adjusted least squares means were used in the magnitude calculations.

Table 6.3. Response endpoint variables and statistical procedures used for identifying differences between reference and exposure areas

Type of Response	Endpoint	Dependent Variable (Y)	Covariate (X)	Statistical Procedure	Endpoint - Effect or Support Analysis[a]
Energy Storage	Condition	Body weight	Length	ANCOVA	Effect
	Relative liver weight	Liver weight	Carcass weight	ANCOVA	Effect
		Liver weight	Length	ANCOVA	Support
Energy Use	Total body weight	n/a	n/a	t-test	Support
	Length	n/a	n/a	t-test	Support

Notes: n/a = not applicable; [a] Indicates how statistical results will be interpreted

The study design consisted of only two areas, one reference and one exposure area; therefore, the two-sample *t*-test for comparing length and weight between areas was used. Statistical analyses were conducted with SYSTAT 11.0.

A general linear model (GLM) followed by an ANCOVA were used to assess the remaining endpoints, including condition and liver weight. Data were $\log_{10}$-transformed prior to ANCOVA analysis to ensure normality and allow comparison of regression lines (slope and intercept). GLM was used to test for homogeneity of slopes between the dependent variable and covariate for each area (i.e., test for significant area covariate interaction). ANCOVA was performed when the GLM did not produce a significant interaction between areas and the covariate (i.e., homogeneity of slopes was not violated). The ANCOVA was used to test for differences in intercepts, which is the effect of area on the dependent variable, using Type III sum of squares. If a significant difference in intercepts had been found, adjusted least squares means and standard error for each area were compared, and the level of significance, direction and magnitude were reported.

Power Analysis

Retrospective power analysis was conducted with the SYSTAT 11.0. Power was estimated for a range of effect sizes using a sample size (i.e., number of fish per area) corresponding to the minimum number of fish used in the statistical analysis of the fish data. Power was estimated for α and β equal at 0.05 and 0.1.

6.3 Results

6.3.1 Supporting Environmental variables

Water pH was slightly acidic in Fingers Creek (5.3 to 5.9) and the Seep Creek system (5.3 to 5.6; Table 4.3). These pH values were non-compliant with the CWQG, but were typical of the range of pH values in Nunavut barrenlands waterbodies reported by RCPL and RL&L (1985). Field conductivity was lower in Fingers Creek (10 to 120 µS/cm) than in the Seep Creek system (90 to 740 µS/cm).

Nitrate and ammonia concentrations were slightly elevated within the exposure area relative to the reference area. Nitrite and total phosphorus concentrations were at or below the MDL for both the reference and exposure areas (Appendix C). In general, metal concentrations were elevated in the exposure area compared to the reference area, and were higher in the stations nearest to the FDP than those farther downstream. In the exposure area, aluminum, arsenic, cadmium, copper, lead, nickel and zinc concentrations exceeded the CWQG for the protection of aquatic life (Appendix C).

6.3.2 Fish Catch data

Fish sampling was conducted in a variety of habitat types in both the reference and exposure areas. Except for gill net locations at Inner Sun Bay of Contwoyto Lake (exposure area) and Fingers Lake (reference), which were in deeper water (3 m), the majority of sampling stations were in shallow water that could be waded (0.3-0.6 m).

In total, 71 fish, representing six species, were captured in the reference area, and 188 fish, representing four species, were captured in the exposure area (Table 6.4; Appendix F). Within the reference area, backpack electrofishing was conducted for a total of 5044 s (1.4 h), the hoop net was set for 189.4 h, baited minnow traps were set for a total of 759.7 h, and gill nets were set for a total of 4.0 h. Within the exposure area, backpack electrofishing was conducted for 2935 s (0.82 h), fyke nets were set for a total of 90.9 h, baited minnow traps were set for a total of 588.6 h and gill nets were set for a total of 102.4 h.

The majority of the Arctic grayling in the reference area were captured by backpack electrofishing (49 fish). Despite considerable effort, only one ninespine stickleback and no slimy sculpin were captured in the reference area (Table 6.4). In the exposure area, similar numbers of Arctic grayling were captured using backpack electrofishing (36 fish) and gill nets (45 fish). Most of the ninespine stickleback were captured in baited minnow traps (Table 6.4).

Table 6.4. Summary of fish catch, 2005 Lupin mine EEM program

Method	Location	Effort	Species	Number of Fish Captured	CPUE
Gill Net		***hours***			***fish/h***
	Fingers Lake (FL1)	4.00	Lake Trout	1	0.25
			Round Whitefish	10	2.50
	Total	**4.00**		**11**	**2.75**
	Seep Creek (SCD1)	96.50	Arctic grayling	45	0.47
	Seep Creek Pond (SCP2)	2.40	no catch	0	0.00
	Inner Sun Bay (C1)	3.50	Arctic char	1	0.29
			Lake Trout	2	0.57
	Total	**102.40**		**48**	**0.47**
Baited Minnow Trap		***hours***			***fish/h***
	Fingers Lake (FL2)	759.70	Ninespine stickleback	1	0.001
			slimy sculpin	1	0.001
	Total	**759.70**		**2**	**0.003**
	Seep Creek (SCD1)	215.80	Ninespine stickleback	70	0.32
	Seep Creek (SC1)	372.80	Ninespine stickleback	20	0.05
	Total	**588.60**		**90**	**0.15**
Hoop Net		***hours***			***fish/h***
	Fingers Creek (FC3)	189.40	Arctic grayling	3	0.02
			Burbot	1	0.01
	Total	**189.40**		**4**	**0.02**
Fyke Net		***hours***			***fish/h***
	Seep Creek (SC3)	90.90	Arctic grayling	5	0.06
			Ninespine stickleback	8	0.09
	Total	**90.90**		**13**	**0.14**
Backpack electrofishing		***seconds***			***fish/100s***
	Fingers Creek (FC3)	5044	Arctic grayling	49	0.97
			Burbot	3	0.06
			Lake Trout	1	0.02
			slimy sculpin	1	0.02
	Total	**5044**		**54**	**1.07**
	Seep Creek (SC1)	904	Arctic grayling	15	1.66
			Ninespine stickleback	1	0.11
	Seep Creek (SC2)	1252	Arctic grayling	15	1.20
	Seep Creek (SC4)	779	Arctic grayling	6	0.77
	Total	**2935**		**37**	**1.26**

Note: individual dates and set times are presented in Appendix F

6.3.3 Fish Health Results

In total, 52 Arctic grayling and one ninespine stickleback were captured in the reference area, and 86 Arctic grayling and 99 ninespine stickleback were captured in the exposure area. Internal and external examinations were conducted for 78 Arctic grayling and 30 ninespine stickleback.