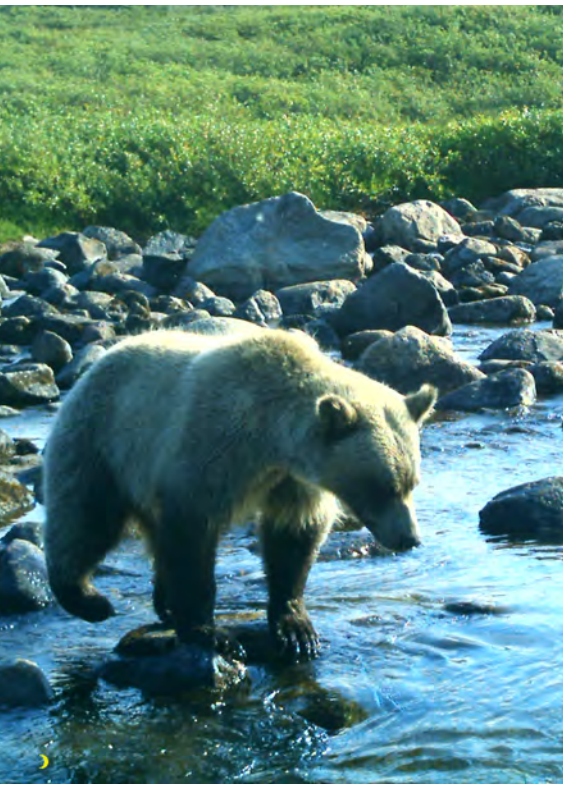
Appendix V5-6M

Doris North Project: 2013 Roberts Lake and Outflow Fish Compliance Monitoring Program Report

TMAC Resources Inc.

DORIS NORTH PROJECT
2013 Roberts Lake and Outflow Fish Compliance Monitoring Report



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March 2014

DORIS NORTH PROJECT

2013 ROBERTS LAKE AND OUTFLOW FISH COMPLIANCE MONITORING REPORT

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Executive Summary

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Executive Summary

The Doris North Project (the Project) is located within the Hope Bay Belt, an 80 by 20 kilometre property located along the south shore of Melville Sound in Nunavut. The property consists of a greenstone belt (the Hope Bay Belt) that contains three main gold deposits. The Doris and Madrid deposits are located in the northern portion of the belt, and the Boston deposit is at the southern end. The Project is located approximately 125 km southwest of Cambridge Bay on the southern shore of Melville Sound. The nearest communities are Umingmaktok (75 km to the southwest of the property), Cambridge Bay, and Kingaok (Bathurst Inlet; 160 km to the southwest of the property).

TMAC Resources Inc. (TMAC) acquired the Hope Bay Belt Project from Newmont Corporation in March 2013. The acquisition included exploration and mineral rights over the Hope Bay Belt, including the Doris North Gold Mine and its permits, licences and authorizations for development received by previous owners. In late 2012, prior to the sale, the Hope Bay Belt Project was placed into care and maintenance, and the project was seasonally closed during the winter of 2012/2013. TMAC re-opened the Doris North Camp in March of 2013 for the purposes of conducting site water management, environmental compliance programs and to support exploration activities. The Doris North Project remains in care and maintenance although it will not be seasonally closed for the winter of 2013/2014.

The compliance requirements for the Roberts Lake and Outflow Compliance Monitoring Program under the Department of Fisheries and Oceans' Fisheries Act Authorization NU-02-0117.3 and the No Net Loss Plan approved under this authorization are:

- evaluate juvenile Arctic Char densities at the Stream E09 enhancement site and at reference stream sites;
- assess the structural stability and vegetation recovery at the Stream E09 enhancement;
- monitor adult Arctic Char survival through the enhanced boulder garden at the outflow of Roberts Lake during upstream migration; and
- assess the structural integrity of the enhancement channels constructed in 2012 in Roberts Lake Outflow.

This report presents the results of the first year (2013) of monitoring after habitat enhancement at Roberts Lake and its outflow were completed in 2012, as outlined in the No Net Loss Plan and its revisions.

Post-enhancement monitoring of the enhanced section of Stream E09 yielded no fish captures, consistent with yearly electrofishing efforts at the same site prior to enhancement. This was the first year of data collection after stream enhancement and additional seasoning of the habitat is required before drawing firm conclusions as to the efficacy of the compensation for increasing juvenile Arctic Char density.

Survival of anadromous Arctic Char travelling through the boulder garden at Roberts Lake Outflow was 93% in 2013; the average for all pre-enhancement years was 62%. This high rate of survival occurred despite extremely low discharge in Roberts Creek that usually hinders fish migrations; there was 58% less discharge in 2013 compared to the average from all baseline years (0.29 m^3/s in 2013; 0.69 m^3/s in all pre-enhancement years). A single year of post-enhancement monitoring has occurred, and these early results indicate that the enhancement is functioning as intended and that it is likely to increase the number of Arctic Char returning to overwinter and spawn in Roberts Lake.

Wildlife cameras revealed that predator activity at the boulder garden was lower in 2013 than in 2012 (pre-enhancement year). Low discharge rates were experienced in all monitored watersheds in the Project area in 2013, presumably leading to high rates of fish stranding and a corresponding increase in foraging opportunities for predators in other streams. Decreased stranding caused by the enhancement channels at the boulder garden in 2013 may have caused wildlife to focus their foraging efforts elsewhere.

The method used to track migrating char was changed for the 2013 season due to safety concerns raised in 2012. The new approach greatly reduced the time that crews spent at the site. Consequently, interactions between humans and dangerous wildlife at the boulder garden fell from 16 in 2012 to 2 in 2013.

Acknowledgements

Acknowledgements

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Field-related logistics support was provided by TMAC, Great Slave Helicopters, Braden Burry Expediting, and Nuna Logistics.

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Glossary and Abbreviations

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Glossary and Abbreviations

Terminology used in this document is defined where it is first used. The following list will assist readers who may choose to review only portions of the document.

BACI	Before After Control Impact
CI	Confidence Interval, typically set at 95%
CPUE	Catch-per-unit-effort
DFO	Fisheries and Oceans Canada
ERM Rescan	ERM Consultants Canada Ltd.
FDR	False Discovery Rate
FL	Fork Length
MMER	Metal Mining Effluent Regulations
n	Sample Size
N	Population size
NNLP	No Net Loss Plan
PIT Tag	Passive Integrated Transponder Tag
SD	Standard Deviation of the mean
SE	Standard Error of the mean
TIA	Tailings Impoundment Area
TMAC	TMAC Resources Inc.

1. Introduction

1. Introduction

The Doris North Project (the Project) is located within the Hope Bay Belt, an 80 by 20 kilometre property located along the south shore of Melville Sound in Nunavut (Figure 1-1). The property consists of a greenstone belt (the Hope Bay Belt) that contains three main gold deposits. The Doris and Madrid deposits are located in the northern portion of the belt, and the Boston deposit is at the southern end. The Project is located approximately 125 km southwest of Cambridge Bay on the southern shore of Melville Sound. The nearest communities are Umingmaktok (75 km to the southwest of the property), Cambridge Bay, and Kingaok (Bathurst Inlet; 160 km to the southwest of the property).

TMAC Resources Inc. (TMAC) acquired the Hope Bay Belt Project from Newmont Corporation in March 2013. The acquisition included exploration and mineral rights over the Hope Bay Belt, including the Doris North Gold Mine and its permits, licences and authorizations for development received by previous owners. In late 2012, prior to the sale, the Hope Bay Belt Project was placed into care and maintenance, and the project was seasonally closed during the winter of 2012/2013. TMAC re-opened the Doris North Camp in March of 2013 for the purposes of conducting site water management, environmental compliance programs and to support exploration activities. The Doris North Project remains in care and maintenance although it will not be seasonally closed for the winter of 2013/2014.

The compliance monitoring requirements applicable to compensation works under the Department of Fisheries and Oceans' Fisheries Authorization NU-02-0117.3 for the loss of fish habitat in Tail Lake and the No Net Loss Plan (NNLP) approved under this authorization is designed to confirm the following:

- Creation of a narrow channel through the Roberts Lake Outflow boulder garden to improve access of fish, primarily Arctic Char (*Salvelinus alpinus*), to Roberts Lake to increase the productive capacity of the lake (completed in September 2012; Rescan 2012a; **addressed by the Roberts Lake and Outflow Fish Compliance Monitoring Program**).
- Creation of pool habitat in Stream E09, a tributary to Roberts Lake, to increase the quantity and quality of nursery habitat for Arctic Char (completed in July 2012; Rescan 2012a; **addressed by the Roberts Lake and Outflow Fish Compliance Monitoring Program**).
- Installation of four rock shoals in Windy Lake to increase the quantity and quality of juvenile Lake Trout (*Salvelinus namaycush*) rearing habitat (completed in April 2011; **addressed by the Windy Lake Shoal Compliance Monitoring Program**).

The Project's NNLP also provided a strategy to compensate for the loss of fish habitat in Tail Lake Outflow by:

- Installation of two rock shoals in Windy Lake to increase the quantity and quality of juvenile Lake Trout rearing habitat (completed in April 2011; **addressed by the Windy Lake Shoal Compliance Monitoring Program**).

Figure 1-1

Doris North Project Location

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Tail Lake was placed on Schedule 2 of the *Metal Mining Effluent Regulations* (MMER) on January 19, 2008, and the *No Net Loss Plan* (Golder 2007) and its updates (Rescan 2010a, 2010b), were approved as compensation. In addition, Fisheries and Oceans Canada (DFO) issued a Fisheries Authorization under the *Fisheries Act* (1985) for the loss of the outflow of Tail Lake (not covered by MMER) on January 19, 2011 (DFO File No: 02-HCAA-CA7-000-000117, Authorization No: NU-02-0117.3). A fish-out was completed in Tail Lake between July and September, 2011 (Rescan 2012b), and the north dam, located across the upper section of Tail Outflow, was completed in 2012.

A series of channels were installed in the boulder garden at Roberts Lake Outflow and two juvenile rearing pools were constructed in Stream E09 in 2012 to partly compensate for the loss of fish habitat caused by the construction of the Tailings Impoundment Area (TIA) in Tail Lake (Rescan 2012a). TMAC contracted ERM Consultants Canada Inc. (ERM Rescan) to undertake monitoring and reporting activities described in the NNLP and its modifications (Golder 2007; Rescan 2010a, 2010b). This report presents the first year of post-enhancement data for the Roberts Lake and Outflow Fish Compliance Monitoring Program.

2. 2013 Monitoring Program Objectives

2. 2013 Monitoring Program Objectives

The overall objective of the 2013 Roberts Lake and Outflow Fish Compliance Monitoring Program was to evaluate changes in the productive capacity of Arctic Char in the Roberts Lake system following the completion of two enhancement projects in 2012. The following tasks were completed in 2013 to fulfil the objective of the monitoring program:

- evaluate juvenile Arctic Char densities at the Stream E09 enhancement site and at reference sites by electrofishing;
- assess the structural stability and vegetation recovery at the Stream E09 enhancement;
- monitor adult Arctic Char survival through the enhanced boulder garden at the outflow of Roberts Lake during upstream migration using two infra-red fish counting fences; and
- assess the structural integrity of the enhancement channels constructed in 2012 in Roberts Lake Outflow.

Prior to the 2013 field season, DFO approved the permanent removal of trap net sampling in Roberts Lake from the monitoring program as this method proved ineffective between 2010 and 2012 (G. Williston (DFO) pers. comm. to M. McGurk (Hope Bay Mining Ltd.)).

3. Methods

3. Methods

3.1 STREAM E09 ENHANCEMENT MONITORING PROGRAM

3.1.1 Study Design and Project History

Baseline sampling determined that most tributaries to Roberts Lake do not support juvenile Arctic Char due to low summer discharge and the presence of barriers to fish passage (Golder 2007). Stream E09 was identified as the best candidate for enhancement as it has adequate baseline flow throughout the summer and is used by rearing juvenile Arctic Char in low abundance. In 2012, two pools were constructed in Stream E09 to provide additional juvenile Arctic Char rearing habitat, following the specifications of the NNLP (Golder 2007). To evaluate the successful use of the enhancement site (Site E09-US) by rearing Arctic Char, two reference sites (Sites E09-MID and E09-DS) were selected downstream within Stream E09 and an additional reference site was selected in Stream E14 (Site E14; Table 3.1-1; Figure 3.1-1).

Table 3.1-1. Roberts Lake Tributary Fish Sampling Locations, Doris North Project, 2013

			UTM		
Tributary	Site	Site Type	Zone	Easting	Northing
E09	D/S	Reference	13 W	441103	7559606
E09	MID	Reference	13 W	441074	7559535
E09	U/S	Enhancement	13 W	440905	7559406
E14	E14	Reference	13 W	436380	7559560

Notes: D/S = downstream, MID = middle reach, U/S = upstream

The key measure of success is to demonstrate whether the enhanced pools support “greater densities” of rearing juvenile Arctic Char than adjacent natural sections of stream (Golder 2007). This report compares the first year of post-enhancement monitoring data (2013) to baseline data collected from 2010 to 2012.

3.1.2 Fish Community

Monitoring of post-enhancement abundance of juvenile Arctic Char involved sampling the fish community of enhancement and reference sites three times during 2013 (Appendix 3.1-1). Each site was marked in 2010 with metal poles and flagging tape so that the same section of creek would be sampled each year (Figure 3.1-1). Block nets (4 mm mesh size) were erected at the upstream and downstream boundaries of the site, perpendicular to the water flow. Block nets were stretched across the stream channel and rocks were hand-placed to secure the bottom of the net to the streambed. Once the net was secured along the stream channel, the ends were secured using ropes.

Three-pass depletion electrofishing was conducted to estimate population density per species following Johnson et al. (2007). Backpack electrofishing was conducted using a Smith-Root LR-24 at each site by one crew leader and one dip netter. Anode ring diameter was 28 cm and dip net diameter was 21 cm with 3.2 mm mesh size. A systematic sweep sampling approach was conducted at each site, in which the entire wetted width was sampled from the downstream to the upstream site boundary (Stanfield 2005). Electrofishing effort was not pre-determined due to differences in site configuration. However, electrofisher voltage (V), duty cycle (%) and frequency (Hz) settings were consistent among sites. All fish captured were placed immediately in a holding tank for species identification, enumeration, and biological processing; and then released downstream of the site.

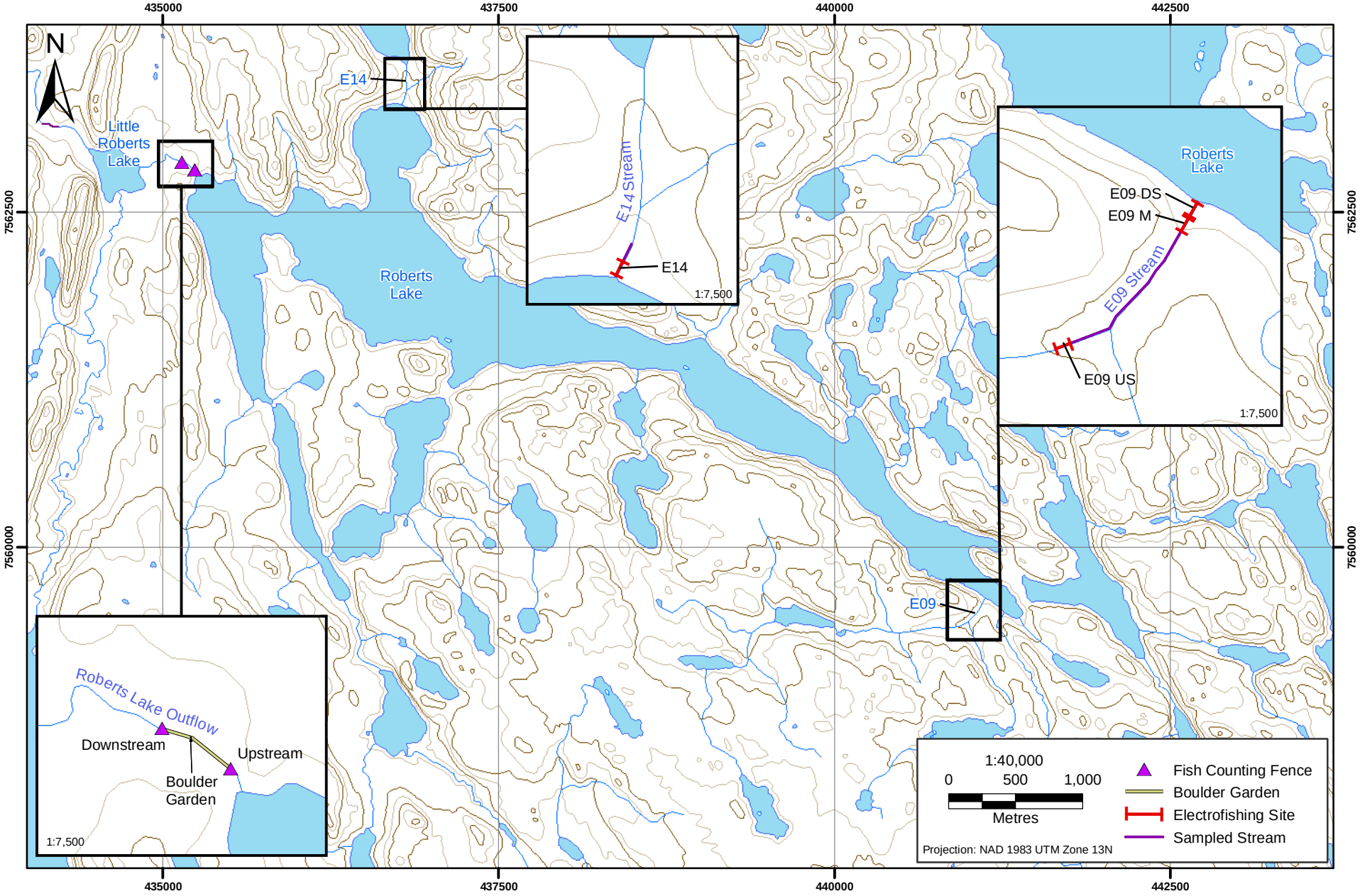


Figure 3.1-1

Sampling Locations for the Roberts Lake and Outflow Compliance Monitoring Program, Doris North Project, 2013

Figure 3.1-1

During the second and third pass events, the same method and level of effort were applied to ensure that detection probabilities at sites would be consistent. Block nets were then removed.

The sampling program was designed so that the assumptions of the closed model removal assessment were met (Johnson et al. 2007). The assumptions were:

- emigration and immigration by fish during the sampling period was negligible;
- all fish within a specified sample group were equally vulnerable to capture during a pass;
- vulnerability to capture of fish in a specified sample group remained constant for each pass (e.g., fish do not become more wary of capture); and
- collection effort and conditions which affect collection efficiency, such as water clarity, remained constant.

3.1.3 Fish Biology

All captured fish were identified to species and given a unique sample number. Fork Length (FL) was measured to the nearest 1 mm with a measuring board. Wounds, tag numbers, fin clips, and other external marks were noted and recorded for each captured fish. Scales and pelvic fin rays were collected for aging purposes from Arctic Char with FL greater than 70 mm (Appendix 3.1-2).

A Passive Integrated Transponder (PIT) tagging program in the Roberts Lake system has been ongoing since 2006; therefore, all captured Arctic Char and Lake Trout were scanned using an AVID microchip scanner (PETIDCO, Calgary, Canada). The unique tag number was recorded for previously tagged fish. Larger fish (> 100 mm FL) without tags were injected under the skin at the pelvic girdle with their own unique PIT tag and smaller fish were marked by partly clipping the left pectoral fin. Upon the completion of data collection, fish were placed into a second water-filled bin for recovery prior to their release.

Age Structure Sample Processing

Aging of captured fish was conducted on fin rays by Stamford Environmental (Gibsons, British Columbia). Individual fin rays were carefully removed from their envelopes, set into epoxy (Koch and Quist 2007) and transverse cross sections were removed using a low speed saw (Isomet, Beuler Inc.). At least three sections (approximately 0.5 mm thick) were removed, fixed onto a labelled slide and polished with wet-dry sand paper. As they were being mounted, the sections were assessed under a microscope to ensure sufficient information was removed for aging (based on shape of the hemisegments; Ferriera et al. 1999; Plate 3.1-1). Sections were fixed sequentially from left to right on a slide beginning with the most proximal section to enable readers to observe changes to annuli in more distal sections. This is useful for identifying loss of first or second annuli on fin rays that were clipped more distally in the field.

The larger ventral hemisection from the principle fin ray was the primary focus as the second and third fin rays were often insufficiently proximal or absent in some samples. Cross sectional shape was noted; as this identifies proximal to distal locations along the fin rays and first or second annuli can be lost in distal sections. Round or short tailed comma shaped sections are more proximal, for instance, than long tailed comma or rod shaped sections (Ferriera et al. 1999). Sometimes more distal sections display better annulus definition; however, winter growth can be clouded over by surrounding summer growth in more proximal sections. Consequently, annulus counts for the fish were determined using all information present on the slide, including all sections and any or all of the first three fin rays present in the sample.

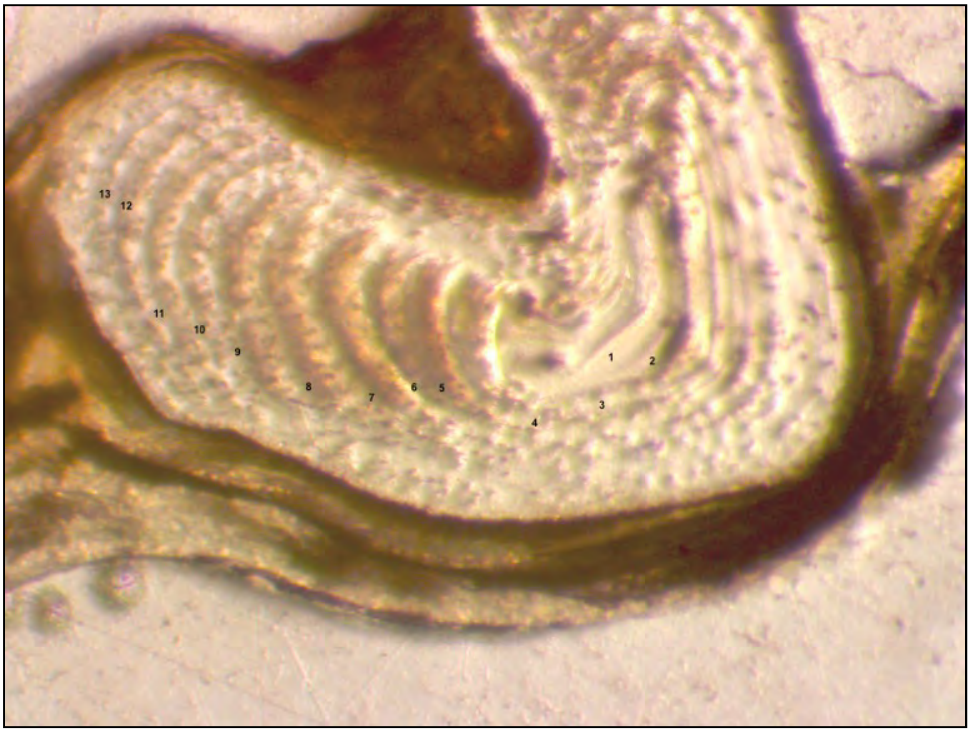


Plate 3.1-1. Fin ray from a 13 year old Arctic Char showing the banding pattern used to determine age.

3.1.4 Stream E09 Enhancement Stability Assessment

The design of the enhancement of Roberts Lake tributary Stream E09 called for the creation of pools of at least 4 m^2 (Golder 2007). The survey completed following construction found that the upstream pool was 5 m^2 and the downstream pool was 6.7 m^2, providing a total of 11.7 m^2 of new habitat. This particular section of Stream E09 is a non-alluvial channel and the presence of natural pools in the same reach suggests that the enhancement pools are unlikely to be subject to infilling (Golder 2007).

The structural stability of each enhancement pool was assessed to determine whether erosion or infilling had occurred. Site photographs were taken and visual signs of erosion were noted. Signs of recovery or failure of transplanted vegetation plugs were recorded. The dimensions of each pool were measured using a tape measure and these dimensions were compared to those recorded immediately following construction.

3.1.5 Data Analysis

CPUE

CPUE is an index of relative abundance that can be used to compare fish populations among different areas. It is defined as the number of fish captured per sampling device per unit time. CPUE was calculated for each species, where applicable.

For electrofishing, CPUE was calculated from the number of fish captured per 100 seconds of electrofishing effort:

$$CPUE = number\ of\ fish\ caught / 100\ s$$

As each site was sampled over the same length (25 m), CPUE is also interpreted as a proportional measure of the density of juvenile Arctic Char.

Density Comparison

Changes in density of juvenile Arctic Char in the enhanced section of Stream E09 were evaluated as changes to CPUE using two statistical tests. The first test examined if the trend in density (CPUE) of the enhanced section (E09-US) differed from two reference sections that were located downstream of the enhancement and within Stream E09 (E09-DS and E09-MID). The second test examined if the trend in density (CPUE) of Stream E09 (all sites pooled) differed from a reference stream (Stream E14). Both statistical tests were constructed in the same manner, using a two-factor mixed model ANOVA (a modified Before/After Control/Impact design (BACI)), where sampling site (Site) and sampling year (Year) were set as fixed and random factors respectively. Each sampling event consisted of two to four sampling replicates. To account for large differences in variance among years and sites (a violation of the assumption of equal variance), the ANOVA models were fit using the observed within group variance by employing the varIdent function in R (Pinheiro and Bates, 2000).

Descriptive Statistics

Descriptive statistics were calculated for biological and CPUE data. This included sample size, mean, standard deviation (SD) of the mean, standard error (SE) of the mean and 95% confidence intervals (CI).

Analyses were conducted using SigmaPlot 12.0 and R v. 3.0.2. Normal probability plots and Shapiro-Wilk tests were employed to test for normality among variables. Levene's test was employed to test for homogeneity of variances. Where necessary, data were transformed with natural logarithms to meet assumptions of normality.

3.1.6 Quality Assurance and Control

Data sheets were reviewed at the end of each field day to ensure that they were complete and collected properly. Field notes were transcribed onto electronic spreadsheets and were reviewed then checked visually against the field forms and any errors corrected.

The data were plotted (e.g., age-length plots) to identify outliers that may have resulted from transcription errors. Outliers were reviewed and removed or corrected, when applicable. Data, particularly the PIT tag numbers, were cross referenced with the scanning log within the AVID microchip PIT tag scanner as well as with previously collected data (i.e., PIT tagged fish information from 2006 to present) to discern any transcription errors that occurred in the field.

Ageing Determination and Precision

Age structures were read a minimum of two times. If consistency was not met between the first two reads, a third was undertaken. Structures assigned inconsistent ages after three reads would have been removed and no age allocated; however, all structures were consistent after either two or three reads. Age readers were given no information on weight, length or sex, so that age estimates were based solely on the annular structure of the fin ray. Readings were conducted as "blind" (independent from each other).

3.2 ROBERTS LAKE OUTFLOW ENHANCEMENT MONITORING PROGRAM

3.2.1 Study Design and Project History

Anadromous Arctic Char cannot overwinter in Arctic marine environments (Swanson et al. 2010) and must migrate to appropriately deep freshwater winter habitat before freeze-up each year. Roberts Lake is the only lake in the watershed that provides critical overwintering habitat for anadromous Arctic Char (Swanson et al. 2010). Doris Lake is upstream of a 4 m high impassable waterfall (Golder 2007) and Little Roberts Lake is too small and shallow (approximately 4 m deep) to provide overwintering habitat (ERM Rescan 2014a).

To reach Roberts Lake, upstream migrants must pass through a boulder garden at the lake outflow. Prior to enhancement, movement through this section of the stream was challenging, particularly during periods of low discharge when flow became braided and shallow. The period of lowest discharge in Roberts Creek typically occurs during August and September (ERM Rescan 2014b), concurrent with upstream migrations of anadromous Arctic Char when, historically, a large fraction of the population perished each year from stranding and predation (Golder 2007).

The NNLP defines a fish passageway through the boulder garden to provide better access for migrants to Roberts Lake (Golder 2007). It was predicted that increased survival of returning adults would increase the spawning population and over time increase the productive capacity of the lake. According to the 2007 design, the efficacy of the enhancement was to be measured by monitoring the outmigration of Arctic Char smolts in spring before and after enhancement.

Fish fences have operated at the Roberts Lake Outflow boulder garden for ten years, between 2002 and 2013. The number of fences, methods used and locations of fences has changed throughout the development of the monitoring program. Table 3.2-1 summarizes the dates, locations and direction of capture of fish fences installed from 2002 to 2013.

Table 3.2-1. Summary of Sampling at Roberts Lake Outflow, Doris North Project, 2002 to 2013

Year	Operation Dates	Fish Fence Location Relative to Boulder Garden (A/B)	Capture Direction (D/U)	Data Source
2002	Aug 16 - Aug 30	A	U	RL&L/ Golder (2003a)
2003	Aug 7 - Sept 8	A/B	U	RL&L/ Golder (2003b)
2004	Aug 9 - Sept 8	A/B	U	Golder (2005)
2005	Aug 4 - Sept 12	A/B	U	Golder (2006)
2006	June 19 – July 22	B	D	Golder (2008a)
2007	June 28 – July 26	B	D	Golder (2008b)
2010	June 29 - Aug 22	A/B	D/U	Rescan (2011)
2011	July 14 - Aug 9	B	D/U	Rescan (2012c)
2012	June 29 - Aug 30	A/B	D/U	Rescan (2013)
2013	July 17 – Sep 7	A/B	D/U	This report

Notes: A = fish fence above boulder garden, B = fish fence below boulder garden, U = fish migrating upstream, D = fish migrating downstream. Grey highlight indicates years that were used for survival estimates.

In 2002, the upstream migration of adult Arctic Char was monitored using one fish fence upstream of the boulder garden. The objective was to enumerate the upstream migration of returning Arctic Char into Roberts Lake in August and early September.

The fence was relocated downstream of the boulder garden in 2003, and a modified fyke net was installed immediately above the boulder garden. The fyke net was installed so that it functioned in the same manner as the fish fence; there was a central trap and two wings that stretched from the trap to each shore, blocking the full width of the channel. This change was made so that survival through the boulder garden could be determined, along with the total number of fish entering Roberts Lake.

In 2004 and 2005 two fish fences were installed each year; one upstream and one downstream of the boulder garden. Again, the purpose was to assess survival through the boulder garden, along with the total number of fish entering Roberts Lake.

In 2006 the program was amended so that data collection would meet the objectives of the draft NNLP. Monitoring of adult Arctic Char migrating into Roberts Lake during the low-discharge period of August and early September was abandoned. Monitoring focused on the abundance of char smolts migrating out of Roberts Lake to the sea during the high-discharge period of late June and early July. One fence was installed downstream of the boulder garden that caught downstream migrants. This sampling program was repeated in 2007, and no fish fences were installed in 2008 or 2009.

In 2010, the program was amended so that fish fences were installed both upstream and downstream of the boulder garden and so that upstream and downstream migrating fish were captured at each fence. The fences were installed at the end of June to catch the downstream migration of smolts and the plan was to operate the fences until mid-September, when the upstream adult migration occurs. However, persistent grizzly bear (*Ursus arctos horribilis*) activity in the boulder garden and associated safety risks meant the fence program was terminated on August 22, 2010.

The sampling approach was changed in 2011 following the bear encounters that occurred toward the end of the 2010 field season. One fence was installed downstream of the boulder garden in Roberts Lake Outflow during the freshet period to monitor smolt outmigration, following the approach proposed in the NNLP. The program was scheduled to end before the main upstream return of adult char to minimize conflict with bears. However, 2011 was the highest freshet flow year on record for Roberts Lake Outflow. The conditions delayed fence installation by several weeks causing the majority of outmigrants to be missed.

Modifications to the program were proposed prior to the 2012 field season due to the low number of smolts captured 2011. A letter sent from HBML to DFO dated June 2, 2012 requested that the program be shifted back to monitoring only adult survival for practical, human safety, and scientific reasons. Smolt outmigration peaks during spring freshet which is a logistically difficult and potentially dangerous time of year to install and maintain a fish fence. Smolt enumeration is an indirect test of the effectiveness of the habitat enhancement, as abundance is strongly influenced by other factors including population dynamics, marine survival, and lake carrying capacity.

The current monitoring program compares survival probabilities for adult Arctic Char migrating upstream before and after enhancement to directly measure whether the constructed channels improve survival through the boulder garden. In addition, comparing total abundance of adult migrants among years measures whether the enhancements increase the overall anadromous population of Arctic Char. The metrics used to assess the effectiveness of habitat enhancement in Roberts Lake Outflow are presented in Table 3.2-2.

In 2012, both smolt outmigration and adult upstream migration were monitored. Wildlife encounters were frequent during the latter portion of the monitoring program when field crews had to be evacuated from site by helicopter on several occasions, so modifications to methods were made prior to the 2013 field season.

Table 3.2-2. Roberts Lake Outflow Productivity Capacity Metrics, Doris North Project, 2013

Tier	Metric	Measurement	Predicted Biological Response	Biological Assumptions
Primary	Successful Migration	Calculate survival (%) of adults migrating between the lower and upper boulder garden fences	The enhanced channel may lead to an increase in survival of fish moving through the boulder garden. This is a direct measure of success of the enhancement.	100% trap capture efficiency or known percentage of escapes.
Secondary	Adult Returns	Calculate abundance of Arctic Char migrating through the upper boulder garden fence	A decrease in boulder garden mortality may lead to an increase in the total number of fish returning each year.	Roberts Lake is not at productive capacity for smolt production. Constant annual marine survival of adults. Constant smoltification percentage of char population. Sampling period covers the entire migration period or a comparable portion among years.

In 2013, the Vaki Riverwatcher system was selected to monitor fish movement remotely. The Riverwatcher system automates the monitoring of fish movements by using infra-red scanners and a high-resolution camera to identify species, length, and direction of travel. The modifications to the monitoring program were approved by DFO prior to the 2013 field season (G. Williston (DFO) pers. comm. to A. Holzapfel (Hope Bay Mining Ltd.)).

The enhancement to Roberts Lake Outflow was completed in the fall of 2012, following the conclusion of pre-enhancement data collection for that year (Rescan 2012a). The 2013 sampling program was designed to monitor the survival of adult Arctic Char by enumerating fish downstream and upstream of the boulder garden (Figure 3.1-1; Table 3.2-3). This report presents the results from the first year of post-enhancement monitoring.

Table 3.2-3. Roberts Lake Outflow Fish Counting Fence Locations, Doris North Project, 2013

	UTM		
Fish Fence	Zone	Easting	Northing
Lower	13 W	435142	7562877
Upper	13 W	435225	7562806

3.2.2 Arctic Char Survival Monitoring

Arctic Char Enumeration

Survival of migrating Arctic Char was monitored in 2013 using two Vaki Riverwatchers, one installed upstream and one installed downstream of the boulder garden at Roberts Lake Outflow (Table 3.2-3). The Riverwatcher system consists of an infra-red scanner and a high-resolution camera powered by two 120 W solar panels and four 6 V deep cycle batteries (Plate 3.2-1). The infra-red scanner calculates total length and direction of travel for each fish and a paired video recording is provided for species identification. The upstream fish counter started operating on July 16 and the downstream counter on July 17.

Plate 3.2-1. Solar Panels Providing Power to the Vaki Riverwatcher downstream of the boulder garden, July 22, 2013.

Each fish counter was installed in the centre of the channel and the infra-red scanner was orientated perpendicular to the direction of flow. Four wings (two on each side) were constructed between each Riverwatcher and the stream banks so that fish could not pass through undetected (Plate 3.2-2). Two wings were installed on each side to prevent fish passage if one wing failed. The wings consisted of aluminum frames with removable conduit rods (1.8 cm diameter) spaced 1.3 cm apart, and were reinforced with galvanized mesh hardware cloth and sand bags. Wooden "A" frames supported the panels and were held in position with large weighted buckets. An electric fence was constructed around the perimeter of the work area to prevent damage from bears.

The scanner and video recorder simultaneously logged the date, time, direction, and fish length for each passing fish and paired these data with a video recording to be used for species identification (Appendix 3.2-1). Data and videos were saved on computers located on site in weather-proof containers next to the stream. In addition, the Riverwatchers continuously logged water temperature throughout the sampling period.

Field crews made site visits every five to seven days throughout the monitoring period to verify that the scanner and computer were operational. Crews downloaded data, checked the battery status, cleaned the scanner and underwater video tunnel, checked and cleaned the fence wings, and made notes of wildlife activity in the area.

Identification of Adult Arctic Char

Arctic Char smolts (first time migrants to seawater) are generally classified as individuals 150 to 250 mm in length (Scott and Crossman 1973; Johnson 1980), but in the Roberts Lake watershed, Arctic Char smolts can reach up to 350 mm prior to their first ocean migration (Swanson 2010; Golder 2008b). For this study, fish greater than 350 mm were classified as adult Arctic Char. Species was not assigned to fish smaller than 350 mm as identification from video was not definitive and in many cases not possible.

Plate 3.2-2. The fish fence downstream of the boulder garden on July 22, 2013.

Predator Activity

Predator activity at the boulder garden was first monitored in 2012 using motion sensing cameras (Rescan 2013). In 2013, three motion sensing wildlife cameras (Bushnell Trail Sentry) were installed from July 18 to September 19 to quantify the frequency of predator visits (Appendix 3.2-2).

Stream Hydrology

A hydrometric station has been used to track discharge in Roberts Lake Outflow since 2003 (ERM Rescan 2014b). The 2013 station consisted of a pressure transducer paired with a data logger (model 0-5 psi vented Aquistar PT-2X Smart Sensor® (Instrumentation Northwest Inc.)). The transducer continuously sampled water level and these data were recorded by the data logger at 10 minute intervals. Full details of the hydrology monitoring program including data processing methods are described in ERM Rescan (2014b).

3.2.3 Enhancement Stability Assessment

Visual stability assessments were completed on July 22 and September 18, 2013. The same personnel that completed construction in 2012 inspected each channel, looking for signs of infilling or erosion. Representative photographs were taken of each channel to document the structural integrity.

Section 4.1.2 of the NNLP specifies the creation of a clear flow path 12 to 15 m in length through the "stranding zone" in the middle of the boulder garden in Roberts Lake Outflow. In place of a single channel, four clear channels were built with a total length of 69 m between September 3 and 10, 2012 (Rescan 2012a). The three additional channels provide alternative routes for fish if the structural integrity of any one channel was to deteriorate over time.

The enhancement of the boulder garden will likely remain structurally stable over time as substrate is large, the degree of embeddedness is high, and there are very few large boulders downstream. The channels were designed so that the surrounding areas remain stable after construction, and boulders that were removed from the channel were relocated to a more stable location so that they are unlikely to move back into the channel during future freshets.

3.2.4 Data Analysis

CPUE

CPUE is an index of relative abundance that can be used to compare fish populations among different areas. It is defined as the number of fish captured per sampling device per unit time.

For fish fences, abundance was calculated from the number of fish captured per fence per 24 h:

Abundance = number of fish caught per 24 h

Boulder Garden Survival

The percentage of survival of adult fish moving upstream through the boulder garden was calculated for each year in which both an upstream and a downstream fence were in operation (Table 3.2-1).

Fish that passed the lower fence toward the end of the program may have had inadequate time to reach the upper fence before sampling ended. A portion of these fish would have survived but would have been classified as mortalities if they had not passed the upper fence at the end of the sampling period (causing an overestimation of mortality).

To accommodate for the travel time between fences, an appropriate end date for the lower fence was calculated. This was established by calculating the total number of days required for 95% of fish to pass between the fences across all pre-enhancement years. This value equaled seven days. This means that 95% of fish successfully passed upstream from one fence to the other within seven days and that fish not passing through within seven days suffered mortality. This method assumes that 5% of the mortalities may have successfully migrated through boulder garden after seven days and is analogous to a 5% error rate (or alpha 0.05).

The same seven day window was used to calculate the start date for the upstream fence. If simultaneous start dates were used for both fences, fish between the fences at the start would only be counted at the upstream fence, causing an overestimation of survival.

Survival rates from baseline years were recalculated following the 2013 methods, which generally resulted in a slight increase in survival (less than 5%) estimates for most baseline years. As an example, if fences were installed July 1 and removed September 1, then the enumeration interval for the downstream fence would be July 1 to August 26, whereas the enumeration interval for the upstream fence would be July 7 to September 1.

Survival rate (%) through the boulder garden was calculated using the equation:

*Survival Rate = net number of fish caught in the upstream fence / net number of fish caught in the lower fence * 100%*

In baseline years, the net number of fish caught at both fences was done by direct enumeration of individually tagged fish passing upstream in each fence. Thus, an individual was counted moving

upstream once, even if it was observed to pass upstream and downstream at a single fence multiple times. In 2013 an extra step in this calculation was required, because individual fish were not tagged resulting in an inability to track individuals moving two or more times (upstream and downstream) through a single fence. Many Arctic Char were recorded at the downstream fence multiple times moving in both upstream and downstream directions. To account for this, in 2013 the net number of fish in both fences was calculated by subtracting the number of char moving downstream from the number moving upstream separately for each fence. Subsequent calculation of Survival Rate was completed in the same manner as baseline years.

Length Frequency

Length-frequency distributions were constructed to show the number of fish representing specific size classes and compare size distributions between the two fences. To plot length frequency distributions, multiple measurements on an individual fish passing through the same fence multiple times needed to be filtered out. As stated previously, individual fish were not tracked in 2013, making this process more complicated in 2013 than in baseline years when individuals were tagged and could simply be removed using their identifying number.

The simplest approach for removing individual fish counts that were measured more than once in 2013 would be to pair equal lengths of fish passing up and downstream at a single fence and then removing those pairs from the data set. However, a comparison of the accuracy of upstream and downstream length measurements from the same fence revealed that there was a significant difference (paired *t*-test, $T_{79} = 6.58$, $P < 0.001$) in upstream and downstream measures taken from the same fish that passed through the scanner in one direction then turned and again passed through the scanner in the opposite direction without leaving the view of the camera. On average, the difference in total length for fish passing downstream was 64 mm less than for the same fish passing upstream, as fish passing downstream regularly passed through the scanners at oblique angles (see Appendix 3.2-3 for further discussion). This resulted in an inability to accurately pair length measurements.

As multiple measurements on an individual could not be accurately removed for 2013, unfiltered data were used to generate the length frequency distributions for each fence in that year. Thus, in 2013 distributions reflect the general size distribution of fish but they should be interpreted with caution due to the duplication of individual length measurements.

Of note, during the 2013 sampling period, the frequency of multiple measurements being taken on an individual from the same video was far greater at the downstream fence compared to the upstream fence (541 occurrences at the downstream fence; two occurrences at the upstream fence). This resulted because fish rested and staged near the downstream fence before attempting to traverse the boulder garden (resulting in repeated length measurements on the same individual), whereas fish that passed through the upper fence went directly into the lake.

In baseline years, fork length was manually measured for all Arctic Char caught in the fish fence traps. In 2013, post-enhancement, the Vaki Riverwatcher estimated the total length, rather than fork length, of each fish using an infra-red scanner. The change in length measures should produce marginal differences as Arctic Char have a shallow fork in their tail resulting in similar measures of fork and total length.

Underwater Video Review

Underwater videos were reviewed to determine the species of each fish record. Microsoft Windows Media Player software was used to view each video and data were added to a Microsoft Excel spreadsheet

automatically generated by Vaki Winari software. Species was determined and recorded for each fish where possible and unusual marks or behaviour were noted (Plates 3.2-3 and 3.2-4).

Plate 3.2-3. An adult Arctic Char swims upstream through the Vaki Riverwatcher located downstream of the boulder garden on August 18, 2013.

Plate 3.2-4. A Lake Trout swims upstream on August 12, 2013.

Discharge Calculations

Rating curves were established for Roberts Lake Outflow hydrologic station so that water level data could be converted into a continuous discharge time series (i.e., a hydrograph). Rating curves are hydraulic functions expressed as a parabolic equation of the form:

$$Q = C\ (h - a)$$

where Q is the discharge (m^3/s), C and b are regression coefficients, h is the stage (water level in m), and a is the stage at zero flow (datum correction in m). Data and discharge calculations are presented in ERM Rescan (2014b).

Statistical Analysis

Descriptive statistics were calculated for biological and CPUE data. Sample size, mean, standard deviation (SD) of the mean, standard error (SE) of the mean and 95% confidence intervals (CI) were calculated.

The post-enhancement survival rate (2013) was compared to baseline survival rate (pooled among years) and then to each baseline year separately (2003, 2004, 2005, 2010, and 2012) using the χ^2 squared test for independence. For comparisons to each baseline year, each test was carried out using a fixed significance level of $\alpha = 0.05$, but was then adjusted to account for the increase in error rate caused by multiple testing using the False Discovery Rate (FDR; Whitlock and Schluter 2009).

SigmaPlot 12.0 software and R 2.14.1 (R Core Team 2013) were used for statistical analyses. For all statistical analysis, significance was accepted at $\alpha = 0.05$ except where multiple testing was performed as indicated above.

3.2.5 Quality Assurance and Control

During video review, all events where the same fish passed through a scanner in one direction, then turned and passed in the opposite direction without leaving the view of the camera (and therefore excluding the possibility that it was actually another fish) were removed from the survival estimates. These measurements were used to compare the accuracy of upstream and downstream size estimates.

Following the initial assessment of all underwater videos, a second fish biologist randomly selected and reviewed over 40% of the videos to check the accuracy of species identification. Differences in assigned species accounted for less than 2% of entries.

4. Results

4. Results

4.1 STREAM E09 ENHANCEMENT MONITORING PROGRAM

4.1.1 Test 1: Comparing Trends between Reference and Enhanced Sites within E09

CPUE fluctuated over time, but was greatest at sites downstream of the enhancement at Stream E09 and nearest Roberts Lake. In contrast, no fish were caught at the enhancement site (E09-US) across all sampling years, including the first year post-enhancement (Figure 4.1-1). The trend in CPUE through time differed significantly among sites (Site by Year interaction: $F_{(6,22)} = 7.58$, $P = 0.0002$) and was driven largely by the fluctuations in CPUE at E09-DS (Figure 4.1-1). There was a significant effect of site on CPUE ($F_{(3,22)} = 52.87$, $P < 0.0001$), though the presence of a significant interaction term makes interpreting main effects difficult. Based on Figure 4.1-1; however, it appears that CPUE at reference sites is higher than at the enhancement site across most sampling years. The main effect of Year was non-significant ($F_{(3,1)} = 0.16$, $P = 0.91$).

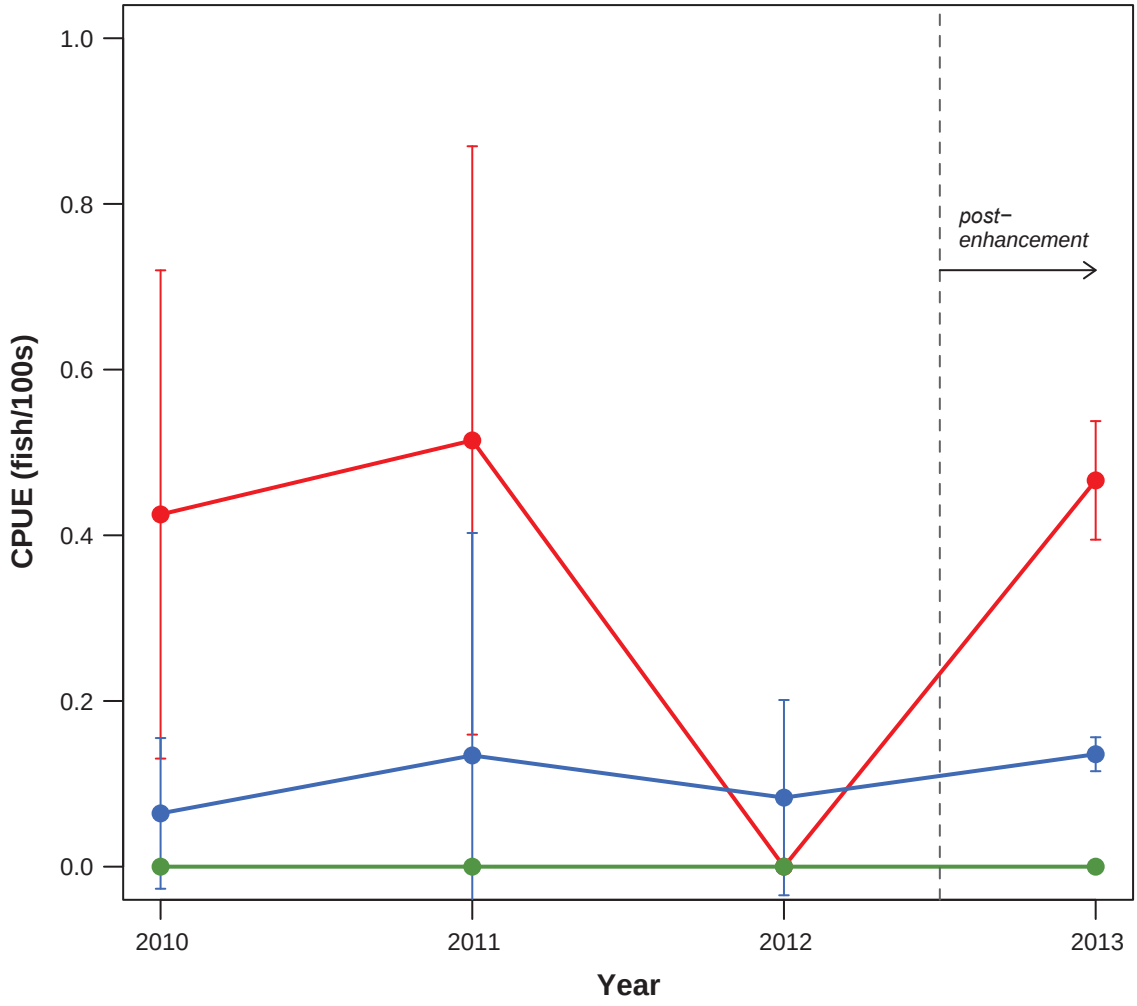
4.1.2 Test 2: Comparing Trends between Reference Stream E14 and Enhanced Stream E09

CPUE fluctuated over time in both streams, though reference Stream E14 showed significantly greater variation in CPUE over time than the pooled samples from Stream E09 (Figure 4.1-2) as shown by the significant interaction of Site by Year between streams ($F_{(3,39)} = 3.35$, $P = 0.029$). CPUE was significantly greater at the reference Stream E14 than at Stream E09 ($F_{(2,39)} = 14.34$, $P < 0.0001$), though the presence of a significant interaction term makes interpreting main effects difficult. However, Figure 4.1-2, shows that CPUE at reference Stream E14 is higher than Stream E09 in all sampling years. The main effect of Year was non-significant ($F_{(3,1)} = 0.54$, $P = 0.73$).

4.1.3 Overall Assessment of Stream E09 Enhancement

Yearly electrofishing efforts have consistently failed to capture any fish in the upstream section of Stream E09 (E09-US). In contrast, the density (CPUE) of juvenile Arctic Char at all reference sites has been variable, though rarely zero between 2010 and 2013. Although this pattern was also observed in the single year post-enhancement, additional seasoning of the habitat is required before drawing firm conclusions as to the efficacy of the compensation for increasing the density of Arctic Char juveniles in this stream.

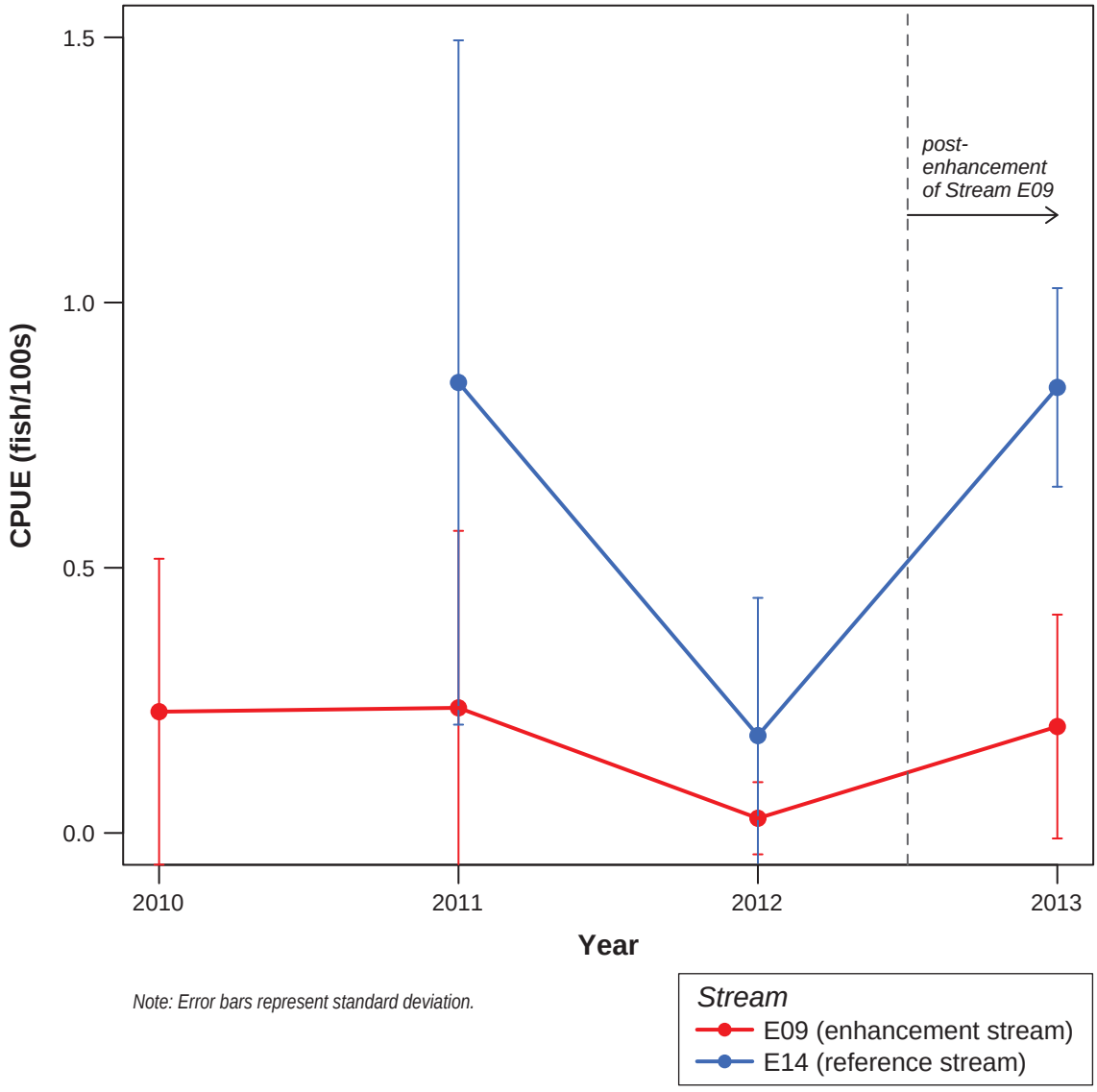
Future monitoring years will increase the ability to evaluate Arctic Char production by employing two comparison tests. First, changes in density will be examined by observing if CPUE at E09-US increases to non-zero values that are on-par with reference sites within the stream. The second test, comparing overall production in Stream E09 to reference Stream E14, will indicate if density of Stream E09 increases over time compared to reference stream. The two comparisons are complementary and important for different reasons. The first comparison directly tests if the enhancement provides fish to access the upper reaches of Stream E09 and, thus, additional habitat for foraging and rearing. Trends of CPUE over time within Stream E09 suggest that fewer fish use the upper reaches: Figure 4.1-1 shows that the greatest CPUE was observed in the site nearest Roberts Lake (E09-DS), followed by the middle range site (E09-MID), and then zero catches in upper enhancement site (E09-US).



Note: Error bars represent standard deviation.

Average Annual CPUE of Juvenile Arctic Char at Enhancement and Reference Sites in Stream E09, 2010 to 2013

Figure 4.1-1



Note: Error bars represent standard deviation.

Figure 4.1-2

Average Annual CPUE of Juvenile Arctic Char at Stream E09 and Stream E14, 2010 to 2013

The distribution of juvenile char in Stream E09 is likely influenced by channel morphology, in which a number of cascades in the final 300 m before Stream E09 enters Roberts Lake possibly creates an obstacle to upstream migration (to sites E09-MID and E09-US) especially during low discharge years. Because of the channel obstacle, CPUE at the enhancement site E09-US may never reach levels equal to the downstream reference locations (E09-DS and E09-MID). This scenario does not necessarily indicate that density has not increased because sampling is only a snapshot in time and efforts could simply not capture fish if numbers remain low. The second comparison, comparing Stream E09 to reference Stream E14, does not rely on capturing fish above the enhancement structure to determine the efficacy of the compensation project. Instead, it examines whether or not Arctic Char production in Stream E09 has increased, as a whole, compared to a reference stream. If enhancement does increase density of Arctic Char, an increase in CPUE across Stream E09 is expected as juveniles migrate among sites along its entire length.

4.1.4 Enhancement Stability Assessment

The two juvenile Arctic Char rearing pools were similar in size in 2013 as to when they were constructed in 2012 (Table 4.1-1). They currently have a total area of 11.5 m^2, exceeding the requirements of the approved design by 3.5 m^2 (Golder 2007). There were no signs of structural instabilities; no infilling or erosion was observed (Plates 4.1-1 and 4.1-2). Transplanted and riparian vegetation has recovered well; no dead or dying plants were observed.

Table 4.1-1. Dimensions of Stream E09 Enhancement Pools in 2012 and 2013

Year	Upstream Pool Area (m^2)	Mean Upstream Pool Depth (mm)	Downstream Pool Area (m^2)	Mean Upstream Pool Depth (mm)	Total Pool Area (m^2)
2013	4.6	220	6.9	200	11.5
2012	5	190	6.7	180	11.7

The channel area was poorly defined and consisted of dense vegetation and braided flow prior to enhancement. In 2012, a small channel was created upstream and downstream of the pools to connect them to the nearest naturally occurring pools. The new channel remained stable and should provide improved connectivity in this reach.

4.2 ROBERTS LAKE OUTFLOW ENHANCEMENT MONITORING PROGRAM

4.2.1 2013 Arctic Char Monitoring

A total of 2011 fish (1,537 Arctic Char, 467 Lake Trout, and seven Lake Whitefish (*Coregonus clupeaformis*) were identified in underwater video recordings from two infra-red fish counting fences at Roberts Lake Outflow in 2013. Appendix 3.2-1 lists species, date, direction of migration, and total length for all fish records.

The number of Arctic Char migrating upstream per day at the fish fence downstream of the boulder garden ranged between 0 and 40, while at the upstream fence the range was from 0 to 28 (Figure 4.2-1). The main upstream run commenced on August 7 and appeared to be receding toward the end of the sampling period; however, power supply failure at the downstream fence on September 5 terminated the program early and it is unknown if additional upstream migrants arrived later.

Plate 4.1-1. The upstream juvenile Arctic Char enhancement pool, 17 July 2013.

Plate 4.1-2. The downstream enhancement pool, 17 July 2013.

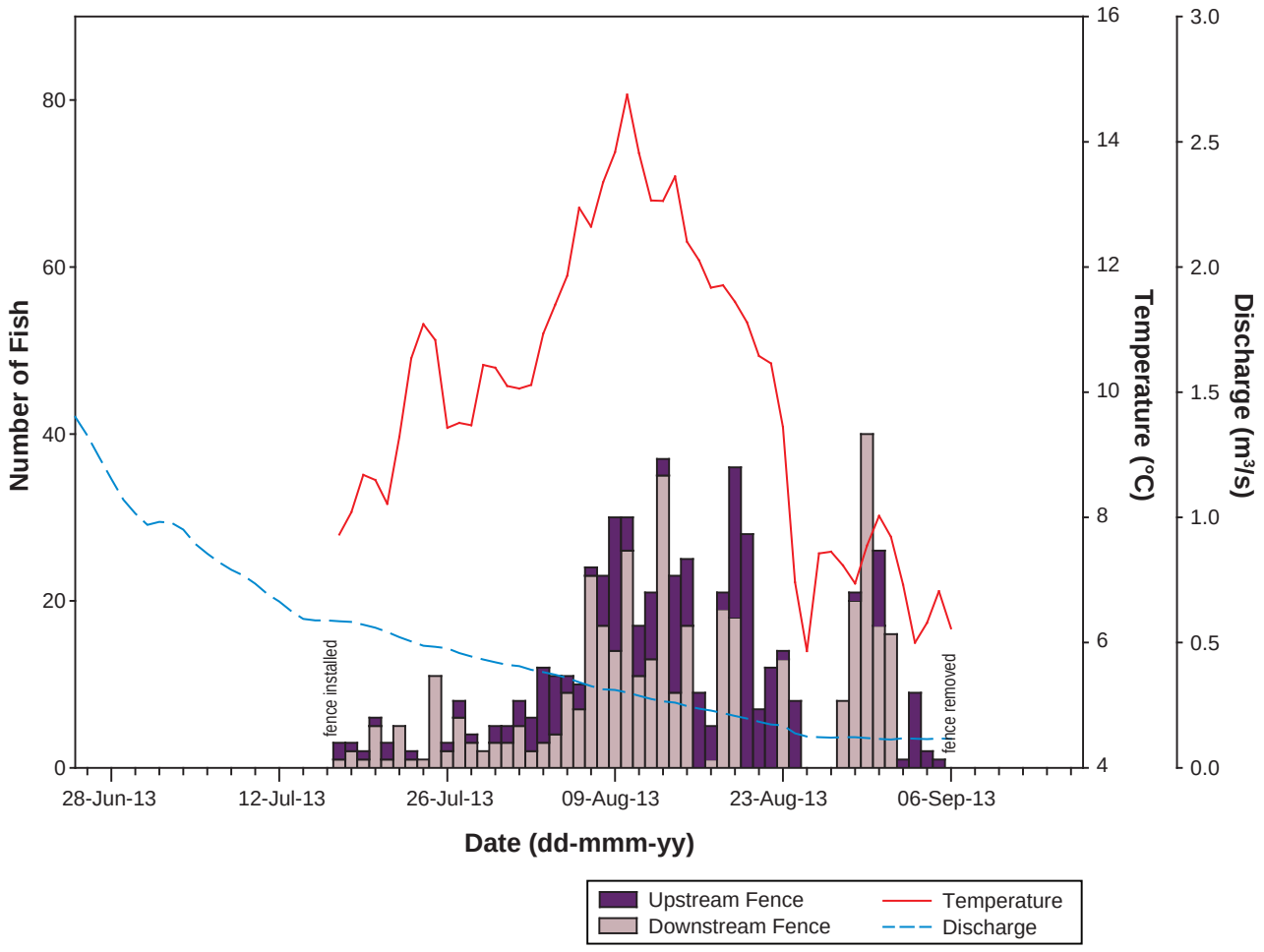


Figure 4.2-1

Water Temperature, Discharge, and Number of Arctic Char per Day in Roberts Lake Outflow, Doris North Project, 2013

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No Arctic Char passed through either fence for three days toward the end of August. This coincided with a wind storm that had gusts in excess of 100 km/h (ERM Rescan 2014c) and a drop in water temperature (Figure 4.2-1). Both scanners remained in operation throughout this period, so the storm appears to have reduced fish activity.

The range in total length of adult Arctic Char moving into the lake at the fence upstream of the boulder garden (350 mm to 1,170 mm) was similar to the downstream fence (350 mm to 1,240 mm; Figure 4.2-2), indicating that fish length did not influence survival probability. This supports results from previous years, which also suggest survival through the boulder garden was not associated with length (Rescan 2013).

4.2.2 Pre- and Post-enhancement Survival

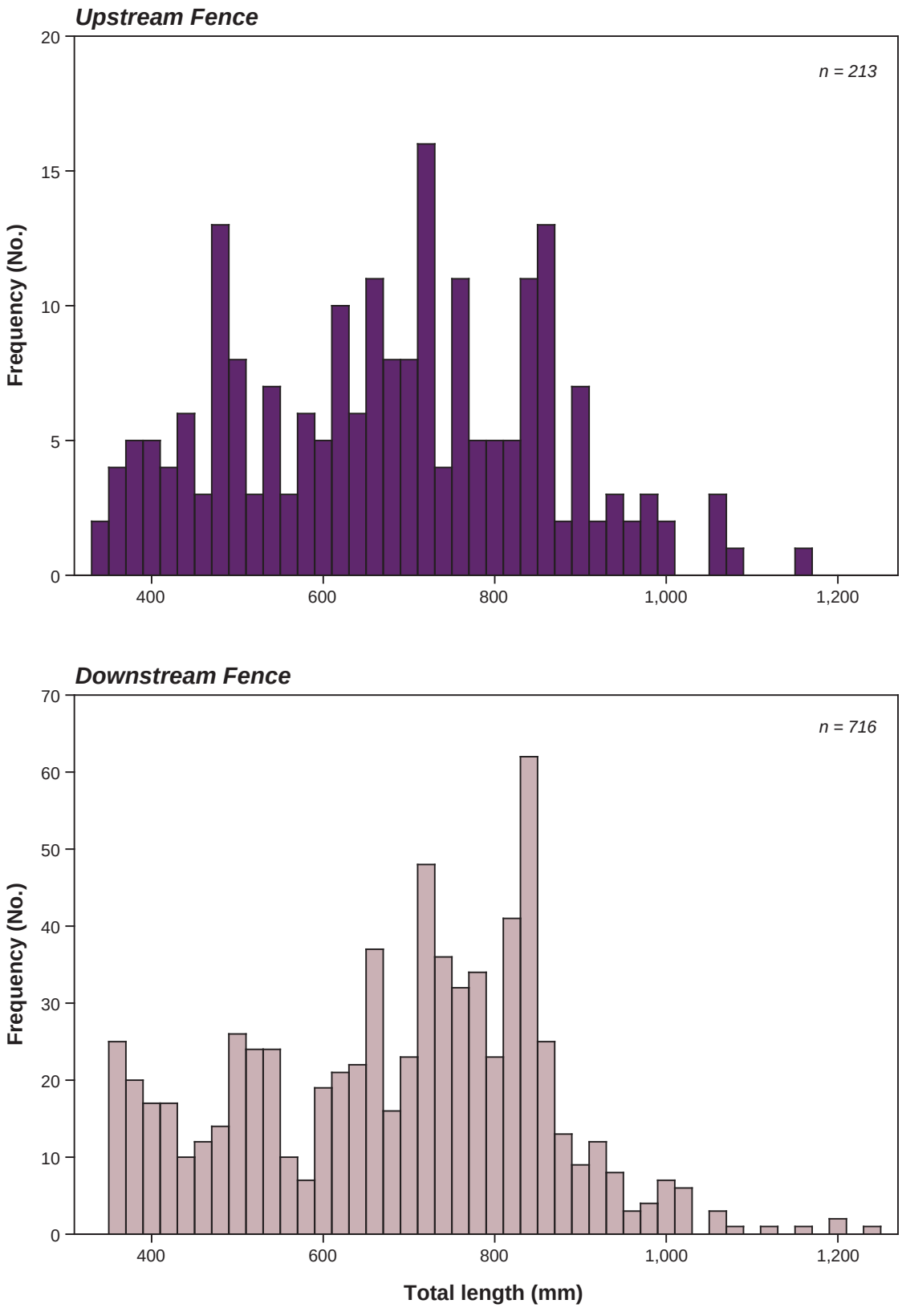
Post-enhancement survival through the boulder garden was 93%: significantly greater in 2013 when compared to combined survival prior to enhancement ($\chi^2_{(1, 5)}$ = 13.00, P < 0.001). A total of 211 of 226 Arctic Char successfully passed through the boulder garden in 2013 (Table 4.2-1). The remaining 15 fish (7%) were unaccounted for, possibly dying as a result of stranding in the boulder garden or predation.

Table 4.2-1. Summary of the Readjusted Survival Rates of Arctic Char Passing Upstream through Roberts Lake Outflow, Doris North Project, 2003 to 2013

Year	Sample Timing	Sampling Period	Mean Flow (m^3/s)	Total Fish	Successful Fish	Unsuccessful Fish	Percent Survival (%)
2003	Pre-enhancement	August 7 - August 30	0.67	286	221	65	77
2004	Pre-enhancement	August 9 - September 2	0.15	106	34	72	32
2005	Pre-enhancement	August 4 - September 12	0.57	110	52	58	47
2010	Pre-enhancement	June 30 - August 17	1.32	47	37	10	79
2012	Pre-enhancement	July 30 - August 23	0.74	144	83	61	58
Average	**Pre-enhancement**	**2003 to 2012**	**0.69**	**139**	**85**	**53**	**62**
2013	Post-enhancement	July 18 – September 6	0.29	226	211	15	93

Variability in yearly survival was high in pre-enhancement years and ranged from 32% to 79% (Table 4.2-1) (Note: these percentages only reflect survival during the sampling interval, and not the entire run for that year, as outlined in Section 3.2). Combined pre-enhancement survival was 62%, with a total of 693 adult Arctic Char passing the fence downstream of the boulder garden and 427 upstream over 216 days of sampling in five years.

To further examine which particular pre-enhancement years were significantly lower in survival than 2013, each pre-enhancement year was tested against survival in 2013 separately. These comparisons showed that survival in 2013 was significantly greater than three of the five years of pre-enhancement data (greater than 2012, 2005, and 2004; Table 4.2-2), though survival in 2013 was always higher (by a minimum of 24%) than pre-enhancement years.



Arctic Char Absolute Total Length-Frequency Distribution for Upstream Migrants at each Fish Counting Fence in Roberts Lake Outflow, Doris North Project, 2013

Figure 4.2-2

Table 4.2-2. Comparisons of Post-Enhancement Survival to Each Pre-enhancement Year for Arctic Char in Roberts Lake Outflow, Doris North Project, 2003 to 2013

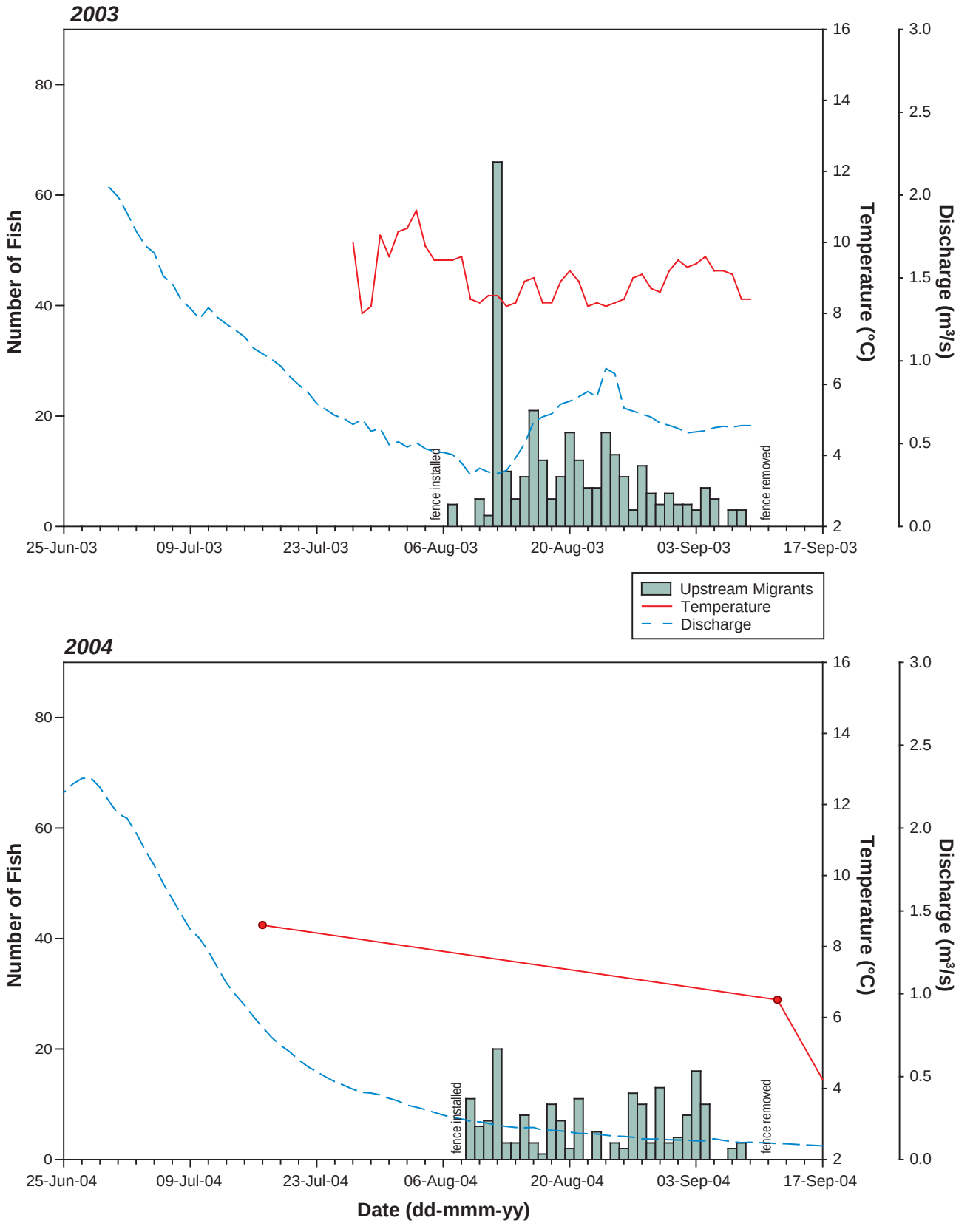
Comparison	χ^2	Degrees of Freedom	FDR Adjusted *P* Value
2013 vs 2012	8.18	1	<0.01
2013 vs 2010	0.40	1	0.53
2013 vs 2005	12.29	1	0.001
2013 vs 2004	24.50	1	<0.001
2013 vs 2003	2.11	1	0.18

Note: P values were adjusted using the False Discovery Rate to account for multiple comparisons.

The timing of the main pulse of Arctic Char migration does not appear to follow changes in temperature or discharge, nor does the daily migration of individuals. The numbers of Arctic Char captured over the sampling years, with regards to date, temperature, and discharge are shown in Figures 4.2-1 and 4.2-3 through 4.2-5. From these graphs it appears that the main upstream migration period is during the latter half of August, though timing is variable among years. There also appears to be no association between flow and daily fish movement within years (Figures 4.2-1 and 4.2-3 through 4.2-5), as discharge is typically consistently low throughout much of August and September. Annual discharge peaks each year in June, when melting snow and ice create a spring freshet. Discharge monotonically declines throughout the summer in all years, and by late August discharge is at or close to its lowest level of the year.

Although not associated with daily migration, the mean annual flow rate is marginally correlated with survival through the boulder garden in pre-enhancement years ($F_{(1,3)}$ = 6.72, P = 0.08, R^2 = 0.69). Pre-enhancement years experiencing lower mean annual flow also experience significantly lower survival rates of Arctic Char through the boulder garden (Figure 4.2-6). The higher than expected survival in 2003 is likely explained by an increase in discharge during the peak of the migration during late August (Figure 4.2-3). This peak was not observed in any other pre-enhancement year and after removing 2003 as an outlier from the regression analysis, the relationship between survival and mean annual flow became significant ($F_{(1,3)}$ = 383.4, P = 0.002, R^2 = 0.99).

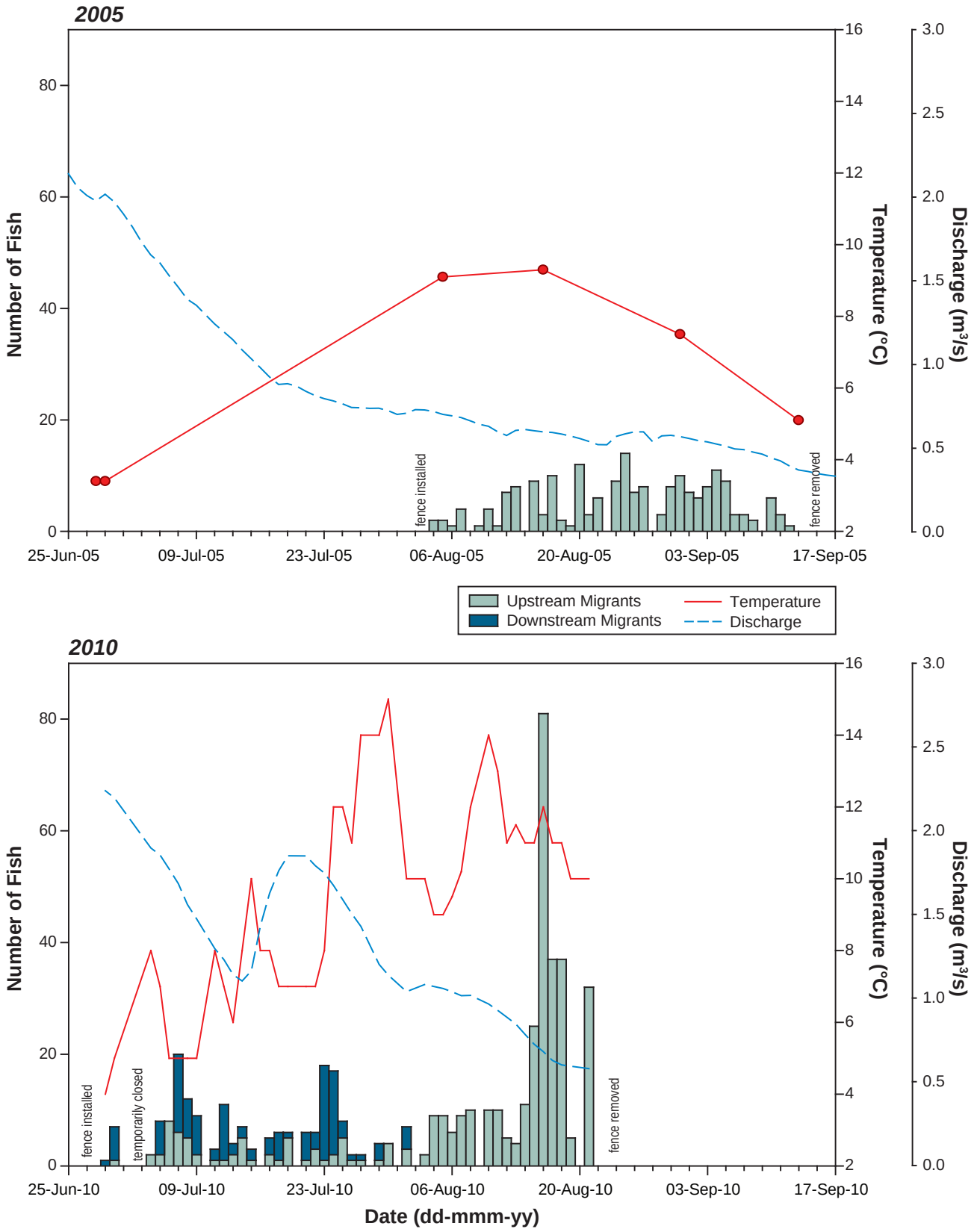
Post-enhancement survival in 2013 was much higher than that predicted by the regression of survival on mean discharge from pre-enhancement years (Figure 4.2-6). The regression model predicted a survival rate of 43% based on the flow experienced in 2013. The observed rate was 50 percentage points (93%) greater than the predicted rate, representing a 116% increase in the observed over the predicted survival rate. In addition, the observed 2013 survival rate was 14 percentage points greater than the highest survival rate from any one year of pre-enhancement data (in 2010 survival was 79%), indicating an 18% increase between these years. Survival was greater in 2013 even though flow was 355% higher in 2010 (1.32 m^3/s in 2010 vs. 0.29m^3/s in 2013). Lastly, survival in 2013 was well beyond the 95% confidence interval of the linear prediction of survival on flow (Figure 4.2-6), lying 2.52 SD from the regression line. This strongly indicates that 2013 survival rate is a significant outlier in the analysis and that post-enhancement survival may no longer be associated with flow as seen in baseline years. This result indicates that the enhanced channels in Roberts Outflow greatly reduced mortality in the boulder garden and is a strong early sign that the enhancement is functioning as it was intended.



Notes: Dots indicate measured values and the associated line is the assumed missing data.
This was used when daily values were not available

Water Temperature, Discharge, and Number of Arctic Char per Day in Roberts Lake Outflow, Doris North Project, 2003 and 2004

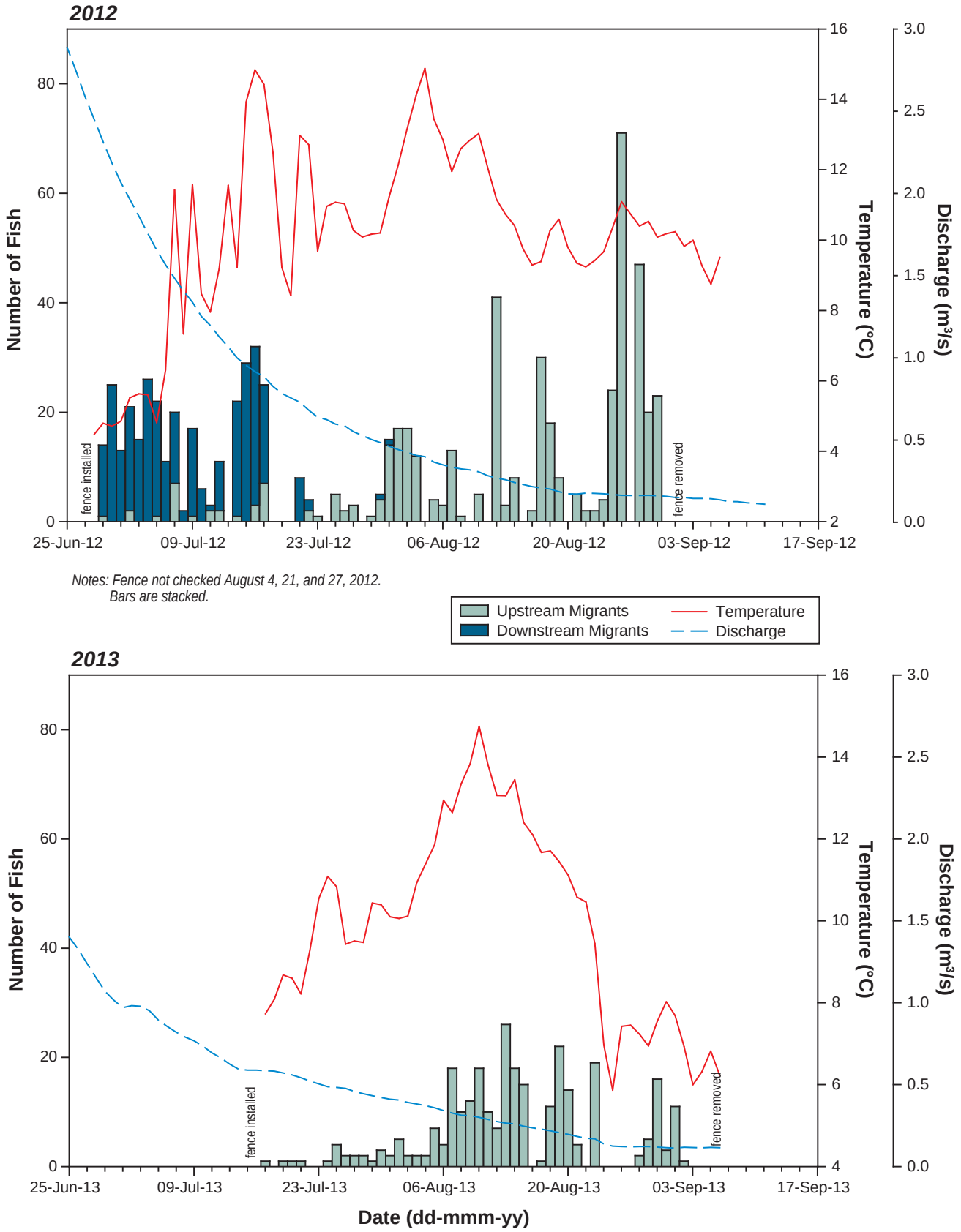
Figure 4.2-3



Notes: Dots indicate measured values and the associated line is the assumed missing data.
This was used when daily values were not available.
Bars are stacked.

Water Temperature, Discharge, and Number of Arctic Char per Day in Roberts Lake Outflow, Doris North Project, 2005 and 2010

Figure 4.2-4



Water Temperature, Discharge, and Number of Arctic Char per Day in Roberts Lake Outflow, Doris North Project, 2012

Figure 4.2-5

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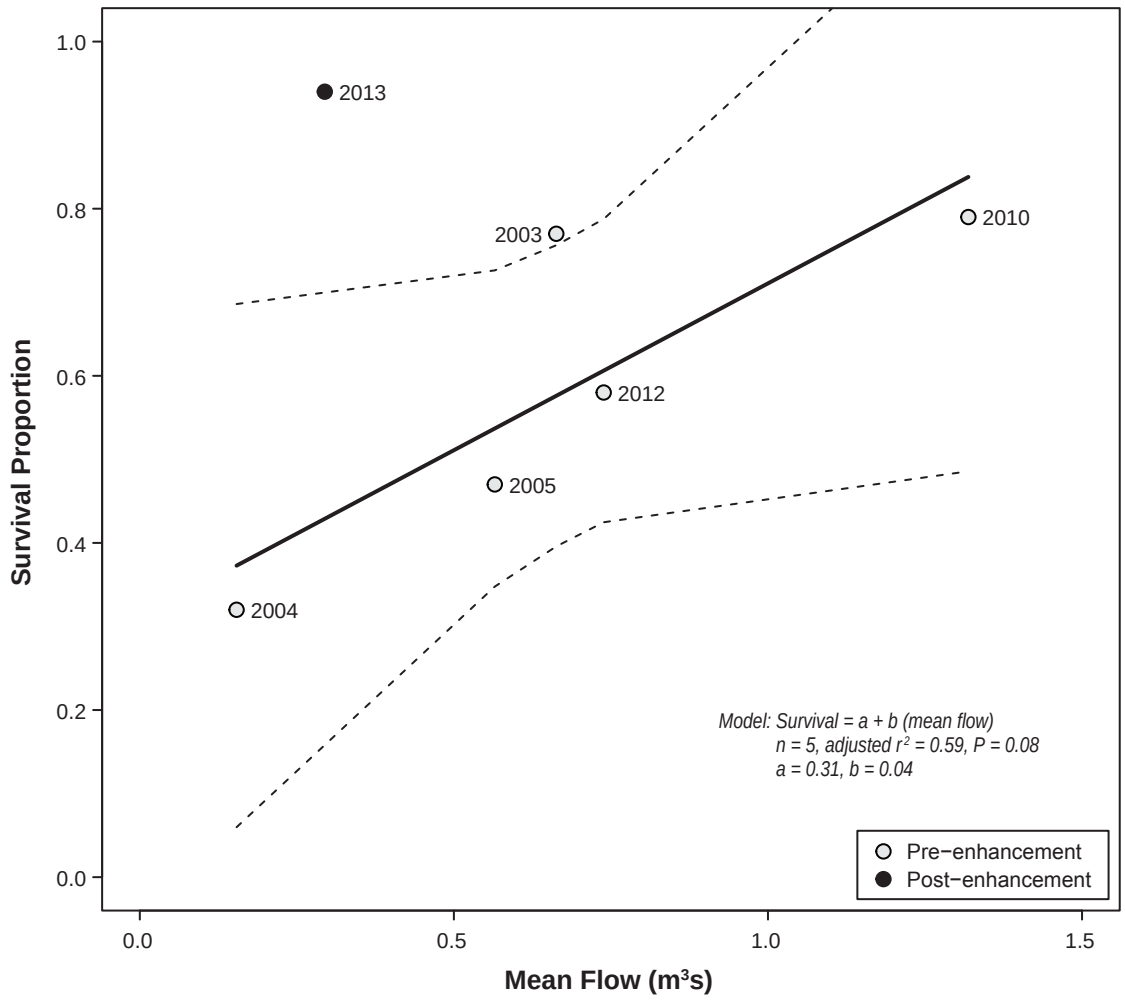

Notes: Dotted lines represent 95% CI.
Solid line represent best fit linear repression.

Figure 4.2-6

Relationship Between Discharge and Adult Arctic Char Survival in Pre and Post-Enhancement Years

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4.2.3 Wildlife

Predator activity at the boulder garden was lower in 2013 than in 2012. The percentage of days grizzly bears were documented at the site by wildlife cameras fell from 46% in 2012 to 30% in 2013. Wolf presence showed similar trends, falling from 75% of days in 2012 to 54% in 2013. Low discharge rates were experienced in all monitored watersheds in the Project area in 2013 (ERM Rescan 2014b). Presumably this led to increases in stranding and a corresponding increase in foraging opportunities for predators in other streams. If the enhancement channels reduced stranding at the boulder garden in 2013, wildlife may have focused their foraging efforts elsewhere.

Predators visit the boulder garden on most days during the Arctic Char migration. Wolves visited the site 72 times on 34 different days over the 63 day period when the remote cameras operated. In the same time period bears visited 23 times on 19 different days (Appendix 3.2-2). Plate 4.2-1 shows a remote camera photograph of a grizzly bear sow and two cubs searching for fish in the downstream section of the boulder garden and in Plate 4.2-2 a wolf (*Canis lupus*) is feeding on a fish in the boulder garden.

Plate 4.2-1. A grizzly bear and two cubs fishing at the downstream end of the boulder garden, August 4, 2013.

Wildlife interactions were lower in 2013 than in previous years as the automation of fish monitoring greatly reduced the hours crews spent at site. In 2013, the crew could not visit the site once during fence installation as there was a pack of several wolves in the immediate area and once during fence deconstruction as a sow and two cubs were at the boulder garden. On both occasions the animals were observed from the air and the helicopter returned the crew to camp. In 2012, field crews observed grizzly bears on 16 different days at or immediately around the boulder garden (Rescan 2013), and they had to be evacuated from site by helicopter on almost every occasion.

Plate 4.2-2. A wolf feeds on a fish in the boulder garden, August 18, 2013.

4.2.4 Enhancement Stability Assessment

The 2013 assessment of the enhancement channels found them to be structurally stable; no signs of infilling or erosion were observed in any of the channels. Each channel was inspected and no obstacles to fish movement were observed, even during low flow conditions in September. Plates 4.2-3 to 4.2-5 present representative photos that show the conditions of the channels toward the end of the 2013 open water season.

In 2012, field crews observed adult Arctic Char easily passing through the boulder garden after the channels were constructed and survival through the boulder garden in 2013 was the highest on record despite extremely low discharge conditions. The visual inspection found that the channels appear stable and show no signs of erosion or infilling. These factors indicate that the channels are functioning as intended, and they have not deteriorated in the year following construction.

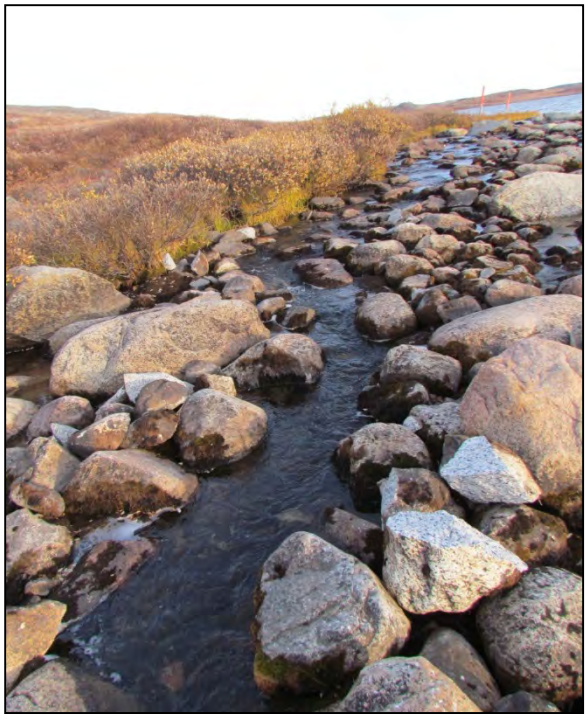

Plate 4.2-3. The channel adjacent to the right bank of the boulder garden, September 18, 2013.

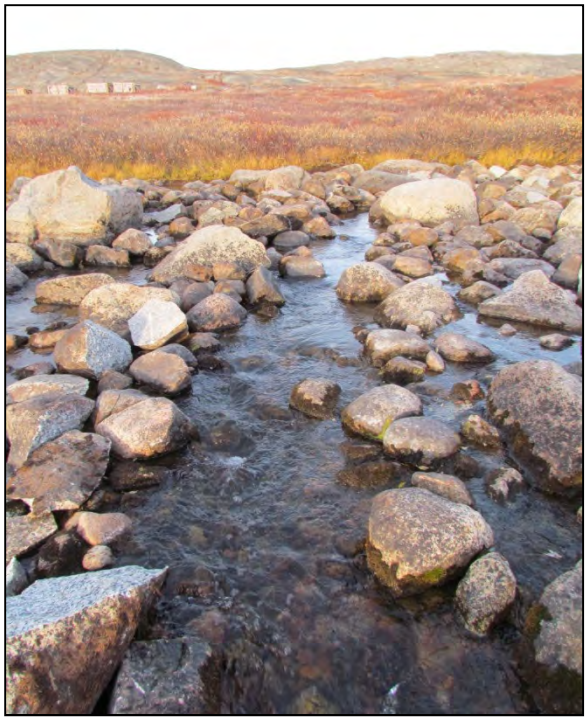

Plate 4.2-4. The channel constructed diagonally across the stranding zone, September 18, 2013.

Plate 4.2-5. An additional channel was constructed along the left bank in an area where stranding was previously observed, September 18, 2013.

5. Summary

5. Summary

The objective of the Roberts Lake and Outflow Fish Compliance Monitoring Program is to evaluate whether the enhancements to Roberts Lake Outflow and Stream E09 have increased the productive capacity of anadromous Arctic Char in the watershed. The increase in productive capacity is to offset for the losses (and therefore achieve no net loss) of fish habitat in Tail Lake. The assessments conducted in 2013, and described herein, fulfill the requirements to monitor during the first year following enhancement. These requirements were laid out in the Fisheries Authorization for the Project (NU-02-0117.2) and in the Project's No Net Loss Plan and its updates (Golder 2007; Rescan 2010a, 2010b).

5.1 ROBERTS LAKE TRIBUTARY MONITORING PROGRAM

Stream E09 was selected for habitat enhancement as it has adequate baseline flow throughout the summer and was already used by rearing juvenile Arctic Char in low abundance. In 2012, two pools were constructed to provide additional rearing habitat for juvenile Arctic Char.

Visual inspection of the enhancement pools in 2013 confirmed that they were stable and exhibited no signs of infilling or erosion. Instream and riparian vegetation appears to be recovering well. The combined surface area of the pools was 11.5 m^2, exceeding the NNLP requirements by 3.5 m^2.

Pre-enhancement electrofishing efforts consistently failed to capture any fish in the enhancement site in Stream E09. Although this pattern was also observed in the single year post-enhancement, additional seasoning of the habitat is required before drawing firm conclusions as to the efficacy of the compensation.

5.2 ROBERTS LAKE OUTFLOW FISH MIGRATION MONITORING PROGRAM

Channels constructed in the boulder garden in 2012 were designed to improve survival of anadromous Arctic Char migrating to critical overwintering habitat in Roberts Lake, particularly during periods of low discharge. Field crews observed an immediate improvement in the ability of fish to pass through the boulder garden following the completion of the channels in 2012. No signs of structural degradation were observed in 2013. There are currently 69 m of functioning channels in the boulder garden, far more than the 12 to 15 m required by the NNLP.

The first year of post-enhancement monitoring indicates that the channels reduce mortality in the boulder garden even during periods of low discharge. Survival of Arctic Char was 93% in 2013; the average for all pre-enhancement years was 62%. This high rate of survival occurred despite an average of 58% less discharge in Roberts Creek in 2013 compared to baseline years (0.29 m^3/s in 2013; 0.69 m^3/s in all pre-enhancement years), which usually hinders fish migrations. Only one year of post-enhancement monitoring has occurred, but these early results indicate that the enhancement is functioning as it was intended and it is likely to increase the number of Arctic Char returning to overwinter and spawn in Roberts Lake.

Predator activity at the boulder garden was lower in 2013 than in 2012. The percentage of days grizzly bears were at the site fell from 46% in 2012 to 30% in 2013. Wolf presence showed similar trends, falling from 75% of days in 2012 to 54% in 2013. Low discharge rates were experienced in all monitored watersheds in the Project area in 2013, presumably leading to high rates of stranding and a corresponding increase in foraging opportunities for predators in other streams. Decreased stranding caused by the enhancement channels at the boulder garden in 2013 may have caused wildlife to focus their foraging efforts elsewhere. In addition, human-wildlife interactions decreased from 16 in 2012 to two in 2013.

References

References

Definitions of the acronyms and abbreviations used in this reference list can be found in the Glossary and Abbreviations section.

1985. *Fisheries Act*, RSC 1985. C. F-14.

ERM Rescan. 2014a. *Doris North Project: 2013 Aquatic Effects Monitoring Program Report*. Prepared for TMAC Resources Inc. by ERM Rescan: Yellowknife, NT.

ERM Rescan. 2014b. *Doris North Project: 2013 Hydrology Compliance Monitoring Report*. Prepared for TMAC Resources Inc. by ERM Rescan: Yellowknife, NT.

ERM Rescan. 2014c. *Doris North Project: 2013 Compliance Monitoring Program - Meteorology*. Prepared for TMAC Resources Inc. by ERM Rescan: Yellowknife, NT.

Ferriera, L. 1999. Macroscopic Structure of the Fin-rays and their Annuli in Pectoral and Pelvic Fins of Chinook Salmon, *Oncorhynchus tshawytscha*. *J. Morphol*. 239:297-320.

Golder. 2005. *Doris North Project Aquatic Studies 2004*. Prepared for Miramar Hope Bay Ltd. by Golder Associates Ltd.: Edmonton, AB.

Golder. 2006. *Doris North Project Aquatic Studies 2005*. Prepared for Miramar Hope Bay Ltd. by Golder Associates Ltd.: Edmonton, AB.

Golder. 2007. *Doris North Project No Net Loss Plan, Revision 6, 2007*. Prepared for Miramar Hope Bay Ltd. by Golder Associates Ltd.: Edmonton, AB.

Golder. 2008a. *Doris North Project Aquatic Studies 2006*. Prepared for Miramar Hope Bay Ltd. by Golder Associates Ltd.: Edmonton, AB.

Golder. 2008b. *Doris North Project Aquatic Studies 2007*. Prepared for Miramar Hope Bay Ltd. by Golder Associates Ltd.: Edmonton, AB.

Johnson, D. H., B. M. Shrier, J. S. O'Neal, J. A. Knutzen, X. Augerot, T. A. O'Neil, and T. N. Persons. 2007. *Salmonid Field Protocols Handbook: Techniques for Assessing Status and Trends in Salmon and Trout Populations*. Bethesda, MD: American Fisheries Society.

Koch, J. D., and M. C. Quist. 2007. A Technique for Preparing Fin Rays and Spines for Age and Growth Analysis. *North American Journal of Fisheries Management* 27:781-784.

Pinheiro, J.C., and D.M. Bates. 2000. *Mixed-Effects Models in S and S-PLUS*. Berlin, Germany: Springer.

R Core Team. 2013. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing.

Rescan. 2010a. *Hope Bay Belt Project: Updates to the Doris North No Net Loss Plan for Tail Lake*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2010b. *Hope Bay Belt Project: Updates to the Doris North No Net Loss Plan for Tail Outflow*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2011. *Hope Bay Belt Project: 2010 Freshwater Fish and Fish Habitat Baseline Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2012a. *Doris North Gold Mine Project: Roberts Outflow and E09 Fish Habitat Enhancement Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2012b. *Doris North Gold Mine Project: 2011 Tail Lake Fish-out Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2012c. *Doris North Gold Mine Project: Doris Mine Site Fisheries Authorization Monitoring Report 2011*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

Rescan. 2013. *Doris North Gold Mine Project: 2012 Roberts Lake and Outflow Fish Monitoring Report*. Prepared for Hope Bay Mining Ltd. by Rescan Environmental Services Ltd.: Vancouver, BC.

RL&L / Golder. 2003a. *Doris North Project Aquatic Studies 2002*. Prepared for Miramar Hope Bay Ltd. by RL&L Environmental Services Ltd. and Golder Associates Ltd.: Edmonton, AB.

RL&L / Golder. 2003b. *Doris North Project Aquatic Studies 2003*. Prepared for Miramar Hope Bay Ltd. by RL&L Environmental Services Ltd. and Golder Associates Ltd.: Edmonton, AB.

Scott, W. B., and E. J. Crossman. 1973. *Freshwater Fishes of Canada*. Oakville, ON: Galt House Publications Ltd.

Stanfield, L.W. 2005. *Ontario Stream Assessment Protocol*. Aquatic Research and Development Section, Ontario Ministry of Natural Resources: Picton, ON.

Swanson, H. K., K. A. Kidd, J. A. Babaluk, R. J. Wastle, P. P Yang, N. M. Halden, and, J. D. Reist. 2010. Anadromy in in Arctic Populations of Lake Trout (*Salvelinus namaycush*): Otolith Microchemistry, Stable Isotopes, and Comparison with Arctic Char (*Salvelinus alpinus*). *Canadian Journal of Fisheries and Aquatic Sciences* 67: 842-853.

Whitlock, M.C., and Schluter, D. 2009. *The Analysis of Biological Data*. Greenwood Village, CO: Roberts and Company Publishers.

Personal Communications

Williston, G. 2012a. Habitat Management Biologist, Fisheries and Oceans Canada, Prescott, ON. Personal Communication to M. McGurk, Hope Bay Mining Ltd.: August 27, 2012.

Williston, G. 2012b. Habitat Management Biologist, Fisheries and Oceans Canada, Prescott, ON. Personal Communication to A. Holzapfel, Hope Bay Mining Ltd: December 5, 2012.

Appendix 3.1-1

Catch and Effort Data from Electrofishing in Tributaries of Roberts Lake, Doris North Project, 2013

ERM

Appendix 3.1-1. Catch and Effort Data from Electrofishing in Tributaries of Roberts Lake, Doris North Project, 2013

Date (dd/mm/yy)	Site	Pass No.	Effort (s)	Species	Catch
10-Jul-13	E09 - DS	1	301	AC	3
10-Jul-13	E09 - DS	2	288	AC	1
10-Jul-13	E09 - DS	2	288	NSB	1
10-Jul-13	E09 - DS	3	331	AC	1
10-Jul-13	E09 - M	1	308	-	-
10-Jul-13	E09 - M	2	274	AC	1
10-Jul-13	E09 - M	3	299	-	-
10-Jul-13	E09 - US	1	258	-	-
10-Jul-13	E09 - US	2	216	-	-
10-Jul-13	E09 - US	3	255	-	-
10-Jul-13	E14	1	324	AC	4
10-Jul-13	E14	1	324	NSB	2
10-Jul-13	E14	2	411	AC	3
10-Jul-13	E14	2	411	LT	2
10-Jul-13	E14	3	388	AC	2
17-Jul-13	E09 - DS	1	220	AC	2
17-Jul-13	E09 - DS	1	220	NSB	1
17-Jul-13	E09 - DS	2	224	-	0
17-Jul-13	E09 - DS	3	218	AC	1
17-Jul-13	E09 - DS	3	218	NSB	1
17-Jul-13	E09 - M	1	233	AC	1
17-Jul-13	E09 - M	2	199	-	-
17-Jul-13	E09 - M	3	218	-	-
17-Jul-13	E09 - US	1	295	-	-
17-Jul-13	E09 - US	2	239	-	-
17-Jul-13	E09 - US	3	230	-	-
17-Jul-13	E14	1	303	AC	4
17-Jul-13	E14	1	303	LT	1
17-Jul-13	E14	2	412	AC	5
17-Jul-13	E14	3	435	AC	3
17-Jul-13	E14	3	435	NSB	1
22-Jul-13	E09 - DS	1	223	AC	1
22-Jul-13	E09 - DS	2	248	AC	1
22-Jul-13	E09 - DS	3	275	AC	1
22-Jul-13	E09 - DS	3	275	NSB	1
22-Jul-13	E09 - M	1	249	AC	1
22-Jul-13	E09 - M	2	220	-	-
22-Jul-13	E09 - M	3	246	-	-
22-Jul-13	E09 - US	1	360	-	-
22-Jul-13	E09 - US	2	309	-	-
22-Jul-13	E09 - US	3	333	-	-
22-Jul-13	E14	1	426	AC	4
22-Jul-13	E14	2	371	AC	2
22-Jul-13	E14	3	388	AC	2
22-Jul-13	E14	3	388	LT	1

Species Code: AC = Arctic Char, LT = Lake Trout, NSB = Ninespine Stickleback

Dashes indicate not applicable

Appendix 3.1-2

Biological Data from Electrofishing in Roberts Lake Tributaries, Doris North Project, 2013

ERM

Appendix 3.1-2. Biological Data from Electrofishing in Roberts Lake Tributaries, Doris North Project, 2013

Date (dd/mm/yy)	Site	Pass	Species Code	Fork Length (mm)	Age (Years)	Marker	PIT Tag No.	Recap (Y/N)
10-Jul-13	E09 - DS	1	AC	72	-	FC	-	N
10-Jul-13	E09 - DS	1	AC	86	-	FC	-	N
10-Jul-13	E09 - DS	1	AC	67	-	FC	-	N
10-Jul-13	E09 - DS	2	AC	78	-	FC	-	N
10-Jul-13	E09 - DS	2	NSB	60	-	-	-	-
10-Jul-13	E09 - DS	3	AC	90	-	FC	-	N
10-Jul-13	E09 - M	2	AC	70	-	FC	-	N
10-Jul-13	E14	1	AC	84	-	FC	-	N
10-Jul-13	E14	1	AC	99	-	FC	-	N
10-Jul-13	E14	1	AC	72	-	FC	-	N
10-Jul-13	E14	1	AC	68	-	FC	-	N
10-Jul-13	E14	1	NSB	60	-	FC	-	N
10-Jul-13	E14	1	NSB	61	-	FC	-	N
10-Jul-13	E14	2	AC	90	-	FC	-	N
10-Jul-13	E14	2	AC	82	-	FC	-	N
10-Jul-13	E14	2	AC	89	-	-	-	Y
10-Jul-13	E14	2	LT	109	-	-	-	-
10-Jul-13	E14	2	LT	124	-	-	-	-
10-Jul-13	E14	3	AC	79	-	-	-	Y
10-Jul-13	E14	3	AC	66	-	FC	-	N
17-Jul-13	E09 - DS	1	AC	74	-	-	-	Y
17-Jul-13	E09 - DS	1	AC	70	1	FC	-	N
17-Jul-13	E09 - DS	1	NSB	57	-	-	-	N
17-Jul-13	E09 - DS	3	NSB	64	-	-	-	N
17-Jul-13	E09 - DS	3	AC	79	1	FC	-	N
17-Jul-13	E09 - M	1	AC	142	-	-	900026000149714	N
17-Jul-13	E14	1	LT	223	-	-	-	-
17-Jul-13	E14	1	AC	80	1	FC	-	N
17-Jul-13	E14	1	AC	92	1	FC	-	N
17-Jul-13	E14	1	AC	68	1	FC	-	N
17-Jul-13	E14	1	AC	69	1	FC	-	N
17-Jul-13	E14	2	AC	157	4	FC	-	N
17-Jul-13	E14	2	AC	74	1	FC	-	N
17-Jul-13	E14	2	AC	88	1	FC	-	N
17-Jul-13	E14	2	AC	82	1	FC	-	N
17-Jul-13	E14	2	AC	78	2	FC	-	N
17-Jul-13	E14	3	AC	88	2	FC	-	N
17-Jul-13	E14	3	AC	89	2	FC	-	N
17-Jul-13	E14	3	AC	77	1	-	-	Y
17-Jul-13	E14	3	NSB	32	-	-	-	-
22-Jul-13	E09 - DS	1	AC	85	1	FC	-	N
22-Jul-13	E09 - DS	2	AC	153	4	FC	-	N
22-Jul-13	E09 - DS	3	AC	77	-	-	-	Y
22-Jul-13	E09 - DS	3	NSB	56	-	-	-	-
22-Jul-13	E09 - M	1	AC	142	-	-	900026000149714	Y
22-Jul-13	E14	1	AC	80	1	FC	-	N
22-Jul-13	E14	1	AC	77	1	FC	-	N
22-Jul-13	E14	1	AC	74	1	FC	-	N
22-Jul-13	E14	1	AC	73	1	FC	-	N
22-Jul-13	E14	2	AC	88	-	-	-	Y
22-Jul-13	E14	2	AC	71	-	-	-	Y
22-Jul-13	E14	3	LT	298	-	-	-	-
22-Jul-13	E14	3	AC	72	1	FC	-	N
22-Jul-13	E14	3	AC	77	-	-	-	Y

Species Code: AC = Arctic Char, NSB = Ninespine Stickleback, LT = Lake Trout

FC: Fin clipped

Recaptured in 2013: Y = yes, N = no

Dashes indicate not applicable

Appendix 3.2-1

Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

ERM

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
16-Jul-13	4:36	U	U	7.6	LT	650
16-Jul-13	4:56	U	U	7.6	LT	450
16-Jul-13	6:15	U	U	7.6	LT	560
16-Jul-13	12:49	U	U	7.6	LT	270
16-Jul-13	14:19	U	U	7.6	LT	430
16-Jul-13	14:27	U	U	7.6	LT	430
16-Jul-13	15:38	U	U	7.6	LT	550
16-Jul-13	18:37	U	U	7.6	LT	690
16-Jul-13	22:41	U	U	7.6	LT	670
17-Jul-13	8:39	U	U	7.7	LT	500
17-Jul-13	9:46	U	U	7.7	LT	520
17-Jul-13	9:50	U	U	7.7	LT	510
17-Jul-13	13:24	D	U	7.7	LT	390
17-Jul-13	13:26	D	D	7.7	LT	310
17-Jul-13	13:28	U	U	7.7	LT	340
17-Jul-13	14:46	U	U	7.7	LT	470
17-Jul-13	14:51	U	U	7.7	LT	420
17-Jul-13	16:55	D	U	7.7	LT	610
17-Jul-13	17:43	U	U	7.7	LT	550
17-Jul-13	18:04	U	U	7.7	LT	490
17-Jul-13	18:13	U	U	7.7	LT	480
17-Jul-13	20:08	D	U	7.7	LT	400
17-Jul-13	20:11	D	D	7.7	LT	360
17-Jul-13	21:25	U	U	7.7	LT	430
17-Jul-13	21:29	U	U	7.7	LT	490
17-Jul-13	21:47	D	U	7.7	LT	370
17-Jul-13	21:47	D	U	7.7	LT	400
17-Jul-13	23:32	D	U	7.7	LT	610
17-Jul-13	23:48	D	U	7.7	LT	390
18-Jul-13	0:34	U	U	8.1	LT	540
18-Jul-13	0:44	U	U	8.1	LT	540
18-Jul-13	6:39	D	U	8.1	AC	1,030
18-Jul-13	7:57	U	U	8.1	LT	510
18-Jul-13	15:51	D	U	8.1	LT	480
18-Jul-13	16:30	D	U	8.1	LT	390
18-Jul-13	19:44	D	D	8.1	AC	-
18-Jul-13	19:44	D	U	8.1	AC	620
18-Jul-13	19:44	D	U	8.1	LT	470
18-Jul-13	19:44	D	U	8.1	LT	-
18-Jul-13	20:12	D	U	8.1	AC	540
18-Jul-13	20:14	D	D	8.1	AC	450
18-Jul-13	20:16	D	D	8.1	AC	600
18-Jul-13	20:17	D	U	8.1	AC	660
18-Jul-13	20:18	D	D	8.1	AC	640
18-Jul-13	20:18	D	U	8.1	AC	660
18-Jul-13	20:20	D	D	8.1	AC	640
18-Jul-13	20:21	D	U	8.1	AC	640

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
18-Jul-13	20:51	D	D	8.1	AC	640
18-Jul-13	22:26	U	U	8.1	LT	520
18-Jul-13	23:40	D	U	8.1	LT	420
18-Jul-13	23:40	D	U	8.1	LT	540
18-Jul-13	23:41	D	U	8.1	LT	450
19-Jul-13	0:38	U	U	8.7	LT	510
19-Jul-13	0:51	U	U	8.7	LT	510
19-Jul-13	0:55	D	U	8.7	AC	800
19-Jul-13	1:01	U	U	8.7	LT	530
19-Jul-13	2:33	D	U	8.7	LT	430
19-Jul-13	2:45	U	U	8.7	LT	550
19-Jul-13	3:33	D	U	8.7	LT	580
19-Jul-13	4:13	U	U	8.7	LT	480
19-Jul-13	4:26	D	D	8.7	LT	470
19-Jul-13	4:26	D	U	8.7	LT	460
19-Jul-13	6:09	D	U	8.7	LT	640
19-Jul-13	6:13	U	U	8.7	LT	400
19-Jul-13	6:41	U	U	8.7	LT	520
19-Jul-13	6:41	U	U	8.7	LT	610
19-Jul-13	6:49	U	U	8.7	LT	530
19-Jul-13	7:34	D	U	8.7	LT	550
19-Jul-13	7:43	D	U	8.7	LT	600
19-Jul-13	8:57	D	U	8.7	LT	870
19-Jul-13	11:20	D	U	8.7	LT	540
19-Jul-13	12:17	D	U	8.7	LT	490
19-Jul-13	12:28	U	U	8.7	LT	510
19-Jul-13	12:30	U	U	8.7	LT	580
19-Jul-13	13:01	U	U	8.7	LT	490
19-Jul-13	14:00	U	U	8.7	LT	500
19-Jul-13	16:09	D	U	8.7	LT	530
19-Jul-13	16:09	D	U	8.7	LT	580
19-Jul-13	16:45	D	U	8.7	LT	490
19-Jul-13	16:45	D	U	8.7	LT	-
19-Jul-13	17:31	U	U	8.7	LT	640
19-Jul-13	18:01	D	U	8.7	LT	500
19-Jul-13	18:43	U	U	8.7	LT	610
19-Jul-13	20:29	U	U	8.7	LT	510
19-Jul-13	21:14	D	U	8.7	LT	580
19-Jul-13	22:05	D	U	8.7	LT	540
19-Jul-13	22:16	D	U	8.7	LT	670
19-Jul-13	22:26	D	U	8.7	LT	460
19-Jul-13	22:52	U	U	8.7	LT	650
19-Jul-13	23:01	U	U	8.7	LT	510
19-Jul-13	23:14	U	U	8.7	LT	510
19-Jul-13	23:37	D	U	8.7	LT	570
20-Jul-13	0:18	U	U	8.6	LT	510
20-Jul-13	0:41	D	U	8.6	LT	700

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
20-Jul-13	1:31	U	U	8.6	LT	640
20-Jul-13	1:59	D	U	8.6	LT	670
20-Jul-13	2:34	U	U	8.6	LT	780
20-Jul-13	2:49	U	U	8.6	LT	520
20-Jul-13	3:46	U	U	8.6	LT	510
20-Jul-13	6:25	D	U	8.6	LT	370
20-Jul-13	8:33	D	U	8.6	LT	600
20-Jul-13	10:30	D	D	8.6	AC	910
20-Jul-13	14:07	D	U	8.6	AC	720
20-Jul-13	15:14	D	D	8.6	AC	900
20-Jul-13	15:14	D	U	8.6	AC	760
20-Jul-13	16:11	D	U	8.6	AC	850
20-Jul-13	16:25	U	U	8.6	LT	430
20-Jul-13	17:06	D	U	8.6	LT	490
20-Jul-13	17:15	D	U	8.6	LT	520
20-Jul-13	18:05	U	D	8.6	LT	380
20-Jul-13	18:06	U	U	8.6	LT	470
20-Jul-13	18:32	D	U	8.6	LT	340
20-Jul-13	18:34	U	U	8.6	LT	540
20-Jul-13	21:35	U	U	8.6	LT	430
20-Jul-13	21:46	D	U	8.6	LT	460
20-Jul-13	22:23	U	U	8.6	LT	430
20-Jul-13	23:27	U	U	8.6	LT	510
20-Jul-13	23:54	D	U	8.6	LT	370
21-Jul-13	0:46	U	U	8.2	LT	510
21-Jul-13	3:11	U	U	8.2	LT	390
21-Jul-13	3:16	U	D	8.2	LT	370
21-Jul-13	4:15	U	U	8.2	LT	330
21-Jul-13	4:21	U	U	8.2	LT	390
21-Jul-13	6:31	D	U	8.2	LT	510
21-Jul-13	7:05	U	U	8.2	LT	480
21-Jul-13	7:25	U	U	8.2	LT	430
21-Jul-13	9:58	D	U	8.2	LT	570
21-Jul-13	10:51	U	U	8.2	LT	510
21-Jul-13	14:09	D	U	8.2	LT	600
21-Jul-13	14:48	U	U	8.2	LT	580
21-Jul-13	14:53	U	U	8.2	LT	450
21-Jul-13	17:45	D	U	8.2	LT	520
21-Jul-13	19:07	U	U	8.2	LT	450
21-Jul-13	20:57	D	U	8.2	LT	510
21-Jul-13	21:38	U	U	8.2	LT	460
21-Jul-13	22:50	D	U	8.2	LT	530
21-Jul-13	23:11	D	U	8.2	AC	810
21-Jul-13	23:54	U	U	8.2	LT	510
21-Jul-13	-	U	U	8.2	LT	330
22-Jul-13	0:44	D	U	9.3	AC	550
22-Jul-13	4:17	D	U	9.3	AC	550

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
22-Jul-13	4:19	D	D	9.3	AC	590
22-Jul-13	4:30	D	U	9.3	AC	660
22-Jul-13	4:32	D	D	9.3	AC	530
22-Jul-13	4:49	D	U	9.3	LT	390
22-Jul-13	4:59	D	D	9.3	AC	680
22-Jul-13	5:03	D	U	9.3	AC	480
22-Jul-13	5:06	D	D	9.3	AC	580
22-Jul-13	5:24	D	U	9.3	AC	510
22-Jul-13	5:25	D	D	9.3	AC	520
22-Jul-13	5:35	D	D	9.3	AC	520
22-Jul-13	5:41	D	D	9.3	AC	540
22-Jul-13	5:46	D	U	9.3	AC	360
22-Jul-13	5:47	D	D	9.3	AC	570
22-Jul-13	5:54	D	D	9.3	AC	510
22-Jul-13	6:04	D	U	9.3	AC	580
22-Jul-13	14:53	U	U	9.3	LT	480
22-Jul-13	15:30	D	D	9.3	LT	400
22-Jul-13	20:15	U	U	9.3	LT	480
22-Jul-13	20:20	D	U	9.3	LT	700
22-Jul-13	21:23	U	U	9.3	LT	620
22-Jul-13	21:27	D	U	9.3	LT	570
22-Jul-13	21:30	U	U	9.3	LT	630
22-Jul-13	22:10	U	U	9.3	LT	510
22-Jul-13	23:42	U	D	9.3	LT	390
22-Jul-13	23:46	U	U	9.3	LT	430
23-Jul-13	0:11	D	U	10.5	LT	400
23-Jul-13	0:24	U	U	10.5	LT	440
23-Jul-13	0:44	D	U	10.5	LT	530
23-Jul-13	1:10	U	U	10.5	LT	360
23-Jul-13	1:34	U	U	10.5	LT	510
23-Jul-13	2:02	U	U	10.5	LT	460
23-Jul-13	3:59	D	U	10.5	LT	420
23-Jul-13	4:15	U	U	10.5	LT	490
23-Jul-13	4:22	U	U	10.5	LT	420
23-Jul-13	10:55	D	U	10.5	LT	510
23-Jul-13	12:17	U	U	10.5	LT	480
23-Jul-13	12:24	U	U	10.5	LT	480
23-Jul-13	17:32	D	U	10.5	LT	450
23-Jul-13	18:15	U	U	10.5	LT	420
23-Jul-13	19:56	D	D	10.5	LT	400
23-Jul-13	20:14	D	U	10.5	LT	400
23-Jul-13	20:33	D	U	10.5	LT	390
23-Jul-13	21:37	U	U	10.5	LT	430
23-Jul-13	22:34	D	D	10.5	LT	520
23-Jul-13	22:56	U	U	10.5	LT	460
24-Jul-13	0:17	D	U	11.1	LT	460
24-Jul-13	1:25	U	D	11.1	LT	390

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
24-Jul-13	1:36	U	U	11.1	LT	430
24-Jul-13	2:24	D	U	11.1	LT	420
24-Jul-13	2:28	D	U	11.1	LT	580
24-Jul-13	3:59	U	U	11.1	LT	580
24-Jul-13	4:27	D	U	11.1	LT	390
24-Jul-13	4:43	D	D	11.1	LT	300
24-Jul-13	10:24	U	U	11.1	LT	350
24-Jul-13	10:33	U	U	11.1	LT	350
24-Jul-13	13:46	D	U	11.1	LT	430
24-Jul-13	14:52	U	U	11.1	LT	400
24-Jul-13	15:15	D	U	11.1	AC	360
24-Jul-13	20:39	D	U	11.1	LT	600
24-Jul-13	21:24	U	U	11.1	LT	570
24-Jul-13	21:45	D	D	11.1	LT	720
24-Jul-13	21:55	D	D	11.1	LT	320
25-Jul-13	0:09	D	U	10.8	LT	510
25-Jul-13	0:09	D	U	10.8	LT	570
25-Jul-13	0:43	U	U	10.8	LT	530
25-Jul-13	0:56	U	U	10.8	LT	510
25-Jul-13	1:17	D	U	10.8	WF	680
25-Jul-13	1:30	D	U	10.8	AC	670
25-Jul-13	2:16	D	D	10.8	AC	370
25-Jul-13	2:34	D	U	10.8	AC	660
25-Jul-13	2:36	U	D	10.8	WF	610
25-Jul-13	2:41	D	D	10.8	AC	600
25-Jul-13	2:44	U	D	10.8	WF	580
25-Jul-13	2:54	U	U	10.8	WF	620
25-Jul-13	2:59	D	U	10.8	AC	620
25-Jul-13	3:38	D	U	10.8	AC	670
25-Jul-13	3:44	D	D	10.8	AC	510
25-Jul-13	3:49	D	U	10.8	AC	630
25-Jul-13	3:54	D	D	10.8	AC	510
25-Jul-13	4:20	D	U	10.8	AC	610
25-Jul-13	4:24	D	D	10.8	AC	510
25-Jul-13	4:41	D	U	10.8	AC	600
25-Jul-13	4:45	D	D	10.8	AC	360
25-Jul-13	5:05	D	U	10.8	AC	600
25-Jul-13	5:10	D	D	10.8	AC	410
25-Jul-13	6:32	D	U	10.8	AC	640
25-Jul-13	6:42	D	U	10.8	AC	630
25-Jul-13	6:44	D	D	10.8	AC	490
25-Jul-13	6:57	D	U	10.8	AC	630
25-Jul-13	6:59	D	D	10.8	AC	490
25-Jul-13	12:13	D	U	10.8	AC	630
25-Jul-13	12:13	D	U	10.8	LT	610
25-Jul-13	12:24	D	D	10.8	AC	420
25-Jul-13	12:32	D	U	10.8	AC	610

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
25-Jul-13	12:33	D	U	10.8	LT	450
25-Jul-13	12:36	D	D	10.8	AC	490
25-Jul-13	12:37	D	U	10.8	AC	610
25-Jul-13	12:58	U	U	10.8	LT	580
25-Jul-13	13:21	D	D	10.8	AC	570
25-Jul-13	13:28	D	U	10.8	AC	640
25-Jul-13	13:32	D	D	10.8	AC	490
25-Jul-13	13:50	U	U	10.8	LT	390
25-Jul-13	14:51	U	U	10.8	LT	420
25-Jul-13	15:13	U	U	10.8	LT	420
25-Jul-13	15:18	D	U	10.8	AC	630
25-Jul-13	15:23	D	U	10.8	LT	530
25-Jul-13	15:55	D	D	10.8	AC	520
25-Jul-13	16:13	U	U	10.8	LT	550
25-Jul-13	17:44	D	U	10.8	LT	670
25-Jul-13	18:10	U	U	10.8	LT	400
25-Jul-13	18:51	D	U	10.8	AC	630
25-Jul-13	19:05	D	U	10.8	LT	530
25-Jul-13	19:38	D	D	10.8	AC	510
25-Jul-13	20:02	U	U	10.8	LT	480
25-Jul-13	20:06	D	U	10.8	LT	420
25-Jul-13	20:10	D	U	10.8	AC	610
25-Jul-13	20:22	D	D	10.8	AC	510
25-Jul-13	20:36	D	U	10.8	AC	660
25-Jul-13	20:47	D	U	10.8	AC	390
25-Jul-13	20:51	D	D	10.8	AC	510
25-Jul-13	21:09	D	U	10.8	AC	630
25-Jul-13	21:36	D	U	10.8	LT	520
25-Jul-13	22:08	U	U	10.8	AC	610
26-Jul-13	2:36	D	U	9.4	LT	610
26-Jul-13	3:24	U	U	9.4	LT	580
26-Jul-13	6:22	D	U	9.4	LT	510
26-Jul-13	7:38	U	U	9.4	LT	450
26-Jul-13	11:37	D	U	9.4	AC	880
26-Jul-13	12:10	U	U	9.4	AC	850
26-Jul-13	12:54	D	U	9.4	LT	510
26-Jul-13	13:25	U	U	9.4	LT	490
26-Jul-13	16:29	D	U	9.4	LT	520
26-Jul-13	17:13	U	U	9.4	LT	510
26-Jul-13	18:07	U	U	9.4	LT	660
26-Jul-13	18:10	U	U	9.4	LT	640
26-Jul-13	18:27	U	U	9.4	LT	640
26-Jul-13	19:52	D	U	9.4	AC	690
26-Jul-13	20:34	U	U	9.4	AC	630
26-Jul-13	22:47	U	U	9.4	LT	630
26-Jul-13	23:46	D	U	9.4	LT	520
26-Jul-13	23:54	U	U	9.4	LT	490

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
27-Jul-13	0:19	D	U	9.5	AC	940
27-Jul-13	0:47	U	U	9.5	AC	940
27-Jul-13	1:10	U	U	9.5	LT	500
27-Jul-13	1:15	U	U	9.5	LT	510
27-Jul-13	2:58	U	U	9.5	LT	450
27-Jul-13	14:33	U	U	9.5	LT	450
27-Jul-13	17:37	U	U	9.5	LT	450
27-Jul-13	21:24	D	U	9.5	LT	370
27-Jul-13	21:28	D	U	9.5	AC	540
27-Jul-13	22:13	U	U	9.5	LT	390
27-Jul-13	22:33	U	U	9.5	LT	400
27-Jul-13	23:48	U	U	9.5	WF	430
28-Jul-13	3:49	D	U	9.5	AC	600
28-Jul-13	4:20	U	U	9.5	WF	430
28-Jul-13	4:46	U	U	9.5	WF	580
28-Jul-13	8:23	U	U	9.5	LT	510
28-Jul-13	11:09	U	U	9.5	LT	490
28-Jul-13	13:25	D	U	9.5	LT	510
28-Jul-13	19:00	U	U	9.5	LT	600
28-Jul-13	21:13	D	U	9.5	LT	660
28-Jul-13	23:19	D	U	9.5	AC	940
28-Jul-13	23:42	D	D	9.5	AC	840
28-Jul-13	23:45	D	U	9.5	AC	910
29-Jul-13	0:07	D	D	10.4	AC	670
29-Jul-13	0:27	D	U	10.4	AC	910
29-Jul-13	0:39	U	U	10.4	AC	470
29-Jul-13	1:10	U	U	10.4	AC	870
29-Jul-13	5:56	D	U	10.4	LT	480
29-Jul-13	7:01	U	U	10.4	LT	450
29-Jul-13	10:25	U	U	10.4	LT	460
29-Jul-13	11:05	D	U	10.4	LT	430
29-Jul-13	14:10	D	U	10.4	LT	570
29-Jul-13	14:32	U	U	10.4	LT	420
29-Jul-13	17:34	D	U	10.4	LT	610
29-Jul-13	23:01	D	U	10.4	AC	960
30-Jul-13	0:02	U	U	10.4	AC	870
30-Jul-13	0:56	D	U	10.4	AC	550
30-Jul-13	1:36	D	U	10.4	AC	840
30-Jul-13	2:01	U	U	10.4	AC	830
30-Jul-13	5:59	U	U	10.4	LT	440
30-Jul-13	9:09	U	U	10.4	LT	470
30-Jul-13	9:32	D	U	10.4	LT	620
30-Jul-13	10:49	U	U	10.4	LT	550
30-Jul-13	12:53	U	U	10.4	LT	480
30-Jul-13	13:47	U	U	10.4	LT	460
30-Jul-13	14:22	U	U	10.4	LT	370
30-Jul-13	14:23	U	U	10.4	LT	390

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
30-Jul-13	15:33	D	U	10.4	LT	390
30-Jul-13	15:50	D	U	10.4	LT	400
30-Jul-13	16:49	U	U	10.4	LT	370
30-Jul-13	17:34	U	U	10.4	LT	460
30-Jul-13	20:24	D	U	10.4	LT	690
30-Jul-13	21:44	U	U	10.4	LT	690
30-Jul-13	23:22	D	U	10.4	AC	1,120
30-Jul-13	23:59	U	U	10.4	LT	440
31-Jul-13	0:30	U	U	10.1	AC	1,060
31-Jul-13	2:07	D	U	10.1	LT	570
31-Jul-13	2:44	U	U	10.1	LT	550
31-Jul-13	9:58	U	U	10.1	LT	460
31-Jul-13	12:42	D	U	10.1	AC	880
31-Jul-13	12:42	D	U	10.1	AC	1,020
31-Jul-13	12:59	U	U	10.1	AC	1,010
31-Jul-13	13:03	D	D	10.1	AC	840
31-Jul-13	13:05	D	U	10.1	AC	880
31-Jul-13	13:36	U	U	10.1	AC	850
31-Jul-13	16:37	U	U	10.1	LT	410
31-Jul-13	17:05	D	U	10.1	LT	560
31-Jul-13	17:35	U	U	10.1	LT	500
31-Jul-13	17:50	U	U	10.1	LT	420
31-Jul-13	18:58	U	U	10.1	LT	850
31-Jul-13	19:15	U	U	10.1	LT	830
31-Jul-13	19:26	U	U	10.1	LT	830
31-Jul-13	20:50	D	U	10.1	LT	510
31-Jul-13	21:20	U	U	10.1	LT	500
1-Aug-13	1:54	U	U	10.1	LT	720
1-Aug-13	14:59	U	U	10.1	LT	480
1-Aug-13	15:01	U	U	10.1	LT	450
1-Aug-13	16:58	U	U	10.1	LT	440
1-Aug-13	19:13	D	U	10.1	LT	390
1-Aug-13	22:16	U	U	10.1	LT	390
1-Aug-13	22:23	U	U	10.1	LT	400
1-Aug-13	22:36	D	U	10.1	AC	1,000
1-Aug-13	22:58	U	U	10.1	AC	960
1-Aug-13	23:07	D	U	10.1	AC	720
1-Aug-13	23:07	D	U	10.1	AC	780
1-Aug-13	23:07	D	U	10.1	AC	850
1-Aug-13	23:31	D	U	10.1	AC	1,060
1-Aug-13	23:43	U	U	10.1	AC	720
1-Aug-13	23:44	U	U	10.1	AC	760
1-Aug-13	23:49	U	U	10.1	AC	850
2-Aug-13	1:54	D	U	10.1	AC	880
2-Aug-13	1:54	D	U	10.1	AC	940
2-Aug-13	2:17	U	U	10.1	AC	840
2-Aug-13	2:17	U	U	10.1	AC	920

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
2-Aug-13	7:11	U	U	10.1	LT	320
2-Aug-13	9:40	U	U	10.1	LT	500
2-Aug-13	10:11	D	U	10.1	LT	270
2-Aug-13	12:14	U	U	10.1	LT	450
2-Aug-13	12:17	U	U	10.1	LT	450
2-Aug-13	12:41	U	U	10.1	LT	450
2-Aug-13	12:59	U	U	10.1	LT	450
2-Aug-13	16:21	U	D	10.1	LT	450
2-Aug-13	20:57	U	U	10.1	AC	1,080
2-Aug-13	21:07	U	U	10.1	AC	1,170
2-Aug-13	21:14	U	U	10.1	LT	610
2-Aug-13	21:19	U	U	10.1	LT	610
2-Aug-13	21:35	U	U	10.1	LT	610
2-Aug-13	21:43	U	U	10.1	AC	770
2-Aug-13	22:22	U	U	10.1	LT	410
2-Aug-13	22:27	U	U	10.1	AC	660
2-Aug-13	22:49	U	U	10.1	LT	450
2-Aug-13	23:04	U	U	10.1	AC	800
2-Aug-13	23:04	U	U	10.1	LT	450
2-Aug-13	23:10	U	U	10.1	AC	900
2-Aug-13	23:23	U	U	10.1	LT	460
2-Aug-13	-	U	U	10.1	AC	1,060
3-Aug-13	1:22	U	U	10.9	LT	570
3-Aug-13	2:23	U	U	10.9	AC	870
3-Aug-13	3:34	U	U	10.9	AC	930
3-Aug-13	3:39	U	U	10.9	AC	880
3-Aug-13	3:45	U	U	10.9	LT	460
3-Aug-13	3:46	U	U	10.9	AC	940
3-Aug-13	3:55	U	U	10.9	LT	510
3-Aug-13	4:19	U	U	10.9	AC	780
3-Aug-13	6:16	U	U	10.9	LT	490
3-Aug-13	6:35	U	D	10.9	LT	420
3-Aug-13	10:52	U	U	10.9	LT	450
3-Aug-13	13:44	D	U	10.9	AC	790
3-Aug-13	14:14	D	U	10.9	LT	550
3-Aug-13	14:54	U	U	10.9	LT	470
3-Aug-13	14:55	U	U	10.9	AC	760
3-Aug-13	15:04	U	U	10.9	LT	410
3-Aug-13	15:14	U	U	10.9	AC	490
3-Aug-13	22:15	D	U	10.9	LT	400
3-Aug-13	22:15	D	U	10.9	LT	480
3-Aug-13	22:18	D	D	10.9	LT	400
3-Aug-13	22:44	D	U	10.9	LT	580
3-Aug-13	22:47	D	D	10.9	LT	480
3-Aug-13	23:18	U	U	10.9	LT	460
3-Aug-13	23:45	U	U	10.9	LT	540
3-Aug-13	23:49	D	U	10.9	AC	780

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
3-Aug-13	23:50	D	U	10.9	AC	840
3-Aug-13	23:55	D	D	10.9	AC	750
4-Aug-13	0:12	U	U	11.4	LT	360
4-Aug-13	0:22	U	U	11.4	AC	910
4-Aug-13	0:22	U	U	11.4	LT	470
4-Aug-13	0:36	U	U	11.4	AC	840
4-Aug-13	1:48	D	U	11.4	LT	580
4-Aug-13	5:26	U	U	11.4	LT	470
4-Aug-13	12:33	U	U	11.4	LT	450
4-Aug-13	13:47	U	U	11.4	LT	530
4-Aug-13	14:50	U	U	11.4	LT	450
4-Aug-13	16:37	U	U	11.4	LT	400
4-Aug-13	17:42	D	U	11.4	LT	550
4-Aug-13	17:42	U	U	11.4	LT	430
4-Aug-13	18:26	U	U	11.4	LT	450
4-Aug-13	21:07	D	U	11.4	AC	550
4-Aug-13	23:34	D	U	11.4	LT	460
4-Aug-13	23:50	D	U	11.4	LT	700
4-Aug-13	-	D	U	11.4	AC	830
5-Aug-13	0:09	U	U	11.9	LT	450
5-Aug-13	0:17	U	U	11.9	LT	450
5-Aug-13	0:29	U	U	11.9	LT	630
5-Aug-13	4:07	U	U	11.9	LT	460
5-Aug-13	4:11	U	U	11.9	LT	460
5-Aug-13	4:57	U	U	11.9	LT	490
5-Aug-13	6:04	U	U	11.9	LT	490
5-Aug-13	6:35	U	U	11.9	LT	460
5-Aug-13	8:41	D	U	11.9	LT	490
5-Aug-13	8:44	D	U	11.9	AC	570
5-Aug-13	9:12	U	U	11.9	LT	480
5-Aug-13	9:42	D	D	11.9	AC	360
5-Aug-13	14:02	D	U	11.9	AC	480
5-Aug-13	17:32	U	U	11.9	LT	480
5-Aug-13	20:49	D	U	11.9	AC	1,240
5-Aug-13	20:49	D	U	11.9	AC	-
5-Aug-13	21:12	U	U	11.9	AC	850
5-Aug-13	21:15	U	U	11.9	LT	420
5-Aug-13	21:18	U	U	11.9	AC	490
5-Aug-13	22:00	U	U	11.9	LT	440
5-Aug-13	22:25	D	U	11.9	AC	880
5-Aug-13	23:00	U	U	11.9	AC	850
5-Aug-13	23:09	D	U	11.9	AC	540
5-Aug-13	23:22	D	U	11.9	AC	940
5-Aug-13	23:28	D	U	11.9	AC	980
6-Aug-13	0:42	U	U	12.9	LT	450
6-Aug-13	3:21	U	U	12.9	LT	490
6-Aug-13	5:17	D	D	12.9	AC	460

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
6-Aug-13	6:52	U	U	12.9	LT	480
6-Aug-13	11:24	U	U	12.9	LT	440
6-Aug-13	12:51	U	U	12.9	LT	420
6-Aug-13	12:57	U	U	12.9	LT	420
6-Aug-13	15:28	U	U	12.9	LT	450
6-Aug-13	16:41	D	U	12.9	LT	280
6-Aug-13	17:03	U	U	12.9	LT	380
6-Aug-13	18:33	D	U	12.9	LT	640
6-Aug-13	19:37	U	U	12.9	LT	430
6-Aug-13	20:14	U	U	12.9	LT	570
6-Aug-13	21:27	U	U	12.9	LT	400
6-Aug-13	22:03	D	U	12.9	AC	580
6-Aug-13	22:13	U	U	12.9	LT	430
6-Aug-13	22:27	D	U	12.9	AC	450
6-Aug-13	22:51	D	U	12.9	AC	720
6-Aug-13	23:25	D	U	12.9	AC	360
6-Aug-13	23:41	U	U	12.9	AC	660
6-Aug-13	23:46	D	U	12.9	AC	480
7-Aug-13	0:29	U	U	12.6	LT	450
7-Aug-13	2:39	D	U	12.6	LT	420
7-Aug-13	3:44	U	U	12.6	LT	420
7-Aug-13	4:52	D	U	12.6	LT	430
7-Aug-13	6:37	D	D	12.6	LT	310
7-Aug-13	9:13	U	U	12.6	LT	370
7-Aug-13	9:36	D	U	12.6	LT	420
7-Aug-13	9:59	D	U	12.6	AC	390
7-Aug-13	11:12	D	U	12.6	AC	540
7-Aug-13	11:12	D	U	12.6	LT	430
7-Aug-13	12:16	D	U	12.6	AC	430
7-Aug-13	13:11	U	U	12.6	LT	390
7-Aug-13	15:33	D	U	12.6	AC	370
7-Aug-13	16:20	D	U	12.6	AC	730
7-Aug-13	16:20	D	U	12.6	AC	730
7-Aug-13	16:20	D	U	12.6	AC	750
7-Aug-13	16:20	D	U	12.6	AC	-
7-Aug-13	16:20	D	U	12.6	AC	-
7-Aug-13	16:29	D	U	12.6	LT	450
7-Aug-13	16:39	U	U	12.6	AC	730
7-Aug-13	16:42	U	U	12.6	AC	700
7-Aug-13	16:58	U	U	12.6	LT	410
7-Aug-13	17:03	U	U	12.6	AC	730
7-Aug-13	17:08	U	U	12.6	AC	550
7-Aug-13	17:12	U	U	12.6	AC	720
7-Aug-13	17:16	D	U	12.6	AC	390
7-Aug-13	17:21	U	U	12.6	LT	440
7-Aug-13	17:56	D	U	12.6	LT	540
7-Aug-13	19:23	D	U	12.6	AC	540

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
7-Aug-13	19:26	D	U	12.6	AC	420
7-Aug-13	19:26	D	U	12.6	AC	430
7-Aug-13	19:52	U	U	12.6	AC	510
7-Aug-13	19:58	D	U	12.6	LT	300
7-Aug-13	21:28	D	U	12.6	AC	450
7-Aug-13	22:16	D	U	12.6	AC	540
7-Aug-13	23:00	D	U	12.6	AC	520
7-Aug-13	23:25	U	U	12.6	LT	450
7-Aug-13	23:32	D	U	12.6	AC	780
7-Aug-13	23:50	D	D	12.6	AC	480
7-Aug-13	23:52	D	U	12.6	AC	780
7-Aug-13	23:55	D	U	12.6	AC	540
8-Aug-13	0:24	U	U	13.4	AC	670
8-Aug-13	0:55	U	U	13.4	AC	520
8-Aug-13	0:59	U	D	13.4	AC	350
8-Aug-13	0:59	U	U	13.4	AC	430
8-Aug-13	0:59	U	U	13.4	AC	510
8-Aug-13	1:37	D	U	13.4	LT	430
8-Aug-13	3:40	U	U	13.4	LT	450
8-Aug-13	3:43	U	U	13.4	AC	500
8-Aug-13	3:58	U	U	13.4	AC	510
8-Aug-13	4:11	D	U	13.4	AC	400
8-Aug-13	4:23	U	U	13.4	AC	490
8-Aug-13	4:54	U	U	13.4	AC	510
8-Aug-13	5:08	U	U	13.4	AC	370
8-Aug-13	5:33	D	U	13.4	AC	420
8-Aug-13	6:51	U	U	13.4	AC	520
8-Aug-13	6:52	D	U	13.4	AC	510
8-Aug-13	7:20	D	U	13.4	AC	510
8-Aug-13	8:11	D	U	13.4	AC	510
8-Aug-13	9:38	U	U	13.4	LT	390
8-Aug-13	10:07	U	U	13.4	AC	490
8-Aug-13	12:16	U	U	13.4	LT	440
8-Aug-13	12:21	D	U	13.4	AC	660
8-Aug-13	12:55	D	U	13.4	AC	1,030
8-Aug-13	13:04	U	U	13.4	AC	640
8-Aug-13	13:21	D	D	13.4	AC	760
8-Aug-13	13:21	D	U	13.4	AC	1,000
8-Aug-13	13:55	U	U	13.4	AC	1,060
8-Aug-13	15:57	U	U	13.4	LT	420
8-Aug-13	17:38	U	U	13.4	LT	480
8-Aug-13	18:08	U	U	13.4	LT	420
8-Aug-13	18:15	U	U	13.4	LT	380
8-Aug-13	20:40	U	U	13.4	AC	390
8-Aug-13	20:42	D	U	13.4	AC	400
8-Aug-13	20:50	D	U	13.4	AC	840
8-Aug-13	21:05	U	U	13.4	AC	810

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
8-Aug-13	21:47	U	U	13.4	LT	400
8-Aug-13	-	D	U	13.4	AC	800
9-Aug-13	0:22	D	U	13.8	AC	870
9-Aug-13	1:00	D	U	13.8	AC	390
9-Aug-13	3:00	D	U	13.8	AC	370
9-Aug-13	3:53	D	U	13.8	LT	420
9-Aug-13	3:54	D	U	13.8	AC	400
9-Aug-13	6:29	D	U	13.8	LT	430
9-Aug-13	10:42	U	U	13.8	LT	420
9-Aug-13	10:49	U	U	13.8	LT	440
9-Aug-13	11:53	D	U	13.8	AC	480
9-Aug-13	12:29	U	U	13.8	LT	460
9-Aug-13	13:09	D	U	13.8	AC	610
9-Aug-13	13:25	U	U	13.8	LT	610
9-Aug-13	14:15	D	U	13.8	AC	810
9-Aug-13	14:17	D	U	13.8	AC	840
9-Aug-13	14:17	D	U	13.8	AC	-
9-Aug-13	14:18	D	U	13.8	AC	510
9-Aug-13	14:18	D	U	13.8	AC	520
9-Aug-13	14:18	D	U	13.8	AC	780
9-Aug-13	14:22	U	U	13.8	LT	400
9-Aug-13	14:38	D	D	13.8	AC	700
9-Aug-13	14:42	U	U	13.8	AC	770
9-Aug-13	14:42	U	U	13.8	AC	850
9-Aug-13	14:52	U	U	13.8	AC	490
9-Aug-13	14:57	U	U	13.8	AC	750
9-Aug-13	15:54	D	U	13.8	LT	580
9-Aug-13	16:28	U	U	13.8	LT	460
9-Aug-13	20:11	D	U	13.8	LT	570
9-Aug-13	21:37	D	U	13.8	AC	1,060
9-Aug-13	22:04	D	D	13.8	LT	390
9-Aug-13	22:36	U	U	13.8	LT	410
9-Aug-13	23:58	D	U	13.8	LT	450
10-Aug-13	0:46	U	U	14.8	LT	430
10-Aug-13	2:09	D	U	14.8	LT	540
10-Aug-13	2:21	D	U	14.8	LT	510
10-Aug-13	2:32	D	U	14.8	LT	400
10-Aug-13	2:48	D	U	14.8	AC	360
10-Aug-13	3:50	D	U	14.8	AC	400
10-Aug-13	4:00	D	U	14.8	AC	390
10-Aug-13	4:00	U	U	14.8	AC	480
10-Aug-13	4:13	D	U	14.8	AC	420
10-Aug-13	8:09	U	U	14.8	LT	280
10-Aug-13	9:06	U	U	14.8	LT	400
10-Aug-13	11:57	D	U	14.8	AC	400
10-Aug-13	12:11	D	U	14.8	AC	420
10-Aug-13	12:38	U	U	14.8	LT	510

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
10-Aug-13	13:32	D	U	14.8	AC	370
10-Aug-13	13:32	D	U	14.8	AC	390
10-Aug-13	13:37	D	U	14.8	AC	430
10-Aug-13	14:04	D	U	14.8	AC	420
10-Aug-13	14:10	D	D	14.8	AC	420
10-Aug-13	14:11	D	U	14.8	AC	400
10-Aug-13	15:10	D	U	14.8	AC	420
10-Aug-13	15:22	D	U	14.8	AC	420
10-Aug-13	18:02	D	U	14.8	LT	390
10-Aug-13	18:04	D	U	14.8	AC	460
10-Aug-13	18:32	U	U	14.8	AC	440
10-Aug-13	18:39	U	U	14.8	LT	390
10-Aug-13	20:47	D	U	14.8	LT	350
10-Aug-13	21:06	D	U	14.8	AC	390
10-Aug-13	21:09	D	U	14.8	LT	490
10-Aug-13	21:37	U	U	14.8	LT	460
10-Aug-13	21:49	D	U	14.8	AC	700
10-Aug-13	21:54	D	U	14.8	AC	630
10-Aug-13	21:54	D	U	14.8	AC	640
10-Aug-13	21:54	D	U	14.8	AC	670
10-Aug-13	21:56	U	U	14.8	LT	310
10-Aug-13	22:09	D	U	14.8	AC	640
10-Aug-13	22:10	D	D	14.8	AC	600
10-Aug-13	22:13	D	U	14.8	AC	630
10-Aug-13	22:15	D	D	14.8	AC	570
10-Aug-13	22:21	U	D	14.8	LT	490
10-Aug-13	22:35	D	U	14.8	AC	650
10-Aug-13	22:39	D	D	14.8	AC	520
10-Aug-13	22:49	D	D	14.8	AC	550
10-Aug-13	23:00	U	U	14.8	AC	670
10-Aug-13	23:26	U	U	14.8	AC	610
10-Aug-13	23:29	U	U	14.8	AC	730
10-Aug-13	23:34	U	U	14.8	AC	730
10-Aug-13	23:47	D	U	14.8	AC	360
11-Aug-13	0:24	U	U	13.8	AC	630
11-Aug-13	1:37	U	U	13.8	LT	500
11-Aug-13	6:29	U	U	13.8	LT	390
11-Aug-13	8:15	U	U	13.8	LT	300
11-Aug-13	10:04	U	U	13.8	LT	420
11-Aug-13	15:52	D	U	13.8	AC	360
11-Aug-13	16:40	D	U	13.8	AC	430
11-Aug-13	16:52	D	U	13.8	AC	720
11-Aug-13	17:26	U	U	13.8	AC	700
11-Aug-13	17:35	D	U	13.8	AC	390
11-Aug-13	17:35	D	U	13.8	AC	610
11-Aug-13	17:35	D	U	13.8	AC	690
11-Aug-13	17:44	U	U	13.8	AC	390

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
11-Aug-13	17:59	U	U	13.8	AC	580
11-Aug-13	18:29	D	U	13.8	AC	390
11-Aug-13	18:44	U	U	13.8	AC	660
11-Aug-13	19:18	D	U	13.8	AC	780
11-Aug-13	19:18	D	U	13.8	AC	960
11-Aug-13	19:43	U	U	13.8	AC	900
11-Aug-13	19:45	D	U	13.8	LT	420
11-Aug-13	19:45	D	U	13.8	LT	430
11-Aug-13	19:50	U	U	13.8	AC	350
11-Aug-13	19:59	U	U	13.8	AC	770
11-Aug-13	21:28	D	U	13.8	AC	980
11-Aug-13	21:36	U	U	13.8	LT	390
11-Aug-13	23:22	U	U	13.8	LT	420
12-Aug-13	0:21	D	U	13.1	LT	470
12-Aug-13	0:51	U	U	13.1	LT	450
12-Aug-13	3:19	D	U	13.1	LT	430
12-Aug-13	3:24	U	U	13.1	LT	440
12-Aug-13	4:01	D	U	13.1	LT	500
12-Aug-13	4:40	D	D	13.1	LT	390
12-Aug-13	4:59	D	U	13.1	LT	500
12-Aug-13	5:14	D	U	13.1	LT	510
12-Aug-13	5:28	D	U	13.1	LT	490
12-Aug-13	5:32	D	U	13.1	AC	940
12-Aug-13	5:34	D	D	13.1	LT	480
12-Aug-13	5:34	D	U	13.1	AC	840
12-Aug-13	5:34	D	U	13.1	AC	880
12-Aug-13	5:34	D	U	13.1	AC	-
12-Aug-13	5:34	D	U	13.1	AC	-
12-Aug-13	5:35	D	D	13.1	AC	670
12-Aug-13	5:37	D	D	13.1	AC	750
12-Aug-13	5:43	D	D	13.1	AC	-
12-Aug-13	5:47	D	D	13.1	AC	520
12-Aug-13	5:53	D	U	13.1	AC	870
12-Aug-13	6:00	D	U	13.1	AC	730
12-Aug-13	6:00	D	U	13.1	AC	820
12-Aug-13	6:02	D	D	13.1	AC	720
12-Aug-13	6:03	D	U	13.1	AC	750
12-Aug-13	6:05	D	D	13.1	AC	810
12-Aug-13	6:05	D	U	13.1	AC	810
12-Aug-13	6:06	D	D	13.1	AC	790
12-Aug-13	6:08	D	D	13.1	AC	990
12-Aug-13	6:19	D	U	13.1	AC	820
12-Aug-13	6:23	D	D	13.1	AC	810
12-Aug-13	6:24	D	U	13.1	AC	860
12-Aug-13	6:27	D	D	13.1	AC	810
12-Aug-13	6:31	D	U	13.1	AC	820
12-Aug-13	6:38	D	D	13.1	AC	-

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
12-Aug-13	6:38	D	D	13.1	LT	570
12-Aug-13	6:38	D	U	13.1	AC	860
12-Aug-13	6:38	U	U	13.1	AC	870
12-Aug-13	6:39	D	D	13.1	AC	790
12-Aug-13	6:40	D	U	13.1	AC	820
12-Aug-13	6:46	D	U	13.1	AC	820
12-Aug-13	6:48	D	U	13.1	LT	520
12-Aug-13	6:51	D	D	13.1	AC	810
12-Aug-13	6:51	D	U	13.1	AC	820
12-Aug-13	6:53	D	D	13.1	AC	810
12-Aug-13	7:33	U	U	13.1	LT	580
12-Aug-13	16:36	D	U	13.1	AC	400
12-Aug-13	16:39	D	U	13.1	AC	360
12-Aug-13	17:39	U	U	13.1	AC	370
12-Aug-13	22:26	U	U	13.1	LT	330
12-Aug-13	22:31	D	U	13.1	LT	360
12-Aug-13	22:40	D	U	13.1	AC	880
12-Aug-13	23:10	D	U	13.1	AC	420
13-Aug-13	3:07	D	U	13.1	AC	400
13-Aug-13	5:31	D	U	13.1	AC	420
13-Aug-13	5:36	D	U	13.1	AC	370
13-Aug-13	5:36	D	U	13.1	AC	400
13-Aug-13	6:45	D	U	13.1	LT	490
13-Aug-13	7:06	D	D	13.1	LT	420
13-Aug-13	8:01	D	U	13.1	AC	870
13-Aug-13	9:01	U	U	13.1	AC	860
13-Aug-13	11:20	D	U	13.1	LT	460
13-Aug-13	11:25	D	U	13.1	LT	460
13-Aug-13	11:45	D	D	13.1	LT	360
13-Aug-13	14:25	D	U	13.1	LT	450
13-Aug-13	14:31	D	D	13.1	LT	370
13-Aug-13	14:38	D	U	13.1	LT	450
13-Aug-13	14:50	D	D	13.1	LT	380
13-Aug-13	15:28	D	U	13.1	LT	460
13-Aug-13	15:34	D	D	13.1	LT	360
13-Aug-13	15:36	D	U	13.1	LT	460
13-Aug-13	15:43	D	D	13.1	LT	350
13-Aug-13	16:08	D	U	13.1	LT	510
13-Aug-13	16:16	D	D	13.1	LT	390
13-Aug-13	17:28	D	U	13.1	AC	360
13-Aug-13	17:29	D	U	13.1	AC	660
13-Aug-13	17:30	D	U	13.1	AC	640
13-Aug-13	17:36	D	U	13.1	AC	510
13-Aug-13	17:36	D	U	13.1	AC	570
13-Aug-13	17:36	D	U	13.1	AC	570
13-Aug-13	17:36	D	U	13.1	AC	820
13-Aug-13	17:36	D	U	13.1	LT	470

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
13-Aug-13	17:42	D	D	13.1	AC	570
13-Aug-13	17:42	D	U	13.1	AC	630
13-Aug-13	17:46	D	D	13.1	AC	780
13-Aug-13	17:48	D	U	13.1	AC	810
13-Aug-13	17:49	D	D	13.1	AC	470
13-Aug-13	17:52	D	U	13.1	AC	370
13-Aug-13	17:52	D	U	13.1	AC	510
13-Aug-13	17:52	D	U	13.1	AC	570
13-Aug-13	17:54	D	D	13.1	AC	810
13-Aug-13	17:55	D	D	13.1	AC	360
13-Aug-13	17:55	D	U	13.1	AC	840
13-Aug-13	17:56	D	U	13.1	AC	570
13-Aug-13	17:57	D	U	13.1	AC	840
13-Aug-13	17:58	D	D	13.1	AC	440
13-Aug-13	17:58	D	U	13.1	AC	570
13-Aug-13	17:59	D	U	13.1	AC	610
13-Aug-13	17:59	D	U	13.1	AC	660
13-Aug-13	17:59	D	U	13.1	AC	720
13-Aug-13	17:59	D	U	13.1	AC	1,020
13-Aug-13	18:01	D	D	13.1	AC	550
13-Aug-13	18:06	D	U	13.1	AC	670
13-Aug-13	18:08	D	D	13.1	AC	700
13-Aug-13	18:08	D	U	13.1	AC	600
13-Aug-13	18:09	D	U	13.1	AC	690
13-Aug-13	18:09	D	U	13.1	AC	770
13-Aug-13	18:09	D	U	13.1	AC	800
13-Aug-13	18:11	D	D	13.1	AC	510
13-Aug-13	18:12	U	U	13.1	AC	700
13-Aug-13	18:16	U	U	13.1	AC	540
13-Aug-13	18:17	D	D	13.1	AC	840
13-Aug-13	18:18	D	U	13.1	AC	710
13-Aug-13	18:18	D	U	13.1	AC	870
13-Aug-13	18:20	D	D	13.1	AC	660
13-Aug-13	18:23	D	U	13.1	AC	640
13-Aug-13	18:24	D	D	13.1	AC	400
13-Aug-13	18:24	D	D	13.1	AC	550
13-Aug-13	18:24	U	U	13.1	AC	990
13-Aug-13	18:26	D	D	13.1	AC	600
13-Aug-13	18:26	D	D	13.1	AC	600
13-Aug-13	18:27	D	U	13.1	AC	640
13-Aug-13	18:28	D	U	13.1	AC	580
13-Aug-13	18:29	D	D	13.1	AC	620
13-Aug-13	18:29	D	U	13.1	AC	640
13-Aug-13	18:29	D	U	13.1	AC	690
13-Aug-13	18:29	D	U	13.1	AC	-
13-Aug-13	18:29	U	U	13.1	AC	780
13-Aug-13	18:31	D	D	13.1	AC	490

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
13-Aug-13	18:32	D	D	13.1	AC	570
13-Aug-13	18:33	D	D	13.1	AC	490
13-Aug-13	18:33	D	U	13.1	AC	720
13-Aug-13	18:34	U	U	13.1	AC	760
13-Aug-13	18:35	D	U	13.1	AC	610
13-Aug-13	18:35	D	U	13.1	AC	650
13-Aug-13	18:35	D	U	13.1	AC	850
13-Aug-13	18:35	U	U	13.1	AC	680
13-Aug-13	18:36	D	D	13.1	AC	390
13-Aug-13	18:36	D	D	13.1	AC	630
13-Aug-13	18:38	D	D	13.1	AC	580
13-Aug-13	18:38	U	U	13.1	AC	640
13-Aug-13	18:39	D	U	13.1	AC	610
13-Aug-13	18:39	D	U	13.1	AC	720
13-Aug-13	18:40	D	D	13.1	AC	460
13-Aug-13	18:41	D	D	13.1	AC	490
13-Aug-13	18:41	D	D	13.1	AC	550
13-Aug-13	18:41	U	U	13.1	AC	490
13-Aug-13	18:42	D	U	13.1	AC	620
13-Aug-13	18:43	D	U	13.1	AC	580
13-Aug-13	18:43	D	U	13.1	AC	610
13-Aug-13	18:43	D	U	13.1	AC	880
13-Aug-13	18:44	D	D	13.1	AC	570
13-Aug-13	18:44	D	D	13.1	AC	590
13-Aug-13	18:45	D	U	13.1	AC	710
13-Aug-13	18:46	D	D	13.1	AC	690
13-Aug-13	18:47	D	D	13.1	AC	540
13-Aug-13	18:47	D	U	13.1	AC	720
13-Aug-13	18:51	D	U	13.1	AC	780
13-Aug-13	18:51	U	U	13.1	AC	550
13-Aug-13	18:53	D	D	13.1	AC	660
13-Aug-13	18:59	U	U	13.1	AC	350
13-Aug-13	19:04	D	D	13.1	AC	590
13-Aug-13	19:05	D	U	13.1	AC	730
13-Aug-13	19:05	D	U	13.1	AC	820
13-Aug-13	19:05	U	U	13.1	AC	590
13-Aug-13	19:07	D	D	13.1	AC	480
13-Aug-13	19:12	D	D	13.1	AC	690
13-Aug-13	19:13	D	U	13.1	AC	730
13-Aug-13	19:13	D	U	13.1	AC	830
13-Aug-13	19:15	D	D	13.1	AC	660
13-Aug-13	19:16	D	D	13.1	AC	700
13-Aug-13	19:16	D	U	13.1	AC	720
13-Aug-13	19:17	D	U	13.1	AC	830
13-Aug-13	19:18	D	D	13.1	AC	560
13-Aug-13	19:18	D	U	13.1	AC	730
13-Aug-13	19:19	D	D	13.1	AC	600

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
13-Aug-13	19:20	D	U	13.1	AC	740
13-Aug-13	19:21	D	U	13.1	AC	550
13-Aug-13	19:22	D	D	13.1	AC	580
13-Aug-13	19:26	D	U	13.1	AC	660
13-Aug-13	19:26	D	U	13.1	AC	750
13-Aug-13	19:29	D	D	13.1	AC	630
13-Aug-13	19:31	D	D	13.1	AC	580
13-Aug-13	19:31	D	D	13.1	AC	600
13-Aug-13	19:36	D	D	13.1	AC	640
13-Aug-13	19:37	D	U	13.1	AC	720
13-Aug-13	19:43	D	D	13.1	AC	400
13-Aug-13	19:46	D	U	13.1	AC	700
13-Aug-13	19:47	U	U	13.1	AC	780
13-Aug-13	19:55	D	D	13.1	AC	610
13-Aug-13	19:55	D	U	13.1	AC	740
13-Aug-13	20:24	U	U	13.1	AC	510
13-Aug-13	20:49	D	U	13.1	AC	520
13-Aug-13	21:07	U	U	13.1	LT	400
13-Aug-13	21:12	U	U	13.1	LT	430
13-Aug-13	22:05	D	U	13.1	AC	880
13-Aug-13	22:47	D	U	13.1	AC	730
13-Aug-13	23:07	U	U	13.1	LT	350
13-Aug-13	23:11	D	U	13.1	AC	770
13-Aug-13	23:59	D	U	13.1	AC	750
14-Aug-13	0:05	D	U	13.4	AC	660
14-Aug-13	0:08	D	U	13.4	AC	760
14-Aug-13	0:13	D	D	13.4	AC	580
14-Aug-13	0:20	D	U	13.4	AC	820
14-Aug-13	0:32	D	U	13.4	AC	700
14-Aug-13	0:34	D	U	13.4	AC	730
14-Aug-13	1:31	D	U	13.4	AC	750
14-Aug-13	1:33	D	U	13.4	AC	730
14-Aug-13	1:41	D	U	13.4	AC	750
14-Aug-13	2:15	D	U	13.4	AC	740
14-Aug-13	2:25	D	U	13.4	AC	720
14-Aug-13	2:44	D	U	13.4	AC	780
14-Aug-13	2:44	D	U	13.4	AC	-
14-Aug-13	2:50	D	D	13.4	AC	640
14-Aug-13	2:53	D	U	13.4	AC	700
14-Aug-13	2:54	D	U	13.4	AC	750
14-Aug-13	2:55	D	U	13.4	AC	760
14-Aug-13	2:59	D	U	13.4	AC	730
14-Aug-13	3:47	D	U	13.4	AC	780
14-Aug-13	3:52	D	U	13.4	AC	720
14-Aug-13	3:52	D	U	13.4	AC	760
14-Aug-13	3:52	U	U	13.4	AC	560
14-Aug-13	3:54	D	D	13.4	AC	550

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
14-Aug-13	3:54	D	D	13.4	AC	700
14-Aug-13	4:03	D	U	13.4	AC	720
14-Aug-13	4:03	D	U	13.4	AC	770
14-Aug-13	4:05	D	D	13.4	AC	600
14-Aug-13	4:06	D	D	13.4	AC	400
14-Aug-13	4:07	D	U	13.4	AC	730
14-Aug-13	4:08	D	U	13.4	AC	750
14-Aug-13	4:09	D	D	13.4	AC	430
14-Aug-13	4:10	D	D	13.4	AC	520
14-Aug-13	4:12	D	D	13.4	AC	630
14-Aug-13	4:14	D	U	13.4	AC	730
14-Aug-13	4:16	D	D	13.4	AC	440
14-Aug-13	4:16	D	D	13.4	AC	570
14-Aug-13	4:19	D	U	13.4	AC	730
14-Aug-13	4:19	D	U	13.4	AC	750
14-Aug-13	4:25	D	D	13.4	AC	600
14-Aug-13	4:25	D	D	13.4	AC	610
14-Aug-13	4:27	D	U	13.4	AC	730
14-Aug-13	4:27	D	U	13.4	AC	760
14-Aug-13	4:32	U	U	13.4	LT	360
14-Aug-13	4:43	D	D	13.4	AC	730
14-Aug-13	5:36	D	U	13.4	AC	760
14-Aug-13	5:37	D	D	13.4	AC	530
14-Aug-13	5:37	D	D	13.4	AC	700
14-Aug-13	5:37	D	U	13.4	AC	760
14-Aug-13	5:38	D	U	13.4	AC	750
14-Aug-13	5:39	D	U	13.4	AC	750
14-Aug-13	5:40	D	D	13.4	AC	750
14-Aug-13	5:40	D	D	13.4	AC	-
14-Aug-13	5:42	D	D	13.4	AC	480
14-Aug-13	5:42	D	U	13.4	AC	720
14-Aug-13	5:50	D	D	13.4	AC	640
14-Aug-13	5:52	D	U	13.4	AC	720
14-Aug-13	5:53	D	D	13.4	AC	720
14-Aug-13	5:53	D	U	13.4	AC	730
14-Aug-13	5:54	D	D	13.4	AC	540
14-Aug-13	6:17	D	U	13.4	AC	730
14-Aug-13	6:20	D	D	13.4	AC	600
14-Aug-13	6:22	D	D	13.4	AC	510
14-Aug-13	6:23	D	U	13.4	AC	720
14-Aug-13	6:28	D	D	13.4	AC	670
14-Aug-13	6:31	D	U	13.4	AC	570
14-Aug-13	6:31	D	U	13.4	AC	720
14-Aug-13	6:31	D	U	13.4	AC	740
14-Aug-13	6:31	D	U	13.4	AC	760
14-Aug-13	6:31	D	U	13.4	AC	-
14-Aug-13	6:35	D	D	13.4	AC	590

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
14-Aug-13	6:35	D	U	13.4	AC	770
14-Aug-13	6:36	D	U	13.4	AC	750
14-Aug-13	6:37	D	D	13.4	AC	580
14-Aug-13	6:37	D	U	13.4	AC	720
14-Aug-13	6:41	D	D	13.4	AC	550
14-Aug-13	6:42	D	U	13.4	AC	660
14-Aug-13	6:43	D	D	13.4	AC	510
14-Aug-13	6:44	D	D	13.4	AC	540
14-Aug-13	6:46	D	D	13.4	AC	570
14-Aug-13	6:46	D	U	13.4	AC	630
14-Aug-13	6:48	D	D	13.4	AC	370
14-Aug-13	6:49	D	U	13.4	AC	660
14-Aug-13	6:50	D	D	13.4	AC	520
14-Aug-13	6:51	D	U	13.4	AC	670
14-Aug-13	6:53	D	D	13.4	AC	550
14-Aug-13	6:54	D	U	13.4	AC	670
14-Aug-13	6:55	U	U	13.4	AC	720
14-Aug-13	6:56	D	D	13.4	AC	530
14-Aug-13	6:59	U	U	13.4	AC	480
14-Aug-13	7:01	D	U	13.4	AC	640
14-Aug-13	7:03	D	D	13.4	AC	560
14-Aug-13	7:04	U	U	13.4	AC	580
14-Aug-13	7:04	U	U	13.4	AC	690
14-Aug-13	21:01	D	U	13.4	AC	360
14-Aug-13	22:17	D	U	13.4	AC	400
14-Aug-13	22:19	U	D	13.4	AC	550
14-Aug-13	22:19	U	U	13.4	AC	560
14-Aug-13	22:20	U	U	13.4	AC	570
14-Aug-13	-	D	U	13.4	AC	760
15-Aug-13	3:02	D	U	12.4	AC	720
15-Aug-13	5:47	U	U	12.4	LT	510
15-Aug-13	7:56	D	U	12.4	AC	930
15-Aug-13	8:25	U	U	12.4	AC	870
15-Aug-13	12:18	U	U	12.4	LT	430
15-Aug-13	13:51	D	U	12.4	AC	820
15-Aug-13	13:55	U	U	12.4	LT	520
15-Aug-13	14:13	U	U	12.4	AC	820
15-Aug-13	15:29	D	U	12.4	AC	790
15-Aug-13	15:42	D	U	12.4	AC	490
15-Aug-13	15:42	D	U	12.4	AC	720
15-Aug-13	15:42	D	U	12.4	AC	830
15-Aug-13	15:42	D	U	12.4	AC	-
15-Aug-13	15:42	D	U	12.4	AC	-
15-Aug-13	15:42	D	U	12.4	AC	-
15-Aug-13	15:47	D	U	12.4	AC	890
15-Aug-13	15:49	D	U	12.4	AC	670
15-Aug-13	15:51	D	U	12.4	AC	850

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
15-Aug-13	15:57	U	U	12.4	AC	730
15-Aug-13	15:58	D	D	12.4	AC	810
15-Aug-13	15:58	D	U	12.4	AC	810
15-Aug-13	16:01	D	D	12.4	AC	840
15-Aug-13	16:01	D	U	12.4	AC	840
15-Aug-13	16:03	D	D	12.4	AC	390
15-Aug-13	16:04	D	D	12.4	AC	700
15-Aug-13	16:06	D	U	12.4	AC	760
15-Aug-13	16:06	D	U	12.4	AC	840
15-Aug-13	16:08	D	D	12.4	AC	700
15-Aug-13	16:08	D	U	12.4	AC	660
15-Aug-13	16:09	D	U	12.4	AC	810
15-Aug-13	16:10	D	D	12.4	AC	640
15-Aug-13	16:11	D	U	12.4	AC	850
15-Aug-13	16:13	U	U	12.4	AC	630
15-Aug-13	16:15	D	D	12.4	AC	490
15-Aug-13	16:15	D	D	12.4	AC	650
15-Aug-13	16:15	D	U	12.4	AC	660
15-Aug-13	16:15	D	U	12.4	AC	910
15-Aug-13	16:15	U	U	12.4	LT	480
15-Aug-13	16:16	D	D	12.4	AC	820
15-Aug-13	16:16	D	U	12.4	AC	850
15-Aug-13	16:19	D	D	12.4	AC	390
15-Aug-13	16:19	D	D	12.4	AC	510
15-Aug-13	16:19	D	U	12.4	AC	630
15-Aug-13	16:19	D	U	12.4	AC	760
15-Aug-13	16:19	D	U	12.4	AC	840
15-Aug-13	16:24	D	D	12.4	AC	610
15-Aug-13	16:24	D	D	12.4	AC	740
15-Aug-13	16:24	U	U	12.4	AC	720
15-Aug-13	16:25	D	U	12.4	AC	630
15-Aug-13	16:25	D	U	12.4	AC	730
15-Aug-13	16:25	D	U	12.4	AC	830
15-Aug-13	16:26	D	D	12.4	AC	750
15-Aug-13	16:26	D	D	12.4	AC	-
15-Aug-13	16:26	D	D	12.4	AC	-
15-Aug-13	16:28	D	U	12.4	AC	790
15-Aug-13	16:29	U	U	12.4	AC	490
15-Aug-13	16:29	U	U	12.4	AC	760
15-Aug-13	16:31	D	U	12.4	AC	840
15-Aug-13	16:33	D	D	12.4	AC	700
15-Aug-13	16:33	D	U	12.4	AC	870
15-Aug-13	16:35	D	D	12.4	AC	830
15-Aug-13	16:35	D	U	12.4	AC	830
15-Aug-13	16:45	D	D	12.4	AC	840
15-Aug-13	16:45	D	U	12.4	AC	850
15-Aug-13	16:47	D	D	12.4	AC	820

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
15-Aug-13	16:47	D	U	12.4	AC	820
15-Aug-13	16:49	D	D	12.4	AC	790
15-Aug-13	16:49	D	U	12.4	AC	850
15-Aug-13	16:58	U	U	12.4	AC	600
15-Aug-13	16:58	U	U	12.4	AC	670
15-Aug-13	17:33	D	D	12.4	AC	840
15-Aug-13	18:17	D	D	12.4	AC	760
15-Aug-13	18:22	D	U	12.4	AC	870
15-Aug-13	18:29	D	D	12.4	AC	670
15-Aug-13	18:59	D	U	12.4	AC	820
15-Aug-13	19:00	D	D	12.4	AC	620
15-Aug-13	19:00	D	U	12.4	AC	870
15-Aug-13	19:02	D	U	12.4	AC	870
15-Aug-13	19:03	D	D	12.4	AC	760
15-Aug-13	19:14	D	U	12.4	AC	850
15-Aug-13	19:20	D	D	12.4	AC	620
15-Aug-13	19:31	D	U	12.4	AC	810
15-Aug-13	19:33	D	D	12.4	AC	650
15-Aug-13	19:34	D	U	12.4	AC	840
15-Aug-13	19:35	D	D	12.4	AC	640
15-Aug-13	19:37	D	U	12.4	AC	850
15-Aug-13	19:38	D	D	12.4	AC	650
15-Aug-13	19:40	D	U	12.4	AC	840
15-Aug-13	19:41	D	D	12.4	AC	670
15-Aug-13	19:47	D	U	12.4	AC	830
15-Aug-13	19:49	D	D	12.4	AC	670
15-Aug-13	19:49	D	U	12.4	AC	830
15-Aug-13	19:51	D	D	12.4	AC	840
15-Aug-13	19:53	D	U	12.4	AC	830
15-Aug-13	19:55	D	D	12.4	AC	840
15-Aug-13	19:55	D	U	12.4	AC	850
15-Aug-13	19:58	D	D	12.4	AC	630
15-Aug-13	20:00	D	U	12.4	AC	840
15-Aug-13	20:04	D	D	12.4	AC	820
15-Aug-13	20:04	D	U	12.4	AC	820
15-Aug-13	20:06	D	D	12.4	AC	810
15-Aug-13	20:06	D	U	12.4	AC	850
15-Aug-13	20:07	D	D	12.4	AC	810
15-Aug-13	20:07	D	U	12.4	AC	810
15-Aug-13	20:11	D	D	12.4	AC	810
15-Aug-13	20:11	D	U	12.4	AC	810
15-Aug-13	20:13	D	D	12.4	AC	790
15-Aug-13	20:14	D	D	12.4	AC	810
15-Aug-13	20:14	D	U	12.4	AC	850
15-Aug-13	20:14	D	U	12.4	AC	860
15-Aug-13	20:15	D	D	12.4	AC	810
15-Aug-13	20:15	D	U	12.4	AC	840

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
15-Aug-13	20:16	D	D	12.4	AC	810
15-Aug-13	20:16	D	U	12.4	AC	830
15-Aug-13	20:18	D	D	12.4	AC	820
15-Aug-13	20:18	D	U	12.4	AC	850
15-Aug-13	20:20	D	D	12.4	AC	790
15-Aug-13	20:21	D	U	12.4	AC	850
15-Aug-13	20:24	D	D	12.4	AC	810
15-Aug-13	20:25	D	U	12.4	AC	850
15-Aug-13	20:27	D	D	12.4	AC	790
15-Aug-13	20:27	D	D	12.4	AC	810
15-Aug-13	20:27	D	U	12.4	AC	850
15-Aug-13	20:28	D	U	12.4	AC	850
15-Aug-13	20:29	D	U	12.4	AC	880
15-Aug-13	20:30	D	D	12.4	AC	810
15-Aug-13	20:30	D	U	12.4	AC	870
15-Aug-13	20:31	D	D	12.4	AC	820
15-Aug-13	20:31	D	U	12.4	AC	870
15-Aug-13	20:33	D	D	12.4	AC	780
15-Aug-13	20:33	D	U	12.4	AC	820
15-Aug-13	20:38	D	D	12.4	AC	690
15-Aug-13	20:39	D	U	12.4	AC	840
15-Aug-13	20:40	D	D	12.4	AC	810
15-Aug-13	20:42	D	U	12.4	AC	820
15-Aug-13	20:43	D	D	12.4	AC	790
15-Aug-13	20:43	D	U	12.4	AC	820
15-Aug-13	20:48	D	D	12.4	AC	810
15-Aug-13	20:48	D	U	12.4	AC	820
15-Aug-13	20:49	D	D	12.4	AC	810
15-Aug-13	20:50	D	D	12.4	AC	810
15-Aug-13	20:50	D	U	12.4	AC	850
15-Aug-13	20:51	D	D	12.4	AC	810
15-Aug-13	20:52	D	U	12.4	AC	860
15-Aug-13	20:53	D	D	12.4	AC	820
15-Aug-13	20:53	D	U	12.4	AC	850
15-Aug-13	20:58	D	D	12.4	AC	840
15-Aug-13	20:58	D	U	12.4	AC	850
15-Aug-13	21:01	D	D	12.4	AC	790
15-Aug-13	21:01	D	U	12.4	AC	840
16-Aug-13	5:30	D	D	12.1	AC	790
16-Aug-13	8:38	D	U	12.1	AC	930
16-Aug-13	8:50	D	D	12.1	AC	850
16-Aug-13	9:15	D	U	12.1	AC	710
16-Aug-13	9:15	D	U	12.1	AC	850
16-Aug-13	9:24	D	D	12.1	AC	940
16-Aug-13	9:29	D	U	12.1	AC	660
16-Aug-13	9:30	D	D	12.1	AC	500
16-Aug-13	9:30	D	U	12.1	AC	830

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
16-Aug-13	9:31	D	D	12.1	AC	740
16-Aug-13	9:31	D	U	12.1	AC	860
16-Aug-13	9:32	D	D	12.1	AC	840
16-Aug-13	9:33	D	U	12.1	AC	660
16-Aug-13	9:33	D	U	12.1	AC	840
16-Aug-13	9:33	D	U	12.1	AC	840
16-Aug-13	9:35	D	D	12.1	AC	790
16-Aug-13	9:35	D	D	12.1	AC	810
16-Aug-13	9:35	D	U	12.1	AC	790
16-Aug-13	9:36	D	D	12.1	AC	810
16-Aug-13	9:36	D	U	12.1	AC	-
16-Aug-13	9:37	D	U	12.1	AC	870
16-Aug-13	9:39	D	D	12.1	AC	810
16-Aug-13	9:39	D	U	12.1	AC	810
16-Aug-13	9:40	D	D	12.1	AC	610
16-Aug-13	9:40	D	D	12.1	AC	810
16-Aug-13	9:40	D	D	12.1	AC	840
16-Aug-13	9:40	D	U	12.1	AC	840
16-Aug-13	9:41	D	D	12.1	AC	840
16-Aug-13	9:41	D	U	12.1	AC	820
16-Aug-13	9:42	D	U	12.1	AC	640
16-Aug-13	9:45	D	U	12.1	AC	850
16-Aug-13	9:47	D	D	12.1	AC	810
16-Aug-13	9:47	D	U	12.1	AC	850
16-Aug-13	9:48	D	D	12.1	AC	810
16-Aug-13	9:48	D	U	12.1	AC	640
16-Aug-13	9:48	D	U	12.1	AC	870
16-Aug-13	9:49	D	D	12.1	AC	810
16-Aug-13	9:49	D	U	12.1	AC	850
16-Aug-13	9:50	D	D	12.1	AC	510
16-Aug-13	9:50	D	D	12.1	AC	660
16-Aug-13	9:53	D	U	12.1	AC	520
16-Aug-13	9:53	D	U	12.1	AC	820
16-Aug-13	9:54	D	D	12.1	AC	810
16-Aug-13	9:55	D	U	12.1	AC	830
16-Aug-13	9:56	D	D	12.1	AC	810
16-Aug-13	9:56	D	U	12.1	AC	820
16-Aug-13	9:57	D	D	12.1	AC	810
16-Aug-13	9:57	D	D	12.1	AC	810
16-Aug-13	9:57	D	D	12.1	AC	820
16-Aug-13	9:57	D	D	12.1	AC	820
16-Aug-13	9:57	D	U	12.1	AC	830
16-Aug-13	9:57	U	U	12.1	AC	710
16-Aug-13	9:58	D	D	12.1	AC	810
16-Aug-13	9:59	D	U	12.1	AC	850
16-Aug-13	10:00	U	U	12.1	AC	450
16-Aug-13	10:01	D	D	12.1	AC	360

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
16-Aug-13	10:01	D	D	12.1	AC	720
16-Aug-13	10:01	D	U	12.1	AC	880
16-Aug-13	10:02	D	D	12.1	AC	810
16-Aug-13	10:02	D	U	12.1	AC	1,060
16-Aug-13	10:03	D	U	12.1	AC	510
16-Aug-13	10:03	D	U	12.1	AC	640
16-Aug-13	10:23	D	D	12.1	AC	480
16-Aug-13	10:34	D	D	12.1	AC	510
16-Aug-13	10:36	U	U	12.1	AC	620
16-Aug-13	10:38	U	U	12.1	AC	810
16-Aug-13	10:45	D	D	12.1	AC	420
16-Aug-13	10:52	D	U	12.1	AC	520
16-Aug-13	10:55	D	D	12.1	AC	430
16-Aug-13	11:01	D	D	12.1	AC	430
16-Aug-13	11:06	D	D	12.1	AC	420
16-Aug-13	11:14	D	D	12.1	AC	550
16-Aug-13	11:25	D	D	12.1	AC	430
16-Aug-13	11:31	D	U	12.1	AC	510
16-Aug-13	11:36	D	D	12.1	AC	460
16-Aug-13	11:41	D	D	12.1	AC	490
16-Aug-13	11:42	D	U	12.1	AC	500
16-Aug-13	11:54	D	D	12.1	AC	450
16-Aug-13	11:58	D	D	12.1	AC	430
16-Aug-13	11:58	D	U	12.1	AC	540
16-Aug-13	12:01	D	D	12.1	AC	520
16-Aug-13	12:08	D	D	12.1	AC	420
16-Aug-13	12:08	D	U	12.1	AC	540
16-Aug-13	12:09	D	D	12.1	AC	580
16-Aug-13	12:10	D	U	12.1	AC	520
16-Aug-13	12:12	D	D	12.1	AC	430
16-Aug-13	12:27	D	D	12.1	AC	430
16-Aug-13	12:36	D	D	12.1	AC	510
16-Aug-13	13:28	D	D	12.1	AC	510
16-Aug-13	15:05	D	D	12.1	AC	420
16-Aug-13	15:37	D	D	12.1	AC	510
16-Aug-13	15:47	D	D	12.1	AC	400
16-Aug-13	15:48	D	D	12.1	AC	430
16-Aug-13	15:50	D	U	12.1	AC	-
16-Aug-13	15:53	D	D	12.1	AC	420
16-Aug-13	15:59	D	D	12.1	AC	510
16-Aug-13	15:59	D	U	12.1	AC	540
16-Aug-13	16:03	D	D	12.1	AC	520
16-Aug-13	16:04	D	D	12.1	AC	430
16-Aug-13	19:45	D	U	12.1	AC	930
16-Aug-13	19:53	D	U	12.1	AC	690
16-Aug-13	19:53	D	U	12.1	AC	870
16-Aug-13	20:03	D	U	12.1	AC	650

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
16-Aug-13	20:03	D	U	12.1	AC	810
16-Aug-13	20:04	D	D	12.1	AC	670
16-Aug-13	20:04	D	D	12.1	AC	720
16-Aug-13	20:04	D	D	12.1	AC	-
16-Aug-13	20:04	D	U	12.1	AC	780
16-Aug-13	20:11	D	D	12.1	AC	510
16-Aug-13	20:11	D	D	12.1	AC	850
16-Aug-13	20:11	D	D	12.1	AC	-
16-Aug-13	20:17	D	D	12.1	AC	610
17-Aug-13	4:39	U	U	11.7	LT	240
17-Aug-13	6:29	U	U	11.7	LT	450
17-Aug-13	12:12	D	U	11.7	AC	1,000
17-Aug-13	12:14	D	D	11.7	AC	750
17-Aug-13	12:30	U	U	11.7	AC	760
17-Aug-13	12:57	D	U	11.7	AC	610
17-Aug-13	13:26	U	U	11.7	AC	580
17-Aug-13	21:46	U	U	11.7	LT	390
18-Aug-13	4:33	U	U	11.7	LT	460
18-Aug-13	4:45	U	U	11.7	LT	250
18-Aug-13	5:01	D	U	11.7	AC	1,080
18-Aug-13	5:08	D	D	11.7	AC	780
18-Aug-13	5:21	D	D	11.7	AC	930
18-Aug-13	5:23	D	U	11.7	AC	1,200
18-Aug-13	10:59	D	U	11.7	AC	750
18-Aug-13	10:59	D	U	11.7	AC	870
18-Aug-13	11:03	D	U	11.7	AC	900
18-Aug-13	11:04	D	U	11.7	AC	950
18-Aug-13	11:07	D	U	11.7	AC	820
18-Aug-13	11:14	D	D	11.7	AC	720
18-Aug-13	11:16	D	D	11.7	AC	720
18-Aug-13	11:17	D	U	11.7	AC	840
18-Aug-13	11:20	D	D	11.7	AC	670
18-Aug-13	11:21	D	U	11.7	AC	820
18-Aug-13	11:22	D	D	11.7	AC	690
18-Aug-13	11:23	D	D	11.7	AC	720
18-Aug-13	11:27	D	D	11.7	AC	810
18-Aug-13	11:27	D	D	11.7	AC	810
18-Aug-13	11:28	D	U	11.7	AC	740
18-Aug-13	11:28	D	U	11.7	AC	840
18-Aug-13	11:29	D	D	11.7	AC	630
18-Aug-13	11:30	D	D	11.7	AC	510
18-Aug-13	11:30	D	U	11.7	AC	780
18-Aug-13	11:31	D	U	11.7	AC	850
18-Aug-13	11:32	U	U	11.7	AC	870
18-Aug-13	11:35	D	D	11.7	AC	750
18-Aug-13	11:36	D	D	11.7	AC	730
18-Aug-13	11:36	D	D	11.7	AC	750

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
18-Aug-13	11:36	D	U	11.7	AC	750
18-Aug-13	11:36	D	U	11.7	AC	780
18-Aug-13	11:37	D	U	11.7	AC	760
18-Aug-13	11:38	D	D	11.7	AC	730
18-Aug-13	11:39	D	D	11.7	AC	750
18-Aug-13	11:39	D	U	11.7	AC	760
18-Aug-13	11:39	U	U	11.7	AC	870
18-Aug-13	11:40	U	U	11.7	AC	910
18-Aug-13	11:41	U	U	11.7	AC	730
18-Aug-13	11:42	D	U	11.7	AC	570
18-Aug-13	11:42	D	U	11.7	AC	660
18-Aug-13	11:42	D	U	11.7	AC	760
18-Aug-13	11:42	D	U	11.7	AC	760
18-Aug-13	11:42	D	U	11.7	AC	790
18-Aug-13	11:44	D	D	11.7	AC	730
18-Aug-13	11:44	D	U	11.7	AC	770
18-Aug-13	11:45	D	D	11.7	AC	750
18-Aug-13	11:45	D	U	11.7	AC	760
18-Aug-13	11:46	D	D	11.7	AC	430
18-Aug-13	11:46	D	U	11.7	AC	750
18-Aug-13	11:47	D	U	11.7	AC	830
18-Aug-13	11:49	D	D	11.7	AC	750
18-Aug-13	11:49	D	D	11.7	AC	820
18-Aug-13	11:49	D	U	11.7	AC	580
18-Aug-13	11:49	D	U	11.7	AC	-
18-Aug-13	11:49	D	U	11.7	AC	-
18-Aug-13	11:49	D	U	11.7	AC	-
18-Aug-13	11:49	D	U	11.7	AC	-
18-Aug-13	11:50	D	U	11.7	AC	520
18-Aug-13	11:50	D	U	11.7	AC	710
18-Aug-13	11:50	D	U	11.7	AC	760
18-Aug-13	11:51	D	D	11.7	AC	640
18-Aug-13	11:51	D	D	11.7	AC	810
18-Aug-13	11:52	D	U	11.7	AC	840
18-Aug-13	11:53	D	D	11.7	AC	630
18-Aug-13	11:53	D	D	11.7	AC	690
18-Aug-13	11:57	U	U	11.7	AC	1,010
18-Aug-13	12:01	D	D	11.7	AC	810
18-Aug-13	12:03	U	U	11.7	AC	640
18-Aug-13	12:04	U	U	11.7	AC	820
18-Aug-13	12:13	U	U	11.7	AC	690
18-Aug-13	12:19	U	U	11.7	AC	690
18-Aug-13	12:25	U	U	11.7	AC	490
18-Aug-13	12:29	U	U	11.7	AC	710
18-Aug-13	12:30	U	U	11.7	AC	490
18-Aug-13	12:38	D	U	11.7	AC	850
18-Aug-13	12:41	D	D	11.7	AC	850

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
18-Aug-13	12:47	U	U	11.7	AC	540
18-Aug-13	13:04	U	U	11.7	AC	820
18-Aug-13	13:36	U	U	11.7	AC	760
18-Aug-13	13:37	U	U	11.7	AC	620
18-Aug-13	13:38	U	U	11.7	AC	710
18-Aug-13	13:42	U	U	11.7	AC	720
18-Aug-13	15:37	D	U	11.7	AC	390
18-Aug-13	20:19	D	U	11.7	AC	390
19-Aug-13	4:56	U	U	11.4	LT	440
19-Aug-13	7:17	U	U	11.4	LT	450
19-Aug-13	8:21	D	U	11.4	AC	840
19-Aug-13	8:27	D	U	11.4	AC	450
19-Aug-13	8:56	D	U	11.4	AC	850
19-Aug-13	8:56	D	U	11.4	AC	910
19-Aug-13	8:58	D	D	11.4	AC	760
19-Aug-13	8:58	D	D	11.4	AC	880
19-Aug-13	9:10	D	U	11.4	AC	950
19-Aug-13	9:14	D	D	11.4	AC	900
19-Aug-13	9:15	D	U	11.4	AC	930
19-Aug-13	9:53	D	U	11.4	AC	840
19-Aug-13	9:56	D	D	11.4	AC	840
19-Aug-13	9:57	U	U	11.4	AC	710
19-Aug-13	9:58	U	U	11.4	AC	880
19-Aug-13	9:59	D	D	11.4	AC	840
19-Aug-13	10:15	D	U	11.4	AC	870
19-Aug-13	10:18	D	U	11.4	AC	700
19-Aug-13	10:18	D	U	11.4	AC	790
19-Aug-13	10:18	D	U	11.4	AC	840
19-Aug-13	10:21	D	D	11.4	AC	690
19-Aug-13	10:21	D	U	11.4	AC	860
19-Aug-13	10:35	D	D	11.4	AC	690
19-Aug-13	10:35	D	D	11.4	AC	760
19-Aug-13	10:35	D	U	11.4	AC	700
19-Aug-13	10:35	D	U	11.4	AC	700
19-Aug-13	10:35	U	U	11.4	AC	360
19-Aug-13	10:36	D	D	11.4	AC	670
19-Aug-13	10:36	D	D	11.4	AC	720
19-Aug-13	10:36	D	U	11.4	AC	760
19-Aug-13	10:39	D	D	11.4	AC	670
19-Aug-13	10:39	D	D	11.4	AC	750
19-Aug-13	10:39	D	U	11.4	AC	760
19-Aug-13	10:40	D	U	11.4	AC	660
19-Aug-13	10:40	D	U	11.4	AC	670
19-Aug-13	10:40	D	U	11.4	AC	740
19-Aug-13	10:40	D	U	11.4	AC	760
19-Aug-13	10:41	D	U	11.4	AC	860
19-Aug-13	10:42	D	U	11.4	AC	690

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
19-Aug-13	10:45	D	D	11.4	AC	580
19-Aug-13	10:45	D	D	11.4	AC	640
19-Aug-13	10:45	D	D	11.4	AC	700
19-Aug-13	10:46	D	D	11.4	AC	470
19-Aug-13	10:46	D	D	11.4	AC	820
19-Aug-13	10:46	D	U	11.4	AC	730
19-Aug-13	10:46	D	U	11.4	AC	870
19-Aug-13	10:46	D	U	11.4	AC	-
19-Aug-13	10:47	D	U	11.4	AC	750
19-Aug-13	10:48	D	D	11.4	AC	700
19-Aug-13	10:48	D	U	11.4	AC	480
19-Aug-13	10:48	D	U	11.4	AC	550
19-Aug-13	10:48	D	U	11.4	AC	570
19-Aug-13	10:48	D	U	11.4	AC	940
19-Aug-13	10:52	D	U	11.4	AC	730
19-Aug-13	10:58	D	U	11.4	AC	660
19-Aug-13	10:58	D	U	11.4	AC	990
19-Aug-13	10:58	D	U	11.4	AC	-
19-Aug-13	10:59	D	D	11.4	AC	660
19-Aug-13	10:59	D	D	11.4	AC	690
19-Aug-13	10:59	D	U	11.4	AC	400
19-Aug-13	11:00	D	D	11.4	AC	700
19-Aug-13	11:01	D	D	11.4	AC	660
19-Aug-13	11:01	D	U	11.4	AC	670
19-Aug-13	11:02	U	U	11.4	AC	420
19-Aug-13	11:02	U	U	11.4	AC	690
19-Aug-13	11:02	U	U	11.4	AC	850
19-Aug-13	11:07	D	D	11.4	AC	750
19-Aug-13	11:07	D	U	11.4	AC	760
19-Aug-13	11:07	D	U	11.4	AC	780
19-Aug-13	11:07	D	U	11.4	AC	-
19-Aug-13	11:07	D	U	11.4	AC	-
19-Aug-13	11:07	D	U	11.4	AC	-
19-Aug-13	11:11	D	D	11.4	AC	750
19-Aug-13	11:11	D	U	11.4	AC	790
19-Aug-13	11:13	D	D	11.4	AC	540
19-Aug-13	11:13	D	U	11.4	AC	780
19-Aug-13	11:15	D	U	11.4	AC	660
19-Aug-13	11:15	D	U	11.4	AC	670
19-Aug-13	11:15	D	U	11.4	AC	710
19-Aug-13	11:15	D	U	11.4	AC	750
19-Aug-13	11:15	U	U	11.4	AC	690
19-Aug-13	11:15	U	U	11.4	AC	910
19-Aug-13	11:16	D	D	11.4	AC	600
19-Aug-13	11:16	U	U	11.4	AC	580
19-Aug-13	11:17	U	U	11.4	AC	790
19-Aug-13	11:18	D	D	11.4	AC	-

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
19-Aug-13	11:18	D	U	11.4	AC	650
19-Aug-13	11:18	D	U	11.4	AC	-
19-Aug-13	11:21	D	D	11.4	AC	750
19-Aug-13	11:21	D	D	11.4	AC	960
19-Aug-13	11:21	D	U	11.4	AC	790
19-Aug-13	11:21	D	U	11.4	AC	810
19-Aug-13	11:21	D	U	11.4	AC	1,010
19-Aug-13	11:22	U	U	11.4	AC	730
19-Aug-13	11:22	U	U	11.4	AC	870
19-Aug-13	11:23	U	U	11.4	AC	700
19-Aug-13	11:23	U	U	11.4	AC	840
19-Aug-13	11:24	D	D	11.4	AC	470
19-Aug-13	11:24	U	U	11.4	AC	690
19-Aug-13	11:25	D	D	11.4	AC	780
19-Aug-13	11:25	D	U	11.4	AC	820
19-Aug-13	11:25	U	U	11.4	AC	690
19-Aug-13	11:26	D	U	11.4	AC	1,010
19-Aug-13	11:27	D	D	11.4	AC	960
19-Aug-13	11:28	D	D	11.4	AC	570
19-Aug-13	11:28	D	U	11.4	AC	1,030
19-Aug-13	11:28	U	U	11.4	AC	820
19-Aug-13	11:29	D	U	11.4	AC	630
19-Aug-13	11:29	D	U	11.4	AC	800
19-Aug-13	11:30	D	D	11.4	AC	970
19-Aug-13	11:30	D	U	11.4	AC	1,010
19-Aug-13	11:31	D	D	11.4	AC	960
19-Aug-13	11:32	D	D	11.4	AC	570
19-Aug-13	11:33	D	U	11.4	AC	650
19-Aug-13	11:33	D	U	11.4	AC	1,020
19-Aug-13	11:33	U	U	11.4	AC	650
19-Aug-13	11:45	U	U	11.4	AC	610
19-Aug-13	11:45	U	U	11.4	AC	750
19-Aug-13	11:51	U	U	11.4	AC	480
19-Aug-13	11:51	U	U	11.4	AC	730
19-Aug-13	11:53	D	U	11.4	AC	750
19-Aug-13	11:58	U	U	11.4	AC	730
19-Aug-13	12:08	D	D	11.4	AC	620
19-Aug-13	12:09	D	U	11.4	AC	810
19-Aug-13	12:11	D	D	11.4	AC	450
19-Aug-13	12:14	D	D	11.4	AC	760
19-Aug-13	12:18	D	D	11.4	AC	760
19-Aug-13	12:25	U	U	11.4	AC	620
19-Aug-13	12:34	U	U	11.4	AC	980
19-Aug-13	12:36	U	U	11.4	AC	660
19-Aug-13	12:38	U	U	11.4	AC	630
19-Aug-13	12:41	U	U	11.4	AC	550
19-Aug-13	14:39	D	D	11.4	AC	660

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
19-Aug-13	17:48	U	U	11.4	LT	330
19-Aug-13	21:02	D	U	11.4	AC	360
20-Aug-13	1:04	D	U	11.1	LT	400
20-Aug-13	1:10	D	D	11.1	LT	340
20-Aug-13	1:14	D	U	11.1	LT	400
20-Aug-13	1:27	D	U	11.1	LT	410
20-Aug-13	1:31	D	D	11.1	LT	330
20-Aug-13	1:37	D	U	11.1	LT	400
20-Aug-13	2:55	D	U	11.1	AC	360
20-Aug-13	4:46	U	D	11.1	LT	270
20-Aug-13	5:37	D	U	11.1	AC	490
20-Aug-13	6:18	U	U	11.1	AC	460
20-Aug-13	7:03	D	U	11.1	AC	660
20-Aug-13	7:11	D	D	11.1	AC	630
20-Aug-13	7:11	D	U	11.1	AC	690
20-Aug-13	7:13	D	D	11.1	AC	660
20-Aug-13	7:13	D	U	11.1	AC	700
20-Aug-13	7:17	D	D	11.1	AC	660
20-Aug-13	7:18	D	D	11.1	AC	640
20-Aug-13	7:18	D	U	11.1	AC	690
20-Aug-13	7:18	D	U	11.1	AC	710
20-Aug-13	7:22	D	U	11.1	AC	690
20-Aug-13	7:23	D	D	11.1	AC	630
20-Aug-13	7:28	D	U	11.1	AC	690
20-Aug-13	7:30	D	U	11.1	AC	700
20-Aug-13	16:21	D	U	11.1	AC	870
20-Aug-13	16:29	D	U	11.1	AC	850
20-Aug-13	16:41	D	U	11.1	AC	760
20-Aug-13	16:42	D	U	11.1	AC	760
20-Aug-13	16:42	D	U	11.1	AC	850
20-Aug-13	16:44	D	D	11.1	AC	810
20-Aug-13	16:46	D	U	11.1	AC	860
20-Aug-13	16:47	D	D	11.1	AC	820
20-Aug-13	16:48	D	D	11.1	AC	670
20-Aug-13	16:48	D	U	11.1	AC	850
20-Aug-13	16:50	D	D	11.1	AC	560
20-Aug-13	16:56	D	D	11.1	AC	730
20-Aug-13	16:56	D	U	11.1	AC	670
20-Aug-13	16:56	D	U	11.1	AC	780
20-Aug-13	17:00	D	D	11.1	AC	750
20-Aug-13	17:00	D	U	11.1	AC	780
20-Aug-13	17:02	D	U	11.1	AC	750
20-Aug-13	17:03	D	D	11.1	AC	750
20-Aug-13	17:18	D	U	11.1	AC	450
20-Aug-13	17:32	U	U	11.1	AC	870
20-Aug-13	20:18	D	U	11.1	AC	450
20-Aug-13	20:53	U	U	11.1	AC	740

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
20-Aug-13	21:34	D	U	11.1	AC	430
20-Aug-13	22:12	D	U	11.1	AC	850
20-Aug-13	22:13	D	U	11.1	AC	890
20-Aug-13	22:26	U	U	11.1	AC	400
20-Aug-13	22:26	U	U	11.1	AC	430
20-Aug-13	22:50	U	U	11.1	AC	850
20-Aug-13	22:58	U	U	11.1	AC	750
21-Aug-13	0:22	U	D	10.6	LT	430
21-Aug-13	0:28	U	U	10.6	LT	490
21-Aug-13	4:28	D	U	10.6	AC	600
21-Aug-13	4:28	D	U	10.6	AC	700
21-Aug-13	4:28	D	U	10.6	AC	-
21-Aug-13	4:49	U	U	10.6	AC	810
21-Aug-13	4:50	U	U	10.6	AC	810
21-Aug-13	4:54	D	U	10.6	AC	750
21-Aug-13	4:56	D	U	10.6	AC	500
21-Aug-13	4:56	D	U	10.6	AC	550
21-Aug-13	4:57	D	U	10.6	AC	550
21-Aug-13	4:57	D	U	10.6	AC	730
21-Aug-13	5:02	D	U	10.6	AC	670
21-Aug-13	5:04	D	U	10.6	AC	580
21-Aug-13	5:04	D	U	10.6	AC	-
21-Aug-13	5:07	D	D	10.6	AC	570
21-Aug-13	5:09	D	D	10.6	AC	540
21-Aug-13	5:19	D	D	10.6	AC	610
21-Aug-13	5:20	U	U	10.6	AC	720
21-Aug-13	5:22	D	D	10.6	AC	600
21-Aug-13	5:22	D	U	10.6	AC	740
21-Aug-13	5:23	D	D	10.6	AC	720
21-Aug-13	5:28	U	U	10.6	AC	670
21-Aug-13	5:32	U	U	10.6	AC	580
21-Aug-13	5:37	U	U	10.6	AC	460
21-Aug-13	5:37	U	U	10.6	AC	630
21-Aug-13	5:38	U	U	10.6	AC	670
21-Aug-13	5:40	U	U	10.6	AC	510
21-Aug-13	5:40	U	U	10.6	AC	530
21-Aug-13	5:42	D	U	10.6	AC	540
21-Aug-13	5:43	D	D	10.6	AC	490
21-Aug-13	5:44	D	U	10.6	AC	520
21-Aug-13	5:51	D	U	10.6	AC	510
21-Aug-13	6:01	U	U	10.6	AC	640
21-Aug-13	6:07	D	U	10.6	AC	510
21-Aug-13	6:09	D	U	10.6	AC	510
21-Aug-13	6:12	D	U	10.6	AC	520
21-Aug-13	6:14	U	U	10.6	AC	950
21-Aug-13	7:20	D	D	10.6	AC	510
21-Aug-13	7:20	D	U	10.6	AC	520

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
21-Aug-13	7:21	D	U	10.6	AC	510
21-Aug-13	7:25	D	U	10.6	AC	520
21-Aug-13	7:57	D	D	10.6	AC	510
21-Aug-13	7:57	D	U	10.6	AC	510
21-Aug-13	10:41	D	U	10.6	AC	510
21-Aug-13	10:49	D	D	10.6	AC	450
21-Aug-13	14:24	D	D	10.6	AC	480
21-Aug-13	14:45	D	D	10.6	AC	510
21-Aug-13	17:14	D	U	10.6	AC	490
21-Aug-13	17:17	D	D	10.6	AC	510
21-Aug-13	17:18	D	D	10.6	AC	430
21-Aug-13	17:18	D	U	10.6	AC	-
21-Aug-13	17:26	D	D	10.6	AC	510
21-Aug-13	17:26	D	U	10.6	AC	510
21-Aug-13	17:56	D	D	10.6	AC	510
21-Aug-13	17:58	D	D	10.6	AC	490
21-Aug-13	18:00	D	D	10.6	AC	510
21-Aug-13	18:02	D	U	10.6	AC	500
21-Aug-13	18:04	D	D	10.6	AC	480
21-Aug-13	18:06	D	D	10.6	AC	490
21-Aug-13	18:08	D	D	10.6	AC	510
21-Aug-13	18:10	D	D	10.6	AC	510
21-Aug-13	18:11	D	D	10.6	AC	490
21-Aug-13	18:15	D	D	10.6	AC	490
21-Aug-13	19:16	U	U	10.6	LT	420
21-Aug-13	19:19	U	U	10.6	LT	440
21-Aug-13	19:23	U	U	10.6	LT	430
21-Aug-13	19:38	U	U	10.6	LT	430
21-Aug-13	19:43	U	U	10.6	LT	430
21-Aug-13	20:03	U	U	10.6	LT	420
21-Aug-13	20:10	D	U	10.6	AC	500
21-Aug-13	20:11	D	D	10.6	AC	490
21-Aug-13	20:44	D	D	10.6	AC	510
21-Aug-13	20:49	D	D	10.6	AC	510
21-Aug-13	20:51	D	U	10.6	AC	520
21-Aug-13	20:52	D	D	10.6	AC	510
21-Aug-13	20:57	D	D	10.6	AC	510
21-Aug-13	21:00	D	D	10.6	AC	490
21-Aug-13	21:06	D	D	10.6	AC	510
21-Aug-13	21:08	D	U	10.6	AC	490
21-Aug-13	21:14	D	D	10.6	AC	510
21-Aug-13	21:17	D	D	10.6	AC	510
21-Aug-13	21:20	D	D	10.6	AC	520
21-Aug-13	21:21	U	U	10.6	LT	420
21-Aug-13	21:24	D	D	10.6	AC	490
21-Aug-13	21:27	D	D	10.6	AC	480
21-Aug-13	21:27	D	U	10.6	AC	510

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
21-Aug-13	21:27	U	U	10.6	LT	430
21-Aug-13	21:40	D	U	10.6	AC	390
21-Aug-13	21:53	D	U	10.6	AC	500
21-Aug-13	21:55	D	U	10.6	AC	460
21-Aug-13	22:02	D	U	10.6	AC	460
21-Aug-13	22:12	D	U	10.6	AC	370
21-Aug-13	22:12	D	U	10.6	AC	520
21-Aug-13	22:27	D	U	10.6	AC	480
21-Aug-13	22:37	D	U	10.6	AC	410
22-Aug-13	0:22	U	U	10.5	AC	450
22-Aug-13	8:31	D	U	10.5	AC	360
22-Aug-13	8:31	D	U	10.5	AC	-
22-Aug-13	8:32	D	D	10.5	AC	840
22-Aug-13	8:34	D	U	10.5	AC	1,210
22-Aug-13	8:40	D	D	10.5	AC	530
22-Aug-13	8:40	D	D	10.5	AC	760
22-Aug-13	8:40	D	U	10.5	AC	930
22-Aug-13	8:40	D	U	10.5	AC	-
22-Aug-13	8:40	D	U	10.5	AC	-
22-Aug-13	8:41	D	D	10.5	AC	840
22-Aug-13	8:41	D	D	10.5	AC	-
22-Aug-13	8:41	D	U	10.5	AC	1,170
22-Aug-13	8:41	D	U	10.5	AC	-
22-Aug-13	8:44	D	D	10.5	AC	780
22-Aug-13	8:44	D	U	10.5	AC	640
22-Aug-13	8:44	D	U	10.5	AC	850
22-Aug-13	8:44	D	U	10.5	AC	-
22-Aug-13	8:46	D	U	10.5	AC	610
22-Aug-13	8:47	D	D	10.5	AC	760
22-Aug-13	8:49	D	D	10.5	AC	510
22-Aug-13	8:51	D	D	10.5	AC	610
22-Aug-13	8:55	D	D	10.5	AC	640
22-Aug-13	8:55	D	D	10.5	AC	-
22-Aug-13	8:55	D	U	10.5	AC	-
22-Aug-13	8:55	D	U	10.5	AC	-
22-Aug-13	8:55	D	U	10.5	AC	-
22-Aug-13	8:57	D	D	10.5	AC	460
22-Aug-13	8:57	D	D	10.5	AC	660
22-Aug-13	8:59	D	D	10.5	AC	660
22-Aug-13	8:59	D	D	10.5	AC	690
22-Aug-13	9:00	D	U	10.5	AC	-
22-Aug-13	9:00	D	U	10.5	AC	-
22-Aug-13	9:02	D	D	10.5	AC	690
22-Aug-13	9:02	D	D	10.5	AC	-
22-Aug-13	9:05	D	D	10.5	AC	670
22-Aug-13	9:06	D	D	10.5	AC	660
22-Aug-13	9:09	D	D	10.5	AC	660

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
22-Aug-13	10:52	D	D	10.5	AC	390
22-Aug-13	10:52	D	D	10.5	AC	-
22-Aug-13	10:52	D	U	10.5	AC	-
22-Aug-13	10:52	D	U	10.5	AC	-
22-Aug-13	10:52	D	U	10.5	AC	-
22-Aug-13	10:52	D	U	10.5	AC	-
22-Aug-13	10:52	D	U	10.5	AC	-
22-Aug-13	10:55	D	D	10.5	AC	480
22-Aug-13	10:55	D	D	10.5	AC	570
22-Aug-13	10:57	D	D	10.5	AC	480
22-Aug-13	10:57	D	D	10.5	AC	540
22-Aug-13	10:57	D	D	10.5	AC	-
22-Aug-13	10:58	D	D	10.5	AC	-
22-Aug-13	10:58	D	U	10.5	AC	570
22-Aug-13	10:59	D	D	10.5	AC	450
22-Aug-13	10:59	D	U	10.5	AC	-
22-Aug-13	11:00	D	U	10.5	AC	420
22-Aug-13	11:00	D	U	10.5	AC	-
22-Aug-13	11:00	D	U	10.5	LT	-
22-Aug-13	11:01	D	D	10.5	AC	450
22-Aug-13	11:01	D	D	10.5	AC	670
22-Aug-13	11:04	D	D	10.5	AC	660
22-Aug-13	11:06	D	D	10.5	AC	640
22-Aug-13	12:16	D	D	10.5	AC	390
22-Aug-13	12:20	D	D	10.5	AC	630
22-Aug-13	12:21	D	D	10.5	AC	610
22-Aug-13	12:23	D	D	10.5	AC	630
22-Aug-13	12:28	D	D	10.5	AC	610
22-Aug-13	12:31	D	D	10.5	AC	580
22-Aug-13	12:33	D	D	10.5	AC	600
22-Aug-13	12:35	D	D	10.5	AC	610
22-Aug-13	12:35	D	D	10.5	AC	730
22-Aug-13	12:36	D	D	10.5	AC	610
22-Aug-13	12:36	D	D	10.5	AC	720
22-Aug-13	12:37	D	D	10.5	AC	390
22-Aug-13	12:39	D	D	10.5	AC	630
22-Aug-13	12:40	D	D	10.5	AC	1,050
22-Aug-13	12:42	D	D	10.5	AC	660
22-Aug-13	12:44	D	D	10.5	AC	630
22-Aug-13	12:47	D	D	10.5	AC	390
22-Aug-13	16:13	D	D	10.5	AC	810
22-Aug-13	16:13	D	U	10.5	AC	-
22-Aug-13	16:15	D	D	10.5	AC	810
22-Aug-13	16:15	D	D	10.5	AC	820
22-Aug-13	16:15	D	U	10.5	AC	-
22-Aug-13	16:15	D	U	10.5	AC	-
22-Aug-13	16:16	D	D	10.5	AC	810

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
22-Aug-13	16:18	D	D	10.5	AC	810
22-Aug-13	16:18	D	U	10.5	AC	-
22-Aug-13	16:19	D	D	10.5	AC	810
22-Aug-13	16:21	D	D	10.5	AC	820
22-Aug-13	16:24	D	D	10.5	AC	690
22-Aug-13	16:24	D	U	10.5	AC	-
22-Aug-13	16:29	D	D	10.5	AC	820
22-Aug-13	16:29	D	U	10.5	AC	-
22-Aug-13	16:30	D	D	10.5	AC	770
22-Aug-13	16:31	D	D	10.5	AC	820
22-Aug-13	16:31	D	U	10.5	AC	850
22-Aug-13	16:31	D	U	10.5	AC	-
22-Aug-13	16:32	D	D	10.5	AC	820
22-Aug-13	16:32	D	U	10.5	AC	-
22-Aug-13	16:33	D	D	10.5	AC	810
22-Aug-13	16:33	D	U	10.5	AC	-
22-Aug-13	22:02	D	U	10.5	AC	360
22-Aug-13	22:35	D	U	10.5	AC	370
22-Aug-13	23:41	D	U	10.5	AC	420
23-Aug-13	4:36	D	U	9.4	AC	830
23-Aug-13	4:42	D	U	9.4	AC	790
23-Aug-13	4:58	D	D	9.4	AC	600
23-Aug-13	4:58	D	D	9.4	AC	610
23-Aug-13	10:28	D	U	9.4	AC	-
23-Aug-13	10:29	D	D	9.4	AC	700
23-Aug-13	10:29	D	U	9.4	AC	750
23-Aug-13	10:31	D	U	9.4	AC	520
23-Aug-13	10:32	D	D	9.4	AC	750
23-Aug-13	10:32	D	U	9.4	AC	750
23-Aug-13	10:33	D	D	9.4	AC	520
23-Aug-13	10:33	D	U	9.4	AC	550
23-Aug-13	10:33	D	U	9.4	AC	730
23-Aug-13	10:34	D	D	9.4	AC	520
23-Aug-13	10:34	D	D	9.4	AC	720
23-Aug-13	10:34	D	U	9.4	AC	550
23-Aug-13	10:34	D	U	9.4	AC	770
23-Aug-13	10:35	D	D	9.4	AC	720
23-Aug-13	10:35	D	U	9.4	AC	760
23-Aug-13	10:36	D	D	9.4	AC	600
23-Aug-13	10:36	D	U	9.4	AC	520
23-Aug-13	10:38	D	D	9.4	AC	720
23-Aug-13	10:38	D	U	9.4	AC	530
23-Aug-13	10:38	D	U	9.4	AC	790
23-Aug-13	10:39	D	D	9.4	AC	520
23-Aug-13	10:40	D	D	9.4	AC	720
23-Aug-13	10:40	D	U	9.4	AC	750
23-Aug-13	10:41	D	D	9.4	AC	720

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
23-Aug-13	10:41	D	U	9.4	AC	740
23-Aug-13	10:42	D	D	9.4	AC	700
23-Aug-13	10:42	D	U	9.4	AC	770
23-Aug-13	10:44	D	D	9.4	AC	730
23-Aug-13	10:44	D	U	9.4	AC	740
23-Aug-13	11:10	U	U	9.4	AC	730
23-Aug-13	11:24	U	U	9.4	AC	630
23-Aug-13	12:15	D	U	9.4	AC	530
23-Aug-13	12:18	D	D	9.4	AC	520
23-Aug-13	12:18	D	U	9.4	AC	520
23-Aug-13	13:02	D	U	9.4	AC	790
23-Aug-13	13:04	D	D	9.4	AC	780
23-Aug-13	13:04	D	U	9.4	AC	790
23-Aug-13	13:05	D	D	9.4	AC	780
23-Aug-13	13:05	D	U	9.4	AC	810
23-Aug-13	13:06	D	D	9.4	AC	760
23-Aug-13	13:06	D	U	9.4	AC	820
23-Aug-13	13:07	D	D	9.4	AC	630
23-Aug-13	13:07	D	D	9.4	AC	760
23-Aug-13	13:09	D	U	9.4	AC	810
23-Aug-13	13:10	D	D	9.4	AC	760
23-Aug-13	13:10	D	U	9.4	AC	810
23-Aug-13	13:11	D	D	9.4	AC	780
23-Aug-13	13:11	D	U	9.4	AC	800
23-Aug-13	13:12	D	D	9.4	AC	750
23-Aug-13	13:12	D	U	9.4	AC	790
23-Aug-13	13:14	D	D	9.4	AC	760
23-Aug-13	13:14	D	U	9.4	AC	780
23-Aug-13	13:15	D	D	9.4	AC	780
23-Aug-13	13:17	D	U	9.4	AC	810
23-Aug-13	13:19	D	D	9.4	AC	760
23-Aug-13	13:19	D	U	9.4	AC	790
23-Aug-13	13:20	D	D	9.4	AC	760
23-Aug-13	13:20	D	U	9.4	AC	820
23-Aug-13	13:41	U	U	9.4	AC	760
23-Aug-13	14:10	D	U	9.4	AC	900
23-Aug-13	14:10	D	U	9.4	AC	990
23-Aug-13	14:41	U	U	9.4	AC	970
23-Aug-13	14:51	U	U	9.4	AC	990
23-Aug-13	15:03	D	U	9.4	AC	450
23-Aug-13	16:32	D	U	9.4	AC	540
23-Aug-13	16:34	D	U	9.4	AC	540
23-Aug-13	16:36	D	U	9.4	AC	520
23-Aug-13	16:37	D	D	9.4	AC	510
23-Aug-13	16:38	D	U	9.4	AC	360
23-Aug-13	16:38	D	U	9.4	AC	530
23-Aug-13	16:39	D	D	9.4	AC	510

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
23-Aug-13	17:09	D	U	9.4	AC	450
23-Aug-13	17:12	D	U	9.4	AC	510
23-Aug-13	17:15	D	D	9.4	AC	460
23-Aug-13	17:16	D	D	9.4	AC	870
23-Aug-13	17:16	D	U	9.4	AC	450
23-Aug-13	17:16	D	U	9.4	AC	900
23-Aug-13	17:18	D	D	9.4	AC	450
23-Aug-13	17:18	D	D	9.4	AC	880
23-Aug-13	17:18	D	U	9.4	AC	930
23-Aug-13	17:19	D	U	9.4	AC	450
23-Aug-13	17:20	D	D	9.4	AC	850
23-Aug-13	17:20	D	U	9.4	AC	930
23-Aug-13	17:33	D	U	9.4	AC	830
23-Aug-13	17:34	D	D	9.4	AC	750
23-Aug-13	17:35	D	U	9.4	AC	800
23-Aug-13	17:35	D	U	9.4	AC	930
23-Aug-13	17:36	D	D	9.4	AC	870
23-Aug-13	17:36	D	D	9.4	AC	-
23-Aug-13	17:37	D	U	9.4	AC	930
23-Aug-13	17:37	D	U	9.4	AC	-
23-Aug-13	17:38	D	D	9.4	AC	870
23-Aug-13	17:38	D	U	9.4	AC	910
23-Aug-13	17:45	U	U	9.4	AC	430
23-Aug-13	17:53	U	U	9.4	AC	480
23-Aug-13	17:54	U	U	9.4	AC	870
23-Aug-13	18:08	D	U	9.4	AC	630
23-Aug-13	18:08	D	U	9.4	AC	640
23-Aug-13	18:09	D	U	9.4	AC	470
23-Aug-13	18:09	D	U	9.4	AC	-
23-Aug-13	18:09	D	U	9.4	AC	-
23-Aug-13	18:10	D	D	9.4	AC	490
23-Aug-13	18:10	D	D	9.4	AC	610
23-Aug-13	18:12	D	D	9.4	AC	490
23-Aug-13	18:12	D	D	9.4	AC	630
23-Aug-13	18:12	D	U	9.4	AC	630
23-Aug-13	18:13	D	U	9.4	AC	510
23-Aug-13	18:14	D	D	9.4	AC	610
23-Aug-13	18:14	D	U	9.4	AC	650
23-Aug-13	19:47	D	U	9.4	AC	510
23-Aug-13	19:52	D	D	9.4	AC	540
23-Aug-13	19:53	D	D	9.4	AC	440
23-Aug-13	19:55	D	D	9.4	AC	550
23-Aug-13	19:55	D	U	9.4	AC	520
23-Aug-13	20:05	D	U	9.4	AC	510
23-Aug-13	20:06	D	D	9.4	AC	570
23-Aug-13	20:06	D	U	9.4	AC	520
23-Aug-13	20:07	D	D	9.4	AC	510

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
23-Aug-13	20:09	D	U	9.4	AC	540
23-Aug-13	20:10	D	D	9.4	AC	510
23-Aug-13	20:11	D	U	9.4	AC	530
23-Aug-13	20:40	D	U	9.4	AC	370
23-Aug-13	20:47	D	U	9.4	AC	620
28-Aug-13	15:18	D	U	7.2	AC	1,010
28-Aug-13	16:41	D	D	7.2	AC	940
28-Aug-13	16:41	D	U	7.2	AC	930
28-Aug-13	16:42	D	U	7.2	AC	930
28-Aug-13	17:41	U	U	7.2	AC	910
29-Aug-13	2:19	D	U	6.9	AC	470
29-Aug-13	19:20	D	U	6.9	AC	360
29-Aug-13	19:32	D	U	6.9	AC	390
29-Aug-13	19:35	D	U	6.9	AC	390
29-Aug-13	19:37	D	U	6.9	AC	390
29-Aug-13	19:39	D	D	6.9	AC	390
29-Aug-13	19:39	D	U	6.9	AC	400
29-Aug-13	19:40	D	D	6.9	AC	360
29-Aug-13	19:40	D	U	6.9	AC	390
29-Aug-13	19:41	D	D	6.9	AC	370
29-Aug-13	19:41	D	U	6.9	AC	390
29-Aug-13	19:48	D	U	6.9	AC	390
29-Aug-13	19:51	D	D	6.9	AC	390
29-Aug-13	19:53	D	U	6.9	AC	390
29-Aug-13	19:59	D	D	6.9	AC	390
29-Aug-13	20:01	D	D	6.9	AC	390
29-Aug-13	20:03	D	U	6.9	AC	360
30-Aug-13	1:01	U	U	7.5	AC	400
30-Aug-13	2:12	D	U	7.5	AC	520
30-Aug-13	2:13	D	D	7.5	AC	380
30-Aug-13	2:17	D	U	7.5	AC	620
30-Aug-13	3:02	U	U	7.5	AC	600
30-Aug-13	4:18	D	U	7.5	AC	390
30-Aug-13	4:18	U	U	7.5	LT	490
30-Aug-13	4:20	U	U	7.5	LT	490
30-Aug-13	4:26	U	D	7.5	LT	520
30-Aug-13	4:27	U	D	7.5	LT	510
30-Aug-13	4:39	D	U	7.5	AC	480
30-Aug-13	4:49	D	D	7.5	AC	400
30-Aug-13	4:50	D	U	7.5	AC	460
30-Aug-13	4:54	D	U	7.5	AC	490
30-Aug-13	4:58	D	D	7.5	AC	450
30-Aug-13	5:01	U	U	7.5	AC	380
30-Aug-13	6:26	U	U	7.5	AC	450
30-Aug-13	10:10	U	D	7.5	LT	420
30-Aug-13	14:33	D	U	7.5	AC	920
30-Aug-13	15:01	D	U	7.5	AC	460

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
30-Aug-13	15:03	D	D	7.5	AC	480
30-Aug-13	15:04	D	U	7.5	AC	480
30-Aug-13	15:04	U	U	7.5	AC	870
30-Aug-13	15:06	D	D	7.5	AC	480
30-Aug-13	15:06	D	U	7.5	AC	640
30-Aug-13	15:07	D	D	7.5	AC	470
30-Aug-13	15:07	D	U	7.5	AC	780
30-Aug-13	15:07	D	U	7.5	AC	-
30-Aug-13	15:08	D	U	7.5	AC	460
30-Aug-13	15:11	D	U	7.5	AC	780
30-Aug-13	15:12	D	D	7.5	AC	460
30-Aug-13	15:12	D	D	7.5	AC	700
30-Aug-13	15:12	D	D	7.5	AC	760
30-Aug-13	15:12	D	D	7.5	AC	-
30-Aug-13	15:13	U	U	7.5	LT	410
30-Aug-13	15:14	D	D	7.5	AC	730
30-Aug-13	15:14	D	D	7.5	AC	-
30-Aug-13	15:14	D	D	7.5	AC	-
30-Aug-13	15:14	D	D	7.5	AC	-
30-Aug-13	15:14	D	U	7.5	AC	720
30-Aug-13	15:14	D	U	7.5	AC	760
30-Aug-13	15:14	D	U	7.5	AC	780
30-Aug-13	15:14	D	U	7.5	AC	-
30-Aug-13	15:15	D	U	7.5	AC	470
30-Aug-13	15:15	D	U	7.5	AC	700
30-Aug-13	15:15	D	U	7.5	AC	700
30-Aug-13	15:16	D	D	7.5	AC	680
30-Aug-13	15:17	D	D	7.5	AC	410
30-Aug-13	15:17	D	D	7.5	AC	670
30-Aug-13	15:17	D	D	7.5	AC	-
30-Aug-13	15:17	D	D	7.5	AC	-
30-Aug-13	15:17	D	U	7.5	AC	710
30-Aug-13	15:17	D	U	7.5	AC	740
30-Aug-13	15:18	D	D	7.5	AC	550
30-Aug-13	15:18	D	U	7.5	AC	720
30-Aug-13	15:19	D	U	7.5	AC	710
30-Aug-13	15:19	D	U	7.5	AC	740
30-Aug-13	15:19	D	U	7.5	AC	-
30-Aug-13	15:21	D	D	7.5	AC	450
30-Aug-13	15:21	D	D	7.5	AC	560
30-Aug-13	15:21	D	D	7.5	AC	570
30-Aug-13	15:21	D	U	7.5	AC	730
30-Aug-13	15:22	D	D	7.5	AC	670
30-Aug-13	15:22	D	D	7.5	AC	-
30-Aug-13	15:22	D	U	7.5	AC	460
30-Aug-13	15:22	D	U	7.5	AC	600
30-Aug-13	15:22	D	U	7.5	AC	660

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
30-Aug-13	15:22	D	U	7.5	AC	670
30-Aug-13	15:22	D	U	7.5	AC	700
30-Aug-13	15:22	D	U	7.5	AC	-
30-Aug-13	15:22	D	U	7.5	AC	-
30-Aug-13	15:23	D	D	7.5	AC	430
30-Aug-13	15:24	D	U	7.5	AC	680
30-Aug-13	15:24	D	U	7.5	AC	730
30-Aug-13	15:25	D	D	7.5	AC	690
30-Aug-13	15:25	D	D	7.5	AC	-
30-Aug-13	15:26	D	D	7.5	AC	370
30-Aug-13	15:26	D	D	7.5	AC	550
30-Aug-13	15:26	D	U	7.5	AC	450
30-Aug-13	15:26	D	U	7.5	AC	670
30-Aug-13	15:26	D	U	7.5	AC	720
30-Aug-13	15:26	D	U	7.5	AC	-
30-Aug-13	15:28	D	D	7.5	AC	-
30-Aug-13	15:28	D	D	7.5	AC	-
30-Aug-13	15:28	D	U	7.5	AC	460
30-Aug-13	15:31	D	D	7.5	AC	460
30-Aug-13	15:31	D	U	7.5	AC	-
30-Aug-13	15:31	D	U	7.5	AC	-
30-Aug-13	15:32	D	D	7.5	AC	660
30-Aug-13	15:32	D	U	7.5	AC	470
30-Aug-13	15:32	D	U	7.5	AC	680
30-Aug-13	15:33	D	U	7.5	AC	690
30-Aug-13	15:41	D	U	7.5	AC	410
30-Aug-13	15:46	D	U	7.5	AC	480
30-Aug-13	15:54	D	D	7.5	AC	400
30-Aug-13	15:54	D	U	7.5	AC	400
30-Aug-13	15:55	D	D	7.5	AC	390
30-Aug-13	15:55	U	U	7.5	AC	670
30-Aug-13	15:55	U	U	7.5	LT	670
30-Aug-13	15:58	D	U	7.5	AC	400
30-Aug-13	16:08	U	U	7.5	AC	450
30-Aug-13	16:11	D	U	7.5	AC	420
30-Aug-13	16:36	U	U	7.5	AC	390
30-Aug-13	23:55	U	U	7.5	AC	860
31-Aug-13	0:10	D	U	8.0	AC	400
31-Aug-13	0:15	D	U	8.0	AC	370
31-Aug-13	6:04	U	D	8.0	LT	400
31-Aug-13	7:17	U	U	8.0	LT	440
31-Aug-13	10:38	D	D	8.0	AC	730
31-Aug-13	10:38	D	U	8.0	AC	730
31-Aug-13	22:01	D	U	8.0	LT	390
31-Aug-13	23:49	D	U	8.0	AC	690
1-Sep-13	0:46	D	U	7.7	AC	750
1-Sep-13	0:48	D	U	7.7	AC	580

Appendix 3.2-1. Biological Data from Fish Counting Fences in Roberts Lake Outflow, Doris North Project, 2013

Date (dd/mm/yy)	Time (24 hr clock)	Box Location (U/L)	Fish Direction (U/D)	Water Temp (˚C)	Species Code	Fork Length (mm)
1-Sep-13	1:09	D	U	7.7	AC	960
1-Sep-13	1:44	D	U	7.7	AC	850
1-Sep-13	1:47	D	U	7.7	AC	910
1-Sep-13	1:50	D	U	7.7	AC	690
1-Sep-13	1:55	D	U	7.7	AC	700
1-Sep-13	1:57	D	U	7.7	AC	750
1-Sep-13	3:04	D	U	7.7	AC	600
1-Sep-13	12:07	D	U	7.7	AC	690
1-Sep-13	12:09	D	D	7.7	AC	660
1-Sep-13	12:10	D	U	7.7	AC	710
1-Sep-13	12:11	D	U	7.7	AC	670
1-Sep-13	12:15	D	D	7.7	AC	550
1-Sep-13	12:16	D	U	7.7	AC	720
1-Sep-13	14:05	U	U	7.7	AC	640
2-Sep-13	0:03	U	U	6.9	AC	630
2-Sep-13	0:05	U	U	6.9	AC	550
2-Sep-13	1:03	U	U	6.9	AC	900
2-Sep-13	3:40	U	U	6.9	AC	760
2-Sep-13	3:41	U	U	6.9	AC	660
2-Sep-13	6:26	U	U	6.9	AC	400
2-Sep-13	13:45	U	U	6.9	AC	400
2-Sep-13	14:06	U	U	6.9	AC	400
2-Sep-13	18:32	U	U	6.9	AC	360
3-Sep-13	2:34	U	D	6.0	LT	390
3-Sep-13	2:58	U	U	6.0	AC	390
3-Sep-13	3:12	U	U	6.0	AC	790
4-Sep-13	1:06	U	D	6.3	LT	310
4-Sep-13	2:38	U	U	6.3	AC	540
4-Sep-13	5:29	U	U	6.3	LT	400
6-Sep-13	6:00	U	U	6.2	LT	490
6-Sep-13	13:34	U	U	6.2	AC	510
6-Sep-13	21:37	U	U	6.2	AC	450
7-Sep-13	3:22	U	D	6.3	LT	430
7-Sep-13	3:46	U	U	6.3	LT	480
7-Sep-13	3:47	U	D	6.3	LT	300
7-Sep-13	5:25	U	U	6.3	LT	440
7-Sep-13	6:03	U	U	6.3	LT	470

Species Code: AC = Arctic char, LT = lake trout, WF = whitefish

Box Location: L = Lower, U = Upper

Fish Direction: D = Downstream, U = Upstream

Dashes indicate not applicable

Appendix 3.2-2

Remote Camera Wildlife Observations at the Boulder Garden, Doris North Project, 2013

ERM

Appendix 3.2-2. Remote Camera Wildlife Observations at the Boulder Garden, Doris North Project, 2013

Date	Start Time	End Time	Species	Number	Observation Type	Location	Zone	Easting	Northing
18-Jul-13	6:16	6:16	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
22-Jul-13	2:41	2:59	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
24-Jul-13	14:59	15:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
25-Jul-13	8:28	8:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
27-Jul-13	2:29	2:44	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
27-Jul-13	20:36	20:36	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
27-Jul-13	22:30	22:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
27-Jul-13	23:15	23:30	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
29-Jul-13	0:48	0:48	Grizzly bear	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
29-Jul-13	19:23	19:31	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
30-Jul-13	1:58	2:02	Grizzly bear	2	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
30-Jul-13	18:23	18:23	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
2-Aug-13	10:01	10:01	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
4-Aug-13	0:15	0:15	Grizzly bear	2	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
4-Aug-13	2:09	3:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
4-Aug-13	11:17	11:17	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
4-Aug-13	12:11	12:24	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
4-Aug-13	21:32	22:04	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
5-Aug-13	7:01	7:01	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
5-Aug-13	11:34	11:34	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
5-Aug-13	23:12	1:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
6-Aug-13	4:46	5:17	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
6-Aug-13	20:55	21:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
7-Aug-13	1:06	2:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
7-Aug-13	20:49	20:49	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
7-Aug-13	22:39	5:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
8-Aug-13	0:00	4:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
8-Aug-13	9:38	9:38	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
8-Aug-13	16:05	16:05	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
8-Aug-13	19:14	19:17	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
8-Aug-13	22:14	22:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
10-Aug-13	0:30	0:46	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
10-Aug-13	14:09	14:28	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
10-Aug-13	22:04	3:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
11-Aug-13	7:44	8:08	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
11-Aug-13	21:44	21:54	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
11-Aug-13	22:45	5:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
12-Aug-13	7:50	7:50	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
12-Aug-13	9:24	9:44	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
12-Aug-13	21:35	2:24	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
13-Aug-13	3:27	3:53	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
13-Aug-13	3:56	3:58	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
13-Aug-13	19:50	3:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
14-Aug-13	12:01	12:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
14-Aug-13	13:26	14:33	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
14-Aug-13	15:32	15:46	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
14-Aug-13	15:34	15:39	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
14-Aug-13	21:12	21:57	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
15-Aug-13	2:30	2:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
15-Aug-13	3:30	3:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
15-Aug-13	16:53	21:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
15-Aug-13	23:00	23:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
16-Aug-13	4:00	4:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
16-Aug-13	12:30	13:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
16-Aug-13	20:10	21:01	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
17-Aug-13	0:00	0:44	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
17-Aug-13	4:30	4:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
17-Aug-13	7:07	7:40	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
17-Aug-13	19:00	20:38	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N

Appendix 3.2-2. Remote Camera Wildlife Observations at the Boulder Garden, Doris North Project, 2013

Date	Start Time	End Time	Species	Number	Observation Type	Location	Zone	Easting	Northing
17-Aug-13	21:10	21:15	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
17-Aug-13	21:14	21:41	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
17-Aug-13	23:08	23:42	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
18-Aug-13	1:14	1:14	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
18-Aug-13	3:24	4:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
18-Aug-13	5:09	5:15	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
18-Aug-13	15:30	16:38	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
18-Aug-13	19:00	19:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
18-Aug-13	21:00	22:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
18-Aug-13	23:00	23:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
19-Aug-13	0:00	0:00	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
19-Aug-13	0:40	0:40	Grizzly bear	2	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
19-Aug-13	12:32	12:57	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
19-Aug-13	12:35	12:45	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
19-Aug-13	15:30	15:58	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
19-Aug-13	19:30	19:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
19-Aug-13	21:30	23:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
19-Aug-13	23:31	23:31	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
20-Aug-13	3:05	3:05	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
20-Aug-13	13:02	13:07	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
21-Aug-13	2:28	2:28	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
21-Aug-13	9:08	9:11	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
21-Aug-13	22:30	22:30	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
23-Aug-13	17:48	17:48	Grizzly bear	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
25-Aug-13	17:36	17:36	Grizzly bear	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
27-Aug-13	1:50	1:51	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
28-Aug-13	20:06	20:11	Grizzly bear	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
28-Aug-13	21:56	22:50	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
1-Sep-13	6:50	6:50	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
1-Sep-13	7:36	7:41	Grizzly bear	3	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
3-Sep-13	15:44	15:44	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
7-Sep-13	21:30	23:29	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
9-Sep-13	3:16	3:16	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
10-Sep-13	21:24	21:24	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
12-Sep-13	2:08	2:08	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
13-Sep-13	9:54	9:54	Grizzly bear	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N
19-Sep-13	20:14	20:14	Wolf	1	Photo	Boulder garden	13 W	435167 m E	7562876.34 m N

Appendix 3.2-3

Supplementary Notes on the Operation of the Vaki Riverwatcher, Doris North Project, 2013

ERM

Appendix 3.2-3. Supplementary Notes on the Operation of the Vaki Riverwatcher, Doris North Project, 2013

The 2013 field season was the first year the Vaki Riverwatcher was used to track migrations of Arctic Char at the Doris North Project. This appendix provides notes on installation, troubleshooting and quality control from the field season.

INSTALLATION AND MAINTENANCE

On August 23 and 24 a major wind storm occurred, during which time the nearby Doris meteorology station recorded a maximum gust speed of 104.0 km/h. A supporting "A" frame collapsed at the upstream fence but the conduit remained in place preventing fish from bypassing the scanner. The high winds also dislodged a solar panel at the upstream fence causing the battery reserves to be depleted, but sufficient power remained and the scanner remained in operation.

In future years, additional weight will be added to "A" frames, and rebar will be hammered into the creek bed for additional support. A stronger support for solar panels will be constructed so that panels are not able to be dislodged.

An extended period of overcast weather rendered the solar panels ineffective and depleted the battery reserves toward the end of the sampling program. This caused the downstream computer to turn off on September 5, prematurely ending the sampling program.

Additional options for power need to be explored. Adding more solar panels and batteries may help, but the same outcome may occur if extended overcast periods occur again.

TROUBLESHOOTING

The scanner cannot operate when data are being downloaded. This means that the tunnel needs to be closed to avoid fish passing undetected. On August 2, the field crew could not reconnect the scanner and computer at the downstream site, and had to close the tunnel overnight until additional help could be sought. At some point during the night the entrance cover became dislodged and was swept downstream. This meant that fish could pass undetected in either direction from that time (some point after 4 pm on August 2) until the crew arrived at 11am the following day. The number of Arctic Char in the stream was low at that time as it was prior to the start of the main run, so it is unlikely that many fish were missed.

The scanner and computer were able to be re-established only once the DC power supply switch was turned off then turned back on. Field crews must be aware that this corrective action may be required if the scanner and computer cannot be reconnected following data transfer.

QUALITY CONTROL

In previous years, individual fish were captured and released in fish fences on a daily basis. In 2013, automated fish counters were used to minimize conflicts with bears. This switch in methods was required due to the unacceptably high safety risk that field crews previously faced while collecting

data. Each approach may be susceptible to methodological error in different ways but a comparative measure of this error was not possible (e.g., by operating both methods concurrently). Differences may include catch versus detection efficiency, species identification accuracy and length measurement precision. Although some uncertainty exists in comparing data with different methods, the data used for such comparisons were selected to minimize differences in methods.

Field crews manually sampling Arctic Char prior to enhancement observed differences in the behaviour of adults above and below the boulder garden. Fish downstream of the boulder garden rested in pools prior to attempting to navigate through the challenging section of stream. These fish freely moved both up and downstream and in 2013 this meant that many Arctic Char were recorded at the lower fence multiple times moving in both directions. In contrast, Arctic Char at the fence above the boulder garden almost always swam away from the fence and travelled into deeper sections of the lake. Consequently, Arctic Char were rarely recorded moving in a downstream direction at the fence above the boulder garden in 2013.

In future years, the location of the Riverwatcher downstream of the boulder garden should be reconsidered and potentially moved farther downstream (less than 100 m) to a location where fish do not move downstream as freely. This will minimize the repeated counts of the same fish.

During video review, all events where the same fish passed through the scanner in one direction then turned and passed in the opposite direction without leaving the view of the camera were removed from the survival estimates. The data were modified when the video showed that two or more fish passed through the scanner simultaneously but were recorded as one fish. In these events, the correct number of fish was entered and the length estimate from the original entry was removed.

As fish swim upstream their longitudinal axis must be parallel to the direction of flow. If the sensor is installed perpendicular to the direction of flow, the total length of each fish will be accurately estimated. However, fish moving downstream are travelling in the same direction as flow and they often simply drift in the current unless evading a perceived danger. Fish drifting downstream may pass through the scanner at an oblique angle or with a curved body, causing an underestimation of length and possibly explaining why downstream measurements were consistently less. The further the longitudinal axis is from perpendicular to the sensors, the greater the underestimation of length will be.