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Skagit Environmental Endowment Commission

**Snorkel Survey of Trout and Char in  
the Canadian Skagit River  
2009**

Prepared for:

**Skagit Environmental Endowment Commission**  
Ministry of the Environment  
1610 Mount Seymour Road  
North Vancouver, B.C.  
V7G 2R9

Prepared by:

R.J. Anaka, D. Neufeld and K.J. Scott  
**Scott Resource Services Inc.**  
31856 Silverdale Avenue  
Mission, B.C.  
V2V 2K9

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### Acknowledgements

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## 1.0 INTRODUCTION

SRS was contracted by the Skagit Environmental Endowment Commission (SEEC) to undertake a fish stock assessment of the Canadian Skagit River. The purpose of this project was to collect and report on current trout/char biological and population information on the Canadian Skagit River, with comparisons made to past results. The 2009 study was divided into three separate sub components: methodology comparison; fish supply and biological sampling. This report covers the fish supply, while separate reports present the results of the other two components.

The 2009 stock assessment involved enumerating rainbow trout (*Oncorhynchus mykiss*) from the Skagit River downstream of the Sumallo River confluence, by snorkelling. The objective of the snorkel survey was to determine the number, size and spatial distribution of rainbow trout and char. Although annual counts were undertaken between 1982 and 1994, the last time a snorkel survey was completed in the Canadian Skagit River was 1998. This survey was the first of three consecutive stock assessment surveys scheduled for the Skagit River. A major analysis of the data from 2009, 2010 and 2011, including comparisons with historical snorkel survey results will be presented in the final report in 2011.

As part of the stock assessment, rainbow trout biological samples were collected by angling. The results from the biological sampling are presented in Anaka et al. (2010a)

Results and discussion of the 2009 methodology comparison can be found in Scott and Anaka (2010).

In total, 14 sections (36.9 km), of the Canadian Skagit River were surveyed, from the confluence of the Sumallo River and Skagit River to Chittenden Bridge (Figure 1). The snorkel survey was conducted by SRS staff from August 31 to September 3, and on September 11, 2009. During the first two floats the weather was clear at time of survey and visibility in the Skagit River was excellent (> 10 m). Rain and thunderstorms occurred during the night of September 2 and throughout the day on September 3. Water clarity decreased significantly following the rainfall event and as a result the final day of the float was postponed until September 11, 2009.

### 1.1 Objectives

The objectives of the Fish Supply component of the 2009 stock assessment of the Canadian Skagit River were to:

1. Count total rainbow trout and char.
2. Categorize rainbow trout and char by size class (<10 cm; 10 to 20 cm; 20 to 30 cm; 30 to 40 cm; >40 cm).
3. Compare distribution of rainbow trout and char by species and location.
4. Calculate abundance indices for rainbow trout within the assessed section of the river.
5. Provide observations and comments effecting trout/char abundance and distribution.
6. Analyze and compare results to previous snorkel surveys on the BC Upper Skagit.

This report addresses objectives 1 through 5 for the current year's data. Objective 6 (analyze and compare results with previous studies) will be included after the 2010 and 2011 assessments are complete.

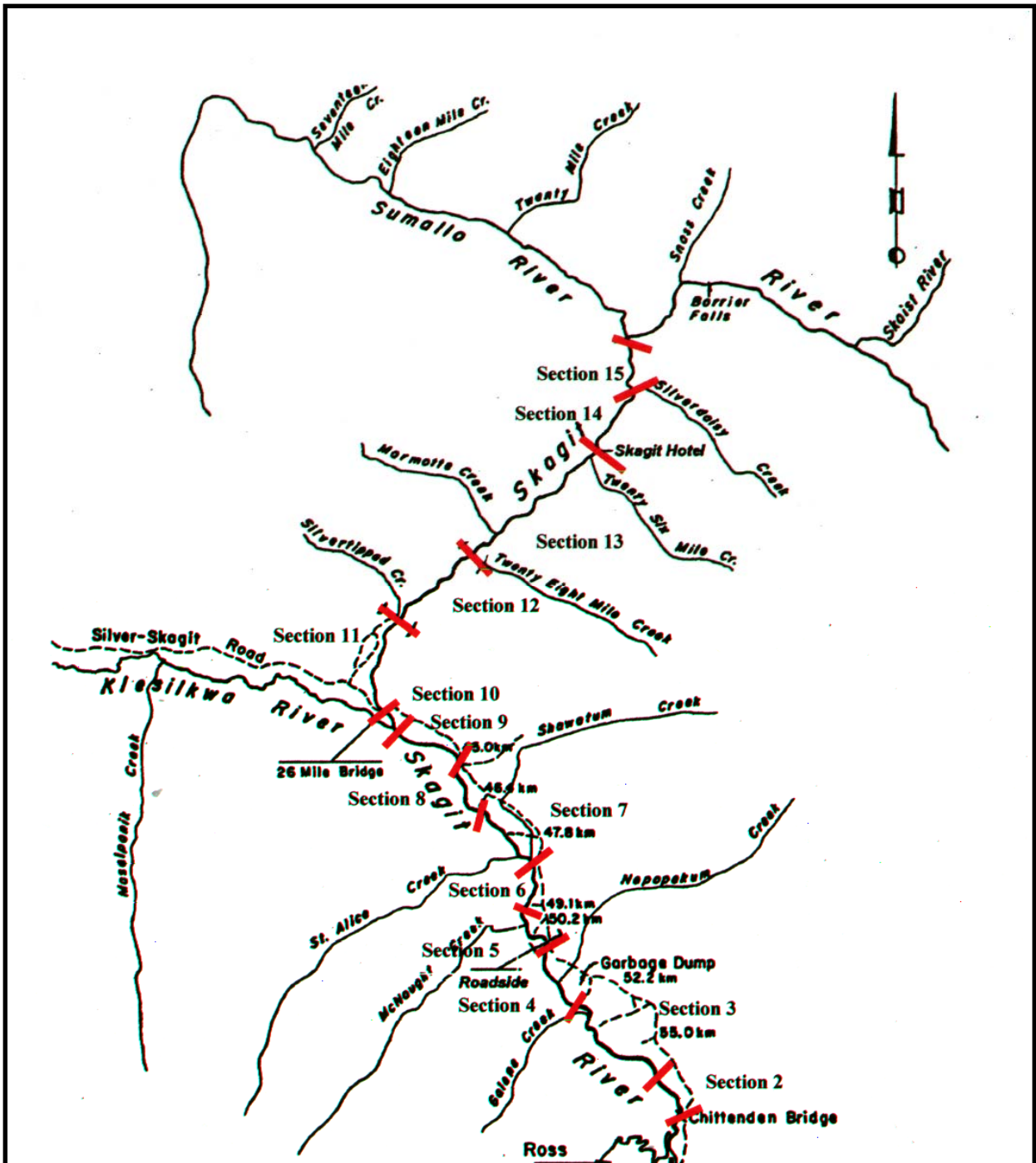


Figure 1: Sections sampled during the snorkel survey of the Canadian Skagit River, 2009.

## 2.0 METHODS

### 2.1 Field data collection

Field data was collected consistent with standard procedures previously employed to survey this portion of the Skagit River drainage (Burrows and Neuman, 1995). The survey team consisted of a senior project manager, project biologist and a field technician. The survey team was organized into floaters and a shore tender for safety. To maximize data consistency from previous years, the river was divided into the same sections and each section was sampled once by floating through it and counting all rainbow trout and char observed by size class. Each floater was equipped with a wet suit, snorkel, mask and personal underwater slate to record observations. The shore tender was equipped with data sheets and safety gear and was responsible for ensuring that the floaters progressed as a unit and for summarizing the data as the float was conducted.

Prior to starting the survey, floaters were visually orientated to the size classes by using pieces of wood dowel cut to the appropriate size class lengths. The pieces of dowel were placed in the Sumallo River, upstream of the first survey section, where floaters observed them. Each morning, prior to floating, the wood dowels were used to re-calibrate floaters to size class length. Safety procedures and emergency response plans were also reviewed prior to commencing the survey.

To minimize duplication of counts, each floater was assigned a lane in the river and only recorded fish observed in that lane. The number of floaters in the water varied between 1 and 3 (average 2) depending on the width of the wetted channel through the area being surveyed (Photographs 1 and 2). For Sections 15 through 9 the survey team was comprised of 2 floaters and one tender. For Sections 8 through 5 the survey team was comprised of 3 floaters and 2 tenders, and for Sections 4 through 2 the survey team included 2 floaters and one tender (Table 1). The tender was responsible for overall communications between each of the floaters so they could be informed of any potential hazards and progress as a unit. As required, the team stopped and collectively reviewed their counts. If a large number of fish were observed within a given location, the said location was re-floated to confirm fish numbers. Once a consensus was reached, the tender recorded the counts on the appropriate section of the data sheet (Appendix 1) and the survey team proceeded, floating the next section of river. The counts were separated by section to be consistent with the previous surveys and to simplify the data analysis.

### 2.2 Field data analysis

The analysis of the field data was undertaken according to those procedures previously utilized by Burrows and Neuman (1995). This included the calculation of abundance indices which refers to the number of fish observed per kilometre per floater. Abundance indices were calculated using the following formula:

Abundance Index = Count for Section / (Section Length (km) x Floater Equivalent).

For the purposes of this survey, the floater equivalent used for this analysis was 2, based on an average of 2 floaters.

In the final analysis (third year compilation report) population trends to determine the number of catchable rainbow trout (ie. > 20 cm in length) per kilometre will be calculated using expansion factors (low and high) previously determined by Burrows and Neuman (1995).

**Table 1: Descriptions and associated lengths of the sections floated during rainbow trout and char survey in the Canadian Skagit River, 2009.**

<b>Section Number</b>	<b>Section Description</b>	<b>Length (m)</b>	<b>Number of Floaters</b>
15	Sumallo River to Silverdaisy Creek	1,900 m	2
14	Silverdaisy Creek to Skagit Hotel	2,570 m	2
13	Skagit Hotel to 28 Mile Creek	6,010 m	2
12	28 Mile Creek to Silvertipped Creek	3,480 m	2
11	Silvertipped Creek to 26 Mile Bridge	3,310 m	2
10	26 Mile Bridge to Klesilkwa River	740 m	2
9	Klesilkwa River to 45 km	2,490 m	2
8	45 km to 46.4 km	1,980 m	3
7	46.4 km to Shawatum Creek	2,510 m	3
6	Shawatum Creek to Fuel Dump	960 m	3
5	Fuel Dump to Roadside	2,490 m	3
4	Roadside to Garbage Dump	2,860 m	2
3	Garbage Dump to 56 km	2,920 m	2
2	56 km to Chittenden Bridge	2,630 m	2
<b>Total Length Enumerated</b>		<b>36,850 m</b>	



**Photograph 1: Examining a pool with coarse woody debris cover. In areas such as this, one floater would walk to the bottom of the pool and observe the fish while the second floater would float into the top end of the pool area.**



**Photograph 2: Two floaters are floating the edge of a deep pool. In this instance, both floaters would count the same area and compare observations.**



### 3.0 RESULTS

#### 3.1 Snorkel survey counts

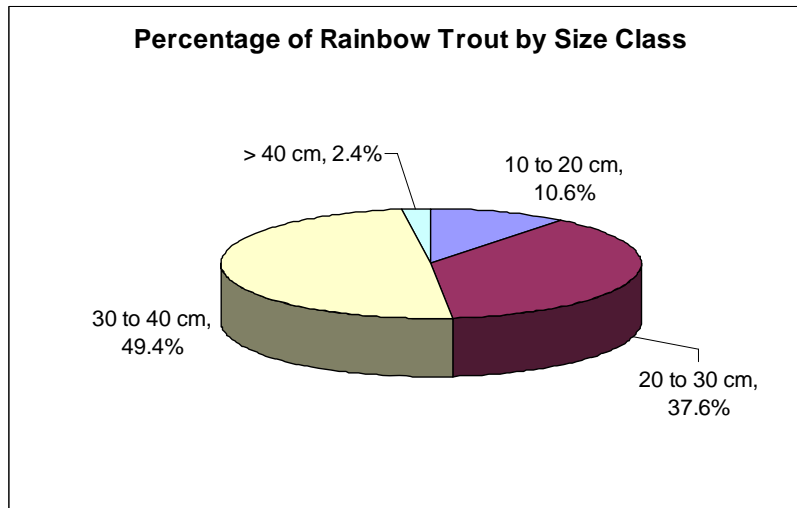
The snorkel survey of the Canadian Skagit River between August 31 and September 3, as well as September 11, 2009 included 14 sections of the river, spanning approximately 36.9 km (Table 1). During the survey, a total of 1442 rainbow trout and 957 char were counted (Table 2). The majority (87 %) of the rainbow trout were found in the two middle size classes. This included 713 (49.4 %) in the 30 to 40 cm size class and 542 (37.6 %) in the 20 to 30 cm size class. The remaining rainbow trout were divided between the smallest and largest size classes. This included 153 (10.6 %) in the 10 to 20 cm size class and 34 (2.4 %) in the > 40cm size class (Figure 2).

Almost all of the char counted (99 %) were found to be > 30 cm in length. The majority (725 or 75.8 %) of these were in the > 40 cm size class while the rest (222 or 23.2 %) were in the 30 to 40 cm size class. Only 8 char (0.8 %) were in the 20 to 30 cm size class and only 2 char (0.2 %) in the 10 to 20 cm size class was observed (Figure 3).

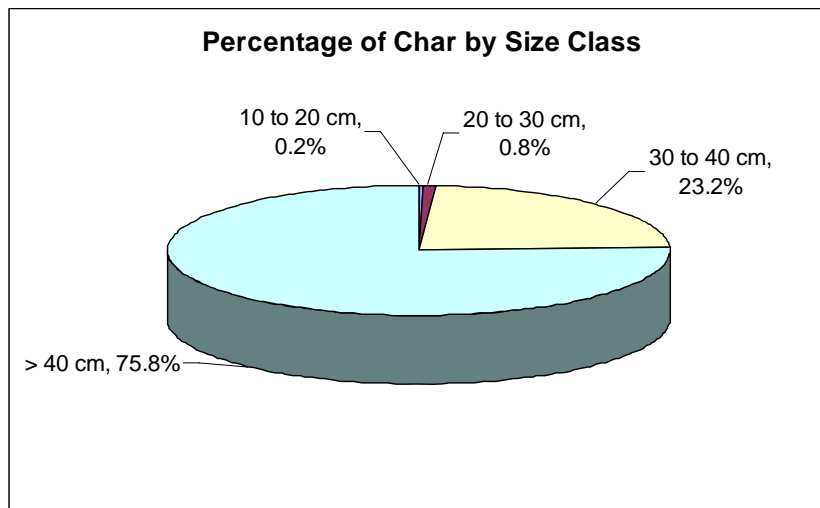
No other fish species were detected.

**Table 2: Summary of rainbow trout and char counted by section during the snorkel survey of Canadian Skagit River, August 31 to September 3, and September 11, 2009.**

Skagit River Float Count 2009										
Section Number	Rainbow Trout					Char				
	10 to 20 cm	20 to 30 cm	30 to 40 cm	> 40 cm	Total	10 to 20 cm	20 to 30 cm	30 to 40 cm	> 40 cm	Total
15	13	28	18	2	61	0	0	0	7	7
14	31	44	26	0	101	0	0	0	8	8
13	13	100	128	5	246	0	0	17	91	108
12	18	50	46	0	114	0	2	16	54	72
11	4	38	82	2	126	0	0	2	4	6
10	3	8	5	1	17	0	0	0	0	0
9	3	32	30	0	65	0	2	9	71	82
8	0	23	65	1	89	0	0	7	80	87
7	23	42	36	1	102	0	0	6	7	13
6	2	18	36	2	58	0	0	8	23	31
5	1	8	24	0	33	0	0	2	58	60
4	0	23	23	1	47	0	0	14	30	44
3	36	77	110	9	232	2	3	95	137	237
2	6	51	84	10	151	0	1	46	155	202
<b>Total</b>	<b>153</b>	<b>542</b>	<b>713</b>	<b>34</b>	<b>1442</b>	<b>2</b>	<b>8</b>	<b>222</b>	<b>725</b>	<b>957</b>
<b>Percent of Total</b>	<b>10.6%</b>	<b>37.6%</b>	<b>49.4%</b>	<b>2.4%</b>		<b>0.2%</b>	<b>0.8%</b>	<b>23.2%</b>	<b>75.8%</b>	



**Figure 2. Percentage of Rainbow Trout by size class counted in the Canadian Skagit River, August/September, 2009.**



**Figure 3. Percentage of Char by size class counted in the Canadian Skagit River, August/September, 2009.**

### 3.2 Fish distribution

The results of the snorkel survey indicated that the distribution of rainbow trout and char varied between species in the upper Skagit River (Sections 15 through 10), but was relatively similar in the lower portion of the river (Sections 9 through 2) (Table 2 and Figure 4). In sections 15 through 10 larger numbers of rainbow trout were found relative to char, whereas the numbers of both species are relatively close in sections 9 through 2. Rainbow trout were found throughout the sampled area, with greater sample numbers counted in the upper section (Sections 15 to 11) relative to lower sections. The char population appeared to be most abundant towards the lower

sections of the river (Sections 3 and 2), with very few fish in the upper-most sections of the river (Sections 15 and 14).

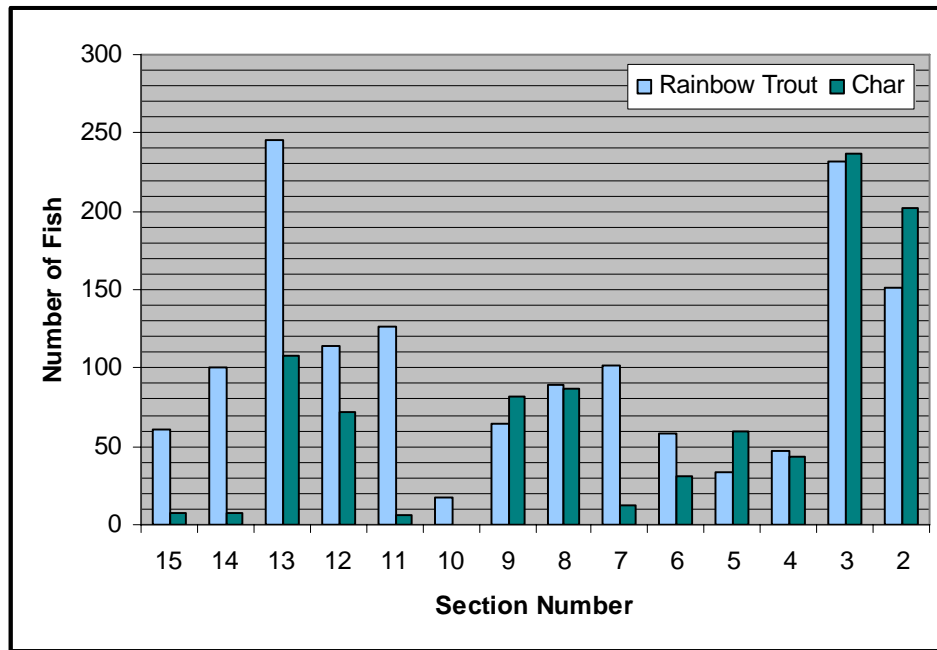


Figure 4. Distribution of rainbow trout and char by section within the Canadian Skagit River.

### 3.3 Abundance Indices

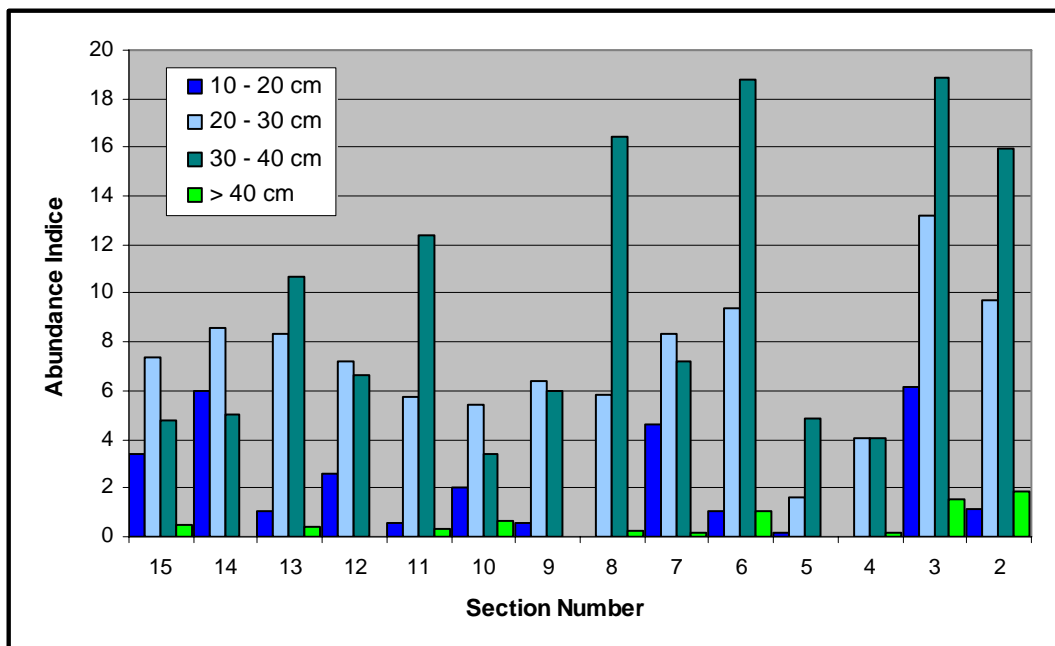
Analogous to the 1998 report (Harper and Scott, 1998a) and similar to Burrows and Neuman’s 1995 report, abundance indices (number of fish per kilometre per floater) were calculated for rainbow trout within the assessed sections of the Canadian Skagit River during the 2009 survey (Table 3 and Figure 5). The highest abundance of < 40 cm rainbow trout was found in the middle (Sections 8 and 6) and downstream sections (Sections 3 and 2) of the river. The > 40 cm rainbow trout were found in highest abundance in the downstream end of the river, in Sections 3 and 2. Trout ranging from 20 to 30 cm were found evenly throughout the river, except in Sections 5 and 4.

To illustrate the availability of catchable fish, the 2009 observed rainbow trout population was grouped into non-catchable (< 20 cm in length) versus catchable (> 20 cm in length), consistent with Burrows and Neuman (1995; Figure 6). Most of the non-catchable fish were found in the middle to upper end of the surveyed area, with a spike of non-catchable in Section 3. While catchable fish were more evenly distributed than non-catchable, the highest abundance of these fish was found in Sections 6, 3 and 2.

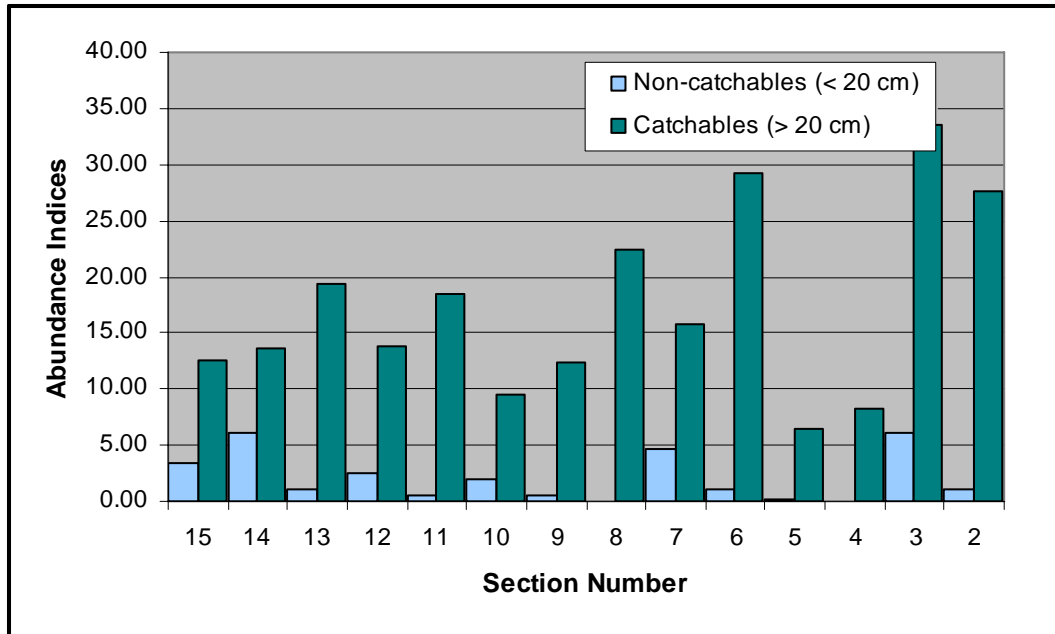
**Table 3: Summary of abundance indices for rainbow trout counted in the Canadian Skagit River, August/September, 2009.**

Section Number	Length of Section (km)	10 to 20 cm		20 to 30 cm		30 to 40 cm		> 40 cm		Total Counted	
		No. of RB	Abundance Index	No. of RB	Abundance Index	No. of RB	Abundance Index	No. of RB	Abundance Index	No. of RB	Abundance Index
15	1.90	13	3.42	28	7.37	18	4.74	2	0.53	61	16.05
14	2.57	31	6.03	44	8.56	26	5.06	0	0.00	101	19.65
13	6.01	13	1.08	100	8.32	128	10.65	5	0.42	246	20.47
12	3.48	18	2.59	50	7.18	46	6.61	0	0.00	114	16.38
11	3.31	4	0.60	38	5.74	82	12.39	2	0.30	126	19.03
10	0.74	3	2.03	8	5.41	5	3.38	1	0.68	17	11.49
9	2.49	3	0.60	32	6.43	30	6.02	0	0.00	65	13.05
8	1.98	0	0.00	23	5.81	65	16.41	1	0.25	89	22.47
7	2.51	23	4.58	42	8.37	36	7.17	1	0.20	102	20.32
6	0.96	2	1.04	18	9.38	36	18.75	2	1.04	58	30.21
5	2.49	1	0.20	8	1.61	24	4.82	0	0.00	33	6.63
4	2.86	0	0.00	23	4.02	23	4.02	1	0.17	47	8.22
3	2.92	36	6.16	77	13.18	110	18.84	9	1.54	232	39.73
2	2.63	6	1.14	51	9.70	84	15.97	10	1.90	151	28.71
<b>Total</b>	<b>36.85</b>	<b>153</b>	<b>2.08</b>	<b>542</b>	<b>7.35</b>	<b>713</b>	<b>9.67</b>	<b>34</b>	<b>0.46</b>	<b>1442</b>	<b>19.57</b>

\*Abundance index (No. of rainbow trout per km per floater) = Count for section/(section length (km) x floater equivalent). Floater equivalent = 2.0 (Burrows and Neuman, 1995).



**Figure 5: Abundance indices by section for rainbow trout counted in the Canadian Skagit River, August/September, 2009. Refer to Table 3 for actual numbers of fish used to generate abundance indices.**



**Figure 6: Abundance indices by section for catchable versus non-catchable rainbow trout counted in the Canadian Skagit River, August/September, 2009.**

#### 4.0 DISCUSSION

The discussion of results for the 2009 snorkel survey is limited since no survey data has been collected for the past decade and since no current data trend exists inferences drawn from the comparison of the 2009 results to earlier studies would be speculation based on a single year's data (i.e. snapshot in time). Following the 2010 and 2011 snorkel surveys a further in depth analysis and discussion of results will occur.

Of interest, sizes of rainbow trout observed in the snorkel survey were similar to those sampled in the biological component of the 2009 fish stock assessment study. During the snorkel survey 87 % of rainbow trout observed were > 20 cm in length, while 98 % of the rainbow trout sampled during the biological portion of the study were > 20 cm in length (Anaka et al. 2010a).

Also of interest is the far greater number of char observed in the 2009 snorkel survey compared to the 1998 survey. In 1998, 186 char were observed during the float survey, whereas 957 char were observed during the 2009 snorkel survey, five times greater than the number of char observed in 1998.

It will be imperative to complete the planned three years of snorkel survey to confirm that large number of char observed in 2009 was not an anomaly.

## 5.0 REFERENCES CITED

- Burrows, J. A. and R. Neuman 1995. Skagit River rainbow trout population trends: underwater census from 1982 to 1994. B.C. Ministry of Environment, Lands and Parks Regional Fish. Rep. No. LM253, 22 p.
- Harper, V.L. and K.J. Scott, 1998a. Snorkel Survey of Trout and Char in the Canadian Skagit River, September, 1998. Prepared for B.C. Ministry of Environment, Lands and Parks by Scott Resource Services Inc., Regional Fish. Rep. No. LM 372.2, 14 p.
- Scott, K.J. and H.R. Neuman. 1988 draft. Aspects of Skagit River rainbow trout life history based on 1986 tagging and test fishing studies and scale analysis. Prepared for B.C. Ministry of Environment, Lands and Parks by Scott Resource Services, 70 p.

**Appendix 1: Sample Field Data Sheet, 2009 Snorkel Survey**

