SUNSHINE COAST LAKES
2005 LAKE SURVEYS

Hotel Lake

WSC: 900-147300-18900
WBID: 00581JERV

Ministry of Environment
Fish & Wildlife
10470 – 152nd Street
Surrey, B.C. V3R 0Y3

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ENVIRONMENTAL STEWARDSHIP
LOWER MAINLAND REGION

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Field assessments were conducted by Jim Roberts and Duane Jesson, Ministry of Environment, Surrey. Report preparation, formatting and statistical analysis were completed by Christy Juteau. The report was reviewed and edited by Jim Roberts.

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1.0 INTRODUCTION

The small lake fisheries management program in the Lower Mainland Region has been given minimal focus over the last ten years, primarily due to staffing/funding constraints and attention to other regional priorities. This is the first year of a proposed multi-year program designed to obtain up-to-date information on the fish stock status of small lake resources within the Sunshine Coast Forest District.

The 2005 project assessed fish stock status and water quality in two small lake habitats within the Sunshine Coast Forest District: Hotel and Garden Bay lakes (Figure 1). Both lakes are currently serviced by a coastal cutthroat trout (*Oncorhynchus clarki clarki*) stocking program. The purpose of this study was to evaluate the current stocking program, assess the health of fish populations and determine the viability of water quality to sustain future fisheries values. These data were then used to make fisheries management decisions regarding conservation and recreation. This report focuses on Hotel Lake results, with some comparison provided to Garden Bay Lake results. Garden Bay Lake results are reported in a separate lake survey document (Juteau & Roberts 2006).

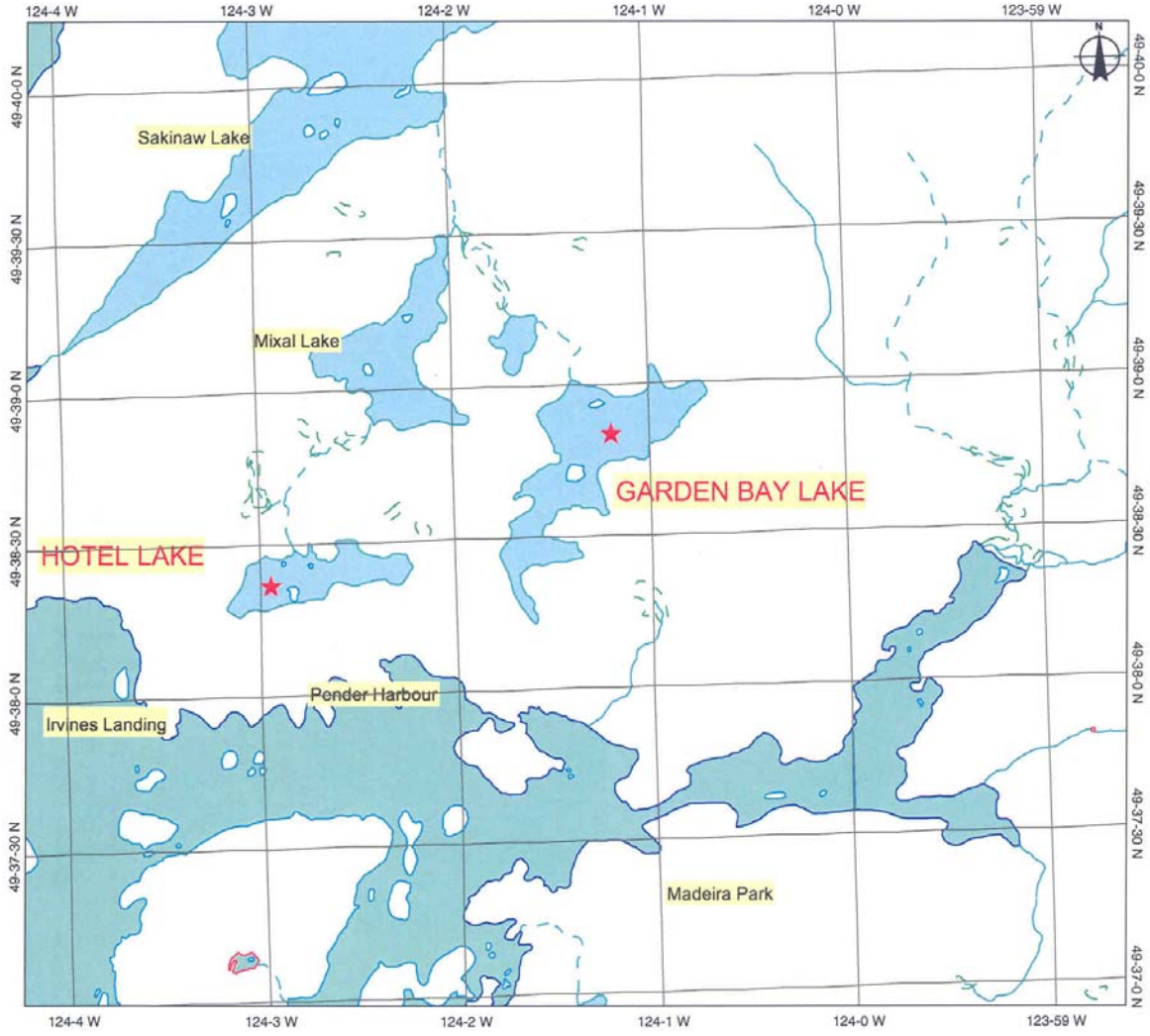

Figure 1. Location of study lakes.

1.1 Objectives

The project objectives were to:

- determine the effectiveness of, and recommend changes if required, to present cutthroat trout stocking programs,
- determine the effectiveness of present recreational angling regulations,
- assess current water quality to determine viability of sustaining healthy fisheries, and
- combine the results of the stock assessment, water chemistry analysis and angler surveys, where applicable, to assist with management action recommendations.

1.2 Management Objectives Prior to Assessment

In accordance with a draft Lower Mainland Region fisheries classification scheme, Hotel Lake is classified by fisheries managers as a *General Use* lake (MoE 2005a, draft document). Lakes classified as *General Use* may support wild and/or stocked fish and generally have moderate to high angler use due to ease of access. The general goal for *General Use* lakes in Ministry of Environment's (MoE) Lower Mainland Region is to "Maintain or expand where possible accessible angling opportunities through the stocking of hatchery fish, or management of wild populations" (MoE 2005a).

The recreational fishery in Hotel Lake is dependent upon the stocking of hatchery fish, with cutthroat trout stocked on an annual basis. Historic stocking, which began in 1933, included rainbow trout fry (Pinantan and Pennask stocks). Since 1965, cutthroat trout has been the only species stocked: including fingerling and yearling/catchable cutthroat trout from Oregon, Washington, Salmon, Paq and Taylor stocks. In more recent years, beginning in 2001, cutthroat trout stocking has focused on triploid (3N) Taylor stock coastal cutthroat trout. Detailed stocking history for Hotel Lake is tabulated in Appendix 1.

Hotel Lake is easily accessed by recreational anglers, with a paved road providing two-wheel drive vehicle access for the public to the western and southern shorelines. In addition, a seasonal recreational resort located on the southwest shoreline (Lakeside Motel and Campground) and a number of private residences dispersed along the lakeshore provide private access points for a variety of recreational users. Although no special angling restrictions apply to this lake, there is a boating restriction that requires the use of electric motors only (MoE 2005b).

Fisheries management activities for *General Use* lakes are intended to typically include: maintaining access, maintaining or installing educational signage, conducting angler demographic and effort surveys, conducting fisheries inventory assessments, and stocking lakes with appropriate species and year classes. The project objectives listed in section 1.1 are consistent with these general fisheries management activities.

Table 1 identifies some physical and chemical properties of Hotel and Garden Bay lakes.

Table 1. Physical and chemical properties of Hotel and Garden Bay lakes (MSRM 2005).

Lake	Elevation (m)	Surface Area (ha)	Max Depth (m)	Surface Total Dissolved Solids - field 2005 (ppm)
Hotel	57	25.2	10.6	23
Garden Bay	43	62.3	52.4	44

2.0 METHODS

Fish stock and water quality data were collected at Hotel Lake by Jim Roberts and Duane Jesson, Ministry of Environment (MoE) October 3-4, 2005.

2.1 Stock Assessment Methods

Stock assessment work included the use of gillnetting and minnow trapping. A bathymetric map identifying net set and minnow trap locations is found in Appendix 2. Gillnets, including one sinking and one floating standard experimental monofilament gillnet, were each set with one end anchored to shore and the other end deep anchored with a marker float. The netting record (Appendix 3) details net dimensions and mesh sizes with specific set and pull times identified. Minnow trapping entailed the placement of two minnow traps baited with sardines within shore edge habitat. The lake catch summary (Appendix 4) provides the results of this stock assessment work.

All fish captured in the nets were field identified and tabulated by species. Individual fish information including fork length (cm), weight (g), sex, maturity and stomach contents were recorded for game fish species (i.e. cutthroat trout). Scale samples were taken from all game fish species and placed into labeled envelopes for age analysis. Scale aging was conducted by Sheldon Reddekopp (independent consultant). Detailed game fish species sample data are tabulated in Appendix 5.

For non-game fish species (i.e. peamouth chub, threespine stickleback, and cottids), fork lengths were noted for a representative sample set (Appendix 4).

Catch per unit effort (CPUE) was calculated for game fish species caught per 100 meters of net per gillnet hour, to allow for comparison to previous assessments.

Fish health was evaluated using Fulton's condition factor (K) equation. Different formulas to determine condition factor exist; however, the following equation is supported by the Provincial Small Lakes Committee:

$$K = 100{,}000 * \frac{\text{Weight (g)}}{(\text{Fork length (mm)})^3}$$

2.2 Water Chemistry Analysis Methods

A limnology sampling station was established at Hotel Lake on October 4, 2005 (bathymetric map indicating the limnostation location is provided in Appendix 2). Water samples were collected at one-meter intervals to the maximum depth using a Verticle Alpha Water Bottle (Vandorn). Dissolved oxygen and water temperature were recorded at each interval. In addition to temperature and oxygen data, the following parameters were also measured in the field and recorded: pH, H_2S, specific conductance, total dissolved solids (TDS) and turbidity. Field conditions such as wind velocity/direction, cloud cover and surface water condition were observed and recorded. Instrumentation used to collect the water chemistry data are listed in Table 2.

Table 2. Instrumentation used for water chemistry data collection.

Water Chemistry Parameters	Instrumentation Used
Dissolved Oxygen	OxyGuard Handy MkIII
Water Temperature	OxyGuard Handy MkIII
Air Temperature	Hand-held alcohol thermometer
pH (field)	HACH pH field test kit (wide range colour comparator)
H_2S (field)	HACH H2S field test kit
Specific Conductance	Hanna TDS/conductivity meter
Total Dissolved Solids	Hanna TDS/conductivity meter
Turbidity	Secchi Disc

3.0 RESULTS

3.1 Stock Assessment Results

3.1.1 Catch per Unit Effort

A total of 12 cutthroat trout were caught in the nets set in Hotel Lake. Two of these were released live from net set #2 with only approximate length measurements recorded. Fork length, weight, sex, maturity and stomach content data were collected and recorded for the remainder of the cutthroat trout caught. In addition, 200 peamouth chub (*Mylocheilus caurinus*), 27 sculpins (*Cottus sp.*) and 1 threespine stickleback (*Gasterosteus aculeatus*) were captured. Minnow traps did not successfully capture any fish. Appendices 4 and 5 list the catch results in more detail.

Catch and effort results are based on the capture of game fish (i.e. cutthroat trout) via gillnet sampling only. Table 3 compares the 2005 catch per unit effort (CPUE) results with similar lake survey efforts undertaken in 1986 and 1990 (MoE 2006). CPUE results for Hotel Lake sampling in 2005 were notably higher than past studies, and approximately double that of Garden Bay CPUE 2005 results (Juteau & Roberts 2006).

Table 3. Cutthroat trout CPUE for Hotel Lake, 2005 results compared with past studies.

Lake	Net	Ct Catch	Net Length (m)	Set Time (hrs)	CPUE - Ct (/100m/hr)	CPUE - Ct (/100m/24hr)
Hotel	Set #1	*7*	91.4	16.3	0.47	11.25
Oct-05	Set #2	5	91.4	17.1	0.32	7.69
	Total	12	*182.8*	*33.4*	*0.20*	***4.71***
Hotel	Set #1	0	91.4	19.3	0.00	0.00
May-90	Set #2	0	91.4	19.0	0.00	0.00
Jun-90	Set #3	7	91.4	17.5	0.44	10.50
	Total	7	*274.2*	*55.8*	*0.05*	***1.10***
Hotel	Set #1	1	91.4	19.0	0.06	1.38
Apr-86	Set #2	4	91.4	19.0	0.23	5.53
	Total	5	*182.8*	*38.0*	*0.07*	***1.73***

3.1.2 Length, Weight and Condition Factor

Table 4 summarizes fork lengths, weights and fish condition factors for cutthroat trout caught in Hotel Lake, including the 2005 results and comparison with the 1990 results (MoE 2006). Sample sizes include only fish for which both length and weight data were collected. Figure 2 compares the length-weight relationships for cutthroat trout sampled from Hotel Lake in 2005 and 1990.

Table 4. Length, weight and condition factor for cutthroat trout in Hotel Lake, 2005 results compared with past studies.

Lake	Sample Date	Sample Size	Fork Length (mm)			Weight (g)			Condition Factor (K)		
			Mean	Range	SD	Mean	Range	SD	Mean	Range	SD
Hotel	Oct-05	10	438.00	283-658	143.83	1216.0	260-3100	1100.40	1.13	0.99-1.19	0.06
	Jun-90	5	424.60	301-627	165.85	518.2	150-1200	506.31	0.52	0.46-0.57	0.05

Figure 2. Length to weight relationships for cutthroat trout sampled from Hotel Lake, 2005 results compared with 1990 results.

In order to provide a secondary comparison of fish condition between the two sample dates (i.e. in addition to condition factor (K), length and weight), logarithms were calculated for each fish and have been graphed below to ensure a linear relationship (Figure 3).

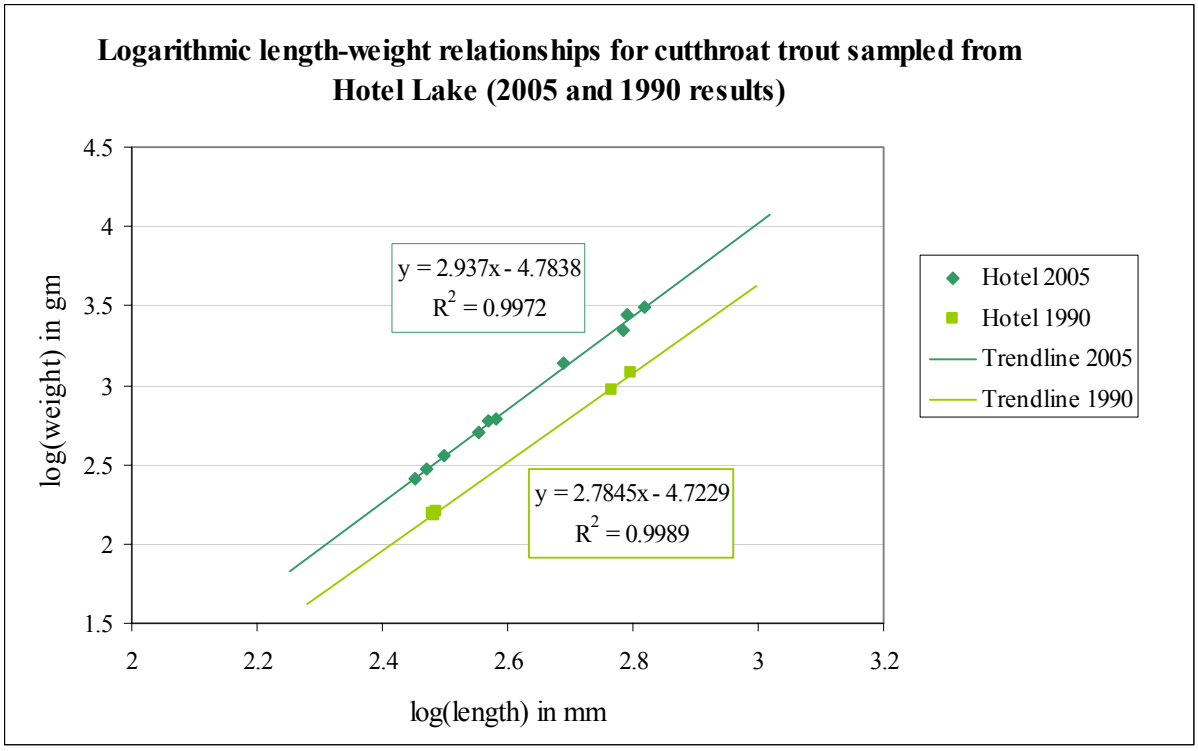

Figure 3. Logarithmic length to weight relationships for cutthroat trout sampled from Hotel Lake, 2005 and 1990 results.

Table 5. Statistical parameters of the cutthroat trout from Hotel Lake, sorted by *b*.

Lake	Year	n	b	loge(a)	K
Hotel	2005	10	2.94	4.78	1.13
	1990	5	2.78	4.72	0.52

From the graphical linear equations: $\log_e(W) = b\log_e(L) + \log_e(a)$, slope ($b$) gives an indication of relative fish robustness. According to slope (b) and condition factor (K), relative fish robustness was greater in 2005 than 1990 (Table 5). Cutthroat trout lengths and weights were greater in Hotel Lake than Garden Bay Lake; however condition factors in Garden Bay were slightly greater than Hotel.

3.1.3 Length Frequency and Mean Length at Age

Table 6 and Figure 4 display cutthroat trout length at age relationships from Hotel and Garden Bay lakes, based on the 2005 data. Figure 5 shows length frequencies for cutthroat trout sampled from both lakes for the 3 different survey years (i.e. 1986, 1990 and 2005). It appears that cutthroat trout from Hotel Lake exhibit greater growth rates than those from Garden Bay Lake.

Table 6. Mean length at age for cutthroat trout sampled in Hotel and Garden Bay lakes, 2005.

Age	HOTEL LAKE Conductivity: 30 mS/cm to 47 mS/cm Total dissolved solids: 13 to 23 ppm			GARDEN BAY LAKE Conductivity: 73 mS/cm to 85 mS/cm Total dissolved solids: 37 to 44 ppm		
	Fork Length (mm)	**Mean Length (mm)**	**Mean Condition Factor**	**Fork Length (mm)**	**Mean Length (mm)**	**Mean Condition Factor**
2	269 283 314 359 372	319.4	1.14	-	-	-
3	382 490	436	1.13	353 364 382	366.3	1.28
4	610 617	614	1.09	429	429	1.19
5	658	658	1.09	459	459	1.29

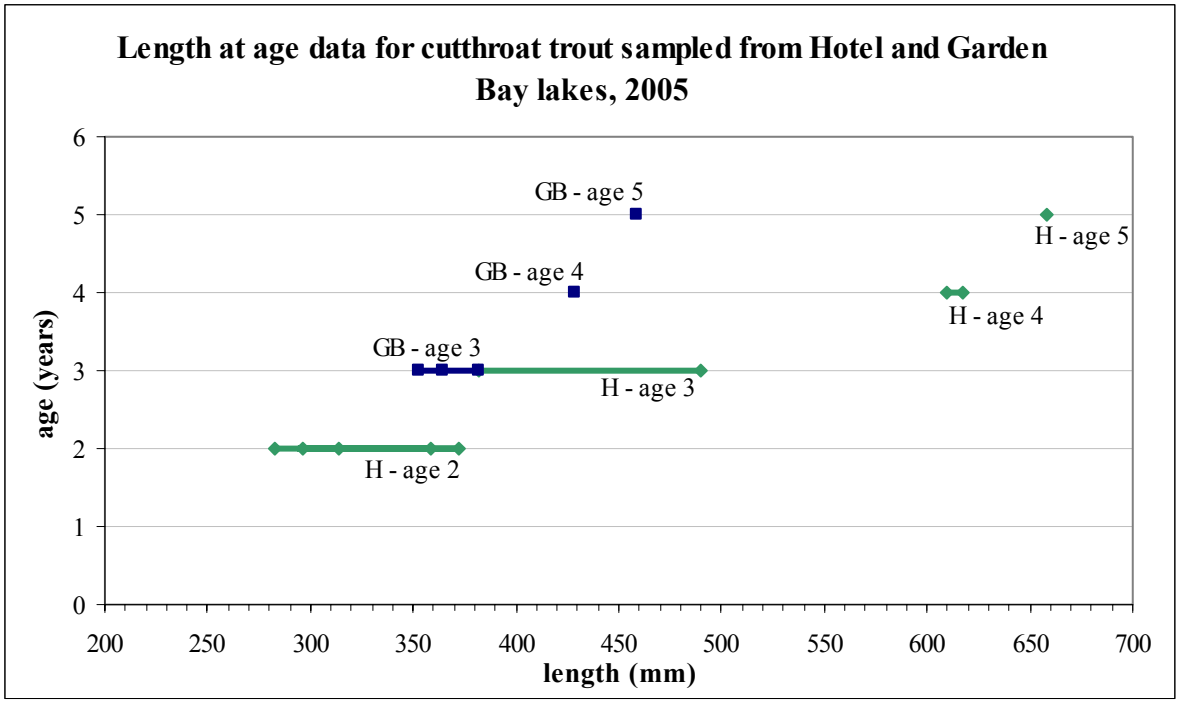

Figure 4. Length-age relationships of cutthroat trout sampled from Hotel (H) and Garden Bay (GB) lakes 2005.

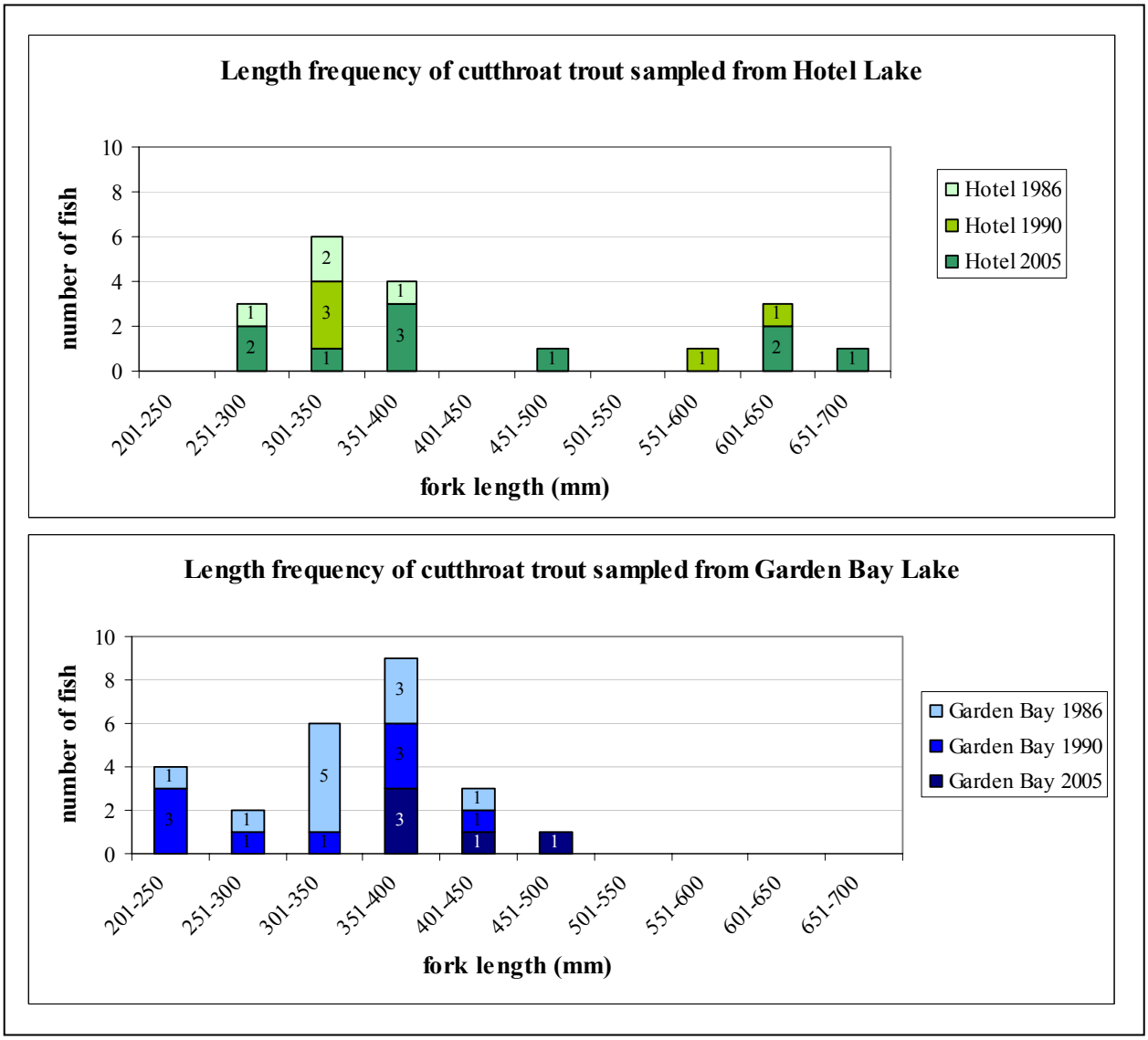

Figure 5. Cutthroat trout length frequency distribution for Hotel and Garden Bay lakes, 2005 results compared with past studies.

3.2 Water Chemistry Results

3.2.1 Dissolved Oxygen and Water Temperature

Dissolved oxygen (DO) is the most critical water quality parameter for maintenance of aquatic life. The instantaneous minimum DO for fish species associated with this lake is approximately 5 mg/L (Table 7).

Since fish and most other forms of aquatic life are poikilotherms (cold-blooded), ambient water temperature directly affects their ability to grow, reproduce and survive. Fish cannot survive at temperatures below 0°C or above 36°C (USEPA 1986). The specific temperature criteria according to the BC MoE (for cutthroat trout) and CCME/USEPA (for rainbow trout) are identified in Table 7. It should be noted that the negative effects of oxygen depletion are amplified as temperature increases.

Detailed Hotel Lake oxygen and temperature results from October 4th, 2005, are tabulated in Appendix 7. Oxygen levels remained at acceptable levels for the majority of the sampling depth,

although levels were close to minimum tolerable levels near 8 m depth. Water temperatures in Hotel Lake remained relatively consistent with increasing depth (Figure 6), indicating lake turnover had already occurred. In contrast, water quality sampling in Garden Bay Lake earlier in the year showed strong evidence of temperature stratification (Juteau & Roberts 2006). This was obviously a result of the timing of this sampling work, with the Garden Bay Lake temperature data collected in the heat of the summer (i.e. August 16, 2005) versus the Hotel Lake data sampling which occurred on October 4, 2005.

Table 7. Water quality guidelines for dissolved oxygen and temperature (MoE 2005, CCME 1999, USEPA 1986).

Parameter	Criteria	Life Stage	MoE	CCME	USEPA
Dissolved Oxygen	Minimum concentration (mg/L) for fish	Early life stages (buried embryo / alevin)	9	9.5	9.5
		Other life stages	5	5.5	5
Temperature	Maximum weekly (°C) for trout	Incubation	9-12	13-15	-
		Spawning	9-12	8-10	-
		Rearing/growth	7-16	18-19	19
		Lethal	-	22-24	24

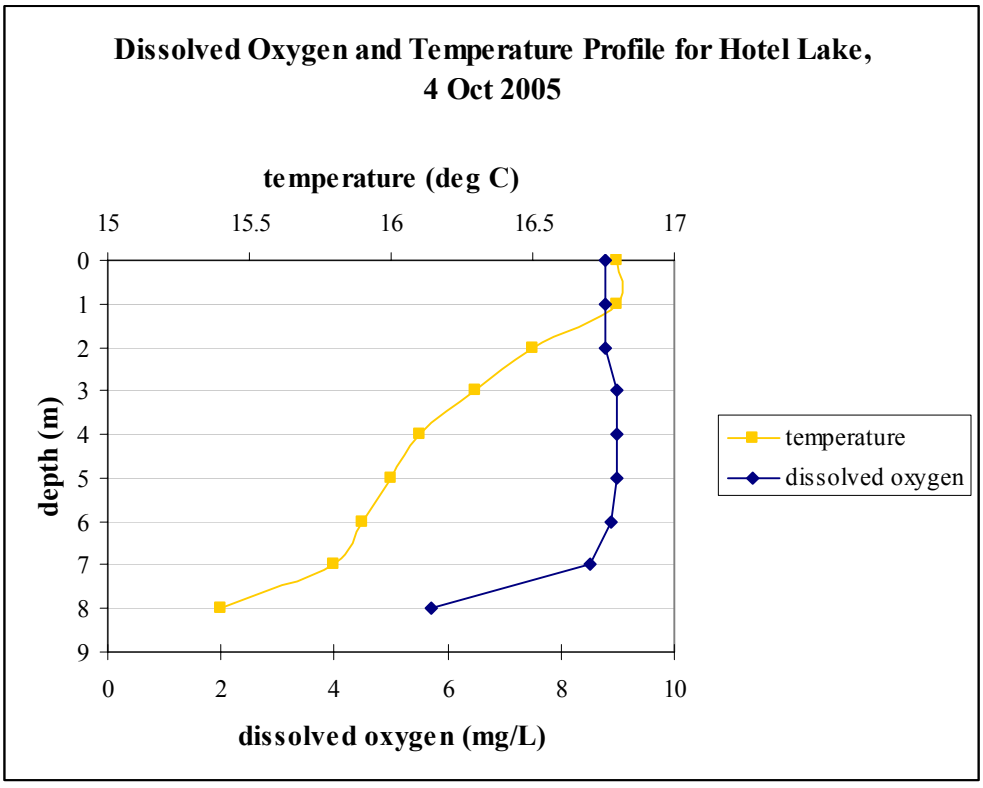

Figure 6. Hotel Lake dissolved oxygen and temperature profile, 4 October 2005.

3.2.2 pH

pH indicates acidity or alkalinity on a scale of 1-14, with a value of 7 being considered neutral. Fish can tolerate a pH range of 5-9 (Hach Company 2005), however the CCME and USEPA guidelines recommend a range of 6.5-9 for the protection of freshwater aquatic life (CCME 1999, USEPA 1986). Water that is too acidic (i.e. pH<5) or alkaline (i.e. pH>9) can have toxic effects on fish and other aquatic life. Precipitation and surrounding geology have major effects on pH. The lakes surveyed in this study are located within the Cascade Mountains on the west coast of BC where there is high rainfall (150-350 cm/yr) and fairly uniform granitic geology with thin soils (MoE 2005). Slow weathering and high runoff creates low levels of carbonates within waterbodies and results in relatively acidic water quality (average=6.7, according to MoE 2005).

Hotel Lake pH measurements fell within the tolerable range for fish: 7.0 at the surface and 6.5 at a depth of 8 m. These values were not significantly different from pH measurements at Garden Bay Lake: 7.5 at the surface and 6.5 at a depth of 20 m.

3.2.3 Hydrogen Sulphide

Hydrogen sulphide (H_2S) is a poisonous gas released in water through the decay of organic matter, reaction of sulfuric compounds with acidic water, and metabolism byproducts of certain bacteria. In short-term studies it has been found that fish can survive in water containing H_2S concentrations of 0.3-0.4 mg/L; however, water containing a H_2S concentration greater than 2.0 µg/L (0.002 mg/L) is considered to be hazardous over the long term (MoE 2005, USEPA 1986). H_2S was not detected in Hotel Lake.

3.2.4 Total Dissolved Solids and Specific Conductance

Total dissolved solids (TDS) indicate the total mineral content of water, including mainly inorganic salts, carbonates, metals and small amounts of organic compounds. Specific conductance or conductivity is a measure of how well a substance can conduct electricity, which is proportional to the concentration of ions in solution. Although TDS and specific conductance or conductivity results differ in value, similar trends are expressed due to their relationship.

All fish species can tolerate a range of dissolved solids under natural conditions, however, TDS levels above 15,000 ppm have been found to be damaging to fish health (USEPA 1986). Low TDS/conductivity lakes typically have lower fish growth rates as compared to higher TDS/conductivity lakes, given that many of the minerals in water provide the basic fuel for primary productivity. Lakes located within coastal regions of BC tend to have relatively low TDS compared with lakes within other regions of the province (Figure 7). Figure 8 identifies the differences in mean TDS across particular MoE management regions (MSRM 2005). Appendix 8 summarizes this in more detail.

Figure 7. Province of BC – MoE Management Regions

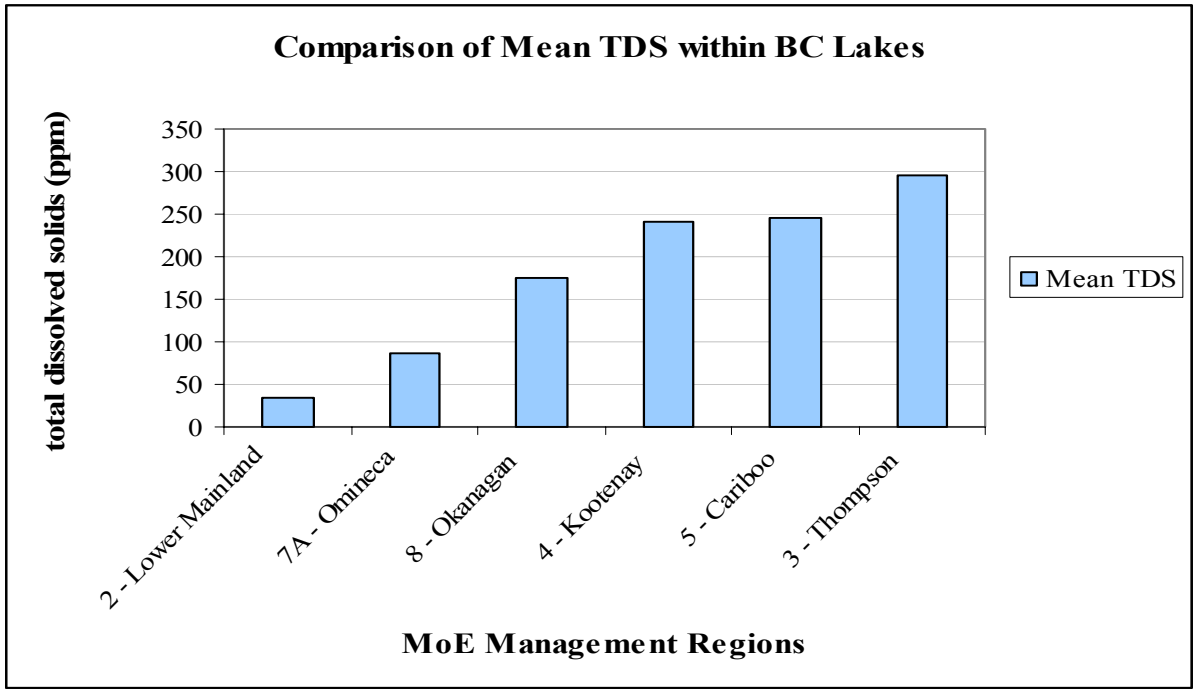

Figure 8. Comparison of mean TDS values from lakes within different MoE management regions.

Figure 9 compares 2005 TDS and conductivity results from Garden Bay and Hotel lakes. TDS and conductivity in Hotel Lake were notably lower than in Garden Bay Lake. This corresponds with cutthroat trout condition factor results being somewhat lower in Hotel Lake than in Garden Bay Lake. Although the TDS, conductivity and condition factors in Garden Bay Lake were higher than Hotel Lake, it is interesting to note that cutthroat trout from the Hotel Lake appear to be exhibiting more rapid growth rates to larger sizes. For instance, five year old fish from Hotel Lake had an average condition factor of 1.09 versus a condition factor of 1.29 for a Garden Bay Lake fish of the same age (Table 6). The size difference between these five year old fish showed a different trend, with the Hotel Lake fish having fork lengths and weights of 658 millimeters and 3100 grams versus a substantially smaller 459 millimeters and 1250 grams for a Garden Bay Lake fish of the same age.

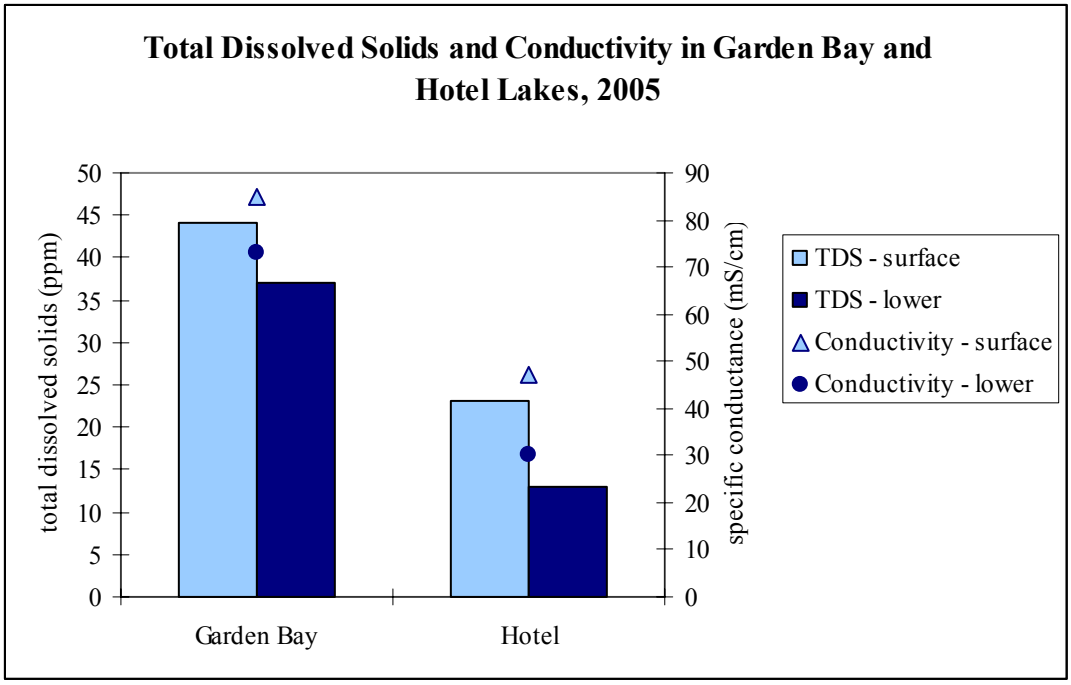

Figure 9. Garden Bay and Hotel lakes TDS and conductivity comparison, 2005.

4.0 DISCUSSION

Based upon the results of stock assessment efforts in 2005, Hotel Lake continues to provide trophy sized coastal cutthroat trout within a location easily accessed by recreational anglers. Anecdotal accounts suggest that larger fish (i.e. two to three kilograms and larger) are not easily caught, but this is not unexpected given the relatively low number of older fish expected to persist in a lake this size along with the difficulties that might be experienced by anglers who want to specifically target them.

CPUE was notably higher than in previous years; but it is unclear if this is a result of the seasonality of sampling or types of nets used. Of four different sampling efforts (i.e. one in 1986, two in 1990, and this effort in 2005), the 2005 sampling date was the only fall stock assessment. In addition, the 2005 sampling effort included floating and sinking nets while the three historic assessments included the use of only sinking nets.

It appears likely that all 12 cutthroat trout were hatchery fish, given the limited spawning/rearing habitat potential of the outlet stream along with the physical evidence that applied to 10/12 of the sampled fish (i.e. all cutthroat trout of two to three years age were adipose clipped and older fish appeared to be triploid (3N) fish, exhibiting minimal gonadal development). In regards to the two larger fish that were live-released, only fork lengths were taken and evidence of a hatchery origin is therefore not available. An inspection of the outlet creek should be undertaken to determine if there are any juvenile cutthroat trout rearing within accessible downstream reaches, in order to confirm with greater certainty that there is no natural recruitment potential.

Condition factors and size at age for cutthroat trout in Hotel Lake are high, especially in consideration of the relatively low TDS and resultant primary productivity that appear to apply. It is anticipated that the relatively diverse and robust prey fish community in Hotel Lake, which includes peamouth chub, is one of the main reasons that this lake continues to support trophy

sized cutthroat trout. Although TDS/conductivity measurements and resultant cutthroat trout condition factors from Garden Bay Lake exceed those recorded for Hotel Lake, the actual sizes of older fish (i.e. age class 5 fish, by length or weight) in Hotel Lake is notably higher. Unlike Hotel Lake, prey fish in Garden Bay Lake appear to be restricted to threespine stickleback and cottids. With 200 peamouth chubs caught in Hotel Lake by two gill net sets over approximately 33 hours, it is readily apparent that this species represents a substantial portion of the fish community's overall biomass in this waterbody. It is interesting to note that threespine stickleback, rather than peamouth chub, were the dominant fish prey species identified in cutthroat trout stomach samples. This may be the result of the timing of the 2005 lake survey work. Peamouth chub spawn in May or June, which may mean that this prey species would be most readily consumed by cutthroat trout in the summer/early fall months when younger age/smaller size classes of chub are present in the lake.

In addition to TDS and specific conductance measurements, it is noted that all other water quality parameters associated with Hotel Lake appear to be well within acceptable parameters for aquatic life.

In regards to previous stock assessment efforts in 1990, cutthroat trout condition factors have improved somewhat over the past 15 years. This appears to suggest that stocking with triploid (3N) cutthroat trout, which became the focus for Hotel Lake in 2001, may be resulting in some improved growth benefits. Further to condition factor, it is also noted that larger cutthroat trout (i.e. fish up to 490 mm fork length and 1380 g weight) were captured in 2005 in comparison to previous sampling efforts. Another benefit of stocking with 3N fish is the availability of "bright" fish (i.e. without spawner or kelt characteristics) throughout the year, including the spring spawning season.

5.0 RECOMMENDATIONS

The following recommendations are provided in relation to the various core objectives of this lake survey project.

Assessment of stocking program

It is recommended that stocking with sterile (3N) rainbow yearlings continue. Although it may be feasible to modestly increase the stocking numbers to increase angler CPUE, this is likely not warranted at this time. Current stocking levels appear to be providing for a valuable fishery that includes trophy sized cutthroat trout. Until more information is available in regards to angler effort and capacity of the lake environment to sustain greater numbers of stocked fish, the stocking program should continue at 500 fish/year.

In relation to this stocking program, it is recommended that a reconnaissance-level assessment of the outlet creek be undertaken to determine if natural recruitment potential is low or non-existent as has been previously assumed.

Effectiveness of present recreational angling regulations

No special angling restrictions apply to this lake, therefore the standard regional daily quota of 4 trout per day, with no more than 1 over 50 centimeters in length currently

applies. Although it fits the definition of a *General Use* lake, Hotel Lake differs from similar stocked lakes within Region 2 given the presence of trophy-sized cutthroat trout. Anecdotal accounts suggest that these larger fish are not easily caught. Based on a review of BC MoE files, it is interesting to note that this lake has had a reputation for large fish with relatively low angler success for more than two decades. It appears likely that the current regulations, in place since 1986, will continue to maintain the quality of the existing fishery unless angler effort or level of sophistication changes. An angler survey would provide valuable information towards confirming this further.

Maintaining the current regulations, at least for the interim pending more assessment information, is consistent with the recently completed "Coastal Cutthroat Trout as Sentinels of Lower Mainland Watershed Health: Strategies for Coastal Cutthroat Trout Conservation, Restoration and Recovery" (Slaney & Roberts 2005). One of the strategies outlined by this document is to "sustain coastal cutthroat angling opportunities", including a focus on the conservation of fisheries in more productive wild cutthroat trout lakes through measures like maximum size restrictions. Cutthroat trout in Hotel Lake are a hatchery-sustained stock, therefore the existing regulations are appropriate providing that the presence of trophy-sized fish can be reasonably maintained without implementation of a more restrictive maximum size restriction.

Assess current water quality

As noted in Section 4.0 of this document, water quality parameters associated with Hotel Lake appear to be well within acceptable parameters for aquatic life.

Use results of stock assessments, water chemistry analysis and angler surveys to guide management

This objective is already addressed above (i.e. regarding comments on stocking, regulations and water quality), with two notable exceptions. Both an angler survey and an assessment for natural recruitment potential have never been completed for this lake and should be undertaken in the short-term.

It should also be noted that future stock assessments will be required to guide the stocking program on this lake. It is apparent that the 15 years which had elapsed between the previous assessment and this lake survey in 2005 was too long a time span to promote active management. As a result, it is recommended that the lake be reassessed in 5 years (2010).

A water quality assessment does not need to be repeated in the short-term, although it is noted that collection of water quality data in the spring-time and/or during the heat of the summer would provide some useful information.

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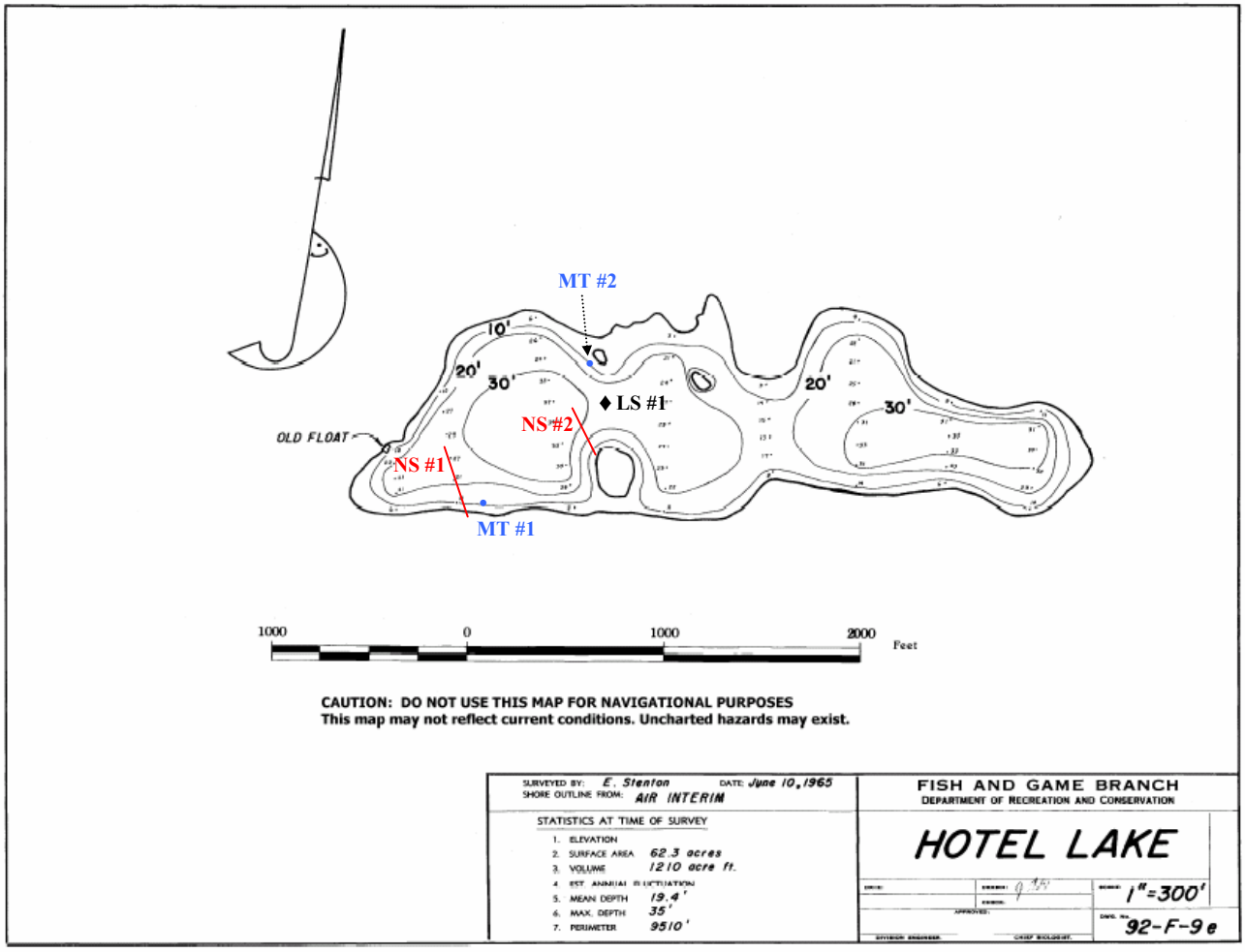
APPENDICES

Appendix 1. Lake stocking history
(MSRM 2005)

Release Date	Gazetted Name	Species Name	Fish Count	Stock	Mark	Ave. Size (gm)	Life Cycle Stage	Watershed Code	Water-body Identifier
3-Nov-05	HOTEL LAKE	Cutthroat Trout	500	TAYLOR 3N	Adipose	118	YEARLING	900-147300-18900	00581JERV
5-Nov-04 to 9–Nov-04	HOTEL LAKE	Cutthroat Trout	500	TAYLOR 3N	Adipose	--	YEARLING	900-147300-18900	00581JERV
16-Apr-03	HOTEL LAKE	Cutthroat Trout	500	TAYLOR 3N	Adipose	59.74	YEARLING	900-147300-18900	00581JERV
13-Mar-02	HOTEL LAKE	Cutthroat Trout	500	TAYLOR		72.99	YEARLING	900-147300-18900	00581JERV
19-Apr-01	HOTEL LAKE	Cutthroat Trout	750	TAYLOR 3N		69.64	YEARLING	900-147300-18900	00581JERV
28-Sep-00	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		21.42	FINGERLING	900-147300-18900	00581JERV
10-Nov-99	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		21.41	FINGERLING	900-147300-18900	00581JERV
22-Sep-98	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		17.24	FINGERLING	900-147300-18900	00581JERV
16-Sep-97	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		13.18	FINGERLING	900-147300-18900	00581JERV
10-Sep-96	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		11.82	FINGERLING	900-147300-18900	00581JERV
11-Sep-95	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		24.63	FINGERLING	900-147300-18900	00581JERV
31-Oct-94	HOTEL LAKE	Cutthroat Trout	1000	PAQ		47.76	FINGERLING	900-147300-18900	00581JERV
29-Jul-93	HOTEL LAKE	Cutthroat Trout	480	TAYLOR		116.33	CATCHABLES	900-147300-18900	00581JERV
8-Jun-92	HOTEL LAKE	Cutthroat Trout	1131	PAQ		118.86	YEARLING	900-147300-18900	00581JERV
18-Apr-91	HOTEL LAKE	Cutthroat Trout	1000	PAQ		32.36	YEARLING	900-147300-18900	00581JERV
6-Sep-90	HOTEL LAKE	Cutthroat Trout	1000	PAQ		16.9	FINGERLING	900-147300-18900	00581JERV
5-Sep-89	HOTEL LAKE	Cutthroat Trout	1000	PAQ		10.3	YEARLING	900-147300-18900	00581JERV
1-Nov-88	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		11	UNKNOWN	900-147300-18900	00581JERV
1-Sep-87	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		15.6	UNKNOWN	900-147300-18900	00581JERV
1-May-86	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		43.9	UNKNOWN	900-147300-18900	00581JERV
1-Sep-85	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		13.2	UNKNOWN	900-147300-18900	00581JERV
1-Oct-84	HOTEL LAKE	Cutthroat Trout	1000	TAYLOR		10.5	UNKNOWN	900-147300-18900	00581JERV
1-Sep-83	HOTEL LAKE	Cutthroat Trout	5000	TAYLOR		10.5	UNKNOWN	900-147300-18900	00581JERV

1-Jan-72	HOTEL LAKE	Cutthroat Trout	5000	SALMON		5	FINGERLING	900-147300-18900	00581JERV
1-Jan-69	HOTEL LAKE	Cutthroat Trout	2000	OREGON		15	FINGERLING	900-147300-18900	00581JERV
1-Jan-68	HOTEL LAKE	Cutthroat Trout	3000	WASH.		15	FINGERLING	900-147300-18900	00581JERV
1-Jan-67	HOTEL LAKE	Cutthroat Trout	3000	OREGON		30	YEARLING	900-147300-18900	00581JERV
1-Jan-66	HOTEL LAKE	Cutthroat Trout	4000	OREGON		0	YEARLING	900-147300-18900	00581JERV
1-Jan-65	HOTEL LAKE	Cutthroat Trout	8100	CORVALLIS		15	FINGERLING	900-147300-18900	00581JERV
1-Jan-34	HOTEL LAKE	Rainbow Trout	5000	PENNASK		0	FRY	900-147300-18900	00581JERV
1-Jan-33	HOTEL LAKE	Rainbow Trout	6000	PINANTAN		0	FRY	900-147300-18900	00581JERV

Appendix 2. Net sets, minnow traps and limnostation locations



Bathymetric map of Hotel lake showing net set (NS), minnow trap (MT) and limnostation (LS) locations.

Appendix 3. Netting record

LAKE: Hotel

NETTING RECORD

Mesh sizes experimental order: 25, 76, 51, 89, 38, 64 mm

NETTING SITE # 1

Type:	Floating monofilament		
Date Set:	October 3, 2005	Time:	16:50
Date Lifted:	October 4, 2005	Time:	09:10
Net Dimensions:	Length: 91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm	Depth: Substrate:	15 – 20 cm Sandy gravel
Deep End Mesh Size:	64 mm	Depth: Substrate:	9.0 m Anchor clean – hard bottom

Comments:

- Set right off resort beach, behind resort office building (tied off to ringbolt on shoreline log).
- Fine mesh at shore.
- Outside (large mesh) sunk 2-3 metres.

NETTING SITE # 2

Type:	Sinking monofilament		
Date Set:	October 3, 2005	Time:	17:35
Date Lifted:	October 4, 2005	Time:	10:40
Net Dimensions:	Length: 91.4 m	Depth:	2.4 m
Shallow End Mesh Size:	25 mm	Depth: Substrate:	8.0 m Sandy gravel
Deep End Mesh Size:	64 mm	Depth: Substrate:	8.0 m Anchor clean – apparent hard bottom

Comments:

- Set off large island, near southern side of lake.
- Fine mesh at shore.
- Set towards deeper water area.

Appendix 4. Lake catch summary.

LAKE: Hotel

LAKE CATCH SUMMARY

SPECIES	NET SITE NO.				ANGLED	OTHER	TOTAL	NUMBER SAMPLED	NUMBER PRESERVED	SIZE RANGE (cm)
	1	2	3	4						
Cutthroat trout	X				-	-	7	-	-	28.3 – 49.0
Peamouth chub	X				-	-	25	-	-	12.5 – 25.3
Stickleback	X				-	-	1	-	-	9.0
Cutthroat trout		X			-	-	5	3*	-	53.3 – 65.8
Lake chub		X			-	-	175	-	-	13.2 – 26.5
Cottids**		X			-	-	27	-	-	9.9 – 20.8

Comments:

* two released live, both ~ 53.0 - 54.0 cm

** apparently prickly sculpins (*Cottus asper*)

Angling:

- 1 angler (17:45-19:20) caught/released 1, 34 cm adipose clipped CCT + 1 other fish hit (similar size)
- Observed 1 other angler trolling willow leaf (none caught in 2 hrs he was on lake. This angler indicated that fishing has been poor this year compared to previous 7 yrs he has resided on and fished lake. Has caught fish up to 2 kg and heard of slightly bigger fish having been caught.

Minnow Traps:

BAIT: sardines

#	HOURS	DEPTH (m)	SUBSTRATE	SPECIES	SIZE RANGE (cm)
1	17 hrs 55 min	0.75	Sandy gravel	Trap empty	-
2	16 hrs 25 min	0.50	Organic bottom	Trap empty	-

Comments:

- MT #1 set at 17:00 (next to some submerged LWD – root wad), pulled at 10:55 the next day
- MT #2 set at 17:40 on outside edge of small island on north side of lake (close to shore, within rushes and near a submerged stump), pulled next day at 09:25

Appendix 5. Individual fish data

Lake: Hotel Lake

Date Captured: October 4, 2005

Sex	Gonadal Maturity		Sample Type	Mark
M - Male	IMM - Immature	GV - Gravid	FR – Fin Ray	AD - Adipose
F - Female	MG - Maturing	SP - Spent	SC - Scale	Clip
? - Not Obvious	MT - Mature	? - Not Obvious	OT - Otolith	

Net Set #1
Method of Capture: floating monofilament gillnet

Species	Fork Length (mm)	Fork Length (cm)	Weight (g)	Sex	Gonadal Maturity	Sample Type	Mark	Age (yr)	Condition Factor	Comments
CCT	283	28.3	260.0	F?	IMM	SC	AD	2	1.15	minimal gonad development, remains of 2 small threespine stickleback (TSB) in gut
CCT	296	29.6	300.0	?	IMM	SC	AD	2	1.16	no signs of gonad development, remains of 1 TSB in gut
CCT	314	31.4	360.0	M	MG	SC	AD	2	1.16	some signs of gonad development, remains of 3 TSB in gut
CCT	358	35.8	510.0	?	IMM	SC	AD	2	1.11	no signs of gonad development, unidentified invertebrate remains in gut
CCT	372	37.2	590.0	?	IMM	SC	AD	2	1.15	minimal gonad development, remains of 5 to 10 TSB in gut
CCT	382	38.2	610.0	M	MG	SC	AD	3	1.09	some signs of gonad development, remains of 3 to 4 TSB in gut
CCT	490	49.0	1380.0	F	IMM	SC	no	3	1.17	minimal gonad development, extensive fat deposits, remains of 3 to 5 TSB in gut

Net Set #2
Method of Capture: sinking monofilament gillnet

Species	Fork Length (mm)	Fork Length (cm)	Weight (g)	Sex	Gonadal Maturity	Sample Type	Mark	Age (yr)	Condition Factor	Comments
CCT	535	53.5	n/a	?	n/a	SC	no	n/a	n/a	fish released alive (only fork length information recorded)
CCT	533	53.3	n/a	?	n/a	SC	no	n/a	n/a	fish released alive (only fork length information recorded)

CCT	610	61.0	2250.0	M	MG	SC	no	4	0.99	some gonad development, well-developed kype (obviously a male fish, even prior to dissection), remains of 5 to 10 TSB in gut
CCT	617	61.7	2800.0	F	IMM	SC	no	4	1.19	minimal gonad development (sex difficult to determine), extensive fat deposits, remains of 1 TSB in gut
CCT	658	65.8	3100.0	F	IMM	SC	no	5	1.09	minimal gonad development (sex difficult to determine), extensive fat deposits, remains of 5 to 10 TSB in gut

Appendix 6. Water Chemistry Summaries

Lake Name: Hotel
Waterbody Identifier: 00581JERV

Field Crew: Roberts and Jesson

WATER CHEMISTRY SUMMARY **Limnology Station No. 1**

Field Conditions:

Date:	04-Oct-2005		
Time:	1255 hrs	Air Temperature:	17.0 °C
Wind Velocity:	5-10 km/hr	Wind Direction:	W → E
Cloud Cover:	2 o.c.	Surface Condition:	ripple
Secchi Disc:	3.75 M	Water Colour:	Greenish-brown

Methods Used:

Dissolved Oxygen:	OxyGuard Handy MkIII
Water Temperature:	OxyGuard Handy MkIII
Air Temperature:	Hand-held alcohol thermometer
pH (field):	HACH pH field test kit (wide range colour comparator)
H2S (field):	HACH H2S field test kit
Specific Conductance	Hanna TDS/conductivity meter
Total Dissolved Solids	Hanna TDS/conductivity meter
Laboratory Used:	No lab sample taken
Water Sampler:	Verticle Alpha Water Bottle (Vandorn)

Water Sample Chemistry:

Sample Depths	Surface (0 m)	Lower (15.0 m)
pH (field)	7.0	6.5
Specific Conductance (field) mS/cm	47	30
Total Dissolved Solids (field) ppm	23	13
H2S (field) mg/L	-	0
Bottom Depth: 8.9 m		

NOTES:
- No H_2S smell on lower water sample, test conducted anyway

Appendix 7. Summer Oxygen/Temperature Data

LAKE NAME: Hotel
DATE: 04 – October – 2005

SUMMER OXYGEN/TEMPERATURE DATA

DEPTH (m)	02 (mg/l)	TEMP (°C)
Surface	8.8	16.8
1.0	8.8	16.8
2.0	8.8	16.5
3.0	9.0	16.3
4.0	9.0	16.1
5.0	9.0	16.0
6.0	8.9	15.9
7.0	8.5	15.8
8.0*	5.7	15.4

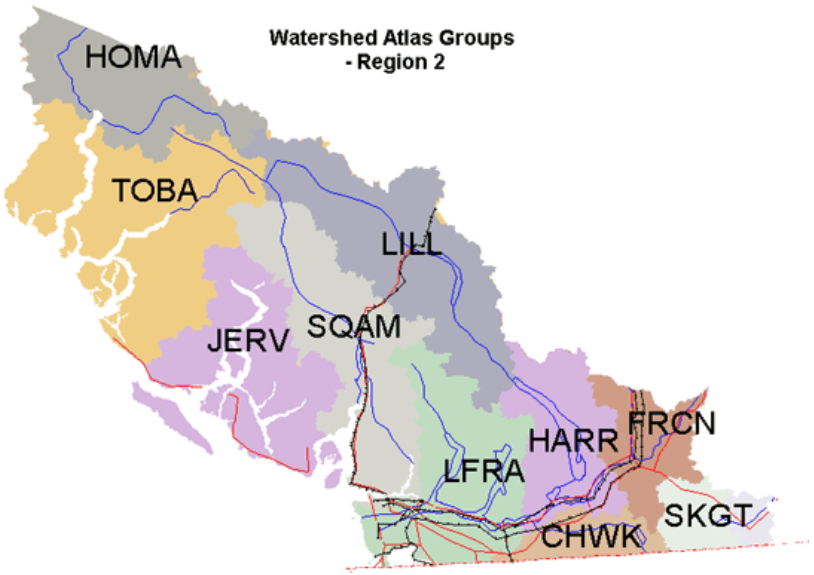
*Last station – limited by water depth.

Appendix 8. Total Dissolved Solids Data
(MSRM 2005)

REGION 2 – Lower Mainland

Watershed	Mean TDS	n
SQUAM	30.12	26
LFRA	28.91	33
LILL	59.58	12
JERV	26.73	30
TOBA	17.42	12
HARR	28.20	25
CHWK	45.00	10
FRCN	39.33	15
SKGT	64.50	6

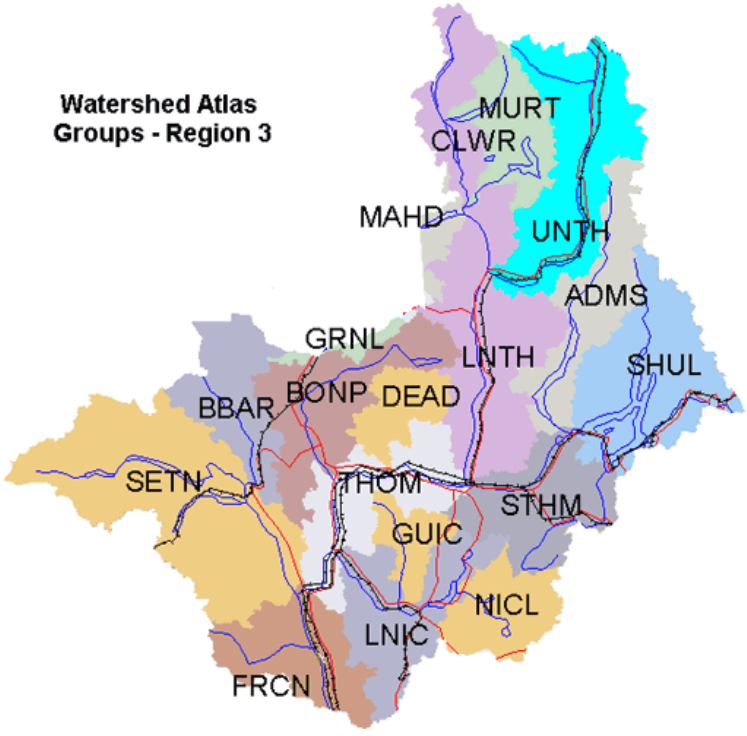
Overall Mean TDS: **33.11** **169**



REGION 3 – Thompson

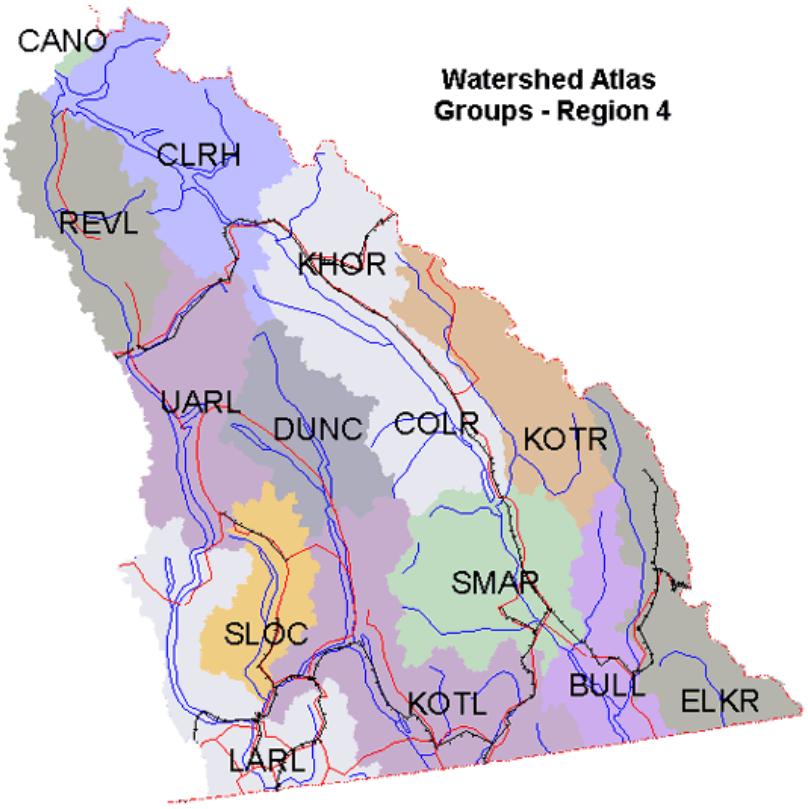
Watershed	Mean TDS	n
THOM	151.11	44
SHUL	114.71	7
STHM	653.35	40
FRCN	51.25	4
SETN	157.67	15
BBAR	1933.70	10
NICL	220.57	88
GUIC	330.13	38
BONP	498.01	75
GRNL	482.62	13
DEAD	125.50	56
ADMS	36.68	31
LNTH	390.46	198
CLWR	47.45	20
MAHD	68.30	54
MURT	27.11	9
UNTH	32.89	56

Overall Mean TDS: **294.56** **758**



Region 4 - Kootenay

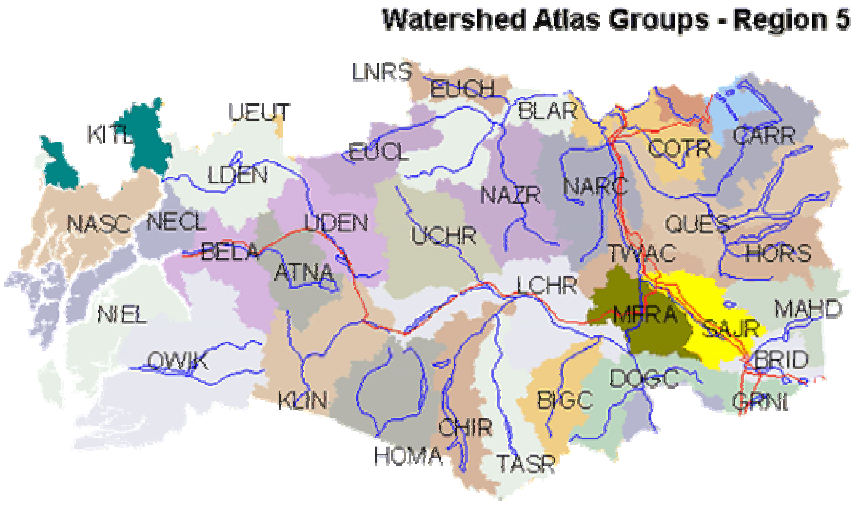
Watershed	Mean TDS	n
SLOC	31.38	24
REVL	32.50	2
CANO	76.00	1
UARL	136.53	17
COLR	331.98	50
KOTL	87.95	22
LARL	101.56	16
CLRH	117.50	8
KHOR	210.55	20
ELKR	135.91	11
DUNC	102.00	1
BULL	628.10	31
SMAR	278.42	26
KOTR	141.60	15
Overall Mean TDS:	**241.62**	**244**



Region 5 - Cariboo

Watershed	Mean TDS	n
UCHR	274	7
QUES	184.7302	23
EUCL	101.8235	17
BLAR	362	13
DOGC	349	12
MFRA	537.12	25
SAJR	480.0769	39
TWAC	329.0833	12
NARC	254.1111	18
COTR	105.5714	14
GRNL	473.8571	14
MAHD	136.1846	65
BRID	250.4815	54
BIGC	137	4
LCHR	274.5556	27
CHIR	198.0417	24
TASR	190.2273	22
CARR	66.375	8
HORS	121.3333	45
EUCH	112.3333	15
NAZR	218.8125	16
HOMA	223.3571	14
KLIN	91.92308	13
ATNA	535.85	20
UDEN	171.4615	13
LDEN	40.5	8
KITL	34	1
NASC	25	1

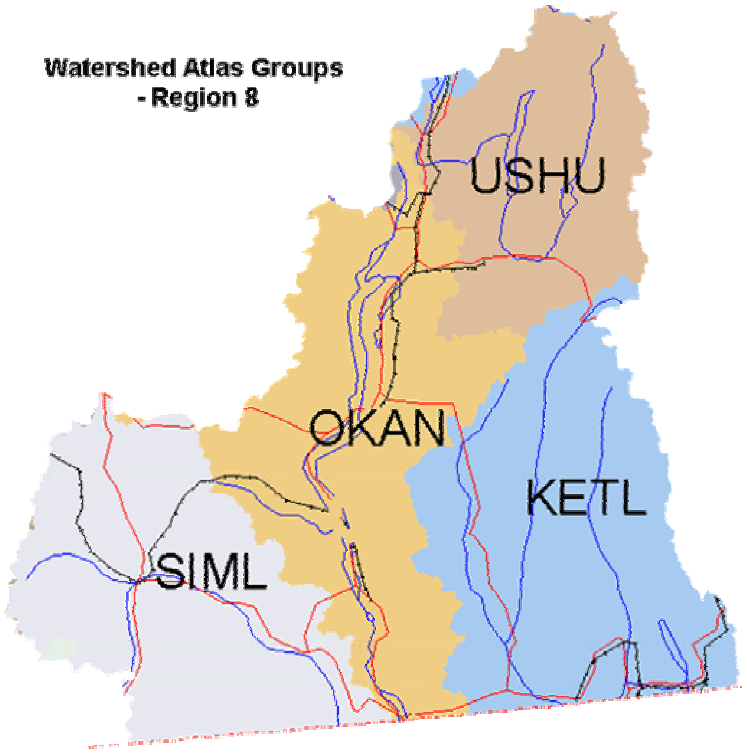
Overall Mean TDS: **245.74** **544**



Region 8 - Okanagan

Watershed	Mean TDS	n
OKAN	244.94	64
KETL	72.58	43
NICL	262.40	5
USHU	113.70	30
SHUL	82.00	1
STHM	337.50	2
SIML	193.80	54

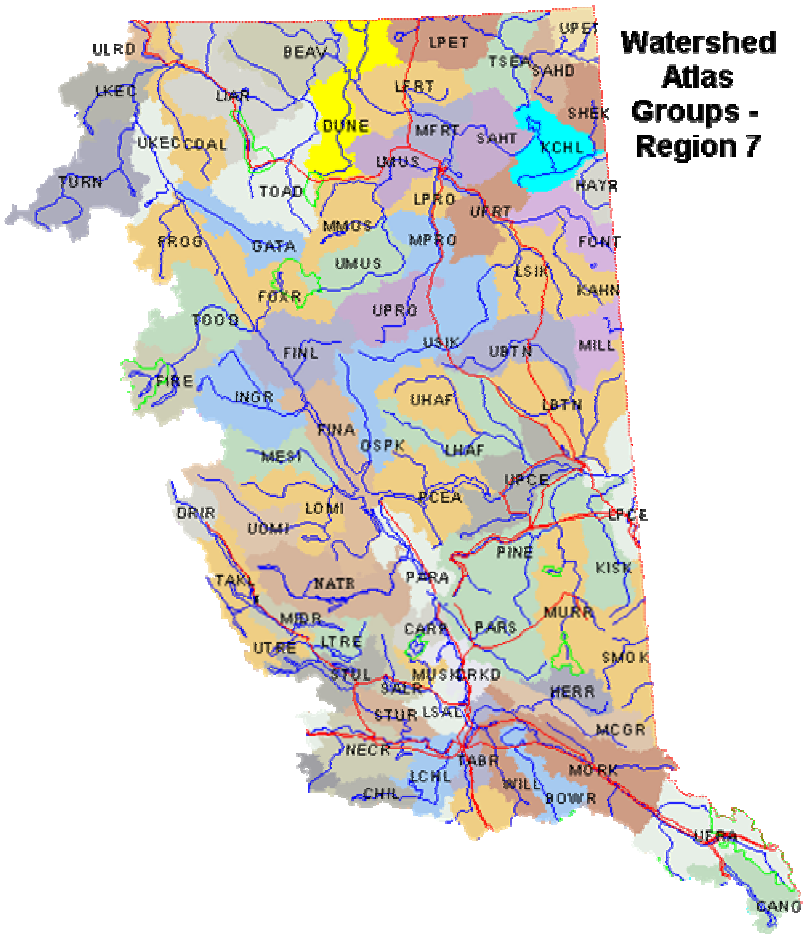
Overall Mean TDS: **174.58** **199**



Region 7A – Omineca (South)

Watershed	Mean TDS	n
UFRA	149.80	10
NATR	95.75	36
FIRE	46.73	11
TABR	84.29	7
SALR	80.53	15
LSAL	66.29	38
MUSK	71.25	16
WILL	58.39	18
MORK	76.79	14
BOWR	57.57	14
CHIL	114.50	24
LCHL	103.79	28
NECR	124.89	19
STUR	94.81	21
STUL	89.67	21
LTRE	74.00	5
UTRE	73.67	12
MIDR	128.42	19
TAKL	46.90	10
DRIR	100.00	1
MCGR	55.13	8
HERR	138.00	3
PARA	106.88	16
CARP	56.90	21
CRKD	60.48	23
FINA	88.25	16
MESI	57.25	4
INGR	87.67	3
PARS	90.69	16
LOMI	53.67	6
UOMI	68.67	12
FINL	67.33	3
FOXR	135.57	7
TOOD	107.33	6
CANO	46.67	3

Overall
Mean TDS: **85.59** **486**



Appendix 9. Photos

Photo 1. Hotel Lake – July 20, 2005

Photo 2. Hotel Lake floating gill net set (netting site #1) – October 3, 2005

Photo 3. Hotel Lake cutthroat trout (61-66 cm) captured in sinking gill net (netting site #2) – October 4, 2005

Photo 4. Large catch of peamouth chub from Hotel Lake – October 4, 2005