ASSESSMENT OF REARING CAPACITY FOR CONSIDERATION OF RE-INTRODUCING SOCKEYE SALMON TO THE COQUITLAM RESERVOIR

Prepared for:

BC Hydro Bridge Coastal Fish and Wildlife Restoration Program
6911 Southpoint Drive (E14),
Burnaby, BC V3N 4X8

BCRP Report No. #05.Co.13

July 2006

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EXECUTIVE SUMMARY

An assessment of fish abundance and biomass, and limnological characteristics in Coquitlam Reservoir was initiated in 2004, to determine whether re-introducing anadromous sockeye salmon to Coquitlam would be rearing-limited. This report presents the 2005 study results with comparisons with the 2004 findings.

The Coquitlam Reservoir is oligotrophic (unproductive), and is a major source of high quality water for the Greater Vancouver Regional District (GVRD). The limnological characteristics of the reservoir were similar during 2004-2005. This lake is characterized by low nutrient concentrations (is phosphorous limited), low phytoplankton biomass, and good water clarity. Its relatively cool water temperature regime, high dissolved oxygen levels, and favourable water quality conditions make it suitable for resident cold-water fishes. It also has low zooplankton stocks (1.2 ug/L) compared with other west coast oligotrophic lakes, which may be limiting fish production.

Since Coquitlam Reservoir is an important source of drinking water for the GVRD, there is concern whether the introduction of fishes, such as anadromous sockeye salmon, will have negative effects on water quality for human consumption. Previous research has found strong interactions among planktivorous fishes, zooplankton, and phytoplankton and water quality. However, there is no research reviewed here that demonstrates direct linkages between sockeye introduction and water quality.

The food chain structure, especially as it relates to the zooplankton standing crop and its relationship to fisheries production, was examined. Analyses of fish stomach contents and stable isotope levels in fish tissue indicated low pelagic (open water) productivity and the importance of nutrients and foods from nearshore and terrestrial areas in fish foraging. The data showed that different fish species rely on quite different food sources. Only kokanee and threespine stickleback forage in the pelagic habitat and obtain their carbon inputs essentially from pelagic food sources.

A total fish population of 404,177 and 194,604 was estimated using hydroacoustics in May and November 2005, respectively. Of these, approximately 37-40% was estimated to be kokanee. In May, the total biomass of fish was estimated to be approximately 18,014 kg (range 15,516 kg to 20,511 kg), and estimated fish production ranged between 290 fish/ha (13 kg/ha) and 384 fish/ha (17 kg/ha). In November, the total biomass of fish was estimated to be approximately 42,260 kg (range 25,095 kg to 59,425 kg), and estimated fish production ranged between 96 fish/ha (21 kg/ha) and 228 fish/ha (50 kg/ha).

Empirical data on current zooplankton and kokanee production indicate that Coquitlam Reservoir is likely to support a relatively small sockeye smolt population (i.e. less than 1 million smolts). Available lake shore spawning habitat in Coquitlam Reservoir could potentially support between 3,000 and 5,000 female sockeye spawners and 5,000 female sockeye would produce a smolt population of approximately 400,000 4.5 g sockeye smolts. This is consistent with zooplankton biomass and observed fall 0+ 1+ kokanee biomass in the fall of 2004.

Predicted sockeye smolt biomass (kg) using a relationship with seasonal mean zooplankton biomass was 1853 in 2004 and 1129 in 2005. These may underestimate the total zooplankton

biomass for the reservoir because only one site was sampled and this was outside of the main area of pelagic fish abundance. However, these predicted sockeye smolt biomasses were similar to estimates of smolt biomass using hydroacoustics estimates of fall juvenile (0+ and 1+) kokanee abundance in 2004 and 2005 after accounting for 30% mortality to smolting (2184 and 529, respectively).

Based on results from the first two years of study we conclude that, should re-introduction of sockeye proceed, a reasonable interim production target would be 400,000 4.5 g sockeye smolts derived from a spawning population of 10,000 sockeye adults. This would balance with presumed available spawning habitat within the reservoir and would account for 1800 kg of sockeye/kokanee smolt biomass. If juvenile sockeye are introduced, it is likely that the kokanee population will decline due to direct competition for the same prey species and similar prey sizes. Any introduction of sockeye to the reservoir will require a pre-cautionary approach and a detailed limnological and fish monitoring program.

INTRODUCTION

The restoration of anadromous fish runs, where practical, is a key objective of the Bridge-Coastal Fish and Wildlife Restoration Program (BCRP). In the Coquitlam-Buntzen BC Hydro system, numerous interested parties including government agencies, the Kwikwetlem First Nation, stewardship groups, environmental Non-Government Organizations (NGOs), and concerned citizens have an interest in restoring anadromous salmon runs in the Coquitlam Reservoir.

In 2002, LGL Limited developed a framework for evaluating fish passage issues in the Bridge – Coastal hydro operating area (Bocking and Gaboury 2002). Following this, the BCRP commissioned an evaluation of the feasibility of restoring anadromous fish stocks into the Coquitlam Reservoir (Bocking and Gaboury 2003). Bocking and Gaboury (2003) estimated the rearing capacity for sockeye salmon of Coquitlam Reservoir using two models; the Euphotic Volume (EV) model of Koenings and Burkett (1987) and the Photosynthetic Rate (PR) model of Shortreed et al. (2000). Both these models estimate sockeye biomass based on the amount of physical space available to juvenile sockeye during the primary growing season of May – October. Bocking and Gaboury (2003) also made several recommendations for future study on issues pertaining to anadromous fish passage and water quality in Coquitlam Reservoir.

This 2005 study provides:

- A limnological characterization of the reservoir;
- Information on the abundance and biomass of the existing kokanee population and other fish species in Coquitlam Reservoir; and
- An assessment of rearing capacity for Kokanee/sockeye and potential effects of re-introducing sockeye in Coquitlam Reservoir.

An assessment of spawning for kokanee in the Coquitlam Reservoir is addressed in a parallel report by Gaboury and Murray (2006).

Goals and objectives

Three specific objectives related to the limnology and fish populations of Coquitlam Reservoir were developed in cooperation with a number of agencies, institutions and concerned groups. Basically, these objectives adhere to the approach outlined by Bocking and Gaboury (2002) as follows:

1. Assess the current limnological features (physical, chemical, phytoplankton and zooplankton) of Coquitlam Reservoir to assist decision making on the potential effects of re-introducing sockeye salmon to the reservoir,
2. Determine the abundance, biomass and age structure of the existing kokanee population in Coquitlam Reservoir using hydroacoustic and various netting techniques, and characterize the fish community, and
3. Evaluate the current biomass of kokanee in the reservoir against the potential sockeye biomass at capacity reported by Bocking and Gaboury (2003), and identify limiting factors and potential initial stocking levels of sockeye in the reservoir.

COQUITLAM RESERVOIR STUDY AREA

The Coquitlam Reservoir, located in southwest British Columbia and comprising an area of approximately 1200 ha (Figure 1), is a major source of domestic water for the Greater Vancouver region. The area is characterized by west coast maritime air with cool wet winters and warm dry summers. The reservoir has mean and maximum depths of approximately 87 and 187 m, respectively, at a pool elevation of 152 m, with complete mixing occurring between November and March. It is approximately 12 km long with an average width of roughly 1 km, and is classified as a monomictic body of water with an ultra-oligotrophic status (Wetzel 2001). Some physical details of the reservoir are presented in Table 1 (Nordin and Mazumder 2005; James 2000).

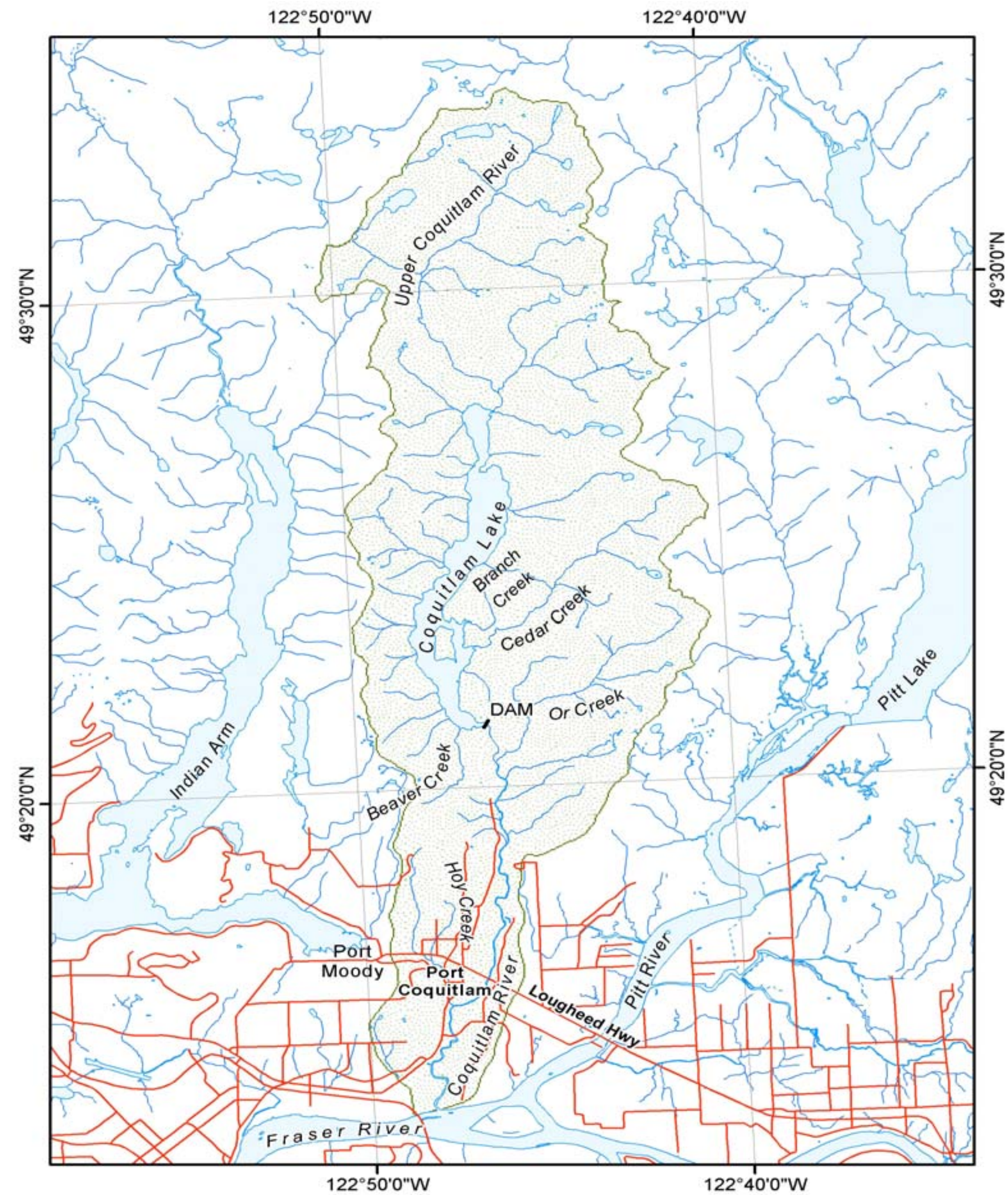

Figure 1. Map of Coquitlam watershed showing local communities and features.

Table 1. Morphological characteristics of Coquitlam Reservoir (Nordin and Mazumder 2005; James 2000).

Attribute	Measure
Lake Volume (m^3)	1,044,000,000
Mean depth (m)	87
Surface area (km^2), (ha)	12 (1200)
Watershed area (km^2)	212
Watershed area contributing to reservoir (km^2)	191
Watershed to Reservoir area ratio [a]	15.9:1
Normal operating elevation (m)	137.48 - 154.86
Normal operating elevation range (m)	17.4
Average annual precipitation (rain) (mm)	3576.8
Average annual precipitation (snow) (mm)	158.2
Inflow (m^3/yr)	725,000
Mean inflow (m^3/s)	23
Water Residence time (yr)	1.44
Sedimentation rates - 1967-1997 (g/m^2/yr), (t/km^2/yr)	192 ($1.92x10^2$)
Sedimentation rates - 1990-2002 (g/m^2/yr)	267
Sedimentation rates - 1905-2002 (mm/year) [b]	1.8mm /year

[a] to the mouth of lower Coquitlam

[b] over the period

In November 2002, a preliminary assessment of the fish population in the reservoir and potential salmonid spawning habitat in the upper Coquitlam watershed was conducted by LGL Limited (Bocking and Gaboury, 2003). The Coquitlam system supports several species of salmonids including kokanee (*Oncorhynchus nerka*) and cutthroat trout (*Salmo clarki*), and a number of coarse fishes including peamouth chub (*Mylocheilus caurinus*), northern pike minnow (*Ptychocheilus oregonensis*), and largescale sucker (*Catostomus macrocheilus*).

In September 2004, a study was conducted to assess fish abundance and biomass (Bussanich et al. 2005). The total population of fish in Coquitlam Reservoir in October was estimated at 648,000 fish (±13%) using hydroacoustics. Of this total, approximately 40% were kokanee. Total kokanee biomass was estimated at 7,700 kg (range 4,500 to 15,800) and of these; 3,100 kg were 0+ (240 kg) and 1+ kokanee (2880 kg). By numbers, eighty-seven percent of the kokanee were in their first or second year of life (termed age-0 and age-1 fish) while 13% were in their third or fourth year (termed age-2 and age-3). The observed sex ratio among the age-2 and-3 kokanee was five males to one female.

Gaboury and Murray (2006) estimated that there is sufficient spawning habitat in the lake (1500 m^2) below the 140 m contour and also in Cedar and Beaver creeks (1000 m^2) to support a kokanee population of 4500 females or a sockeye population of 1500 females.

If the maximum reservoir drawdown is maintained at the 144 m elevation as proposed by Bocking and Gaboury (2003), this would potentially support a kokanee population of about 10,200 females or an equivalent sockeye population of roughly 3400 females. Sediment core data suggest that Coquitlam Reservoir did not have a large population of resident salmonids prior to construction of the dam in 1905 (Nordin & Mazumder 2005). Spawning habitat in the Coquitlam tributaries is currently limited, and kokanee or sockeye (*O. nerka*) are more likely to spawn in the fluvial fans along the lakeshore rather than in the tributaries.

Additional habitat (25,000 m^2) has also been identified in the Upper Coquitlam River and could support another 40,000 female spawners.

METHODS

Field Schedule

Sampling of the reservoir's physical and chemical properties as well as phytoplankton and zooplankton was conducted monthly (January 2004-December, 2005) by the University of Victoria (Field et al. 2005). Juvenile and adult fish populations were sampled in May, September and November 2005, using a combination of hydroacoustics, gillnetting, minnow trapping, trawling, and visual surveys.

Limnology Assessment (Year 2: January to December 2005)

Sampling Sites

Four sampling stations were used for limnological study. Site 1 was located at 49^o 21.40 N, 122^o 47.18' W; Site L2 was located at 49^o 22.57' N, 122^o 47.97' W; Site 3 was located at 49^o 23.58' N, 122^o 47.60' W; and Site 4 was located at 49^o 24.88' N, 122^o 46.43' W using a global positioning system and marked fixed rafts. These sites were located in areas of depth ranging from 9 m to 187 m, covering the length of the lake (Figure 2).

Physical Measurements

Temperature, conductivity, turbidity, and chlorophyll *a* measurements were collected hourly, and downloaded monthly throughout the year, at a depth of 4 m at all sites using a YSI model 6600 Sonde (Hoskin Scientific). Turbidity measurements were also collected hourly and downloaded monthly throughout the year at depths of 15 m, 30 m and 40 m at Sites 2L, 3L and 4L, respectively, using YSI model 600 Sonde (Hoskin Scientific). Generally, the turbidity and chlorophyll *a* data provided by the YSI rafts did not match well with values from more reliable laboratory methods, and thus the turbidity and chlorophyll data from the YSI rafts are not discussed in this report. For more information on these turbidity data, refer to Field and Mazumder (2006). Monthly (from January 2004-December 2005) vertical profiles of temperature, turbidity, chlorophyll *a*, specific conductivity and dissolved oxygen were taken in situ with a YSI model 6600 Sonde (Hoskin Scientific) at each site at 1-m intervals from the surface to a maximum depth of 18 m.

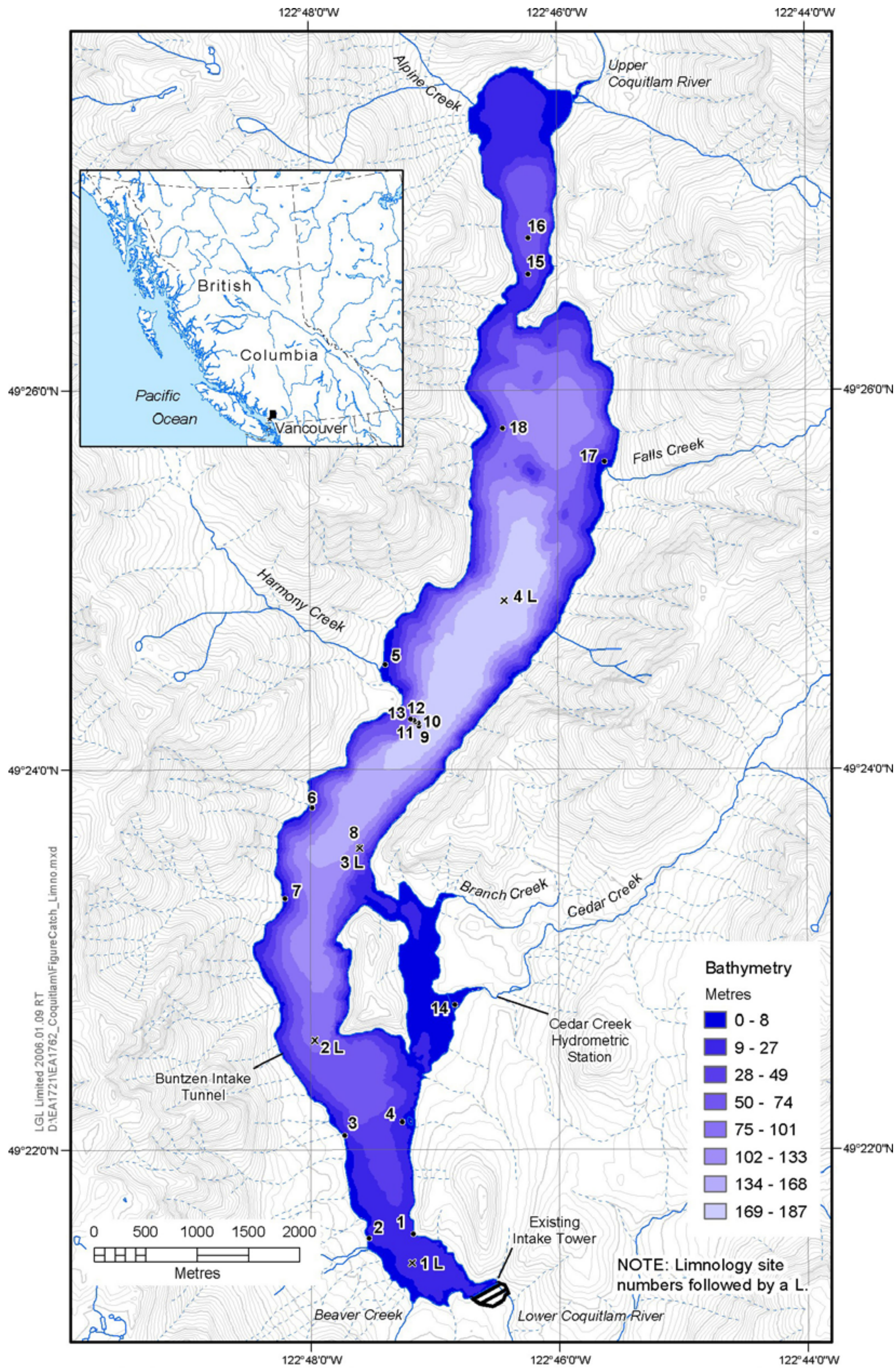

Figure 2. Bathymetric map of Coquitlam Reservoir, showing limnological and fish sampling sites, 2004-2005.

Secchi disk readings of water transparency were measured monthly (time period as above) at each site using a standard 20 cm Secchi disk, to the nearest 0.25 m, without a viewing chamber. Light attenuation measurements were collected monthly from January to December 2005 at 1-m intervals from 0 to 9 m, using a Li-Cor-1400 Light meter and Li-Cor underwater sensor (Hoskin Scientific). Euphotic Zone Depth (EZD), defined as the depth at which light is 1% of the intensity of that at the surface, was determined for each sampling site and date by best-fit linear regression of light intensity with depth

Water samples were also collected monthly (time period as above) in epilimnetic (surface), metalimnetic (middle) and hypolimnetic (bottom) waters at each site using a Van Dorn water bottle for analysis of turbidity and chlorophyll *a*.

Air temperature, wind direction, wind speed, relative humidity and light saturation measurements were collected hourly at each site from January 2004 to December 2005 using a Li-Cor-190 SA Quantum Sensor (Hoskin Scientific), and downloaded monthly. Atmospheric data were collected for an ancillary Greater Vancouver Regional District (GVRD) project and are not reported in this document.

Water Chemistry & Nutrients

Water samples were collected monthly, from January 2004 to December 2005 for water chemistry and nutrient analysis at all sites (L1-L4 inclusive) in epilimnetic (surface) waters, and at Site L2 in metalimnetic (middle) and hypolimnetic (bottom) waters, using a Van Dorn water bottle.

Carbon samples were collected monthly in epilimnetic (surface) waters, metalimnetic (middle) and hypolimnetic (bottom) waters at all sites except Site L2 where carbon was only sampled at a depth of 4 m.

Handling and analysis of samples followed standard water sampling procedures of the NSERC-IRC laboratory at the University of Victoria. Water samples were analysed for total phosphorous (TP), total dissolved phosphorous (TDP), soluble reactive phosphorous (SRP), ammonia-N (NH_4^+), total Kjeldahl nitrogen (TKN), nitrate-N (NO_3), nitrite-N (NO_2), and sulphate-S (SO_4). For carbon measurement, samples were collected monthly at a depth of 4 m at each of the four sites from January 2004 to December 2005.

All water samples to be analysed for nutrients and chemistry were collected in clean dark 2-L Nalgene bottles pre-rinsed with sample water, stored on ice and processed within 2 hours of collection. Processing consisted of filtering samples through nitrocellulose filters into acid-washed bottles for later analysis. Carbon samples, including total organic and dissolved organic carbon were filtered through ashed GFF glass microfibre filters and stored in glass vials with no head space. All samples were kept cool during transport to the University of Victoria, where nutrient samples were frozen and carbon samples were refrigerated until analysed.

All water samples were analyzed at the NSERC-IRC laboratory at the University of Victoria. Carbon samples were processed immediately using a Shimadzu Total Organic Carbon Analyzer. Nutrient samples (TP, TDP, TN, NO_2, NO_3 and SO_4) were analyzed using a Zellweger Analytics Lachat QuickChem autoanalyser. The SRP and chemical anion samples were processed using a

High Performance Liquid Chromatography (HPLC) analyzer made by Dionne Industries. The NH_4^+ samples were analyzed using a Pharmacia photospectrometer.

Phytoplankton

To assess the seasonal fluctuation of algal populations and predict potential bloom problems, phytoplankton cells in whole water samples were identified and enumerated. Samples were settled in Utermohl settling chambers. An Olympus IMT-2 inverted research microscope was used to view the samples. Individual cells were identified to genus or species, measured and counted. QA/QC was done on randomly chosen samples monthly.

Chlorophyll *a*

Chlorophyll *a* (Chl *a*) was measured hourly at a depth of 4 m at each site from January 2004 to December 2005 using a YSI 6600 Sonde (Hoskin Scientific), and downloaded monthly. To validate monitoring by the Sonde, Chl *a* samples were collected monthly in epilimnetic (surface), metalimnetic (middle) and hypolimnetic (bottom) waters at each site. Within 2 hours of sample collection, 1 L of water from each sample site was filtered through an ashed 47 mm diameter, 0.45 µm Whatman GFF glass microfibre filter. Samples were filtered and kept in the dark to prevent chlorophyll from degrading in light. Filters were then folded and placed in 15 ml conical tubes and kept cool during transport to the NSERC-IRC laboratory at the University of Victoria, where they were frozen until analysis.

Chlorophyll-*a* samples were analysed with a Turner Designs Model Trilogy Fluorometer. Extraction of samples was carried out 18-24 hours prior to analysis using 95% ethanol added to the conical tubes. The ethanol extracts the chlorophyll from the filter and after being centrifuged the sample can be decanted off and analysed using the fluorometer.

Zooplankton

Macrozooplankton (excluding nauplii and rotifers) density and biomass were monitored in Coquitlam Reservoir monthly from January to December in 2004 and 2005 at limnological sampling Site L2 only. Vertical plankton hauls were conducted at sampling Site L2 using a 64-µm-mesh net with a mouth diameter of 30 cm. A standard downrigger was used to lower and retrieve the plankton net from a depth of 27 m to the surface at a constant speed of 1 ms^{-1}. Two years of hydroacoustic investigations of fish populations in Coquitlam Reservoir have shown that virtually all fish targets are within the top 30 m of the reservoir (Bussanich et al. 2005). All zooplankton collected were emptied into a 60 mL plastic bottle and kept cool until preserved using a 10% sugared formalin solution.

Zooplankton samples were analysed for species composition, abundance, and length at the NSERC-IRC laboratory at the University of Victoria. Samples were passed through a 64-µm Nitex mesh sieve and carefully rinsed with tap water to remove preservative. Whole samples were then either enumerated, or if zooplankton density indicated, diluted and a sub-sample analysed. Sub-samples had to yield a minimum of 150 enumerated organisms, or additional sub-samples were enumerated. Sub-samples were always counted in their entirety. Samples were returned to preservative once they were enumerated, and stored at the NSERC-IRC laboratory.

When possible, zooplankton was identified to species using the keys of Pennak (1978) and Clifford (1991). Rotifers were not enumerated. Samples were enumerated at 12X to 16X magnification. The counting tray the zooplankton samples were placed in was a clear plastic block with six parallel, interconnected channels cut into its surface. This counting tray held approximately 5 mL of liquid. Enumeration was conducted using a binocular compound microscope connected to a CCD video monitor. This apparatus was run through a PC using Z-Count software developed for the NSERC-IRC laboratory at the University of Victoria. This software counts and determines lengths, and from this calculates zooplankton biomass (mg/m^3) based on empirical sampling of reservoirs (J. Edmundson, Alaska Dept. of Fish and Game, Soldotna, AK, pers. comm.). Lengths were converted to biomass using species-specific regression equations relating wet length to mean dry mass. The software also calculates zooplankton density based on the volume of the sub-samples counted, the size of the plankton net, and the length of the tow.

Fish Populations

Hydroacoustic Surveys

Acoustic sampling was conducted at night 16-17 May, 31 October, and 1 November, and also during the day on 1 November 2005 on the Coquitlam Reservoir, using a 200-kHz and 420-kHz frequency BioSonics DTX echo processor and two transducers (Photo 1). Both the 200-kHz split beam (starboard mounted) and 420-kHz split beam (port mounted), 6^o circular transducers were positioned 0.5 m below the water surface and aimed vertically to sample from 1.5 m below the surface to near bottom.

Photo 1. Echoprocessor used for hydroacoustic sampling on Coquitlam Reservoir, 2005.

A total of 21 transects was sampled twice on Coquitlam Reservoir at night during the May and October-November surveys, and a total of 21 transects were sampled once during the day in the October-November survey (Figure 3**)**.

The threshold for the 200-kHz transducer was set to –75 dB with a 0 dB power level setting, and the 420-kHz transducer was set to –75 dB with a 0 dB power level setting. The sample rate for each transducer was 12 pings per second, and pinged alternately between the two transducers. Data were geo-referenced with a GPS and written to file with the hydroacoustic sample data.

The acoustic system was calibrated in the field using a standard tungsten carbide calibration sphere following data acquisition. A standard 21 mm (420 kHz calibration) and 36 mm (200 kHz calibration) tungsten carbide sphere was used to calibrate the acoustic system. The calibration sphere was lowered to 10 m below the transducer, positioned in the beam, and 2000 to 2500 pings were recorded to estimate target strength and align the aim of the system. *In situ* tests indicated that the transducers were calibrated correctly; therefore, no offset was done for either transducer.

Acoustic data were processed to estimate the mean acoustic size of fish for scaling the echo integration relative densities. Vertical and horizontal data files were processed to output split beam target size. Data were output with Echoview V3.2 to ASCII format files and filtered by location in the beam to use only those targets less than 4 dB off-axis, and a pulse length of 0.5 to 2x the transmitted pulse length of 0.2 msec. Average TS and sigma were calculated for the survey.

The total reflected voltages from echo integration were converted to absolute areal densities (number/hectare) by scaling the voltages by the average density sigmas by report and transect. All data files were processed by echo integration with Echoview 3.2 software. Each vertical data file was processed with 5-m vertical strata from 2 m below the surface to near bottom, with bottom removed by manual bottom-editing in the software. Areal densities were provided for transects 2-23, and areal densities were provided for each 250-m segment at transect 1 (North Basin) using Arc GIS ArcView 8.2®.

We assumed Love's (1977) equation for all aspects was representative of the target strength distribution:

$$TS = 20 \log L - 69.23 \text{ (all aspects)};$$

where,

TS = target strength in decibels; and
L = fork length in centimeters.

Target strengths were used to estimate fish lengths, which were compared with lengths of fish in gillnet catches.

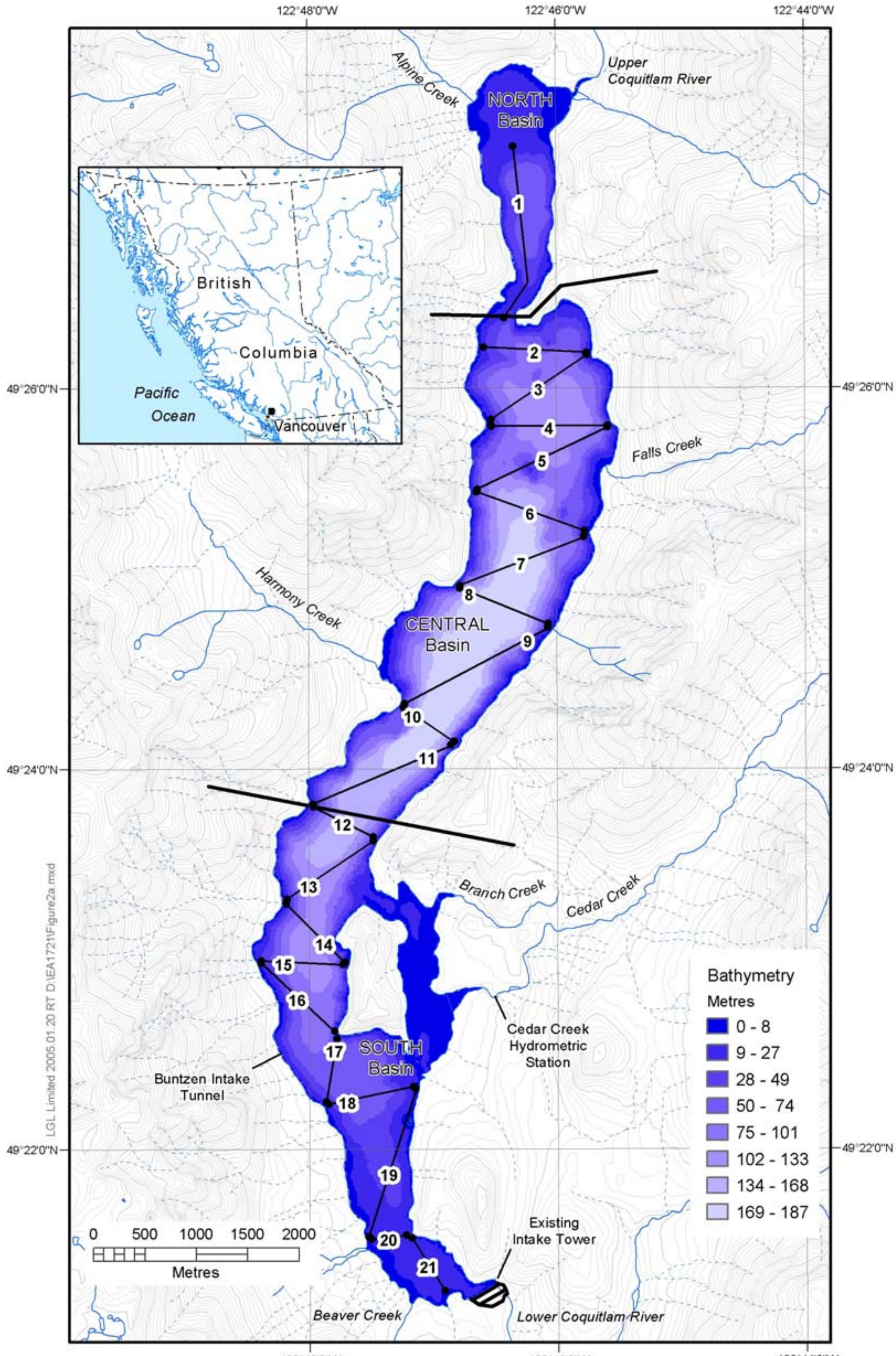

Figure 3. Map of Coquitlam Reservoir showing arbitrary basin boundaries and hydroacoustic survey transects, 2005.

Fish Sampling Operations

A three-person crew conducted the fish gill-netting operation from 15 May to 17 May, 31 October to 2 November and 24 November 2005. Net sampling sites were located throughout the reservoir (Figure 2). A site was deemed suitable for sampling if it met the following criteria:

(1) Historical catch sites (Bocking and Gaboury 2003);
(2) Close proximity to alluvial fans;
(3) Relatively high densities of fish identified in hydroacoustic surveys; and
(4) Free from rocks and other debris on the bed bottom that might damage the nets or jeopardize crew safety.

Gillnetting

Gillnetting (set nets and drift nets) was the primary fish collection method used from 15 May to 17 May, and from 31 October to 2 November to develop an inventory of the fish stocks present in accordance with Resource Inventory Committee (RIC) standards (Anon. 2001). Set netting was the primary technique used and involved anchoring a net from the shore to fish a perpendicular/lateral length nearshore with soak times greater than 1 h. Sunken and floating surface nets were located in littoral and limnetic areas to determine the vertical distribution of fish.

Multi- and single-panel gillnets were used to sample kokanee (juveniles and adults), trout, and coarse fish (peamouth chub, sculpins, suckers) (Appelberg 2000). All nets were constructed of double knotted, light green monofilament nylon (Miracle R-13 L) mesh, and a hang ratio of 2:1. The multi-panel net consisted of six nets or panels 15.2 m long, thread thickness ranging from 0.2 to 0.25 mm, and of mesh sizes 25,38, 51, 64,76, and 89 mm, strung together in a "gang" to form a net 91.2 m long and 2.4 m deep.

Daily gillnetting effort was measured as mean fishing time in minutes, and was calculated as follows:

$$MT = (SI-FO) + \frac{(FO-SO)+(FI-SI)}{2}$$

where,

MT = Mean fishing time (min);
SO = time the gillnet first entered the water;
FO = time the gillnet was fully deployed;
SI = time the gillnet retrieval began; and
FI = time the gillnet retrieval was completed.

Catch-per-unit-effort (CPUE), C_j, the number of fish caught per hour, was computed for set *j* as:

$$C_j = \frac{N}{MT}$$

where:

N = number of fish caught. All CPUE estimates were standardized to a fishing area of 90 m^2.

Trawling

Mid-water trawl sampling was conducted during the night of 24 November 2005 to validate the pelagic species composition of the fish observed acoustically, and collect age composition data of juvenile sockeye. Trawling in May was discontinued following a trial tow and loss of gear on 17 May. The trawl net (3 m x 7 m x 18 m) was constructed of knotless, nylon multi-mesh (3.0, 13, 19, 51 and 102 mm) (Photo 2) and towed behind the boat (Photo 3) at a speed of approximately 1 m/s, for 15 min in a northerly-southerly direction. The net was positioned using a bridle attached to the mainline of a portable winch, with the mouth of the net set agape using horizontally mounted 3 m steel pipes (attached to the head rope and footrope) and a pair of 15 kg cannon balls (attached to the footrope). Selected trawling depths (from near surface to 20 m depth) were achieved by varying the length of the main lines; trawling depths were monitored using a Vemco® data logger attached to the head rope. Catch-per-unit-effort was computed as the number of fish caught per hour trawling.

Photo 2. Mid-water trawl net of multi-mesh sizes used to collect juvenile kokanee in Coquitlam Reservoir, November 2005.

Photo 3. Boat used to pull the mid-water trawl assembly to collect juvenile kokanee in Coquitlam Reservoir, November 2005.

Minnow Trapping

Gee-minnow trapping was the primary fish collection method used from 15 May to 17 May and from 31 October to 2 November to inventory juvenile coarse fish in accordance with Resource Inventory Committee (RIC) standards (Anon. 2001). Catch-per-unit-effort was computed as the number of fish caught per hour of minnow trapping.

Fish Handling

All crew members were experienced with the handling techniques necessary to minimize stress on captured fish. The standard procedure following capture was to assess fish condition. Only fish deemed to be in good condition were released. The remaining fish were sacrificed, placed in labeled, aseptic plastic bags, stored in a cooler, and moved to a central location at the GVRD security building for processing or frozen storage within 3 h.

Adult Kokanee Spawner Surveys

The lower 500 m of the Upper Coquitlam River and Cedar, Harmony and Falls creeks were walked, beginning at the streams' confluences with the reservoir, to determine the presence or absence of kokanee spawners. Each stream surveyed involved a crew of two people, with surveys conducted in September, October and November 2005 during low stream flows.

Biological Sampling (Sex, Age, Size, Genetics, Diet)

All fish captured in gillnets, trawls and minnow traps were identified to species, classified as adult or juvenile using RIC standards (Anon. 2001), and enumerated. On-site sampling information recorded included date, time, gear type and set number, fish species, life stage and sex. The fish were bagged, stored in a cooler and transferred to the field processing station. The samples were then processed and, fork length (FL, mm) and wet weight (g) were recorded for each fish. The fish were sub-sampled by life stage (juvenile, adult) in both the nearshore and offshore samples from each of the three basins (North, Central and South). For each fish sub-sampled, stomach fullness was recorded as empty, 0-25 %, 26-50 %, 51-75 %, or 76-100% full, and the stomach was then removed, bagged and frozen for later dietary analysis. Muscle tissue samples (25 x 25 mm) from fish >120 mm long, and the whole fish for specimens <120 mm long, were bagged and frozen for later isotopic C:N analysis at the University of Victoria. Additional information for kokanee sampled in May, October, and November included age (from scale and otoliths), flesh colour, and DNA for stock discrimination purposes. Scale samples were interpreted by Birkenhead Scale Analysis (Lone Butte, BC) and reported as age-1-, 2- or 3-yr old fish. For DNA analysis a 5-mm diameter of tissue was taken from the adipose fin of adult kokanee, stored in ethanol, and processed and analyzed by Seastar Biotech Inc (Victoria, BC), and reported by Bussanich et al. (2006). Additional information for the October and November kokanee samples included total gonad weight (for both sexes) and egg diameter (mean of 10 eggs), external coloration and evidence of fraying of the caudal fin.

The contents of individual stomachs were placed in a Petri dish, and viewed using a binocular compound microscope at 8 to 12.5X magnification. Any large insects (>2 mm) were identified (terrestrial or aquatic), counted, and discarded. Gut parasites, small fish, spiders, and other large taxa were also identified, counted and discarded. The remaining organisms (<2 mm: zooplankton, small insects, immature parasites, and other small organisms) were enumerated using standard methods for zooplankton. The samples were diluted and sub-sampled, if warranted, so that a minimum of 150 organisms were counted per sample. The results from counting the zooplankton samples were recorded and the total number of organisms in the entire sample (if sub-sampled) was computed.

Food Web Inter-relations

Samples of frozen fish muscle and stomach contents were freeze-dried and ground into a fine, homogenous powder with a mortar and pestle. The powder was weighed into tin cups, combusted and analyzed in a Costech 4010 Elemental Analyzer coupled to a Thermo Delta Advantage continuous flow isotope ratio mass spectrometer. Isotope ratios are reported in ‰ ratios referenced against peedee belemnite carbonate (PDB) for $\delta^{13}C$ and atmospheric nitrogen (Air) for $\delta^{15}N$. Analysis of replicate lab reference material indicated a standard error of 0.15 ‰ for $\delta^{13}C$ and 0.31 ‰ for $\delta^{15}N$ (Shapna Mazumder, pers. comm.).

Fish Community Standing Stock

A stratified random sampling design was used to estimate total fish standing stock (MacLennan and Simmonds 1992) in Coquitlam Reservoir. The surveyed area was stratified into 20 depth regions at 5-m intervals from 0 m to 100 m below the surface. Strata volume for each of the three basins was derived using a bathymetric map, and Arc GIS ArcView 8.2®. For each depth stratum, mean fish density was expanded in proportion to the volume sampled, and these were summed to estimate total fish standing stock for each basin (North, Central, and South; Figure 3). The variance and 95% confidence intervals were calculated for a stratified random sample as per Cochran (1977) for each of the standing stock estimates.

Kokanee Standing Stock

Kokanee standing stock was based on all acoustic tracked fish at 5-m depth intervals from 0 m to 100 m below the surface. For each depth stratum, kokanee acoustic targets were classified by three size classes (length of each acoustic target was estimated using Love's equation (1977)). The three size classes ranged from 30 mm (-53 dB) to 300 mm (-37 dB) as identified by Bussanich et al. (2005). These acoustic size classes are related to kokanee sizes as sub-yearlings (30- 80 mm), yearlings (81-170 mm), and adults (171-300 mm) (Teuscher et al. 1994). This size classification approximates age-0, age-1, and age-2 and older kokanee, respectively. Acoustic targets below 30 mm and above 300 mm were not considered within the size range of juvenile or adult kokanee in the Coquitlam Reservoir. It was assumed that 100% of all acoustic targets between 30 and 170 mm were kokanee. Of the total fish standing stock between 170 and 300 mm, the catch data were used to estimate age-2 and older kokanee.

Biomass, B_j, the kg of kokanee, was computed for age class j as:

$$B_j = N \times m$$

where:

N = estimated number of kokanee; and m = estimated mean wet weight of each age-class.

A least squares regression of length and weight was used to predict the biomass of kokanee for each age class using data collected in 2005 (Ricker 1975).

Lake Rearing Capacity and Kokanee Standing Crop

Bocking and Gaboury (2003) estimated the rearing capacity for sockeye in Coquitlam Lake using the EV model (Koenings and Burkett 1987) and PR model (Shortreed et al. 2000). In these models, euphotic zone depth (EZD) for Coquitlam was estimated from limited information on secchi depths. Two years of study of physical limnology at Coquitlam Reservoir now enables the calculation of EZD from light penetration data. As well, the model predictions of total number of sockeye were based on 3.5 g and 4.5 g average weights of smolts for the EV and PR models, respectively. In 2005, an experimental flow release by BC Hydro resulted in several thousand kokanee emigrating from the reservoir. Average fork length of these mostly 1+ kokanee was between 80 and 90 mm (Decker and Lewis 2006). These lengths are consistent with 3.5 to 4.5 g sockeye smolts (Baxter and Bocking 2006).

With the availability of empirical data on euphotic zone depth (EZD) we were able to revise the original EV and PR estimates of total lake rearing capacity as well as estimate total sockeye smolt biomass (standing crop) from mean seasonal macro zooplankton (excluding nauplii) biomass using an equation from Koenings and Kyle (1997). This was done for both 2004 and 2005.

RESULTS

Limnological Assessment

Water Temperature and Dissolved Oxygen

Coquitlam Reservoir has an annual pattern of thermal stratification. Using Site L2 as an example, in January through March 2005, the lake was 4-5 °C throughout the water column (Figure 4; Appendix 1). In April 2005 the lake began to warm and by the end of April the surface waters had warmed to 13 °C although the deeper waters were still at 4-5 °C. The lake continued to warm through to August when the maximum surface water temperatures were seen (22 °C) along with the maximum thermal stratification. The mixed surface warm layer (epilimnion) extended down to 6 m; a wide thermocline (zone of rapid temperature decrease) occupied the depths from 6-12 m, where temperature decreased from 21 to 7 °C. The deep-water zone (hypolimnion) was at depths below 12 m and had temperatures of 6 to 7 °C. Water cooled after August and by October surface waters were 12 °C and the lake mixed, likely in November as by 3 December the lake was again isothermal at 6 °C.

Dissolved oxygen (DO) concentrations at all stations generally remained near the saturation concentration (Figure 5; Appendix 2). In surface waters, the minimum concentrations were measured in summer when temperatures were highest – when oxygen saturation capacity in water is reduced. There was no evidence of oxygen depletion or that fish would be limited by oxygen concentrations anywhere in the lake.

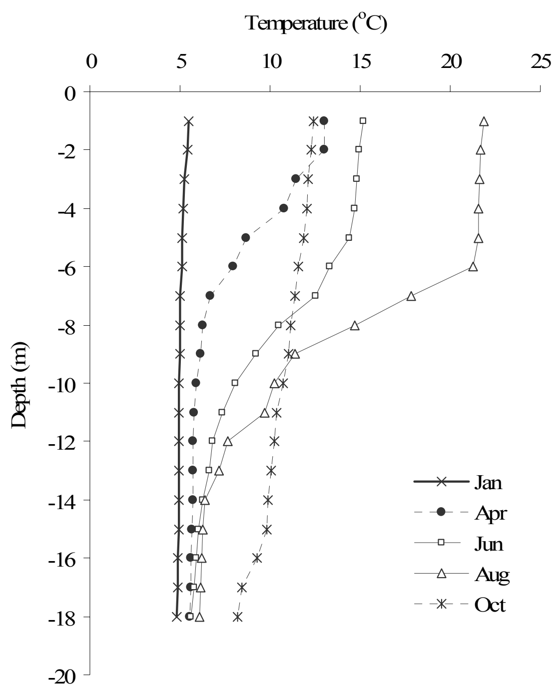

Figure 4. Variation in temperature with depth at Site L2 in Coquitlam Reservoir, 2005.

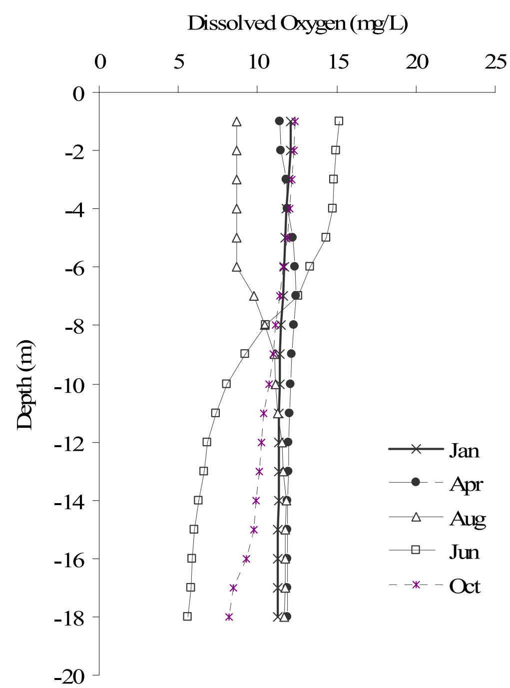

Figure 5. Variation in dissolved oxygen (DO) concentration with depth at Site L2 in Coquitlam Reservoir, 2005.

Secchi Depth & Turbidity

Water clarity as Secchi depth was very good in Coquitlam Reservoir throughout 2005, although somewhat lower than 2004. Secchi depth ranged from 2.5 to 10 m at the four sampling sites throughout the year (Figure 6; Appendix 3). The lowest water clarity was in January at Sites L3 and L4 and highest in August at Site L4. There seemed to be a general trend with water being slightly clearer, on average, with distance from the dam.

Turbidity data from lab analysis of grab water samples indicate that Coquitlam Reservoir waters are very clear. Turbidity was generally less than 1.0 nephelometric turbidity unit (NTU) at all depths, at all sites, on all dates, with the exception of January, when turbidity at a depth of 4 m ranged from just over 1 NTU (Sites L1, L2, and L4) to 1.6 NTU (Site L3) (Figure 7).

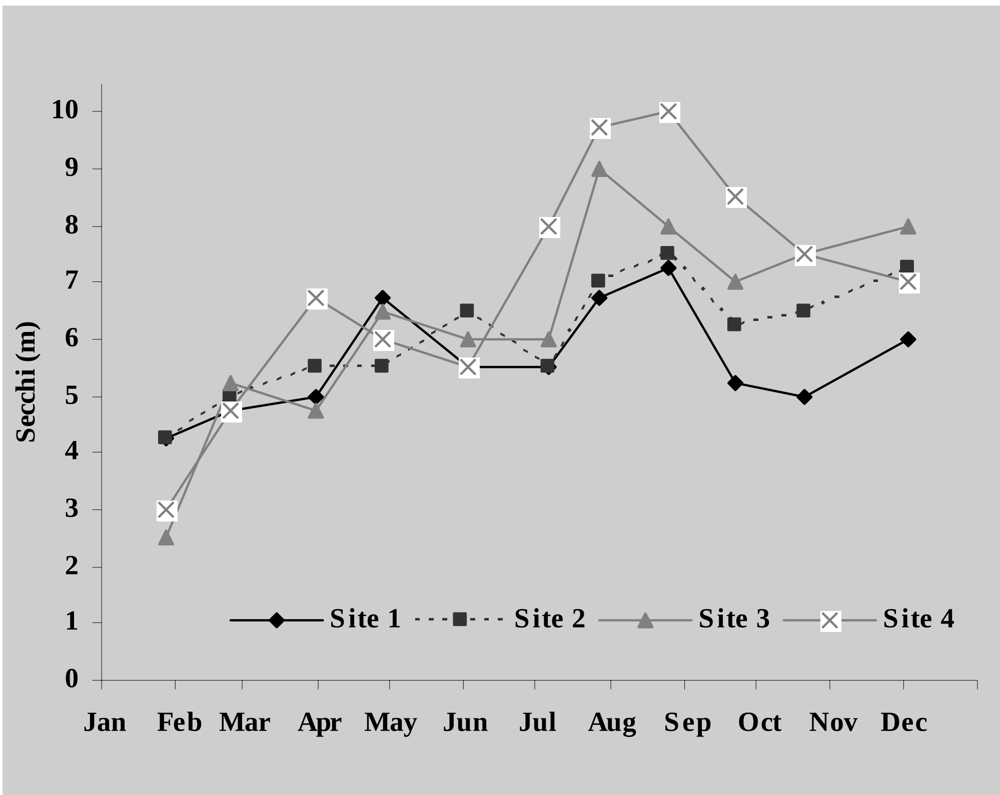

Figure 6. Water transparency as Secchi depth, at four sites in Coquitlam Reservoir, January to December, 2005.

Water Chemistry & Nutrients

The pH of Coquitlam Reservoir ranged from around neutral to slightly acidic with a range of 6-8 in 2005 (Appendix 4). Nutrient samples were collected at Site L2 from January to December 2005. Total phosphorous (TP) concentrations were very low and generally in the range from 1 to 5 µg/L; typical of ultra-oligotrophic (unproductive) lakes (Figure 8; Appendix 5). Two anomalously high samples in December 2005 are suspected of being inaccurate but included here.

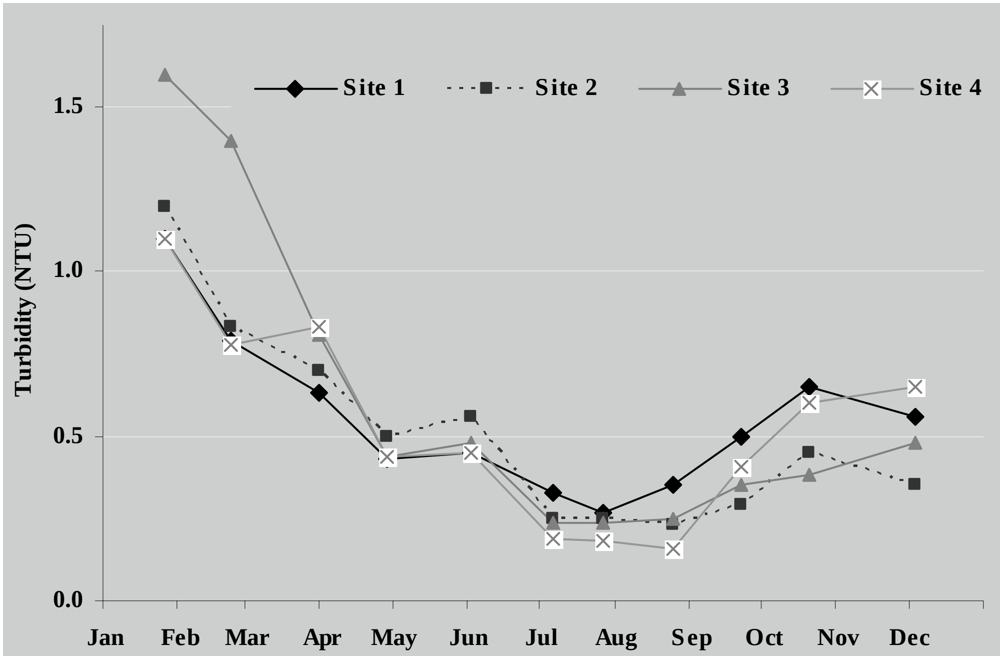

Figure 7. Water transparency as turbidity at a depth of 4 m, at four sites in Coquitlam Reservoir, January to December, 2005.

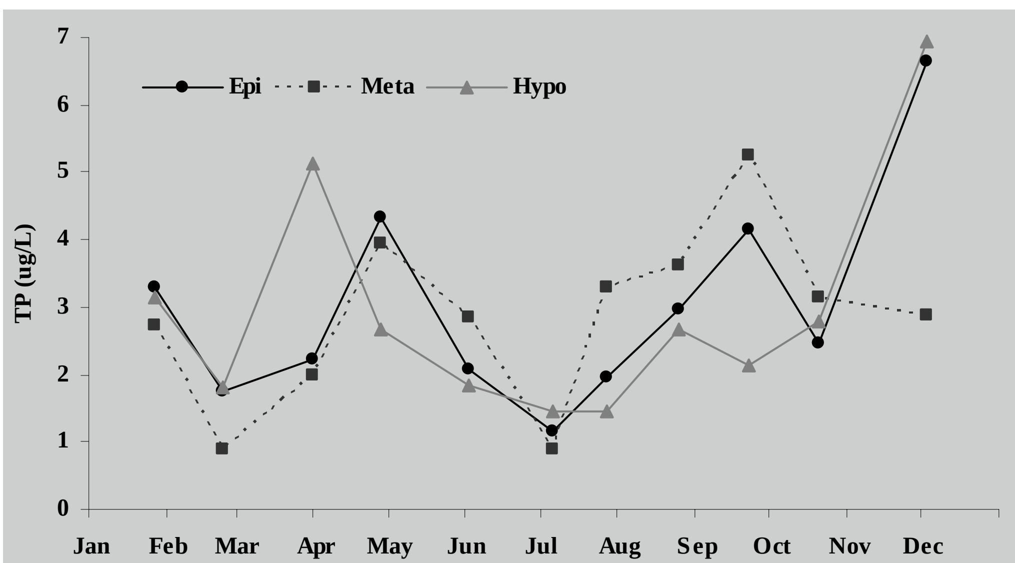

Figure 8. Total Phosphorus (TP) at Site L2 in surface (epilimnetic), middle (metalimnetic) and bottom (hypolimnetic) waters in Coquitlam Reservoir, January to December, 2005.

Mean epilimnetic (surface) TP was 3.0 µg/L; including the high December value. Without the December value it was 2.6 µg/L.

Total nitrogen (TN) concentrations were also very low, ranging from 100-230 µg/L, typical of ultra-oligotrophic lakes and similar to 2004 (Figure 9; Appendix 6). TN remained below 200 µg/L at most depths throughout the year and yearly mean epilimnetic TN was 136 µg/L, again similar to 2004.

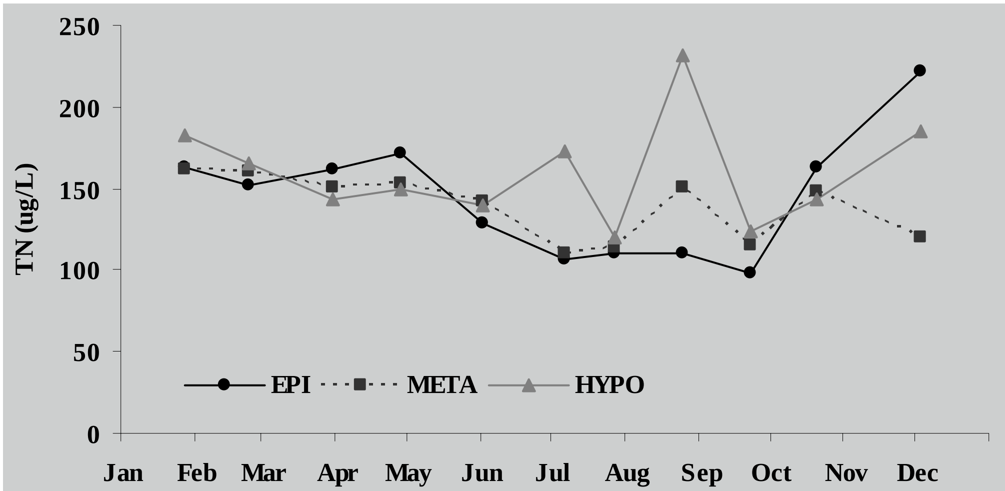

Figure 9. Total Nitrogen (TN) at Site L2 in surface (epilimnetic), middle (metalimnetic) and bottom (hypolimnetic) waters in Coquitlam Reservoir, January to December, 2005.

Nitrate-nitrite was also measured with concentrations in the 50-110 ug/L range with no obvious annual pattern (Figure 10; Appendix 7).

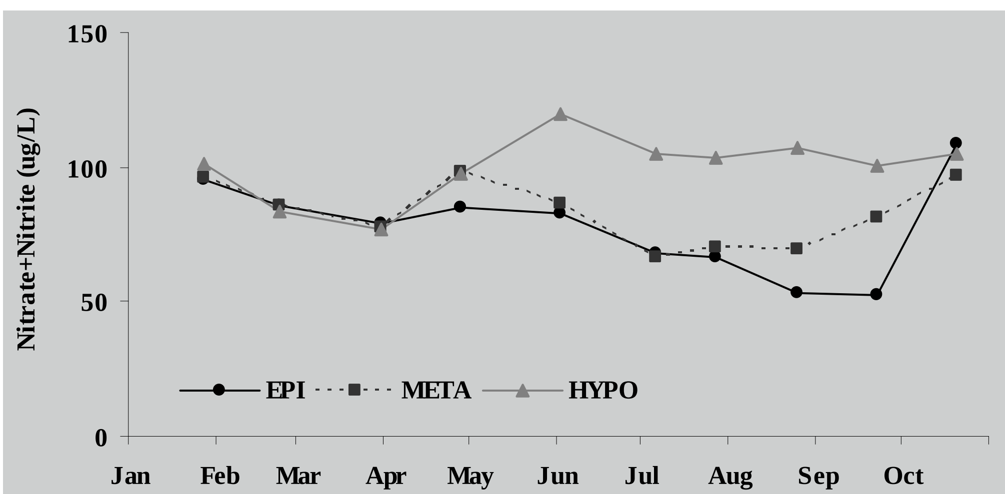

Figure 10. Nitrogen as nitrate plus nitrite at Site L2 in surface (epilimnetic), middle (metalimnetic) and bottom (hypolimnetic) waters in Coquitlam Reservoir, January to October, 2005.

The nitrogen to phosphorus ratio (TN: TP) is a good indicator of which of these two nutrients is the limiting factor in lake productivity (phytoplankton growth); with TN: TP >20 indicating phosphorus limitation, while TN: TP <10 indicates potential nitrogen limitation. TN: TP was always >25 throughout the year (phosphorus limitation) and the mean N: P ratio for the epilimnion was 59:1 (Figure 11; Appendix 8).

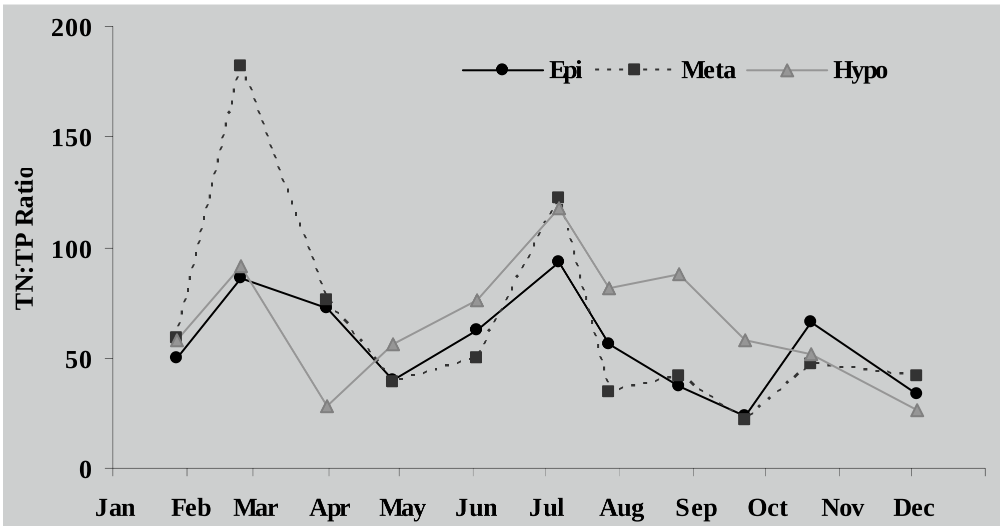

Figure 11. Ratio of Total Nitrogen to Total Phosphorus (TP:TN) in surface (epilimnetic), middle (metalimnetic) and bottom (hypolimnetic) waters at Site L2 in Coquitlam Reservoir, January to December, 2005.

Total organic carbon (TOC) and dissolved organic carbon (DOC) concentrations were also very low, typical of ultra-oligotrophic lakes (Figure 12 and Figure 13; Appendix 9). Total organic carbon varied only within a narrow range (1.5-2.5 mg/L) at all depths at all sites throughout the year. Yearly mean TOC in epilimnetic waters was 1.8 mg/L, which was slightly higher than the 2004 data. Dissolved organic carbon concentrations were in the range of 1.6-2.1 mg/L, again very low and indicative of the ultra-oligotrophic nature of Coquitlam Reservoir.

Chlorophyll *a*

Chlorophyll *a* concentrations remained below 1.5 µg/L all year at Site L2; somewhat lower than 2004, with peak readings in May and October (Figure 14; Appendix 10). As with nutrients, values this low (epilimnetic mean of 1.6 ug/L) are typical of ultra-oligotrophic lakes.

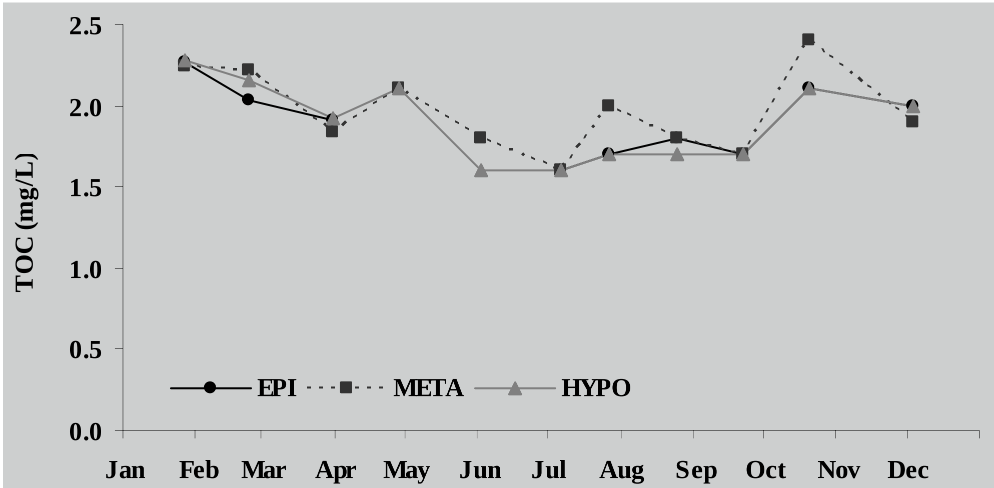

Figure 12. Total Organic Carbon (TOC) in surface (epilimnetic), middle (metalimnetic) and bottom (hypolimnetic) waters at Site L2 in Coquitlam Reservoir, January to December, 2005.

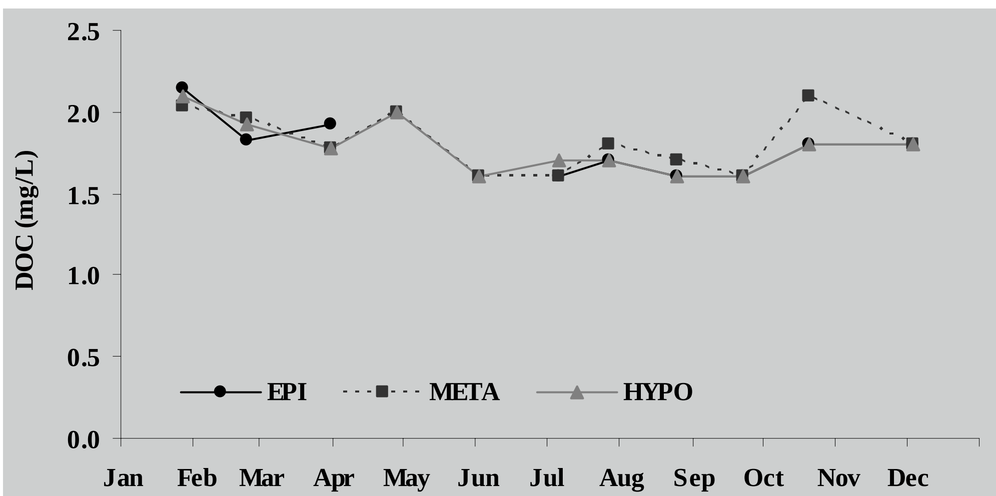

Figure 13. Dissolved Organic Carbon (DOC) in surface (epilimnetic), middle (metalimnetic) and bottom (hypolimnetic) waters at Site L2 in Coquitlam Reservoir, January to December, 2005.

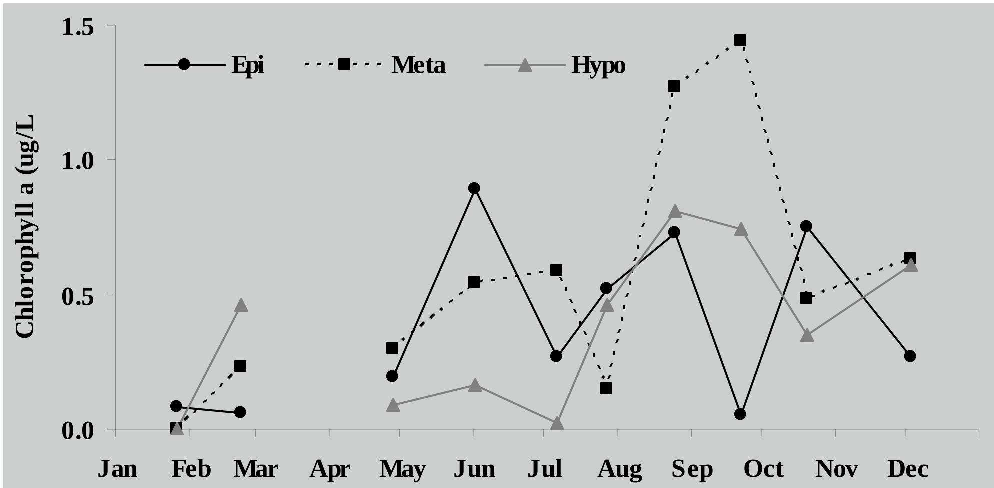

Figure 14. Chlorophyll *a* in surface (epilimnetic), middle (metalimnetic) and bottom (hypolimnetic) waters at Site L2 in Coquitlam Reservoir, January to December, 2005.

<u>Phytoplankton</u>

Like nutrient and Chlorophyll *a* concentrations, phytoplankton biomass was low, following the pattern seen in 2004. Total phytoplankton biomass varied through the year, with peaks in March (>500 µg/L), July (400 ug/L) and September (400 µg/L), somewhat higher than was seen in 2004. In the early part of the year, the phytoplankton community was dominated by Chrysophytes and Chlorophtes and in late summer and early fall by Cyanophyta (blue-green algae) and Dinophyceae (dinoflagellates) (Figure 15).

<u>Zooplankton</u>

The zooplankton community (excluding rotifers) within Coquitlam Reservoir was numerically dominated by small taxa, principally *Bosmina*, cyclopoid copepods and copepod nauplii (larvae), with densities ranging from one to four animals per litre. Total densities of all other species combined remained below one animal per litre throughout the year (Figure 16). These low densities are typical of ultra-oligotrophic systems.

Zooplankton biomass exhibited seasonal variation, with minimum biomass in January (<0.25 ug/L) and peaks in April (>3.5 ug/L) and July (approximately 2.5 ug/L) (Figure 17). Small taxa (nauplii, cyclopoid copepods, *Bosmina*) comprised the majority of zooplankton biomass all year except in July and August, when the larger *Daphnia* species contributed at least 50% to total biomass (Figure 17). The low values observed for zooplankton biomass are typical of ultra-oligotrophic systems.

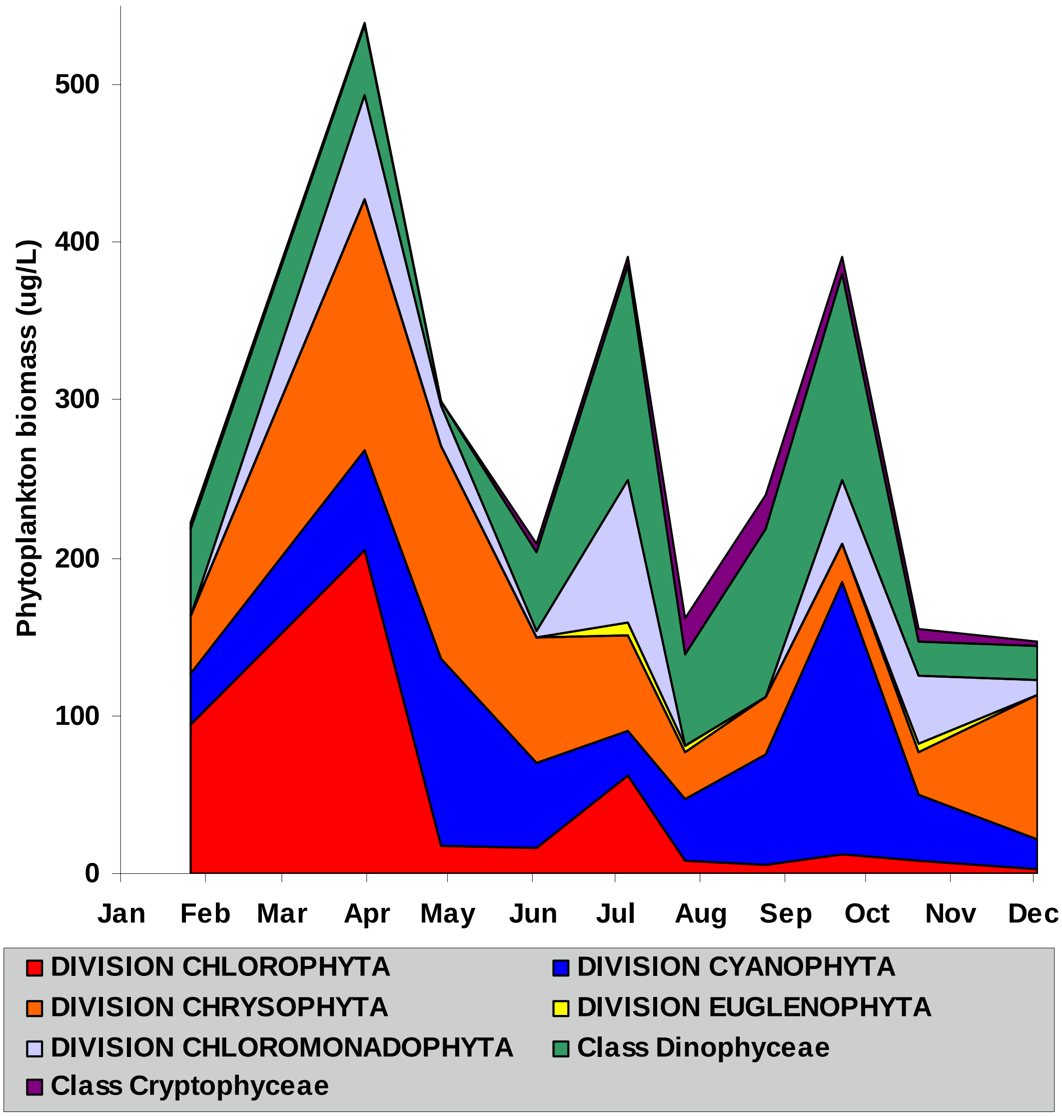

Figure 15. Phytoplankton biomass by major groups at Site L2 in Coquitlam Reservoir, January to December, 2005.

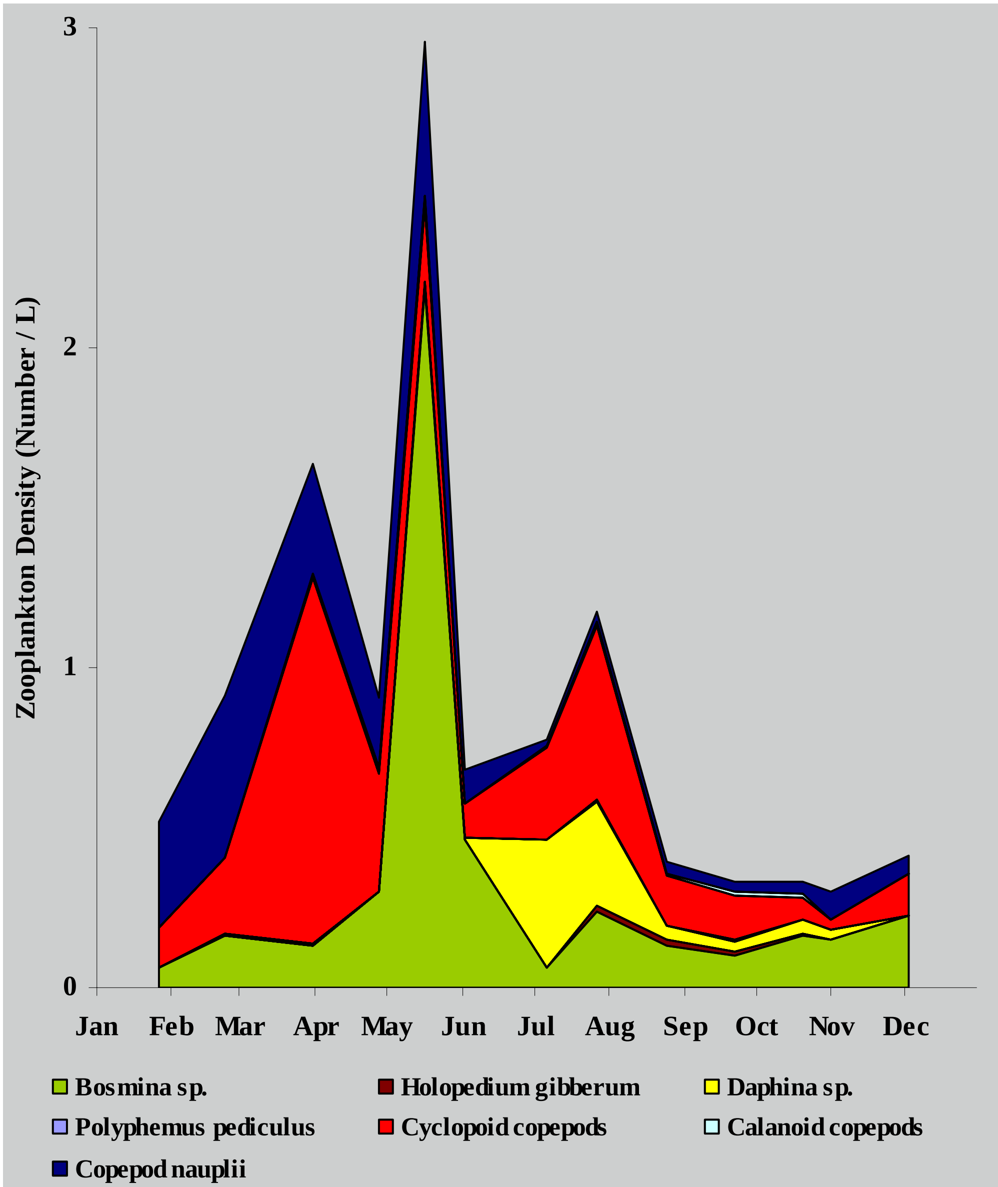

Figure 16. Zooplankton density at Site L2 in Coquitlam Reservoir, January to November, 2005.

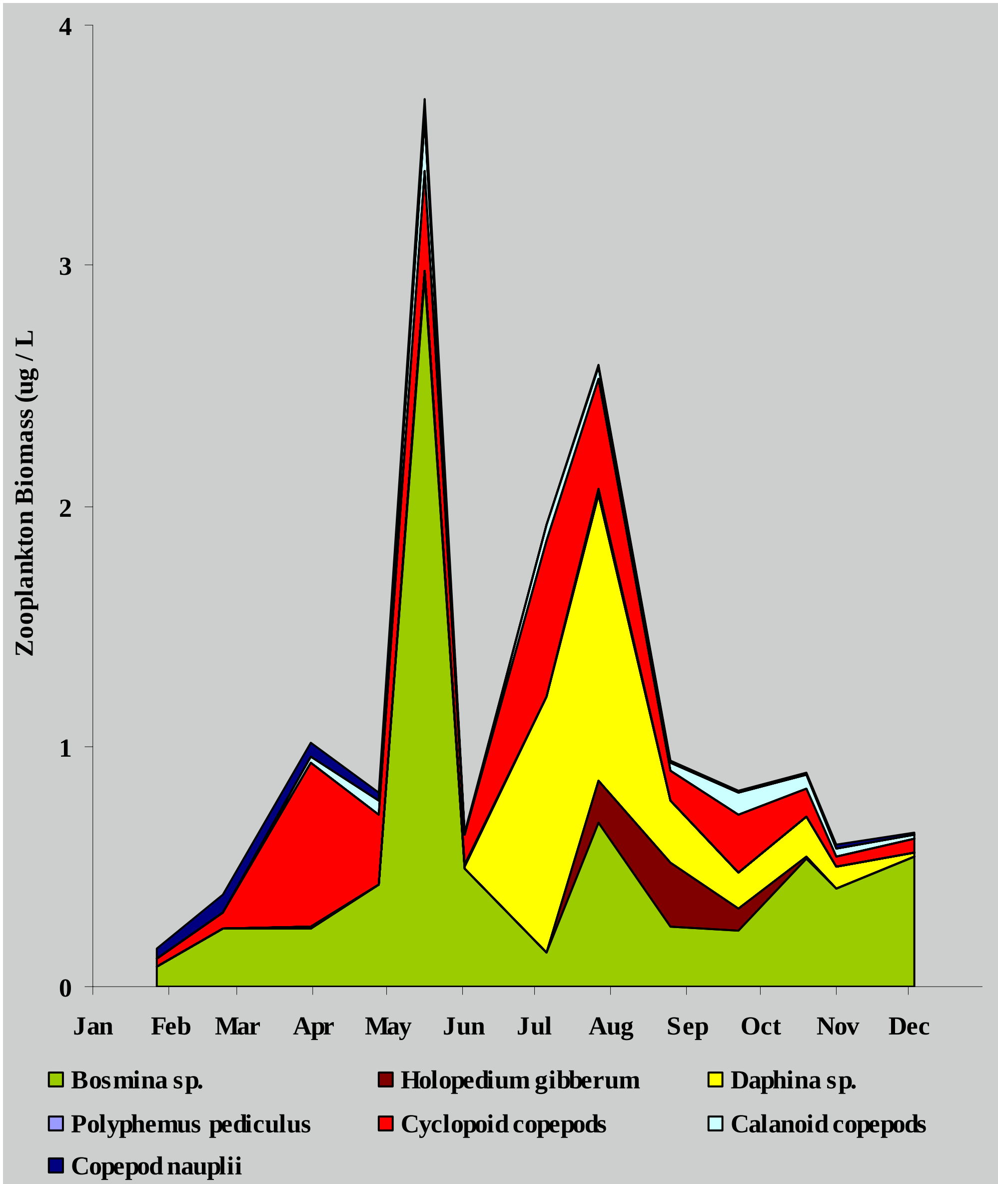

Figure 17. Zooplankton biomass at Site L2 in Coquitlam Reservoir, January to November, 2005.

Fish Assessments

Fish Distribution and Abundance Using Hydroacoustics

The total mean fish target strength in Coquitlam Reservoir was –52.6 dB during the May survey and –46.0 dB during the October survey (Appendices 13-18). The mean size of fish tended to be smaller in the top 5 m and at depths exceeding 30 m in Coquitlam Reservoir during the May survey (ranging from –53.0 dB to –57.8 dB) and in the top 10 m and 30 m interval during the November survey (ranging from –52.1 dB to –56.8 dB). The mean size of fish ranged from –55.1 dB to –59.6 dB in May and from –55.1 dB to –59.6 dB in October. In May, a mean fish length of 113 mm was estimated using Love's equation (1977), while target distribution ranged between 41 mm and 179 mm (Figure 18). In November, a mean fish length of 223 mm was estimated using Love's equation (1977), while target distribution ranged between 46 mm and 281 mm.

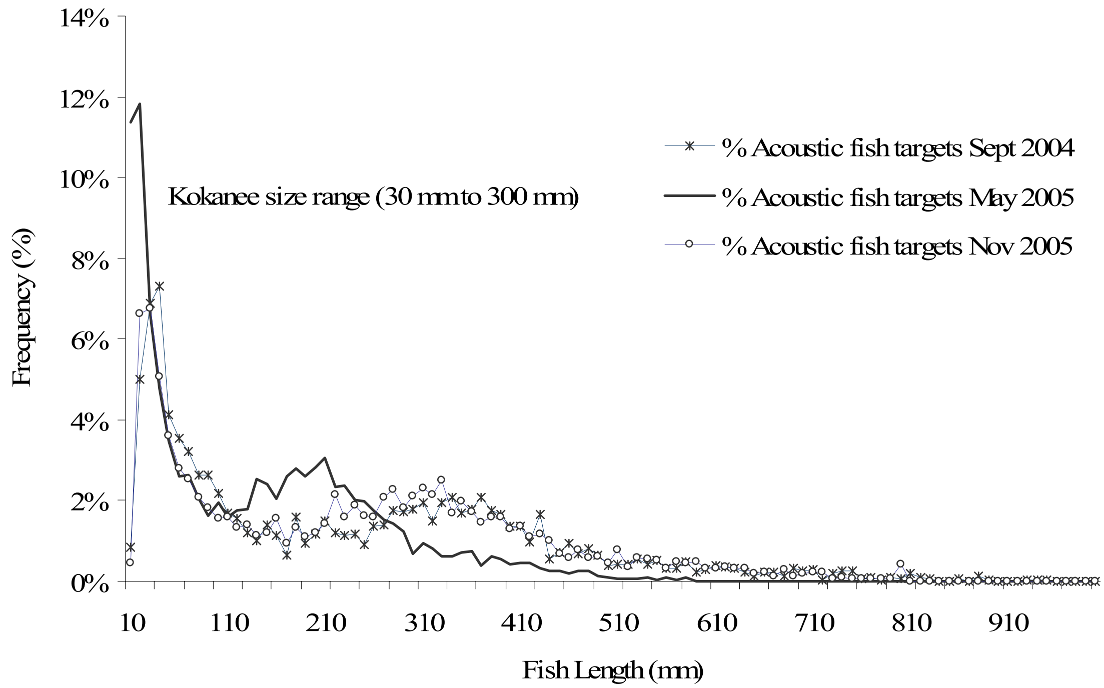

Figure 18. Fish size distribution based on acoustic targets, Coquitlam Reservoir, 27 September, 2004, 15-17 May 2005, and 1 November 2005.

Fish densities (N/ha) in Coquitlam Reservoir varied by location and by season (Appendix 19 and 20). Fish were most abundant at the central region (between 49° 23.20'N and 49° 25.00') during the May survey (Figure 19). In November fish were most abundant at the south region (between 49° 21.70' N and 49° 22.70' N) and the central region (between 49° 24.50' N and 49° 25.00' N) (Figure 20). The surface to 25 m interval contributed 95% of the total fish and densities ranged from 42 fish/ha to 122 fish/ha in May (Figure 21). The surface to 5 m depth interval of Coquitlam Reservoir contributed 48% of the total fish densities. Densities ranged from 7 fish/ha to 97 fish/ha between the surface and 35 m in November with fewer kokanee targets detected below 35 m.

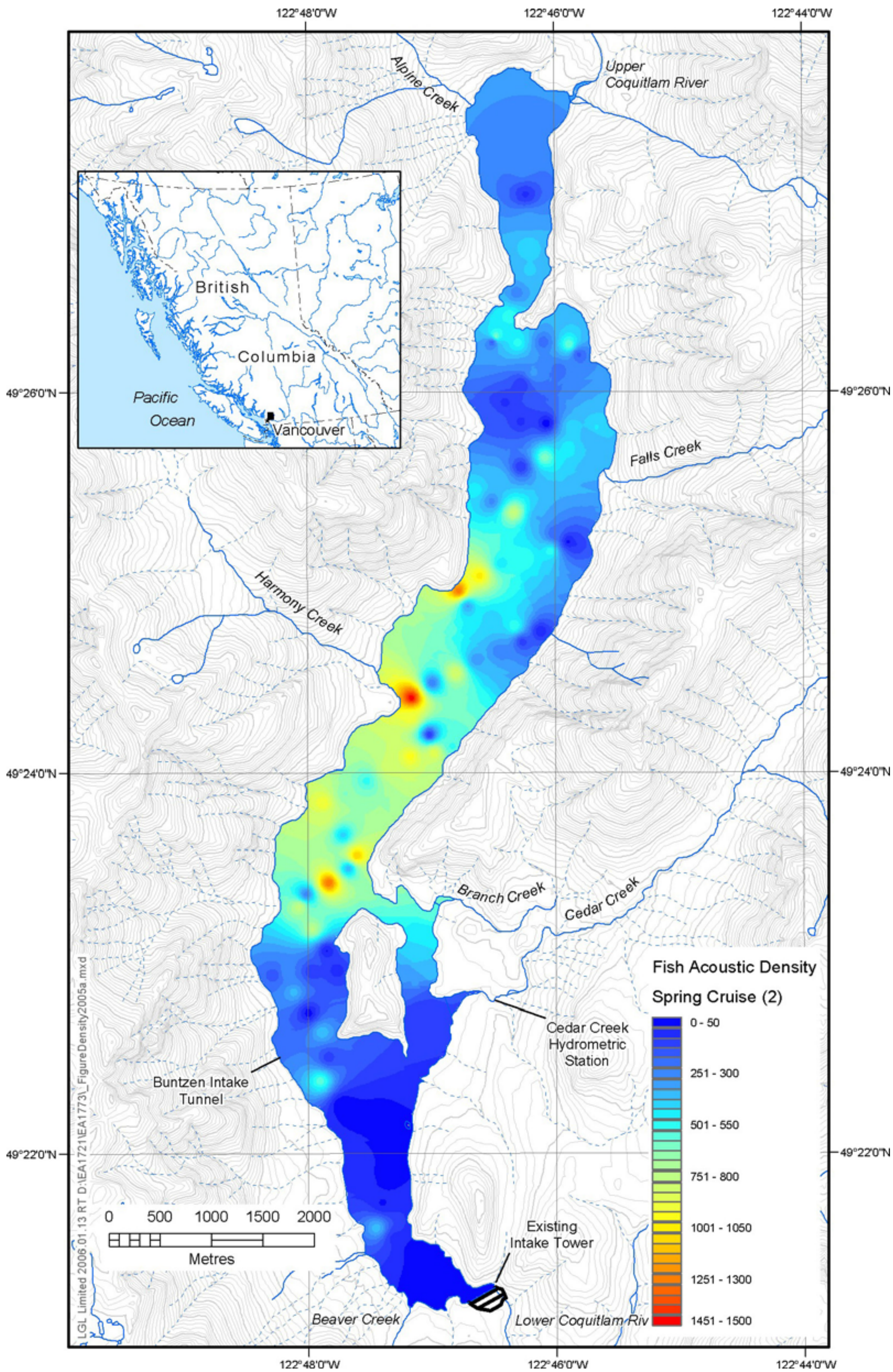

Figure 19. Fish acoustic density surface model (inverse distance weighted) derived from sampling at Coquitlam Reservoir, 15 – 17 May 2005.

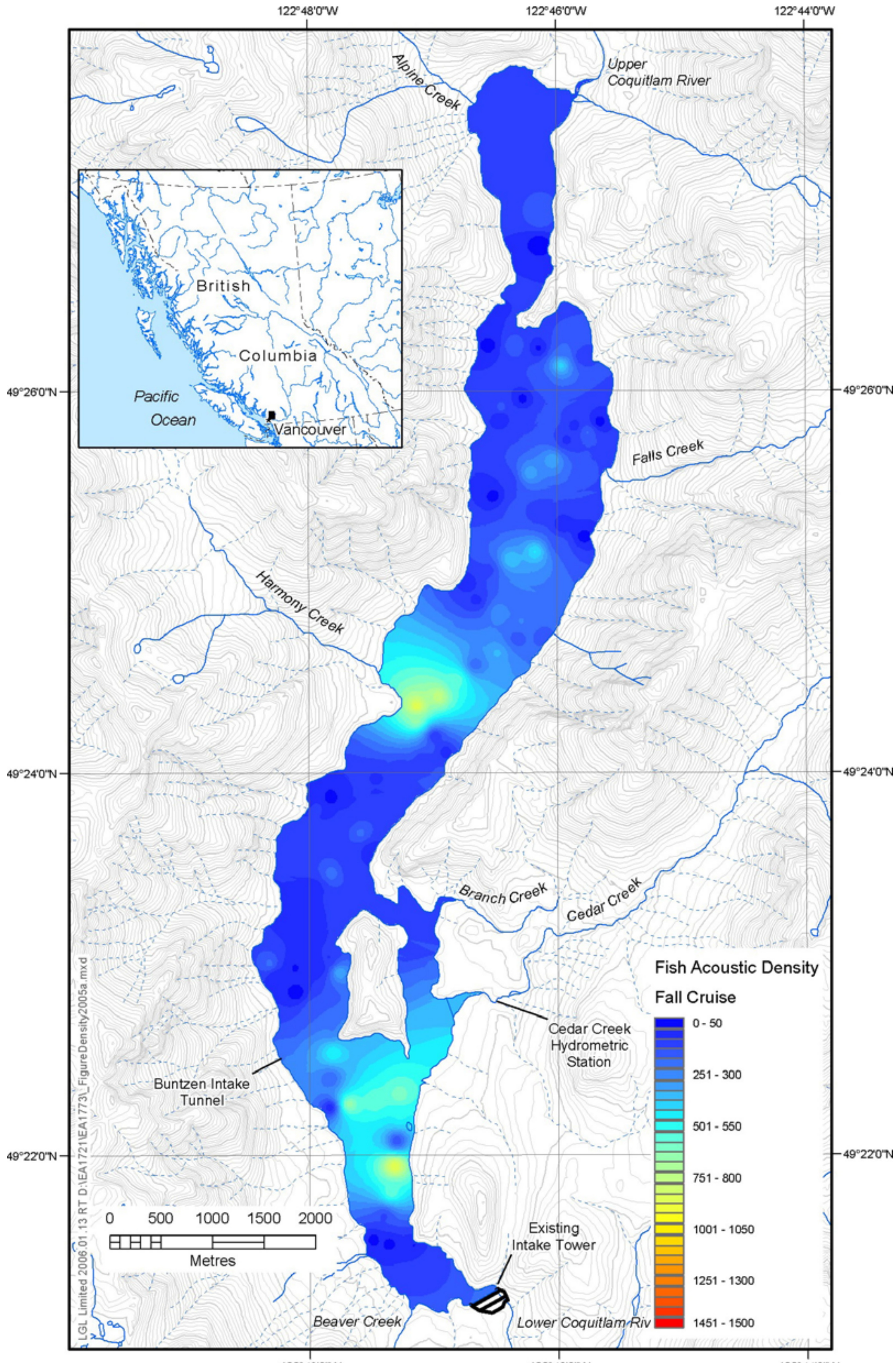

Figure 20. Fish acoustic density surface model (inverse distance weighted) derived from density sampling at Coquitlam Reservoir, 1 November 2005.

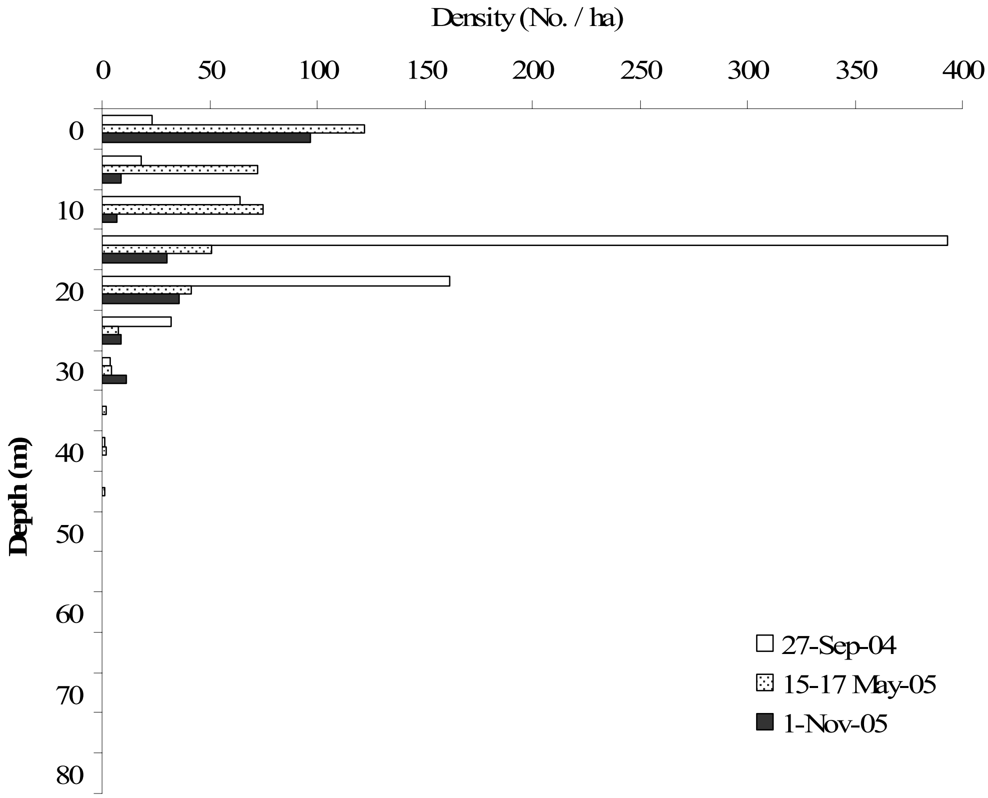

Figure 21. Fish densities (N/ha), by depth strata, using echo integration, Coquitlam Reservoir, 27 September 2004, 15-17 May 2005, and 1 November 2005.

<u>Gillnetting Spring Survey</u>

Gillnetting in the Coquitlam Reservoir during the night on 15-17 May for a total 187-h effort resulted in a total catch of 257 fish: 137 kokanee (53 %), 55 Northern pikeminnow (21 %), 28 cutthroat trout (11 %), 27 peamouth chub (11 %), 7 sucker (3 %), and 3 redside shiner (1 %) (Figure 22, Appendix 21, Appendix 26, Photo 4).

A total CPUE (catch per hour standardized for a 90 m^2 set area) of 3.23 fish was estimated for the gillnet operation. The proportion of the total CPUE was highest and similar in the South (48%) and North (47%) basins, with the Central Basin constituting only 4% the catch. CPUE ranged from a low 0.02 for redside shiner to a high 1.86 for kokanee. CPUE for kokanee was 0.86 (46%), 0.14 (8%), and 0.86 (46%) in the North, Central, and South basins, respectively (Appendix 3). Of a total 41.7 kg of fish, 20.3 kg was Northern pikeminnow (49%), 10.9 kg kokanee (26%), 6.4 kg cutthroat trout (15%), 2.1 kg sucker (5%), 1.9 kg peamouth chub (5%), and 0.05 kg redside shiner (<1 %).

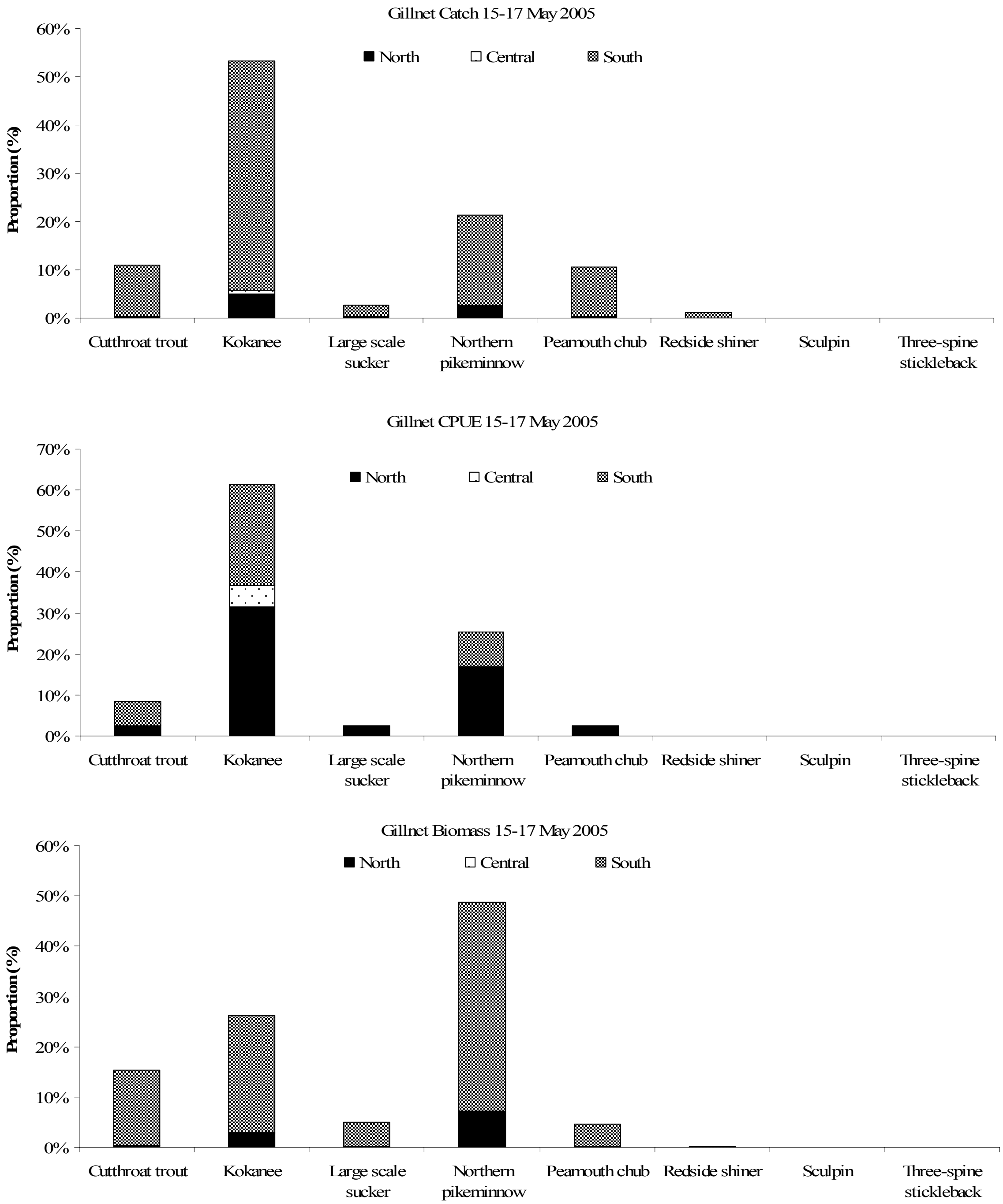

Figure 22. Summary of the proportional catch, catch per unit effort (CPUE), and biomass by species of fish collected using gillnets, Coquitlam Reservoir, 15-17 May 2005.

Photo 4. Juvenile coarse fish from Coquitlam Reservoir - Northern pikeminnow (top), threespine stickleback (center), and peamouth chub (bottom).

Gillnetting Fall Survey

Gillnetting was conducted at Coquitlam Reservoir during the nights of 31 October – 2 November (134-h effort). The total catch constituted 93 kokanee (43 %), 52 peamouth chub (24 %), 30 Northern pikeminnow (14 %), 25 cutthroat trout (12 %), 12 sucker (6 %), 3 sculpin (1%), and 1 coho (<1 %) (Figure 23, Appendix 23, Appendix 28).

A total CPUE (catch per hour standardized for a 90 m^2 set area) of 4.04 fish was estimated for the fall gillnetting operation. Proportionally, CPUE was highest in the Central Basin (57%), followed by the South Basin (28%), and the North Basin (21%). Total CPUE ranged from 0.04 for coho and sculpins to 2.02 for kokanee. Of the total CPUE for kokanee, 0.45 (22 %), 0.97 (48 %), and 0.60 (30 %) were taken in the North, Central, and South basins, respectively. Of the total 35.0 kg of fish caught, kokanee constituted 36%, cutthroat trout 25%, Northern pikeminnow 19%, peamouth chub 13%, sucker 7%, and both coho and sculpin <1%.

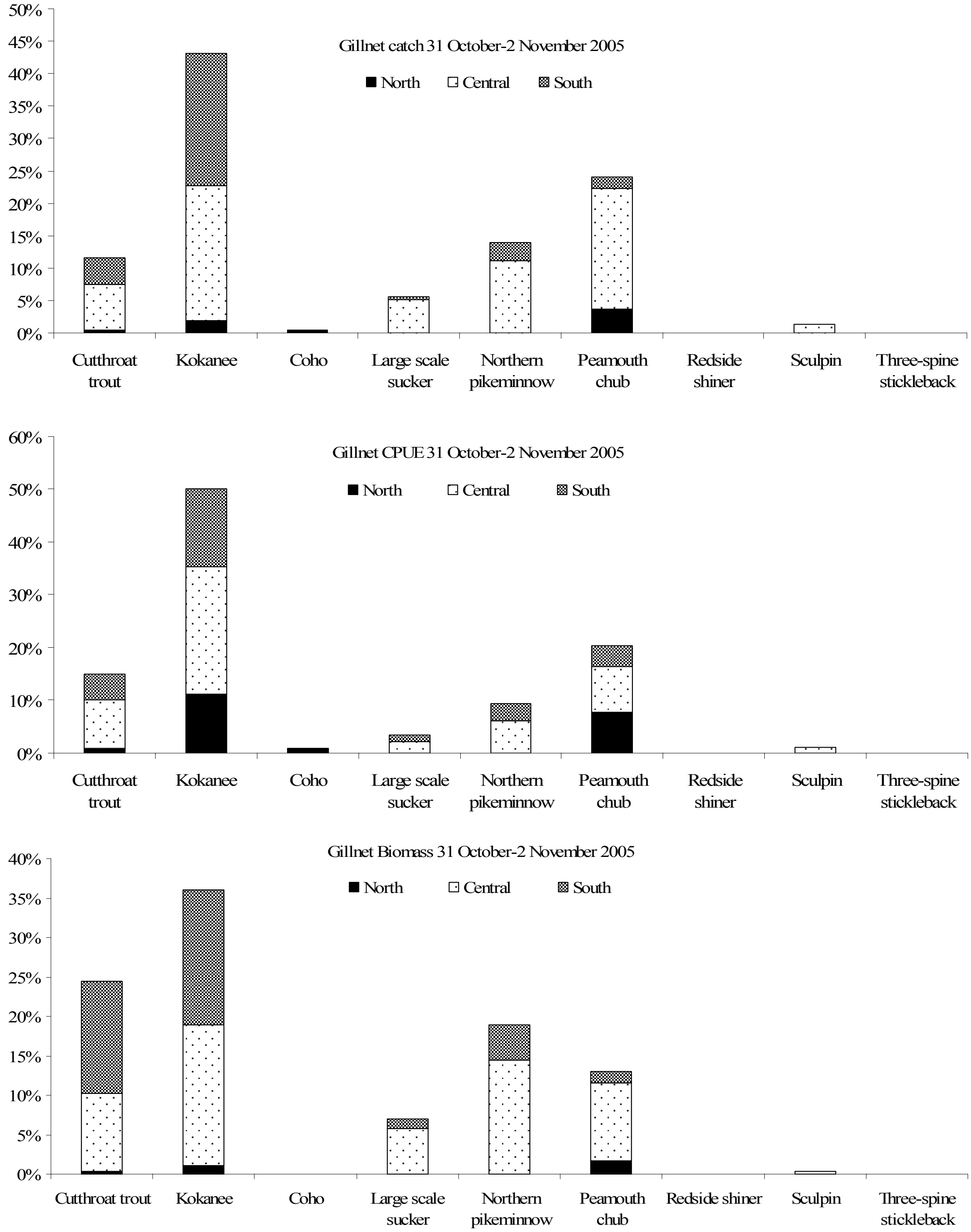

Figure 23. Summary of proportional catch, CPUE, and biomass of fish species collected using gillnets, Coquitlam Reservoir, 31 October-2 November 2005.

Minnow Trapping Fall Survey

Minnow trapping was conducted in Coquitlam Reservoir during the nights of 15-18 September for a total of 176-h effort. A total of 112 fish were caught. The catch comprised 38 Northern pikeminnow (34%), 30 redside shiner (27%), 30 three-spine stickleback (27%), 7 sculpin (6%), 5 cutthroat trout, and 1 peamouth chub (1%) (Appendix 22, Appendix 27). CPUE (standardized as number of fish caught per trap per hour) for the minnow trapping survey was 0.66 fish. The proportion of the total CPUE was highest in the North Basin (56%), and intermediate in the South (23%), and Central (21%) basins. CPUE ranged from 0.02 for both sculpins and cutthroat trout to 0.38 for Northern pikeminnow. Of a total 0.45 kg of fish, Northern pikeminnow constituted 46%, sculpin 16%, redside shiner 15%, cutthroat trout 14%, three-spine stickleback 7%, sucker 1%, and peamouth chub <1%.

Minnow trapping was also conducted in the Coquitlam Reservoir during the nights of 31 October–2 November for a total 99-h effort. Total catch consisted of 26 redside shiner (67 %) 9 Northern pikeminnow (23 %) and 4 sculpin (10%) (Appendix 24, Appendix 29). Total CPUE (catch standardized by trap per hour) was 0.38 fish, with the highest proportion of fish captured in the Central Basin (40%) followed by the South (32%) and North (28%) basins. Total CPUE ranged from 0.03 for sculpin to 0.21 for redside shiner with Northern pikeminnow comprising 55%, redside shiner 33%, and sculpin 12%.

Mid-water Trawl Fall Survey

Mid-water trawling was operated in Coquitlam Reservoir during the night on 24 November for a total 0.6-h effort, resulting in three juvenile kokanee captured, yielding a CPUE of 4.80 fish per trawl hour (Appendix 25).

Adult Kokanee Spawner Distribution and Maturation

The Coquitlam Reservoir was test netted during 31 October- 2 November 2005 to obtain a better understanding of the distribution of kokanee spawners. Both sexually mature and spent kokanee were captured in gillnets in the South and Central basins of the reservoir. A total of 41 female and 52 male kokanee were caught. Of the total number of females caught, 70% were spawning, 10% were spent, and 20% were immature. Of the males caught, 80% were spawning, 10% were spent, and 10% were immature. Of 24 aged 2+ and 26 age-3+ male kokanee, 83% and 96%, respectively, were spawning in November 2005. For the same time period, of 11 age-2+ and 30 age-3+ female kokanee, 45%) and 28 93%, respectively, were spawning. The sex ratio of mature kokanee in 2005 was 1:1.2.

It was suspected that kokanee were broadcast spawning over large boulders as the majority of spawners showed no evidence of caudal fraying, or abrasion marks on their bellies. Kokanee were most abundant in four likely beach spawning areas: Site I (Falls Creek), Site C, Site D (Harmony Creek), and Site E (Figure 24). Peak kokanee spawning was estimated to occur in the first two weeks of November.

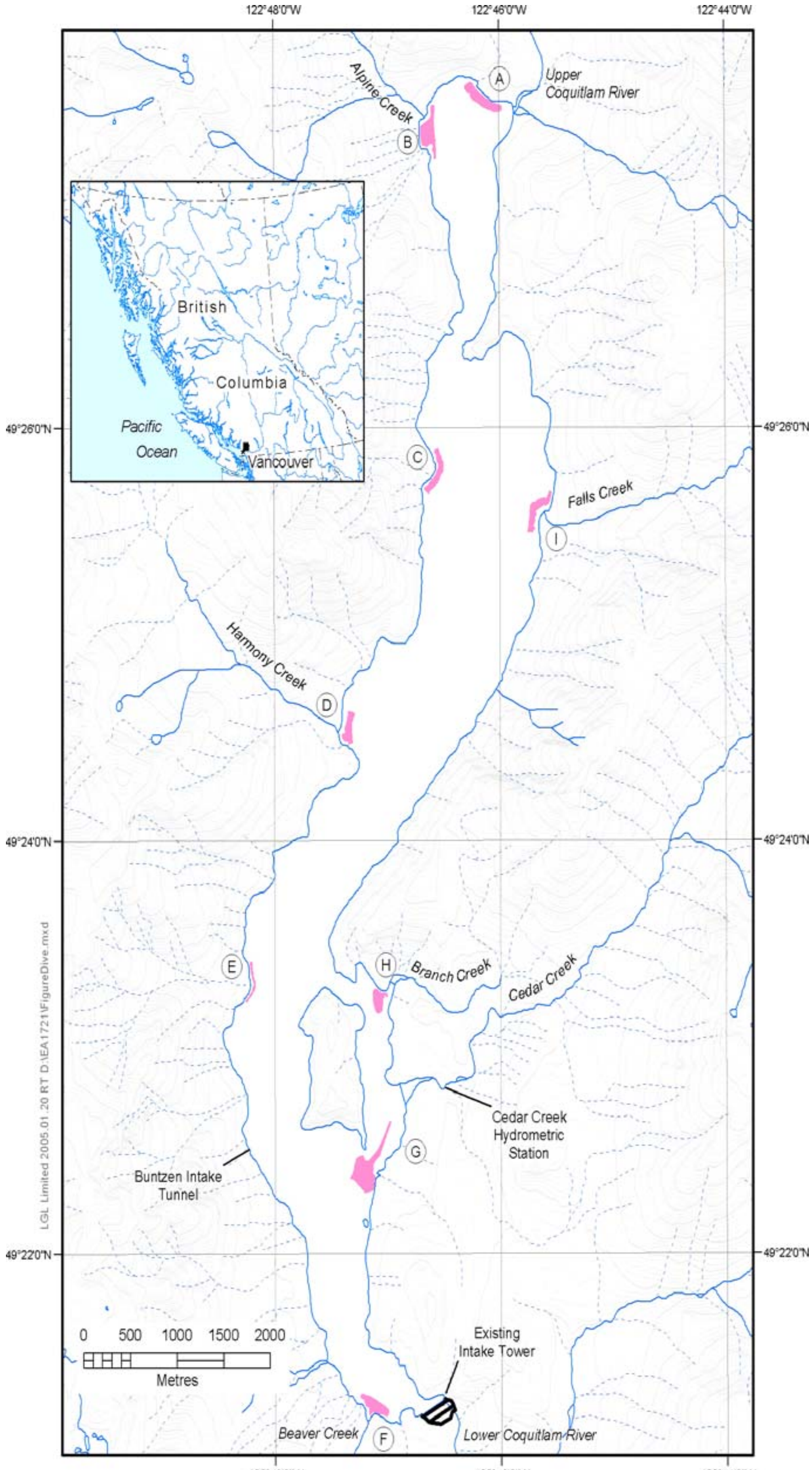

Figure 24. Map of Coquitlam Reservoir showing fluvial fans and potential kokanee beach spawning sites (Bocking and Gaboury 2003).

During spawning surveys done on foot in the lower 500 m of the Upper Coquitlam River and Cedar, Harmony and Falls creeks between September and November, 2005, no kokanee were seen, nor was there any evidence of redds.

Biological Characteristics of Coquitlam Kokanee

Of the 137 kokanee sampled in May, lengths (and weights) ranged between 128 mm (22 g) and 225 mm (123 g) (Photo 5, Appendix 30 and 32). The sex ratio among age-2 and age-3 kokanee was 0.8:1.0. Age-1 fish constituted 1%, age-2 43%, and age-3 56% (Figure 25). The dominant age class among female and male kokanee was age-3 and age-2, respectively. Mean length and weight for age-2 females and males, respectively, were 179.3 mm and 176.7 mm, and 58.2 g and 60.9 g.

Photo 5. An example of kokanee length measurement and scales collected, Coquitlam Reservoir, 2005.

The lengths (and weights) of 96 kokanee sampled in November ranged between 128 mm (27 g) and 251 mm (182 g) (Appendix 31, Appendix 34). The sex ratio among age-2 and age-3 kokanee was 1.0:1.2. Age-0 fish comprised 3%, age-1 2%), age-2 (37%) and age-3 58 % of the sample of fish that was aged (Figure 25). Age-3 was the dominant age for both male and female kokanee. Mean length (and weight) for age-0 and age-1 kokanee were 52.7 mm (1.4 g) and 136.5 mm (36.1 g), respectively. Mean length and weight for age-2 female and male kokanee, respectively, were 210.2 mm and 215.3 mm, and 116.4 g and 120.2 g.

Growth rates of kokanee collected in Coquitlam Reservoir were relatively high for age-1 fish, but otherwise typical for age-2 and age-3. Specific growth rates based on Ricker's growth equation (1975) were 1.36 %/day, 0.30 %/day and 0.07 %/day for 1-, 2- and 3-yr-old fish. Absolute growth rates were 0.11 g/day, 0.23 g/day and 0.09 g/day, respectively, for 1-, 2- and 3-yr-old fish.

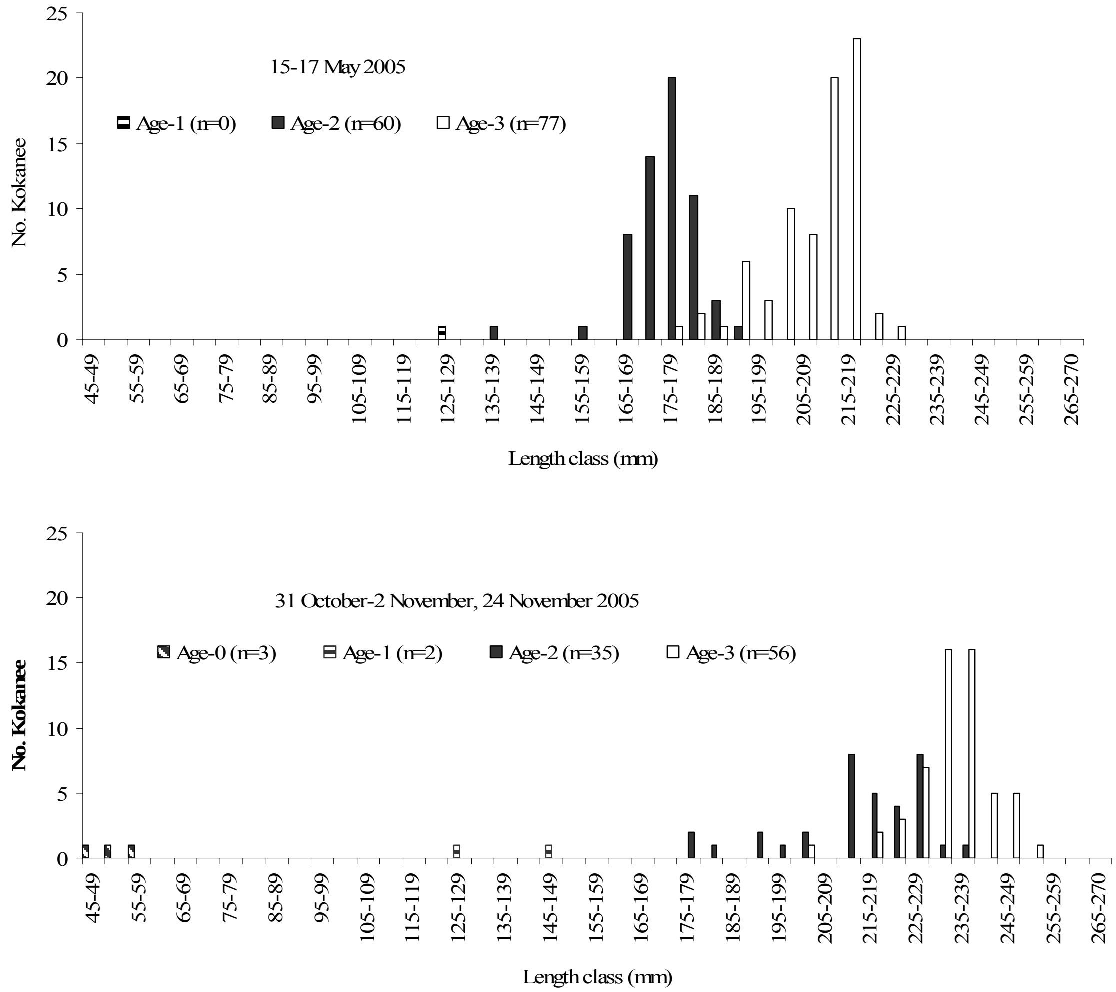

Figure 25. Length frequency and age distribution of kokanee in Coquitlam Reservoir, 15-17 May, 31 October-2 November, and 24 November, 2005.

<u>Diet of Kokanee, Cutthroat Trout, and Peamouth Chub</u>

In both 2004 and 2005, the diet of kokanee consisted primarily of zooplankton. In autumn 2004, the dominant food comprised larger prey such as *Daphnia*. In 2005, the analysis of stomach contents was done in two time periods, May and November (Appendix 36). In May, kokanee consumed primarily cyclopoid copepods, with small numbers of other zooplankton. In September, the dominant prey consumed was the cladoceran *Holopedium*, with variable amounts of other zooplankton such as copepods, *Daphnia, Leptodora* and *Polyphemus*. Kokanee did not appear to feed selectively, but rather fed on whatever taxa of zooplankton was dominant.

Cutthroat trout (Appendix 37) appeared to be generalist feeders, eating substantial numbers of several zooplankton taxa, as well as aquatic and terrestrial insects.

The diets of several species of coarse fish were also examined. From an analysis of their gut contents, it was found that in May, peamouth chub fed on a mixture of zooplankton (*Bosmina*) and aquatic insects, Northern pikeminnow and redside shiner consumed almost entirely Bosmina, and longnose sucker consumed a mixture of cyclopoid copepods and aquatic insects. For the November samples, the only species for which dietary data are complete is peamouth chub, for which the main prey consisted of *Daphnia*, *Daphnia* ephippia and *Holopedium*.

Coquitlam Reservoir Fish Food Web

The diets of fish in Coquitlam Reservoir were also examined indirectly by examining the compositions of stable isotopes of nitrogen and carbon in the muscle tissue of fish. The compositions of fish carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) were used to assess the structure of the fish food web. The carbon stable isotope signature gives an indication of whether the food (e.g., zooplankton, aquatic insects, other fish) is from the open-water part of the ecosystem or of watershed origin and originating in the nearshore littoral, shallow-water areas (e.g., terrestrial insects). For carbon isotopes, the enrichment during a trophic step is low (0-1‰) and usually regarded as negligible. Hence, the consumer's $\delta^{13}C$ is close to that of its carbon source. In lakes, terrestrial carbon sources usually display higher $\delta^{13}C$ values than aquatic carbon sources. Fish $\delta^{13}C$ values provide information on which of these carbon sources support the bulk of fish production. On the other hand, the nitrogen stable isotope signature provides information on where in the food chain a fish species belongs and what the dominant source of food might be. For example, a fish that eats other fish would have a higher nitrogen stable isotope signature than a fish which only eats zooplankton. The consumer's $\delta^{15}N$ is usually 3-4‰ higher than that of its prey, resulting in a ^{15}N-enrichment for species that occupy higher trophic positions within the food web.

The $\delta^{15}N$ data of the Coquitlam fish suggest a two-level food web, with cutthroat trout and sculpins as top predators. Intra-species variability in $\delta^{13}C$ signature is generally high in this system and not related to the sample lipid content. The high variability suggests that in this food web there are no clearly pelagic versus littoral/terrestrial food chains but rather an intricate and interconnected food web, with a gradient in the use of pelagic and littoral/terrestrial carbon sources by fish (Figure 26).

There are no noticeable differences in the food web configuration between 2004 and 2005 (Figure 26). Carbon isotope values ($\delta^{13}C$) values of CT, NSC, PCC, RSS and SC are centered around 27‰, suggesting a major use of terrestrial or littoral carbon sources. CT showed a significant decrease in $\delta^{13}C$ and a significant increase in ^{15}N between 2004 and 2005, but no changes in $\delta^{13}C$ variability, which is consistent with the significant increase in the proportion of pelagic carbon on which CT rely. NSC and PCC did not exhibit significant changes in their $\delta^{13}C$ and $\delta^{15}N$ values, but a significant decrease in their $\delta^{13}C$ variability suggests more specific foraging on terrestrial and littoral carbon sources for these species.

Only kokanee and the threespine stickleback foraged in the pelagic habitat and obtained their carbon essentially from pelagic sources. Kokanee sampled in 2004 and 2005 showed a significant decrease in $\delta^{13}C$ variability in 2004, consistent with more specific carbon foraging on pelagic sources (Figure 27).

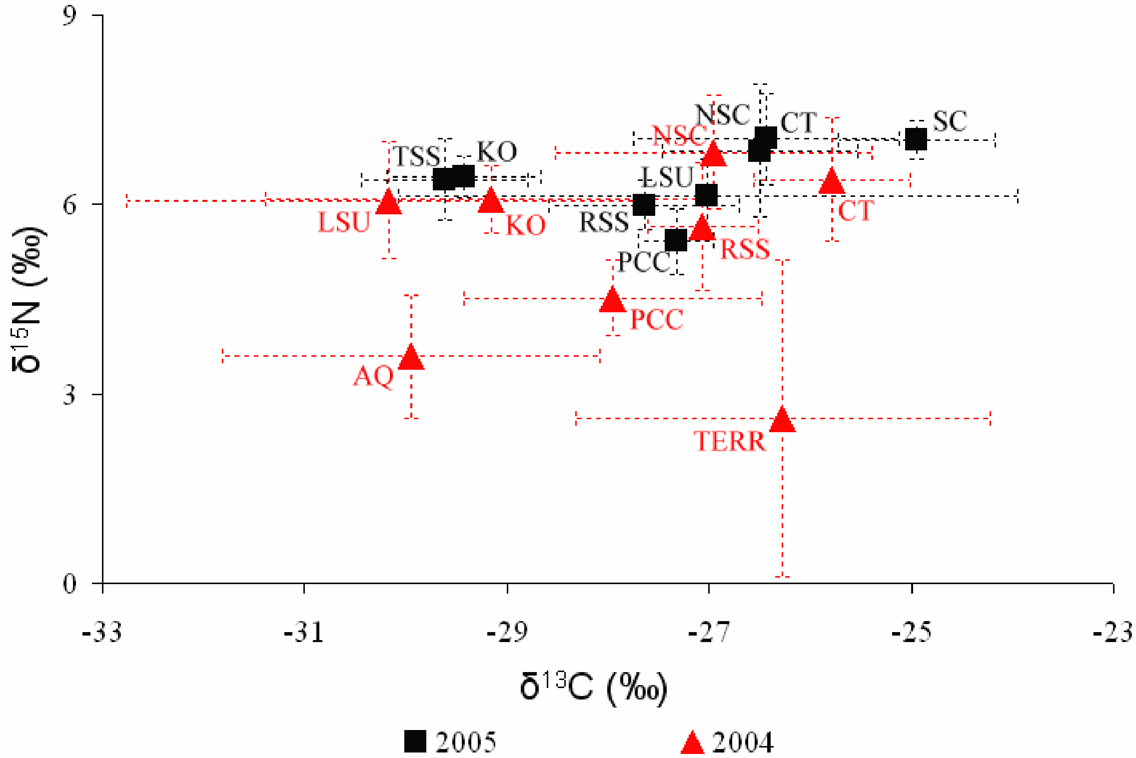

Figure 26. Comparison of bi-plot diagrams of the C- and N-isotope compositions of fish species and of their potential food sources in 2004 and 2005. Species codes are: KO = kokanee, CT = cutthroat trout, PCC = peamouth chub, NSC = Northern pikeminnow, LSU = largescale sucker, RSS = redside shiner, SC = sculpin, TSS = threespine stickleback, AQ = aquatic prey, TERR = terrestrial prey.

Fish Standing Stock

On 16 May 2005, the total fish population in Coquitlam Reservoir was estimated at 404,177 fish (348,136 to 460,218 fish at 95 % CI) (Table 2). The total fish population within each of the basins was estimated at 31,281 fish (±51% at 95% CI) for the North Basin, 275,323 fish (±17% at 95% CI) for the Central Basin, and 97,573 fish (±33% at 95% CI) for the South Basin (Appendix 38). Total fish biomass in the reservoir was approximately 18,014 kg (range 15,516 to 20,511 kg) (Appendix 40). Fish production in the reservoir ranged between 290 fish/ha (13 kg/ha) and 384 fish/ha (17 kg/ha) in 2005. An estimated 39% of the fish population in the reservoir was kokanee (156,912 kokanee; 95 CI of 92,136 to 221,688). Total biomass of kokanee was 7,266 kg (range 4,846-13,346 kg).

On 1 November 2005, the total fish population in Coquitlam Reservoir was estimated at 194,604 (115,560 to 273,648 at 95% CI). An estimated 13,893 fish were in the North Basin, 95,213 fish (±40% at 95% CI) in the Central Basin, and 85,498 fish (±87% at 95% CI) in the South Basins (Appendix 39). Total fish biomass was approximately 42,260 kg (range 25,095 to 59,425 kg) (Appendix 41).

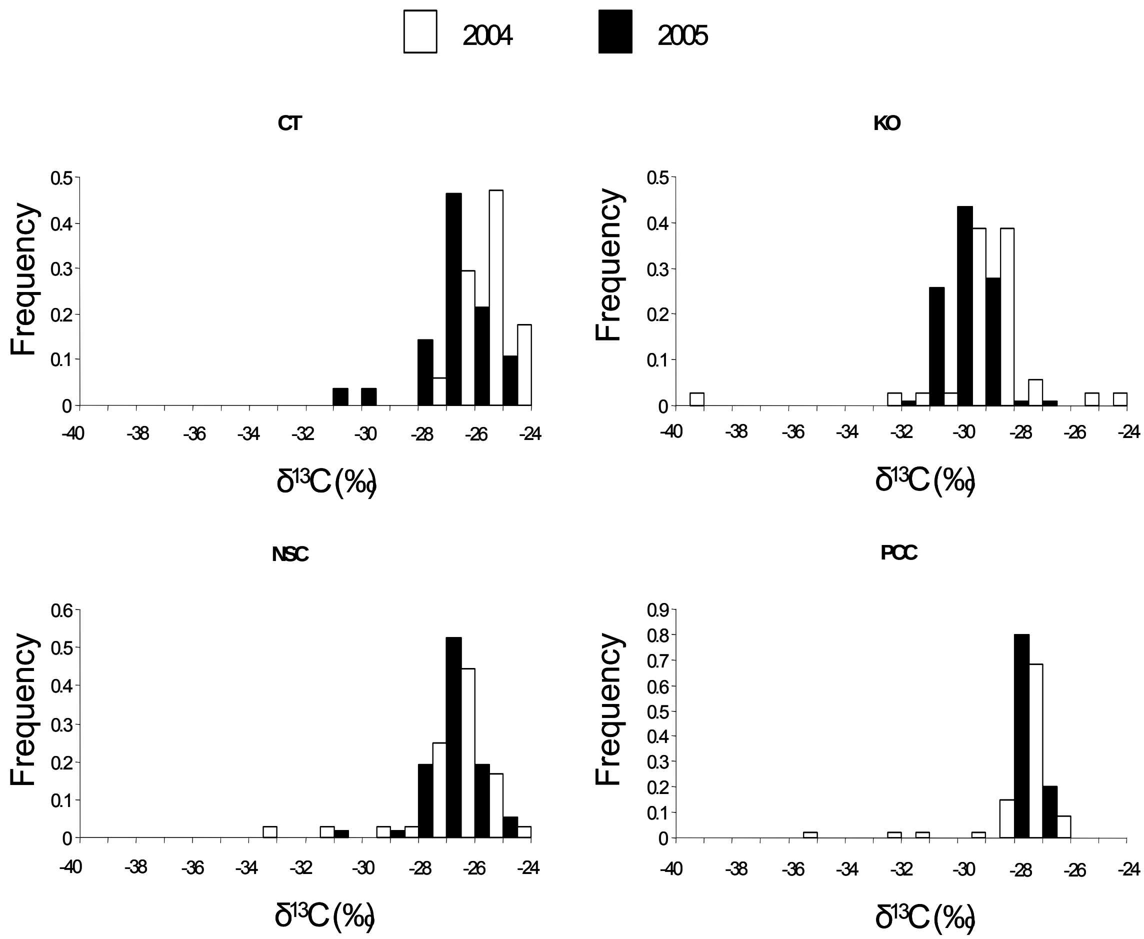

Figure 27. Frequency distributions of individual δ^{13}C-values for cutthroat trout, kokanee, northern pikeminnow, and peamouth chub in Coquitlam Reservoir.

Table 2. Summary of fish population characteristics, Coquitlam Reservoir, 2004-2005.

	Sep-04	May-05	Nov-05
Fish Population Estimate	648,420	404,177	194,604
Lower 95 % CI	564,678	348,136	115,560
Upper 95 % CI	732,162	460,218	273,648
Mean acoustic density (# / ha)	698	382	200
Fish standing crop (kg/ha)	31.3	15.0	35.2
Mean length (mm)	68	179	223
Vertical distribution (m)	0-30	0-30	0-35
Percent Kokanee (%)	39	39	37

Fish production in the reservoir ranged between 96 fish/ha (21 kg/ha) and 228 fish/ha (50 kg/ha) in 2005. Kokanee comprised 37% of the total fish population in the reservoir (71,159 kokanee; 95 CI of 27,429 to 197,645). Total kokanee biomass was 3212 kg (range 1667 to 14,643 kg).

Kokanee Standing Stock

Of the estimated 156,912 kokanee present in May, 45% were age-0+, 26% were age-1+ and 29% were age-2 and older (Table 3). The estimated biomass of age-0 kokanee was 99 kg, while age-1 and age-2 and older comprised 981 kg and 6187 kg, respectively (Appendix 42). Production estimates were as follows: age-0 = 59 fish/ha (0.1 kg/ha); age-1 = 34 fish/ha (0.8 kg/ha); and age-2 and older = 38 fish/ha (5.1 kg/ha) (Appendix 42).

Of the estimated 72,159 kokanee population in November, 34% were age-0+, 42% were age-1+, and 24% were age-2 and older (Table 3). Biomass of age-0, age-1, and age-2 and older fish was 34 kg, 735 kg, and 2352 kg, respectively (Appendix 43). Production estimates were as follows: age-0 = 20 fish/ha (<0.1 kg/ha); age-1= 25 fish/ha (0.6 kg/ha); and age-2 and older = 14 fish/ha (2.0 kg/ha) (Appendix 43). A least squares regression of weight by age was used to compute mean fish weight per age class: age-0+ = 1.4 g; age-1+ = 24 g; and age-2+ and older = 135 g.

Table 3. Kokanee population parameters, Coquitlam Reservoir, 2004-2005.

	Sep-04					May-05					Nov-05				
Parameter[a]	Age-0+	Age-1+	Age-2+	Age-3+	Total	Age-0+	Age-1+	Age-2+	Age-3+	Total	Age-0+	Age-1+	Age-2+	Age-3+	Total
Population Estimate	106,357	117,969	34,067		258,393	70,388	40,694	45,830		156,912	24,221	30,514	17,424		72,159
Lower 95 % CI	59,480	69,749	4,133		133,362	33,198	3,752	7,776		44,726	4,538	6,897	11,073		22,508
Upper 95 % CI	153,234	166,188	84,450		403,872	107,578	77,636	83,884		269,098	91,084	109,950	87,895		288,929
Mean densities (#/ha)	88	98	28		214	59	34	38		131	20	25	14		59
Standing crop (kg/ha)	0.2	2.4	3.8		6.4	0.1	0.8	5.1		6.0	0.03	0.6	2.0		2.6
Length / weight (n)	-	5	38	2	45	-	1	59	77	137	3	2	35	56	96
Mean length (mm)	-	158.6	224.5	254.5	218.5	-	128	175.1	208.4	193.5	52.7	136.5	213.7	233.7	218.7
SD length (mm)	-	5.5	18.0	17.7	27.9	-	-	7.9	9.9	19.6	5.5	12.0	14.9	8.5	35.8
Mean weight (g)	-	47.0	136.0	177.0	128.0	-	-	59.3	97.9	80.6	1.4	36.1	119.0	149.7	131.5
SD weight (g)	-	3.7	28.8	32.5	40.4	-	-	7.4	14.5	23.1	0.5	13.0	26.4	18.6	37.8

[a] Age-2+ and Age-3+ estimates pooled for population, mean densities, and standing crop.

Coquitlam kokanee exhibit fairly constant circuli patterns for the entire growing period up to age-3 with very weak winter checks (Carol Lidstone, Birkenhead Scales, Lone Butte, BC, pers. comm.). This pattern seems to be consistent between different brood years so that we can rule out effects of environmental variation. The increased juvenile growth and early spawning traits of Coquitlam kokanee (i.e., younger age at sexual maturity) appear to be similar to those found in other studies of kokanee (Alm 1959 and Nilsson 1990).

Rearing Capacity and Potential Sockeye Production

Estimates of the rearing capacity of juvenile sockeye were updated from the original estimates of Bocking and Gaboury (2003) using empirical estimates of Euphotic Zone Depth (EZD). Bocking and Gaboury (2003) used an estimated EZD of 15.6 m in their original model estimates of 15,000 kg smolt biomass (EV Model) and 13,000 kg smolt biomass (PR model). Note that in Bocking and Gaboury (2003) photosynthetic rate was approximated since there are no empirical estimates of photosynthetic rate for Coquitlam Reservoir.

The three year (2003-05) average EZD for Coquitlam Reservoir was determined as 12 m based on light penetration. The re-calculated smolt biomass estimate at capacity for Coquitlam Reservoir was then 11,500 kg using the EV Model (Table 4). No estimate is presented using the PR model as there are still no empirical data for photosynthetic rate in Coquitlam Reservoir. A request to conduct radio isotope analysis to determine photosynthetic rate was not approved by the GVRD.

It is likely that the EV Model over-predicts sockeye smolt biomass for the ultra-oligotrophic Coquitlam Reservoir. Hyatt (pers. comm.) suggests that non-glacial, coastal oligotrophic lakes could produce between 1.5 and 5.0 kg/ha of sockeye fry biomass in the fall with typical values between 2.0 and 3.0 kg/ha. Using this Oligotrophic Lake Productivity Model we estimated that Coquitlam could produce between 1800 and 6000 kg/ha of fall sockeye fry (Table 4).

Total sockeye smolt biomass and seasonal mean macrozooplankton biomass for the growing season (May – Oct) preceding smolting have been shown to be highly correlated for sockeye lakes ($r^2 = 0.92$; Koenings and Kyle 1997). Koenings and Kyle (1997) determined that, for 18 BC and Alaskan sockeye lakes, sockeye smolt biomass (kg/km^2) was 2.11 times seasonal mean macrozooplankton biomass (mg/m^2). Applying this relationship (Zooplankton Biomass Model) to Coquitlam zooplankton data for 2004 and 2005, it is possible to predict total sockeye biomass at smolting. Estimated sockeye smolt biomass using the Zooplankton Biomass Model for 2005 and 2006 smolt years were 1,853 and 1,129, respectively (Table 4).

These three model estimates of sockeye smolt biomass were compared with actual Fall Fry Standing Crop of 0+ and 1+ kokanee as measured using hydroacoustics and accounting for 30% winter mortality as suggested by Koenings and Kyle (1997). To relate these actual biomass estimates to sockeye we assumed that the forage area that would be available to sockeye is currently occupied primarily by 0+ and 1+ kokanee. The same 30% winter mortality assumption was applied to the model estimates to estimate Fall Standing Crop of sockeye.

Each estimate of smolt biomass was converted to numbers of smolts by dividing by the mean weight of smolts. Although there are no data available for what the average weight of a Coquitlam sockeye smolt might be, a suitable proxy is the average weight of kokanee 1+ 'smolts' that emigrated from the reservoir in 2005. Unfortunately weights were not taken from the thousand kokanee measured for length in 2006 (Alf Leake, BC Hydro, pers. comm.). However, Bussanich et al. (2005) determined a length-weight relationship for Coquitlam kokanee and this can be used to derive weights for kokanee that emigrated as 1+ fish in 2005. Assuming a mean length of 80 mm (actual mean not available at this time but mean length of Alouette 1+ kokanee emigrants in 2005 was also 80 mm (Baxter and Bocking 2006), the mean weight of emigrating 1+ kokanee at Coquitlam in 2005 would have been estimated at 7.6 g. In contrast, the mean weight of Alouette 1+ kokanee is 4.4 g.

Until such time as empirical data for the weight of 1+ kokanee emigrating in 2006 from Coquitlam Reservoir are available, we recommend using a mean weight of 4.5 g per kokanee smolt and 4.0 g as an approximate weight for fall fry. The 7.6 g estimate from the weight-length relationship seems on the high side.

The required number of spawners to produce the estimated number of sockeye smolts was determined using an egg-to-smolt survival of 3%, a fecundity of 2500 and a sex ratio of 1:1. Excluding the EV Model, estimates of the required number of spawners ranged from 3,136 (Observed Fall Standing Crop for 2004) to 24,889 (High Oligotrophic Lake Productivity).

Table 4. Comparison of different model estimates of smolt biomass, smolt numbers and required spawners for Coquitlam Reservoir.

Method	Year	Euphotic Zone Depth (m)	Lake Area (km^2)	EV Units[2]	Seasonal Mean Zooplankton Biomass (mg/m^2)	Fall Standing Crop (kg)[3]	Estimated Smolt Biomass (kg)[4]	Estimated Smolt Number[5]	Estimated Eggs Required[6]	Estimated Spawners Required[7]	Potential Return per Spawner	
											1:1	5:1
EV (Koenings and Burkett 1987)		12	12	144		16,522	11,566	2,570,151	85,671,704	68,537	68,537	342,687
Oligotrophic Lake Productivity	Low		12			1,800	1,260	280,000	9,333,333	7,467	7,467	37,333
	High		12			6,000	4,200	933,333	31,111,111	24,889	24,889	124,444
Zooplankton Biomass (Koenings and Kyle 1997)	2004		12		73.17	2,647	1,853	411,703	13,723,440	10,979	10,979	54,894
	2005		12		44.57	1,612	1,129	250,781	8,359,351	6,687	6,687	33,437
Observed Fall Standing Crop	2004					3,120	2,184	485,333	16,177,778	12,942	12,942	64,711
	2005					756	529	117,600	3,920,000	3,136	3,136	15,680
Mean of all estimates excluding EV model										11,017	11,017	55,083

[1] pers. comm. Kim Hyatt

[2] EV Units = Euphotic Zone Depth x Lake Area

[3] Estimated fall standing crop using EV Model is calculated as: fall standing crop = 1.3 x Smolt Biomass
Oligotrophic Lake Productivity Model is calculated as: low productive = 1.5 x Lake Area; high productive = 5 x Lake Area
Zooplankton Biomass Model is calculated as: Fall Standing Crop = 1.3 x Smolt Biomass
Observed Fall Standing Crop is combined 0+ and 1+ kokanee biomass estimated from hydroacoustics

[4] Estimated smolt biomass using EV Model is calculated as: Smolt Biomass = -130 + 81.22 x EVunits
Oligotrophic Lake Productivity Model is calculated as: Smolt Biomass = 0.7 x Fall Standing Crop
Zooplankton Biomass Model is calculated as: Smolt Biomass = 2.11x Zooplankton Biomass x Lake Area
Observed Fall Standing Crop is calculated as: Smolt Biomass = 0.7 x Fall Standing Crop

[5] Assumes 4.5 g smolts

[6] Assumes 3% egg to smolt survival

[7] Assumes female fecundity of 2500 and 1:1 sex ratio

DISCUSSION

Limnological Assessment

Based on two years of monitoring data, plus previously gathered data, Coquitlam Reservoir displays limnological and water quality characteristics typical of oligotrophic (unproductive) lakes (Wetzel 2001). The 2005 data agree well with previous data from 2004 (Field et al. 2005) as well as 2000 and 2001 (Basu 2001), which showed very low concentrations of phosphorus (P) and nitrogen (N), and low phytoplankton (algal) biomass, indicative of the unproductive state of Coquitlam Reservoir. An initial review done by Stockner (2003) also concluded that Coquitlam was very unproductive. In addition, our data support sediment-coring (paleolimnological) data which show that the reservoir has been an unproductive lake since at least before construction of the dam in 1905 (Nordin & Mazumder 2005).

Phosphorus (P) and nitrogen (N) have been shown to be significant factors limiting phytoplankton (algal) biomass and water clarity in surface waters (Schindler et al. 1971; Dillon and Rigler 1974). Low nitrogen and especially phosphorus concentrations likely play a major role in the low algal biomass and good water clarity observed in Coquitlam Reservoir. The reservoir has a circum-neutral pH. It had low concentrations of total organic carbon (TOC), which in combination with low algal biomass and good water clarity, indicate good water quality for drinking water (low colour, few organic and inorganic particulates). Good quality source water is crucial as it generally requires lower treatment intensities than poor source water, and results in healthier, better-tasting finished drinking water with fewer toxic disinfection by-products (DBP's) (Davies and Mazumder 2003; Davies et al. 2004).

The 2005 Secchi and turbidity data showed some interesting trends. It appears that winter water clarity can be quite poor, depending on winter runoff conditions, with the January and February 2005 values showing poorer clarity than summer, when phytoplankton growth should be highest. This pattern would imply that the winter runoff and inorganic particulates may have a larger effect on water clarity than summer organic biological particulates (phytoplankton growth).

Turbidity is an important indicator of water quality, especially for drinking water supplies. High levels of turbidity can protect bacteria and viruses from disinfection, stimulate the growth of bacteria, and result in the need for an increased dosage of disinfectants (World Health Organization 2004; Health Canada 2003). Higher dosages of disinfectants generally result in higher levels of toxic disinfection by-products (DBPs), such as Trihalomethanes (THMs) (Health Canada 2003). Both inorganic and organic suspended particles can impart taste and odor problems, and some biological organisms produce toxic substances (e.g. species of the blue-green algae *Microcystis* produce the liver toxin, microcystin-LR) (Health Canada 2003).

For the benefit of water managers, guidelines for turbidity levels have been set by several governing bodies, including the Province of British Columbia, the Government of Canada and the World Health Organization. As of this writing, the British Columbia provincial guideline for induced turbidity is 1.0 NTU in reservoirs such as Coquitlam (i.e. waters of exceptional clarity where background turbidity is less than or equal to 5.0 NTU) (Singleton 2001). Although turbidity in Coquitlam is generally below this 1.0 NTU guideline, our data show that winter values can occasionally exceed this threshold. In a recent study of the water distribution systems of the

GVRD, Aramini et al. (2000) showed that the probability of gastroenteritis increased as turbidity increased. According to Health Canada (2003), turbidity levels as low as 0.83 NTU may result in increased microorganism growth, and increases in turbidity of only 0.2 to 0.3 NTU are associated with increased concentrations of *Giardia* cysts. During periods where turbidity exceeds the 1.0 NTU guidelines, more extensive monitoring of water quality may be necessary.

Although overall algal biomass in Coquitlam Reservoir is low, a substantial portion of the algal community consists of cyanobacteria (blue-green algae). Several types of blue-greens that were observed at low biomass in Coquitlam Reservoir (e.g., *Microcystis*, *Anabaena*) have the potential to cause problems of taste and odour, and/or toxicity at higher biomass (Davies and Mazumder 2003). The low water temperatures and nutrient concentrations normally observed in the reservoir make the likelihood of a large bloom of blue-greens unlikely. However, continued regular monitoring of key nutrients and algae are indicated, because an increase in nutrients has the potential to trigger a shift in the algal community to greater biomass of obnoxious species such as blue-greens (Reynolds, 1984; Carmichael, 2001). Should blooms of blue-greens or other noxious algae be observed in future, sampling for taste and odour compounds may be warranted.

The conclusion that can be drawn from the fish stomach content and stable isotope results is that fish productivity (at least for the species that were sampled and assuming they represent all of the fish community) relies essentially on littoral/terrestrial carbon sources. This pattern is consistent between summer (data from September 2004) and winter/spring (May 2005). Only some species (kokanee being the dominant one) rely indirectly on phytoplankton production. This configuration of the Coquitlam Reservoir food web is consistent with its low trophic status, and scarcity of the pelagic resource. We know that fish in Coquitlam Reservoir are rearing-limited, and if yearling sockeye are introduced, it is likely that the kokanee population will decline due to direct competition for the same prey and selectivity for similar prey sizes.

Fish Abundance

Inter-annual variation in fish abundance in Coquitlam Reservoir was apparent between 2004 and 2005 (Table 3, Bussanich et al. 2005). From acoustic surveys, the total fish population was estimated at 648,000 (565,000-732,000; 95% CI), 404,177 (348,136 to 460,218; 95 % CI) and 194,604 (115,560 to 273,648; 95 % CI) in September, 2004, May 2005 and November 2005, respectively. Mean densities in fall 2005 (200 fish/ha) were lower than fall 2004 (698 fish/ha). Whole lake fish abundance in fall was lower in 2005 (194,604) than in 2004 (648,420), while whole lake biomass in fall was higher in 2005 (42,260 kg) than in 2004 (37,700 kg). A higher proportion of larger fish (> 200 mm) was detected in 2005. Kokanee juvenile abundance was significantly lower in fall 2005 (25,000 (Age-0+), 30,000 (Age-1+)) than in fall 2004 (106,000 (Age-0+), 118,000 (Age-1+). The average size of fish targets in fall was larger in 2005 (79 mm) compared to 2004 (68 mm) (2004). Fall fish population estimates were 3 times greater in 2004 than in 2005.

Population estimates may vary depending on fish distribution, behaviour, background acoustic noise levels, and other environmental factors (MacLennan and Simmonds 1992, Freon et al. 1993, Mitson 1993, McAllister 1998). We were unable to apportion age-0 and age-1 kokanee population estimates from other fish species, therefore, our kokanee population estimates for these age classes are likely to be over-estimated.

Representative samples from the pelagic fish community were needed to identify the species present and adjust the hydroacoustic population estimate for the different depth strata. Only age-0 kokanee were captured using mid-water trawling, however, larger resident fish were intermingled with the smaller kokanee in the surface to 30 m depth range. In addition to collecting age, size and sex data on populations, errors associated with species distribution and composition can be reduced by intensive mid-water trawling and multi-panel, floating gillnets (mesh sizes ranging from 3 mm to 91 mm). As estimates of fish populations based on trawling and gillnetting are influenced by several variables, it is important to quantify and explain as much of the variation as possible (He 1993, Walsh and Hickey 1993, Wardle 1993).

Additional years of fish population assessment are required to more rigorously examine annual variability as occurred for example between 2004 and 2005. Factors potentially affecting fish population estimates include:

- sampling error between years;
- fish behavioural differences – e.g., adult kokanee distribution in September 2004 versus November 2005 – there was greater probability of acoustically detecting adult fjsh off-shore in 2004 versus adults near-shore in 2005;
- reservoir operational differences that affected juvenile kokanee abundance (e.g. variability in reservoir drawdown);
- variation in the zooplankton community; and
- changes in predation rates between years.

Kokanee Age Structure, Growth & Survival

Egg-to-fry survival in 2005 was relatively low compared with other kokanee stocks in reservoirs (Fredricks et al. 1995). Bussanich et al. (2005) estimated that 6000 female spawners in 2004 deposited approximately 2.28 million eggs (assumed 380 eggs per female). In fall 2005, there was an estimated 24,200 age-0+ kokanee present, arising from 1.1% egg-to-fry survival kokanee egg-to fry survival has ranged from 1.0% to 7.7% in other reservoirs (Fredricks et al. 1995).

Over-winter fry survival for kokanee in the Coquitlam Reservoir in 2005 was similar to that for kokanee stocks in other reservoirs (Fredricks et al. 1995). Bussanich et al. (2005) estimated that there were 106,400 age-0+ kokanee present in 2005. In the present study, the estimate of 40,700 age-1+ kokanee in spring 2005 indicates an over-winter fry survival of 38%. The range in over-winter fry survival for kokanee has been considerable in other reservoirs (Fredricks et al. 1995).

Kokanee Spawner Abundance, Distribution & Potential Egg Deposition

Gaboury and Murray (2006) indicated that tributaries to Coquitlam Reservoir that are accessible to adfluvial salmon do not appear to provide a significant amount of suitable spawning habitat. Spawner surveys revealed that streams accessible to adfluvial fish, such as Cedar Creek, and the fans areas of Harmony and Falls creeks did not appear to be utilized by kokanee for spawning in 2005. Similarly, based on the quality and quantity of spawning habitat in the accessible tributaries, it is not expected that significant numbers of re-introduced sockeye would utilize these streams for spawning. The spawning period for kokanee likely began in mid-October, peaked in early-

November, and was completed by late-November. Recorded water temperatures in late October and early November ranged from 6 ^{o}C to 12 ^{o}C over which kokanee are known to spawn.

Gaboury and Murray (2006) indicated that there is sufficient lake spawning habitat (1500 m^2) below the 140 m elevation and in Cedar and Beaver creeks (1000 m^2) to support a kokanee population of approximately 4500 females or a sockeye population of 1500 females. If the maximum reservoir drawdown is maintained at the 144 m elevation as proposed by Bocking and Gaboury (2003), this would potentially support a kokanee population of about 10,200 females or an equivalent sockeye population of roughly 3400 females. In addition, sediment core data suggest that the Coquitlam Reservoir never had a relatively large population of salmonids prior to construction of the dam in 1905 (Nordin & Mazumder 2005).

There appears to currently be sufficient habitat in the reservoir basin to support between 4500 and 10,200 kokanee female spawners. Using the 1.2:1 sex ratio observed in 2005, the reservoir could support an adult kokanee population as large as 10,000 – 22,600 based on available spawning habitat. The population of mature kokanee estimated to be present in the reservoir in November 2005 was 17,400. In 2005, 24% of the kokanee population was in their third or fourth year of life. The observed sex ratio in the age-2 and age-3 mature kokanee was 1.2 males to 1 female (n = 91). Of the age-2 and age-3 observed, 70% of the age-2 and 100 % age-3 kokanee would spawn in November 2005. The estimated total female spawners for 2005 would be approximately 6900 females (4400 to 34,800 95% CI). The estimated total eggs deposited for 2005 would be approximately 2.62 million (based on 380 eggs per female observed in 2005).

Lake Productivity & Implications of Re-Introducing Sockeye

There have been concerns raised about the effects of the introduction of sockeye on the zooplankton community, mainly related to increased grazing pressure. An adequate understanding of the trophic structure is of key importance in managing the resource. Food chain pyramids are useful in understanding the inter-relationships of energy flow in lake systems (Carpenter et al. 1985, Persson 1999). The amount of phytoplankton produced is directly related to the amount of nutrients supplied to a lake (Sakamoto 1966; Pridmore and McBride 1984). There is also considerable documentation that zooplankton productivity is directly related to phytoplankton productivity (Rublee 1992, Canfield and Jones 1996). Moreover, there is evidence that the production of obligate planktivorous fish, like kokanee or juvenile sockeye is heavily dependent on zooplankton abundance (Baldwin et al 2000). The Coquitlam Reservoir with its simple food chain in the pelagic zone would result in that sockeye production would be influenced by zooplankton, phytoplankton and nutrient levels in the lake.

In considering the biological pyramid of the reservoir, it is essential to establish the phosphorus (P) characteristics of the lake, since biological productivity is directly related to P. Total P is estimated at 3132 kg, using a typical concentration of about 3 ug/L TP and a lake volume of $1044x10^6m^3$. Preliminary estimates of P load (range between 4.97 tonnes/year and 6.64 tonnes/year) used the Vollenweider (1968) model that relates loading to flushing rate and lake depth (Stockner 2003). Adjustments to lake TP concentration (from 1.5 ug/L to 3 ug/L TP) and the flushing rate (from 0.3 year to 1.4 years exchange time), resulted in a P loading estimate of 2.24 tonnes/year (or 0.187 $g/m^2/yr$). Findings of the present study and others (Field et al. 2005) indicate that Coquitlam Reservoir in 2004 and 2005 was strongly P-limited.

Phosphorus input to the reservoir from marine-derived nutrients via sockeye returning from the sea need to be considered. Would sockeye at carrying capacity of the reservoir result in an appreciable rise in nutrient levels in the lake? Based on estimates of fish production, this does not seem likely. Assuming 3000 adult sockeye returned to Coquitlam and spawned, each weighing 2.7 kg and contributing approximately 0.5% phosphorus (Larkin and Slaney 1997, Mathieson et al 1988), the estimated P input would be 40 kg/year - this would be less than 5% of the annual load and well within the range of natural variation.

Reliable estimates of phytoplankton and zooplankton biomass are important to understanding the trophic structure in Coquitlam Reservoir. Phytoplankton biomass for the reservoir was estimated using the regression equation of Desortova (1981): Chl *a* (ug/L) = -1.69+6.38B, where B is mg/L phytoplankton. The mean summer concentration of 0.4 ug/L in the top 16 m of the lake (80 kg chlorophyll *a* in the euphotic zone) would equate to about 330 ug/L wet weight phytoplankton biomass, and is within the 2005 estimated range (140 to 530 ug/L). Phytoplankton chlorophyll content can vary widely, but typically comprises 0.5-5% of the biomass (Nichols and Dillon 1978, Lewis 1991). A total algal biomass production of 20,000 kg biomass in the epilimnion, or 66,000 kg in the euphotic zone, was estimated for the lake (assuming 330 ug/L average biomass and an epilimnetic volume of 60×10^6 m^3).

A total 264 kg (dry weight) zooplankton biomass was estimated for the top 20 m of the lake (220×10^6 m^3), based on a mean standing crop of 1.2 ug/L (dry weight) (approximate range 0.5 to 3.5 ug/L). The biomass would double (528 kg) if the top 40 m of the lake were used as the productive volume for zooplankton. The volumetric biomass estimate (1.2 ug/L) is relatively low compared to west coast, oligotrophic lakes assessed for the Fisheries and Oceans Lake Enhancement Program. Simpson et al (1981) reported zooplankton standing crops of 6.7 mg/m^3 (ug/L) and 3 mg/m^3 for Woss and Nimpkish lakes, respectively on Vancouver Island. Similarly, Stockner et al. (1980) reported zooplankton standing crops of 9 mg/m^3, 7.5 mg/m^3, and 5.4 mg/m^3 for Great Central, Henderson, and Kennedy lakes, respectively. These lakes produce two to five times greater zooplankton standing crops than Coquitlam.

Rearing Capacity and Potential Sockeye Production

The question of estimating fish productivity in general has received considerable attention since the initial work of Ryder (1982) who proposed the Morpho-edaphic index (MEI) based on the relationship he found between fish yield and two lake characteristics: mean depth and the concentration of total dissolved solids. This question has been followed up on by many researchers and the general idea modified in a variety of ways using phosphorus concentration, primary production, temperature and other factors. Rearing capacity models for the management of BC, Washington, and Alaska sockeye stocks have been tested for over 20 years. Alaskan models rely on seasonal euphotic zone depth (EV model) (Koening and Kyle 1997), while BC models have modified the Alaskan model, and use photosynthetic rates (PR model) (Shortreed et al. 2000). However, as mentioned previously, none of these models may be particularly useful in determining sockeye rearing capacity in the ultra-oligotrophic Coquitlam Reservoir.

The reservoir is an unproductive lake ecosystem as is reflected in its low concentrations of nutrients, phytoplankton and zooplankton compared with other lakes in British Columbia, Washington, and Alaska (Figure 28, Koenings and Burkett 1987; Hume et al. 1996; Costella et al

1983). In eutrophic lakes, coldwater fishes may be subjected to a temperature-oxygen squeeze, where warm surface waters push fish to deeper water, while depleted oxygen in deep waters force fish to the surface. As an unproductive lake, Coquitlam Reservoir exhibits cool temperatures and well-oxygenated waters that are very favourable for coldwater sport-fishes, such as salmon, and the resident cutthroat trout and kokanee. As a result, the entire water column is likely available as usable habitat for these fishes.

Coquitlam Reservoir is considered a rearing (forage) limited system. According to Koenings and Burkett (1987), if approximately 85% of the out-migrant smolts were age-1 (and of threshold size), this would suggest density-dependent forage limitation in one growing season. If Coquitlam Reservoir is rearing-limited as a result of lack of forage, we need to examine whether density-dependence is regulating the kokanee population. We suspect that years with high kokanee stock abundance will be associated with low abundance of recruits, whereas years with low stock abundance will produce high numbers of recruits.

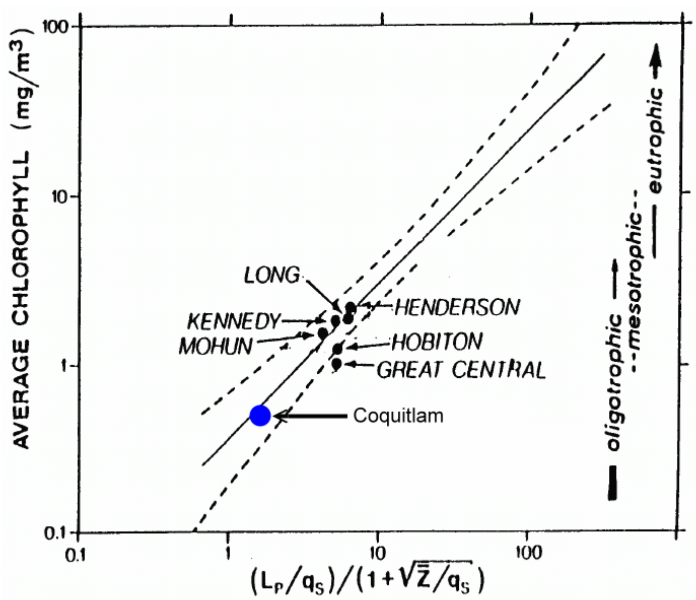

Figure 28. Relation between areal TP load at 1.4 year residence time and average Chlorophyll *a* concentrations in Coquitlam Reservoir and other coastal BC lakes.

Table 4 illustrates that sockeye smolt biomass predicted from seasonal mean macrozooplankton biomass and from fall standing crop of 0+ and 1+ kokanee is substantially less than predicted from the EV Model. There are a number of plausible explanations for this difference:

1. The EV model over-estimates rearing capacity for sockeye in Coquitlam Reservoir,
2. Seasonal mean zooplankton biomass estimates from Site L2 underestimate the zooplankton biomass for the reservoir, and
3. The entire forage area available to all age classes of kokanee would be available for sockeye hence the fall standing crop prediction of sockeye smolt biomass using just 0+ and 1+ fall biomass is an underestimate of potential sockeye smolt biomass.

Unfortunately, there is no way to determine if explanation 1 (EV model overestimates) is valid since the model relies solely on EZD and lake area. The exact determination of photosynthetic rate might further refine the estimate of rearing capacity but this is unlikely given restrictions on the use of radio isotopes in this drinking water reservoir. As well, Shortreed et al. (2000) indicated that the PR model is more closely correlated in lakes and years when grazing pressure is minimal. In the presence of continuous high grazing pressure, a lake (like Coquitlam) may develop a predator-resistant, less productive zooplankton community even though PR remains the same.

With respect to zooplankton, when comparing the location of limnology Site L2 (Figure 2) with the location of kokanee in the lake during May and November of 2005 (Figure 19 and Figure 20) and September 2004 (Bussanich et al. 2005), it is evident that the kokanee are patchy in their distribution. In May of 2005 and September of 2004, they were mostly concentrated over the deepest and centre part of the reservoir. Therefore, it seems reasonable that the zooplankton data collected to date might underestimate the total lake zooplankton density. By how much will not be known unless future zooplankton sampling is conducted at more of the sample sites.

With respect to the forage area, total sockeye smolt biomass would increase from 2184 kg to 5376 kg in September of 2004 if the entire kokanee biomass were replaced by sockeye. The total sockeye smolt biomass using November 2005 estimates would increase from 529 kg to 2184 kg, but the validity of this is not certain.

As can be seen, modeling and predicting sockeye production from a lake system like Coquitlam can be difficult. Additional years of data for, at a minimum, zooplankton biomass and fall kokanee abundance would significantly increase understanding of annual variability in lake productivity and the interrelationship between zooplankton and kokanee. Until such time, it is known that given seasonal mean macrozooplankton biomass and fall standing crop of kokanee observed in 2004 and 2005, between 500 and 2100 kg of sockeye smolts might have been produced from those growing years. Based on a mean smolt size of 4.5 g, this translates into between 117,000 and 485,000 sockeye smolts that might have been produced in those two years.

Determining a target for the number of sockeye spawners, should re-introduction proceed, is even more problematic as two critical assumptions are introduced. These assumptions are; 1) egg-to-smolt survival and 2) sockeye fecundity. Sex ratio can likely be safely assumed to be 1:1. For the purpose of determining a potential spawner target based on the various model estimates of smolt production, we assumed an egg-to-smolt survival of 3.0% and a fecundity of 2500 eggs per female. Both these assumptions seem reasonable and within the ranges observed for other sockeye lakes.

RECOMMENDATIONS

Any introduction of sockeye to the reservoir will require a pre-cautionary approach and a long-term limnological and fish monitoring program. The following specific recommendations are proposed.

Limnological Assessment

1. Seasonal sampling is sufficient for the purpose of monitoring physical, chemical, phytoplankton and macrozooplankton trends (i.e. May - October). Of these zooplankton is the most critical.
2. From a drinking water quality perspective, investigate the factors which affect disinfection by-product generation from a relative risk approach (seasonality, precursors, temporal and spatial variation in turbidity).

Fish Population Assessment

To improve our understanding of regulating factors of *O. nerka* populations in Coquitlam Reservoir:

1. Continue monitoring fall (November) fish abundance using the standard hydroacoustic and trawling techniques in 2005; and
2. Assess trends in population abundance relative to environmental correlates (i.e. reservoir elevations).

Interim Production Target

Based on the above analysis, it seems reasonable to establish an interim sockeye production goal of 400,000 sockeye smolts (approximately 550,000 fall fry). At 4.0 g per fall fry, this number of sockeye would account for 2750 kg of fish biomass in the reservoir in the fall, on average each year. Assuming a fecundity of 2500 eggs per female sockeye and 3% survival from egg to smolt, approximately 5000 females or 10,000 total spawners would be required to produce 400,000 sockeye smolts. This suggested target is relatively consistent with the amount of lake spawning habitat that could be available for sockeye in the reservoir 50% of the time (144 m elevation) (Figure 29). If it is determined later that the reservoir can sustain a higher abundance of sockeye juveniles, then additional spawning habitat would need to be found, likely in the Upper Coquitlam River.

Pacific salmon populations go through periods of low and high productivity (Beamish et al. 1997). In terms of adult returns, at current low marine survival rates, returns per spawner for Coquitlam sockeye would likely be in the vicinity of 1:1 but could increase to higher returns per spawner (5:1) should marine survival improve. Returns per spawner between 3 and 10 were common for Fraser River sockeye in the 1950s through 1990s (DFO 1999). Although changes in freshwater conditions can affect stock productivity both within and among stocks, marine conditions appear to be the main driver (e.g. Beamish et al. 1997).

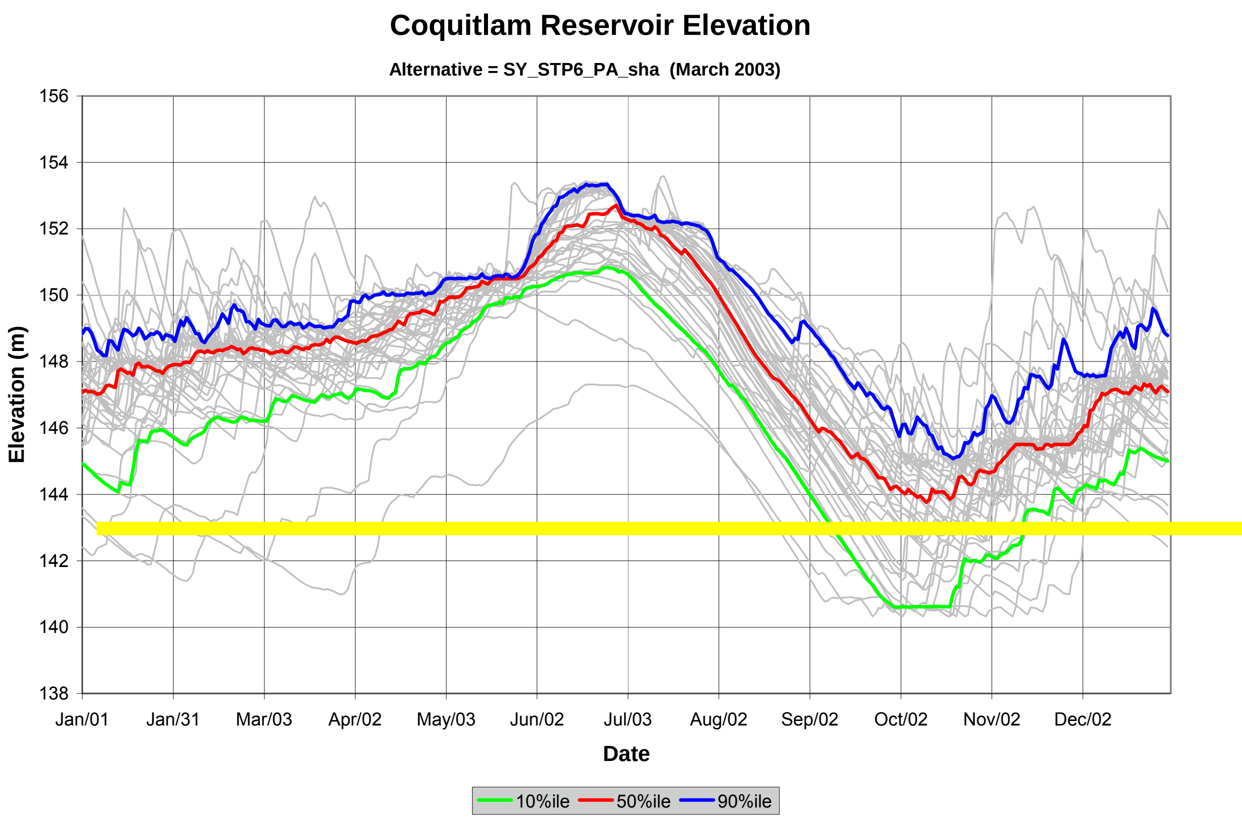

Figure 29. Coquitlam reservoir elevations modeled for Water Use Plan alternative SY_STP6_PA-sha. The median reservoir elevation for the 30 years modeled remained above 144 m during spawning and incubation.

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APPENDICES

Appendix 1. Temperature profile data at Coquitlam Lake Station 2 for 2005.

Depth (m)	27-Jan	23-Feb	31-Mar	28-Apr	5-Jun	6-Jul	27-Jul	25-Aug	22-Sep	22-Oct	5-Dec
1	5.5	4.8	6.0	13.0	15.2	17.6	20.5	21.9	17.3	12.4	6.3
2	5.5	4.8	6.0	13.0	15.0	17.6	20.4	21.7	17.2	12.3	6.2
3	5.3	4.8	6.0	11.4	14.8	17.6	20.3	21.6	17.1	12.1	6.2
4	5.2	4.8	6.0	10.8	14.7	17.2	19.9	21.6	17.1	12.0	6.2
5	5.2	4.7	5.9	8.7	14.4	15.4	19.0	21.5	17.1	11.9	6.2
6	5.1	4.7	5.9	8.0	13.3	14.1	17.2	21.3	17.0	11.6	6.2
7	5.0	4.7	5.9	6.7	12.6	13.3	15.3	17.9	17.0	11.4	6.2
8	5.0	4.7	5.7	6.2	10.5	12.8	13.8	14.7	13.7	11.2	6.2
9	5.0	4.7	5.7	6.1	9.2	11.7	13.2	11.4	11.7	11.0	6.2
10	5.0	4.7	5.5	5.9	8.1	10.5	10.4	10.3	9.6	10.7	6.2
11	5.0	4.7	5.4	5.8	7.4	10.1	8.7	9.7	8.7	10.4	6.2
12	5.0	4.7	5.4	5.7	6.8	9.9	8.0	7.7	7.7	10.3	6.2
13	4.9	4.7	5.3	5.7	6.6	8.2	7.6	7.2	7.0	10.1	6.2
14	4.9	4.7	5.3	5.7	6.3	7.2	7.0	6.4	6.5	9.9	6.2
15	4.9	4.7	5.3	5.7	6.0	6.7	6.7	6.3	6.3	9.8	6.2
16	4.9	4.7	5.2	5.6	5.9	6.5	6.5	6.2	6.2	9.3	6.2
17	4.9	4.7	5.2	5.6	5.8	6.3	6.4	6.1	6.0	8.5	6.2
18	4.8	4.7	5.2	5.6	5.6	6.1	5.9	6.1	5.9	8.2	6.2

Appendix 2. Dissolved oxygen profile data at Coquitlam Lake Station 2 for 2005.

Depth (m)	27-Jan	23-Feb	31-Mar	28-Apr	5-Jun	6-Jul	27-Jul	25-Aug	22-Sep	22-Oct	5-Dec
1	12.1	10.6	12.2	11.4	10.6	9.7	9.1	8.7	9.2	10.7	11.2
2	12.1	10.6	12.2	11.5	10.6	9.7	9.1	8.7	9.2	10.7	11.2
3	11.9	10.6	12.2	11.8	10.6	9.7	9.1	8.7	9.2	10.7	11.1
4	11.9	10.5	12.1	11.9	10.7	9.8	9.1	8.7	9.2	10.7	11.1
5	11.8	10.5	12.1	12.2	10.7	10.1	9.3	8.7	9.1	10.7	11.1
6	11.7	10.5	12.1	12.3	11.0	10.3	9.7	8.7	9.1	10.7	11.1
7	11.6	10.5	12.1	12.4	11.1	10.5	10.0	9.8	9.1	10.8	11.1
8	11.5	10.5	12.1	12.3	11.5	10.6	10.2	10.4	10.1	10.8	11.1
9	11.4	10.5	12.1	12.2	11.7	10.8	10.3	11.0	10.5	10.8	11.1
10	11.4	10.5	12.1	12.1	11.9	10.9	10.8	11.1	10.9	10.9	11.1
11	11.4	10.5	12.1	12.0	12.0	11.0	11.1	11.3	11.0	11.1	11.0
12	11.3	10.5	12.1	12.0	11.9	11.0	11.2	11.6	11.3	11.0	11.1
13	11.3	10.5	12.0	11.9	11.9	11.3	11.2	11.6	11.4	10.9	11.0
14	11.3	10.5	12.0	11.9	11.9	11.5	11.3	11.8	11.5	11.0	11.0
15	11.3	10.5	12.0	11.9	12.0	11.5	11.4	11.8	11.5	11.0	11.0
16	11.3	10.5	11.9	11.9	11.9	11.5	11.4	11.7	11.5	11.1	11.0
17	11.3	10.5	11.9	11.9	11.9	11.5	11.5	11.7	11.5	11.3	11.0
18	11.3	10.5	11.9	11.9	11.9	11.5	11.5	11.7	11.5	11.4	11.0

Appenidix 3. Secchi disc (water clarity) data at Coquitlam Reservoir 2005

Date	Site 1	Site 2	Site 3	Site 4
27-Jan	4.3	4.3	2.5	3.0
23-Feb	4.8	5.0	5.3	4.8
31-Mar	5.0	5.5	4.8	6.8
28-Apr	6.8	5.5	6.5	6.0
2-Jun	5.5	6.5	6.0	5.5
6-Jul	5.5	5.5	6.0	8.0
27-Jul	6.8	7.0	9.0	9.8
25-Aug	7.3	7.5	8.0	10.0
22-Sep	5.3	6.3	7.0	8.5
20-Oct	5.0	6.5	7.5	7.5
3-Dec	6.0	7.3	8.0	7.0

Appendix 4. Site 2 pH data at Coquitlam Reservoir 2005.

Date	Epilimnetic	Metalimnetic	Hypolimnetic
27-Jan	8.56	7.29	7.13
23-Feb	6.55	6.64	6.53
31-Mar	7.63	7.45	7.37
28-Apr	7.33	7.02	6.73
2-Jun	6.71	6.46	6.21
6-Jul	6.38	6.37	6.27
27-Jul	6.59	6.31	6.54
25-Aug	6.45	6.29	6.2
22-Sep	6.4	6.07	6.22
20-Oct	6.45	6.36	6.29
3-Dec	6.27	6.28	6.23

Appendix 5. Site 3 total phosphorus data at Coquitlam Reservoir 2005.

Date	Epilimnetic	Metalimnetic	Hypolimnetic
27-Jan	3.28	2.73	3.13
23-Feb	1.76	0.89	1.81
31-Mar	2.24	1.98	5.12
28-Apr	4.33	3.93	2.67
2-Jun	2.07	2.86	1.84
6-Jul	1.14	0.90	1.47
27-Jul	1.96	3.29	1.46
25-Aug	2.96	3.61	2.66
22-Sep	4.16	5.25	2.14
20-Oct	2.47	3.13	2.80
3-Dec	-	-	-

Appendix 6. TN data for site 2 at Coquitlam Reservoir 2005.

Date	Epilimnetic	Metalimnetic	Hypolimnetic
27-Jan	163.54	161.22	182.84
23-Feb	151.80	160.75	165.92
31-Mar	162.30	150.52	143.00
28-Apr	171.77	153.65	149.47
2-Jun	128.70	142.71	140.03
6-Jul	106.23	110.04	172.40
27-Jul	109.77	114.25	119.49
25-Aug	110.46	150.92	232.19
22-Sep	98.37	115.37	124.09
20-Oct	163.25	148.67	143.34
3-Dec	-	-	-

Appendix 7. Nitrate-nitrite data for site 2 at Coquitlam Reservoir 2005.

Date	Epilimnetic	Metalimnetic	Hypolimnetic
27-Jan	95.31	96.08	101.55
23-Feb	85.52	85.71	83.39
31-Mar	79.02	77.84	76.95
28-Apr	84.75	98.37	97.20
2-Jun	82.72	86.43	119.96
6-Jul	67.84	66.39	104.77
27-Jul	66.76	70.27	103.35
25-Aug	53.40	69.76	107.14
22-Sep	52.72	81.31	100.33
20-Oct	108.49	96.76	104.96
3-Dec	-	-	-

Appendix 8. Nitrogen to Phosphorus data for site 2 at Coquitlam Reservoir 2005.

Date	Epilimnetic	Metalimnetic	Hypolimnetic
27-Jan	50	59	58
23-Feb	86	182	92
31-Mar	73	76	28
28-Apr	40	39	56
2-Jun	62	50	76
6-Jul	93	122	117
27-Jul	56	35	82
25-Aug	37	42	87
22-Sep	24	22	58
20-Oct	66	47	51
3-Dec	-	-	-

Appendix 9. TOC/DOC data for site 2 at Coquitlam Reservoir 2005

	TOC				DOC		
Date	Epilimnetic	Metalimnetic	Hypolimnetic	4m	Epilimnetic	Metalimnetic	Hypolimnetic
27-Jan	2.3	2.2	2.3	2.3	2.1	2.0	2.1
23-Feb	2.0	2.2	2.2	2.1	1.8	2.0	1.9
31-Mar	1.9	1.8	1.9	1.9	1.9	1.8	1.8
28-Apr	-	2.1	2.1	-	-	2.0	2.0
2-Jun	-	1.8	1.6	1.6	-	1.6	1.6
6-Jul	1.6	1.6	1.6	1.5	1.6	1.6	1.7
27-Jul	1.7	2.0	1.7	1.7	1.7	1.8	1.7
25-Aug	1.8	1.8	1.7	1.6	1.6	1.7	1.6
22-Sep	1.7	1.7	1.7	1.7	1.6	1.6	1.6
20-Oct	2.1	2.4	2.1	1.9	1.8	2.1	1.8
3-Dec	2.0	1.9	2.0	2.0	1.8	1.8	1.8

Appendix 10. Chlorophyll data for site 2 at Coquitlam Reservoir 2005.

Date	Epilimnetic	Metalimnetic	Hypolimnetic
27-Jan	0.08	0	0
23-Feb	0.06	0.23	0.46
31-Mar	nc	nc	nc
28-Apr	0.19	0.30	0.09
2-Jun	0.89	0.54	0.16
6-Jul	0.27	0.59	0.02
27-Jul	0.52	0.15	0.46
25-Aug	0.73	1.27	0.81
22-Sep	0.05	1.44	0.74
20-Oct	0.75	0.48	0.35
3-Dec	0.27	0.63	0.61

Appendix 11. Summary of hydroacoustic sampling at Coquitlam Lake Reservoir in May 16-17, 2005.

Route No.	Transect [a] No.	Date dd-mm	Start hh:mm	End hh:mm	Duration hh:mm:ss	Distance m	Bearing °	Cruise Day / Night	Comments
1	21	16-May	21:35:05	21:40:50	0:05:45	520	320	Night	No wind, no precipitation
2	20	16-May	21:40:50	21:44:30	0:03:40	380	260	Night	No wind, no precipitation
3	19	16-May	21:44:30	21:56:56	0:12:26	1,550	10	Night	No wind, no precipitation
4	18	16-May	21:56:56	22:04:15	0:07:19	890	270	Night	No wind, no precipitation
5	17	16-May	22:04:15	22:11:35	0:07:20	720	10	Night	No wind, no precipitation
6	16	16-May	22:11:35	22:20:37	0:09:02	1,000	330	Night	No wind, no precipitation
7	15	16-May	22:20:37	22:27:53	0:07:16	790	90	Night	No wind, no precipitation
8	14	16-May	22:27:53	22:35:31	0:07:38	800	315	Night	No wind, no precipitation
9	13	16-May	22:35:31	22:43:58	0:08:27	1,050	60	Night	No wind, no precipitation
10	12	16-May	22:43:58	22:50:38	0:06:40	680	310	Night	No wind, no precipitation
11	11	16-May	22:50:38	23:04:44	0:14:06	1,500	75	Night	No wind, no precipitation
12	10	16-May	23:04:44	23:10:53	0:06:09	660	325	Night	No wind, light precipitation
13	9	16-May	23:10:53	23:24:22	0:13:29	1,610	90	Night	No wind, light precipitation
14	8	16-May	23:24:22	23:33:01	0:08:39	1,000	290	Night	No wind, light precipitation
15	7	16-May	23:33:01	23:44:46	0:11:45	1,360	90	Night	No wind, no precipitation
16	6	16-May	23:44:46	23:54:46	0:10:00	1,180	270	Night	No wind, no precipitation
17	5	16-May	23:54:46	0:08:52	0:14:06	1,460	70	Night	No wind, no precipitation
18	4	17-May	0:08:52	0:19:05	0:10:13	1,180	270	Night	No wind, no precipitation
19	3	17-May	0:19:05	0:28:54	0:09:49	1,170	55	Night	No wind, no precipitation
20	2	17-May	0:28:54	0:37:24	0:08:30	1,070	270	Night	No wind, no precipitation
21	1	17-May	0:37:24	0:54:44	0:17:20	1,380	0	Night	No wind, light precipitation
22	1	17-May	0:54:44	1:15:07	0:20:23	1,380	180	Night	No wind, no precipitation
23	2	17-May	1:15:07	1:23:26	0:08:19	1,070	90	Night	No wind, no precipitation
24	3	17-May	1:23:26	1:34:46	0:11:20	1,170	210	Night	No wind, no precipitation
25	4	17-May	1:34:46	1:44:41	0:09:55	1,180	110	Night	No wind, no precipitation
26	5	17-May	1:44:41	1:57:21	0:12:40	1,460	220	Night	No wind, no precipitation
27	6	17-May	1:57:21	2:09:01	0:11:40	1,180	120	Night	No wind, no precipitation
28	7	17-May	2:09:01	2:21:03	0:12:02	1,360	215	Night	Moderate wind, no precipitation
29	8	17-May	2:21:03	2:29:13	0:08:10	1,000	120	Night	Moderate wind, no precipitation
30	9	17-May	2:29:13	2:43:34	0:14:21	1,610	215	Night	Moderate wind, no precipitation
31	10	17-May	2:43:34	2:49:17	0:05:43	660	120	Night	Moderate wind, no precipitation
32	11	17-May	2:49:17	3:03:11	0:13:54	1,500	215	Night	No wind, no precipitation
33	12	17-May	3:03:11	3:09:25	0:06:14	680	125	Night	No wind, no precipitation
34	13	17-May	3:09:25	3:16:29	0:07:04	1,050	210	Night	Light wind, no precipitation
35	14	17-May	3:16:29	3:23:20	0:06:51	800	150	Night	Light wind, no precipitation
36	15	17-May	3:23:20	3:29:14	0:05:54	790	270	Night	Light wind, no precipitation
37	16	17-May	3:29:14	3:37:37	0:08:23	1,000	140	Night	No wind, no precipitation
38	17	17-May	3:37:37	3:41:51	0:04:14	720	190	Night	No wind, no precipitation
39	18	17-May	3:57:37	4:02:52	0:05:15	890	120	Night	No wind, no precipitation
40	19	17-May	4:02:52	4:11:32	0:08:40	1,550	190	Night	Light wind, no precipitation
41	20	17-May	4:11:32	4:14:50	0:03:18	380	100	Night	No wind, no precipitation
42	21	17-May	4:14:50	4:19:00	0:04:10	520	170	Night	No wind, no precipitation
43	22	17-May	3:41:51	3:47:51	0:06:00	520	330	Night	Bunzten Tunnel, no wind, no precipitation
44	22	17-May	3:47:51	3:57:37	0:09:46	520	160	Night	Bunzten Tunnel, no wind, no precipitation
				Total	6:43:55	44,940			

Appendix 12. Summary of hydroacoustic sampling at Coquitlam Lake Reservoir in October 31 to November 02, 2005.

Route No.	Transect [a] No.	Date dd-mm	Start hh:mm	End hh:mm	Duration hh:mm:ss	Distance m	Bearing °	Cruise Day / Night	Comments
1	1	31-Oct	21:28:00	21:45:00	0:17:00	1,989	180	Night	Light wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
2	2	31-Oct	21:45:00	21:57:00	0:12:00	1,404	110	Night	Light wind, no precipitation , electrical noise detected / determined to be depth sounder on vessel
3	3	31-Oct	21:57:00	22:11:58	0:14:58	1,751	250	Night	Light wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
4	4	31-Oct	22:11:58	22:22:45	0:10:47	1,262	100	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
5	5	31-Oct	22:22:45	22:36:37	0:13:52	1,622	250	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
6	6	31-Oct	22:36:37	22:47:06	0:10:29	1,227	110	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
7	7	31-Oct	22:47:06	22:59:12	0:12:06	1,416	250	Night	Light wind, slight precipitation, electrical noise detected / determined to be depth sounder on vessel
8	8	31-Oct	22:59:12	23:09:05	0:09:53	1,156	125	Night	Light wind, slight precipitation, electrical noise detected / determined to be depth sounder on vessel
9	9	31-Oct	23:09:05	23:23:58	0:14:53	1,741	245	Night	No wind, heavy precipitation, electrical noise detected / determined to be depth sounder on vessel
10	10	31-Oct	23:23:58	23:30:37	0:06:39	778	130	Night	No wind, heavy precipitation, electrical noise detected / determined to be depth sounder on vessel
11	11	31-Oct	23:30:37	23:44:11	0:13:34	1,587	240	Night	No wind, heavy precipitation, electrical noise detected / determined to be depth sounder on vessel
12	12	31-Oct	23:44:11	23:50:53	0:06:42	784	120	Night	No wind, Light precipitation, electrical noise detected / determined to be depth sounder on vessel
13	13	31-Oct	23:50:53	0:00:19	0:09:26	1,104	240	Night	No wind, no precipitation
14	14	1-Nov	0:00:19	0:26:59	0:26:40	3,120	125	Night	File 00:22:17 also included in same transect (local area connection failed/locked, transect re-run over area needing coverage
15	15	1-Nov	0:26:59	0:33:59	0:07:00	819	270	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
16	16	1-Nov	0:33:59	0:42:49	0:08:50	1,034	125	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
17	17	1-Nov	0:42:49	0:50:02	0:07:13	844	180	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
18	18	1-Nov	0:50:02	0:56:39	0:06:37	774	80	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
19	19	1-Nov	0:56:39	1:09:11	0:12:32	1,466	180	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
20	20	1-Nov	1:09:11	1:12:40	0:03:29	408	90	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
21	21	1-Nov	1:12:40	1:16:00	0:03:20	390	150	Night	No wind, no precipitation, electrical noise detected / determined to be depth sounder on vessel
22	1	1-Nov	10:31:45	10:46:00	0:14:15	1,667	170	Day	No wind, light precipitation electrical noise detected / determined to be depth sounder on vessel
23	2	1-Nov	10:46:00	10:56:15	0:10:15	1,199	130	Day	No wind, light precipitation electrical noise detected / determined to be depth sounder on vessel
24	3	1-Nov	10:56:15	11:05:34	0:09:19	1,090	240	Day	No wind, light precipitation electrical noise detected / determined to be depth sounder on vessel
25	4	1-Nov	11:05:34	11:15:58	0:10:24	1,217	110	Day	No wind, light precipitation electrical noise detected / determined to be depth sounder on vessel
26	5	1-Nov	11:15:58	11:28:48	0:12:50	1,502	245	Day	No wind, light precipitation
27	6	1-Nov	11:28:48	11:38:49	0:10:01	1,172	120	Day	No wind, light precipitation
28	7	1-Nov	11:38:49	11:50:08	0:11:19	1,324	260	Day	No wind, light precipitation
29	8	1-Nov	11:50:08	11:58:53	0:08:45	1,024	145	Day	No wind, light precipitation
30	9	1-Nov	11:58:53	12:11:44	0:12:51	1,503	230	Day	No wind, light precipitation
31	10	1-Nov	12:11:44	12:17:30	0:05:46	675	150	Day	No wind, light precipitation
32	11	1-Nov	12:17:30	12:30:21	0:12:51	1,503	230	Day	No wind, light precipitation
33	12	1-Nov	12:30:21	12:35:58	0:05:37	657	110	Day	No wind, light precipitation
34	13	1-Nov	12:35:58	12:45:01	0:09:03	1,059	130	Day	No wind, light precipitation
35	14	1-Nov	12:45:01	12:52:20	0:07:19	856	130	Day	No wind, light precipitation
36	15	1-Nov	12:52:20	12:59:27	0:07:07	833	270	Day	No wind, light precipitation
37	16	1-Nov	12:59:27	13:07:40	0:08:13	961	130	Day	No wind, light precipitation
38	17	1-Nov	13:07:40	13:13:41	0:06:01	704	195	Day	No wind, light precipitation
39	18	1-Nov	13:13:41	13:21:06	0:07:25	868	80	Day	No wind, light precipitation
40	19	1-Nov	13:21:06	13:39:05	0:17:59	2,104	200	Day	No wind, light precipitation
41	20	1-Nov	13:39:05	13:42:16	0:03:11	372	80	Day	No wind, light precipitation
42	21	1-Nov	13:42:16	13:48:00	0:05:44	671	150	Day	No wind, light precipitation
43	1	1-Nov	22:08:20	22:22:14	0:13:54	1,626	180	Night	No wind, light precipitation
44	2	1-Nov	22:22:14	22:31:48	0:09:34	1,119	110	Night	No wind, heavy precipitation
45	3	1-Nov	22:31:48	22:41:13	0:09:25	1,102	240	Night	No wind, heavy precipitation
46	4	1-Nov	22:41:13	22:50:50	0:09:37	1,125	190	Night	No wind, light precipitation
47	5	1-Nov	22:50:50	23:03:47	0:12:57	1,515	225	Night	No wind, heavy precipitation
48	6	1-Nov	23:03:47	23:13:37	0:09:50	1,151	130	Night	No wind, light precipitation
49	7	1-Nov	23:13:37	23:24:39	0:11:02	1,291	250	Night	No wind, heavy precipitation
50	8	1-Nov	23:24:39	23:32:42	0:08:03	942	120	Night	No wind, heavy precipitation
51	9	2-Nov	23:32:42	23:45:48	0:13:06	1,533	270	Night	No wind, heavy precipitation
52	10	2-Nov	23:45:48	23:50:44	0:04:56	577	140	Night	No wind, light precipitation
53	11	2-Nov	23:50:44	0:02:43	0:11:59	1,402	230	Night	No wind, light precipitation
54	12	2-Nov	0:02:43	0:09:25	0:06:42	784	120	Night	No wind, light precipitation
55	13	2-Nov	0:09:25	0:19:12	0:09:47	1,145	240	Night	No wind, heavy precipitation
56	14	2-Nov	0:19:12	0:26:26	0:07:14	846	140	Night	No wind, moderate precipitation
57	15	2-Nov	0:26:26	0:34:12	0:07:46	909	270	Night	Light wind, heavy precipitation
58	16	2-Nov	0:34:12	0:41:55	0:07:43	903	125	Night	Light wind, heavy precipitation
59	17	2-Nov	0:41:55	0:48:18	0:06:23	747	190	Night	Light wind, moderate precipitation
60	18	2-Nov	0:48:18	0:54:29	0:06:11	723	90	Night	Light wind, moderate precipitation
61	19	2-Nov	0:54:29	1:06:39	0:12:10	1,424	210	Night	No wind, moderate precipitation
62	20	2-Nov	1:06:39	1:10:02	0:03:23	396	90	Night	No wind, moderate precipitation
63	21	2-Nov	1:10:02	1:15:00	0:04:58	581	140	Night	No wind, moderate precipitation
				Night[1]	3:48:00	26,676			
				Day[1]	3:16:15	22,961			
				Night[2]	3:06:40	21,840			
				Total	10:10:55	71,477			

Appendix 13. Summary of target strength, sigma, and estimated fish length, by depth strata, of single targets tracked using a 200 kHz, 6° transducer aimed downward during night time, at Coquitlam Reservoir, May 2005.

Strata Depth (m)	Number of Targets	Target Strength (dB)		Sigma (dB re 1 m^{-1})		Expected Mean Target Size (mm)
		Mean	SD	Mean	SD	
2-5	15	-56.7	4.6	3.65E-06	4.18E-06	48.4
5-10	121	-51.5	8.2	3.62E-05	6.77E-05	121.5
10-15	412	-49.2	9.0	6.01E-05	9.99E-05	163.8
15-20	798	-48.5	9.1	7.23E-05	1.16E-04	179.6
20-25	1295	-50.1	8.7	4.88E-05	8.17E-05	146.1
25-30	797	-53.0	8.6	3.38E-05	6.86E-05	110.9
30-35	480	-56.5	6.1	1.09E-05	3.43E-05	60.9
35-40	328	-57.7	5.3	7.55E-06	2.93E-05	49.7
40-45	318	-57.8	3.5	2.42E-06	3.18E-06	40.8
45-50	242	-57.5	3.1	2.38E-06	2.57E-06	41.3
50-55	99	-56.0	5.1	6.84E-06	1.66E-05	56.8
55-60	72	-57.6	3.2	2.31E-06	2.25E-06	40.8
60-65	78	-56.2	3.2	3.36E-06	4.39E-06	48.3
65-70	64	-56.1	3.3	3.28E-06	2.76E-06	48.6
70-75	52	-56.3	3.5	3.19E-06	2.53E-06	48.1
75-80	41	-56.1	2.7	2.97E-06	1.97E-06	47.5
80-85	33	-55.5	2.3	3.23E-06	1.63E-06	50.3
Grand Total	5,245	-52.6	53.3	3.58E-05	4.78E-09	113.2

Appendix 14. Summary of target strength, sigma, and estimated fish length, by depth strata, of single targets tracked using a 420 kHz, 6° transducer aimed sideward during night time, at Coquitlam Reservoir, May 2005.

Strata Range (m)	Number of Targets	Target Strength (dB)		Sigma (dB re 1 m^{-1})		Expected Mean Target Size (mm)
		Mean	SD	Mean	SD	
0-5	22	-57.8	4.8	4.39E-06	1.12E-05	45.4
5-10	414	-57.5	4.6	3.91E-06	8.22E-06	45.9
10-15	673	-57.2	4.6	4.59E-06	1.56E-05	47.6
15-20	660	-56.5	4.2	4.36E-06	9.23E-06	49.8
20-25	239	-55.2	4.9	8.40E-06	2.83E-05	61.7
Grand Total	2008	-56.8	57.0	4.83E-06	1.98E-10	49.6

Appendix 15 Summary of target strength, sigma, and estimated fish length, by depth strata, of single targets tracked using a 200 kHz, 6° transducer aimed downward during night time, at Coquitlam Reservoir, November 2005.

Strata Depth (m)	Number of Targets	Target Strength (dB) Mean	SD	Sigma (dB re 1 m^{-1}) Mean	SD	Expected Mean Target Size (mm)
2-5	76	-52.6	6.3	3.44E-05	1.25E-04	99.0
5-10	154	-52.5	6.6	2.04E-05	5.41E-05	94.3
10-15	529	-45.7	8.9	1.05E-04	1.46E-04	231.2
15-20	1406	-43.0	8.1	1.33E-04	1.46E-04	281.6
20-25	1302	-44.5	8.4	1.11E-04	1.36E-04	248.6
25-30	402	-48.1	9.0	7.27E-05	1.05E-04	184.3
30-35	129	-52.1	7.0	2.50E-05	5.51E-05	103.1
35-40	84	-54.9	5.0	6.15E-06	7.43E-06	61.7
40-45	45	-56.8	3.8	3.23E-06	3.88E-06	46.1
45-50	51	-54.8	7.0	2.84E-05	9.16E-05	85.1
50-55	65	-53.6	5.2	9.94E-06	1.67E-05	73.6
55-60	62	-54.1	4.5	6.40E-06	6.18E-06	65.3
60-65	30	-53.0	5.8	1.18E-05	1.44E-05	81.5
65-70	32	-54.9	3.3	4.27E-06	3.70E-06	55.6
70-75	38	-53.0	4.4	7.96E-06	7.17E-06	73.4
75-80	25	-53.4	2.3	5.27E-06	3.09E-06	64.2
Grand Total	4,430	-46.0	46.9	9.80E-05	8.62E-09	221.3

Appendix 16 Summary of target strength, sigma, and estimated fish length, by depth strata, of single targets tracked using a 420 kHz, 6° transducer aimed sideward during night time, at Coquitlam Reservoir, November 2005.

Strata Range (m)	Number of Targets	Target Strength (dB) Mean	SD	Sigma (dB re 1 m^{-1}) Mean	SD	Expected Mean Target Size (mm)
0-5	35	-57.6	4.3	2.84E-06	3.10E-06	43.3
5-10	97	-57.6	4.2	3.12E-06	5.16E-06	43.6
10-15	41	-55.3	4.5	5.28E-06	7.52E-06	57.1
15-20	15	-54.1	6.4	1.66E-05	4.17E-05	79.4
20-25	8	-55.6	5.7	7.76E-06	1.56E-05	60.9
Grand Total	196	-56.6	57.09	5.16E-06	1.51E-10	49.8

Appendix 17. Summary of target strength, sigma, and estimated fish length, by depth strata, of single targets tracked using a 200 kHz, 6° transducer aimed downward during day time, at Coquitlam Reservoir, November 2005.

Strata Depth (m)	Number of Targets	Target Strength (dB)		Sigma (dB re 1 m^{-1})		Expected Mean Target Size (mm)
		Mean	SD	Mean	SD	
2-5	8	-54.04	3.3737	4.99E-06	3.30E-06	61.2
5-10	9	-56.72	4.6232	3.28E-06	2.89E-06	47.6
10-15	58	-50.45	9.4502	6.25E-05	1.20E-04	155.0
15-20	71	-54.30	5.9803	1.20E-05	2.69E-05	73.6
20-25	146	-51.31	8.134	3.98E-05	7.75E-05	125.4
25-30	103	-53.67	5.4675	1.32E-05	3.25E-05	76.5
30-35	67	-55.76	3.7678	4.08E-06	5.54E-06	52.1
35-40	53	-56.29	4.0721	3.74E-06	4.32E-06	49.7
40-45	39	-57.84	4.5805	4.21E-06	9.56E-06	44.9
45-50	58	-53.23	4.0157	6.84E-06	5.79E-06	69.6
50-55	92	-55.71	3.533	3.67E-06	2.96E-06	51.4
55-60	49	-56.73	2.9987	2.67E-06	1.84E-06	44.7
60-65	57	-52.68	5.9818	1.78E-05	3.73E-05	89.0
65-70	55	-55.60	2.8671	3.44E-06	2.58E-06	50.7
70-75	31	-52.93	4.2555	7.50E-06	6.03E-06	72.7
75-80	33	-51.83	4.1701	9.81E-06	8.85E-06	82.6
Grand Total	929	-54.0	54.3	1.62E-05	2.12881E-09	78.6

Appendix 18. Summary of target strength, sigma, and estimated fish length, by depth strata, of single targets tracked using a 420 kHz, 6° transducer aimed sideward during day time, at Coquitlam Reservoir, November 2005.

Strata Range (m)	Number of Targets	Target Strength (dB)		Sigma (dB re 1 m^{-1})		Expected Mean Target Size (mm)
		Mean	SD	Mean	SD	
0-5	6	-54.2	5.3	7.96E-06	1.18E-05	67.6
5-10	161	-57.1	4.2	4.64E-06	1.66E-05	47.3
10-15	360	-55.9	5.4	9.14E-06	3.34E-05	60.0
15-20	421	-55.6	5.7	1.31E-05	5.25E-05	65.3
20-25	215	-55.5	5.4	1.14E-05	4.27E-05	64.0
Grand Total	1163	-55.9	56.2	1.04E-05	1.62E-09	61.0

Appendix 19. Fish densities (No. • hectare^{-1}), by depth strata, for hydroacoustic surveys at Coquitlam Reservoir in May, 2005.

Cruise 1

Depth (m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Mean	Stdev	Variance	Sample Size	Stratum Area (ha)
0-5	119	255	28	268	467	184	97	142	26	112	216	92	144	85	114	11	69	42	45	87	55	127	106	11,284	21	1202
5-10	69	134	95	119	9	96	58	14	3	6	107	1	36	86	5	6	51	8	35	0	1	45	45	2,048	21	1140
10-15	4	29	45	113	11	50	33	31	119	267	153	85	30	43	49	69	19	59	1	0	0	58	63	4,030	21	1030
15-20	51	38	17	82	48	81	49	36	103	87	30	24	59	57	41	24	2	1	0			44	30	884	19	932
20-25	43	4	28	51	13	79	59	71	123	48	120	16	107	122	61	19	0	15	0			52	42	1,803	19	869
25-30	2	0	14	4	3	0	3	36	19	50	17	32	4	46	2	24	7	2	0			14	16	265	19	834
30-35	1	0	2	2	76	3	1	18	1	27	12	0	0	2	0	2	0	0				8	19	344	18	802
35-40	4	0	1	1	1	2	1	0	18	1	0	1	27	0	0	0	0	0				3	7	53	18	767
40-45	4	0	3	6	7	2	5	1	0	2	1	2	0	0	0	0	7	0				2	3	7	18	735
45-50	1	0	7	21	3	4	2	0	0	0	0	0	0	0	0	0	0					2	5	28	17	705
50-55	0	0	2	2	0	4	2	0	11	0	0	0	0	0	0	0	0					1	3	7	17	672
55-60		0	3	2	0	0	1	0	1	0	1	0	0	0	0	0	0					1	1	1	16	633
60-65		0	4	1	0	2	0	0	0	0	0	0	0	0	0	0	0					0	1	1	16	584
65-70		0	0	1	1	2	0	0	0	0	0	0	0	0	0	0						0	1	0	15	545
70-75			0	0	0	1	0	0	0	0	0	0	0	0	0	0						0	0	0	14	519
75-80			0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	0	14	493
80-85			0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	0	14	464
85-90																									0	436
90-95																									0	409
95-100																									0	384
100-105																									0	359
105-110																									0	336
Total	297	460	250	674	640	509	312	350	423	602	658	253	407	440	271	155	154	125	81	87	56	356	343	20,756	297	-

Cruise 2

Depth (m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Mean	Stdev	Variance	Sample Size	Stratum Area (ha)
0-5	31	155	143	73	190	157	318	303	198	181	189	154	2	58	149	9	74	67	1	14	13 #	118	95	8,949	21	1202
5-10	23	59	27	56	44	7	318	31	246	70	132	439	380	35	50	113	21	3	11	18	4	99	131	17,124	21	1140
10-15	50	140	63	52	162	138	45	58	108	245	340	109	172	126	92	38	2	2	3	2	0	93	88	7,675	21	1030
15-20	79	86	22	44	53	49	108	113	47	28	168	125	32	124	13	12	0	0	7			58	50	2,470	19	932
20-25	13	27	4	0	22	90	28	63	83	25	51	129	63	1	0	0	1	1	1			32	38	1,435	19	869
25-30	2	0	0	0	2	0	0	1	0	0	0	0	10	0	0	0	0	0	0			1	2	5	19	834
30-35	6	0	8	0	0	0	0	1	1	0	0	0	2	0	0	0	1	0				1	2	5	18	802
35-40	4	0	0	0	0	0	0	1	0	0	0	1	3	0	0	0	0	0				1	1	1	18	767
40-45	8	0	1	0	5	0	0	1	1	4	0	0	13	0	0	0	0	2				2	4	12	18	735
45-50	2	0	0	0	0	0	0	1	0	2	0	0	9	0	0	0	0					1	2	5	17	705
50-55	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0					0	0	0	17	672
55-60		0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0					0	0	0	16	633
60-65		0	0	0	0	3	0	2	0	0	0	0	7	0	0	0	0					1	2	4	16	584
65-70		0	0	0	0	0	0	2	0	0	0	0	0	0	0	0						0	0	0	15	545
70-75			0	0	0	0	3	0	0	0	0	0	0	0	0	0						0	1	1	14	519
75-80			1	0	0	0	0	1	0	0	0	0	2	0	2	0						0	1	0	14	493
80-85			0	0	0	0	0	0	0	0	0	0	0	0	0	0						-	-	-	14	464
85-90																									0	436
90-95																									0	409
95-100																									0	384
100-105																									0	359
105-110																									0	336
Total	219	466	270	225	477	443	821	578	685	556	882	958	695	345	306	172	99	76	23	34	18	407	416	37,686	297	-

Mean Density (All Cruises)

Depth (m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Mean	Stdev	Variance	Sample Size	Stratum Area (ha)
0-5	75	205	85	170	328	171	208	222	112	147	203	123	73	71	132	10	72	54	23	51	34	122	80	6,479	21	1202
5-10	46	97	61	87	26	51	188	22	125	38	119	220	208	61	27	59	36	5	23	9	3	72	66	4,295	21	1140
10-15	27	84	54	83	87	94	39	44	113	256	247	97	101	84	70	54	10	30	2	1	0	75	68	4,686	21	1030
15-20	65	62	20	63	50	65	78	75	75	57	99	74	46	90	27	18	1	1	4			51	31	945	19	932
20-25	28	15	16	26	17	84	44	67	103	36	85	72	85	61	30	10	0	8	1			42	33	1,083	19	869
25-30	2	0	7	2	2	0	2	19	9	25	9	16	7	23	1	12	4	1	0			7	8	65	19	834
30-35	3	0	5	1	38	1	1	10	1	14	6	0	1	1	0	1	0	0				5	9	84	18	802
35-40	4	0	1	0	0	1	1	0	9	0	0	1	15	0	0	0	0	0				2	4	16	18	767
40-45	6	0	2	3	6	1	3	1	0	3	0	1	6	0	0	0	4	1				2	2	5	18	735
45-50	1	0	4	11	1	2	1	0	0	1	0	0	5	0	0	0	0					2	3	7	17	705
50-55	0	0	1	1	0	2	1	0	6	0	0	0	0	0	0	0	0					1	1	2	17	672
55-60		0	1	1	0	0	1	1	0	0	1	1	1	0	0	0	0					0	0	0	16	633
60-65		0	2	0	0	2	0	1	0	0	0	0	4	0	0	0	0					1	1	1	16	584
65-70		0	0	0	1	1	0	1	0	0	0	0	0	0	0	0						0	0	0	15	545
70-75			0	0	0	0	1	0	0	0	0	0	0	0	0	0						0	0	0	14	519
75-80			1	0	0	0	0	1	0	0	0	0	1	0	1	0						0	0	0	14	493
80-85			0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	0	14	464
85-90																									0	436
90-95																									0	409
95-100																									0	384
100-105																									0	359
105-110																									0	336
Total	258	463	260	449	559	476	566	464	554	579	770	606	551	392	289	163	127	101	52	60	37	382	308	17,669	297	-

Appendix 20. Fish densities (No. • hectare^{-1}), by depth strata, for hydroacoustic surveys at Coquitlam Reservoir in November, 2005.

Night Cruise

Depth (m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Mean	Stdev	Variance	Sample Size	Stratum Area (ha)
0-5	19	10	13	19	21	8	12	47	233	181	18	36	41	19	78	32	491	325	322	25	82	97	135	18,127	21	1202
5-10	40	4	15	0	19	2	5	10	2	1	1	21	10	0	8	10	25	5	1	6	6	9	10	100	21	1140
10-15	16	22	11	1	5	6	6	0	5	0	2	0	1	3	0	20	10	31	1	0	0	7	9	76	21	1030
15-20	23	35	50	14	83	21	75	32	28	59	21	13	29	24	4	0	6	40	10			30	23	534	19	932
20-25	12	45	75	53	46	18	117	49	68	44	26	25	24	19	26	12	19	6	0			36	28	802	19	869
25-30	2	0	25	14	10	17	23	11	16	14	6	10	4	1	9	0	1	5	0			9	8	60	19	834
30-35	1	0	84	0	6	0	1	41	11	0	0	9	1	0	21	0	2	26				11	21	459	18	802
35-40	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0				0	0	0	18	767
40-45	0	0	0	0	0	0	0	0	2	0	0	0	2	3	0	0	0	0				0	1	1	18	735
45-50	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0					0	0	0	17	705
50-55	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0					0	0	0	17	672
55-60		0	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0					0	1	1	16	633
60-65		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0					0	0	0	16	584
65-70		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	0	15	545
70-75			0	0	0	1	0	0	0	0	0	0	0	0	0	0						0	0	0	14	519
75-80			0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	0	14	493
80-85			0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	0	14	464
85-90																									0	436
90-95																									0	409
95-100																									0	384
100-105																									0	359
105-110																									0	336
Total	94	106	272	100	191	75	239	190	370	299	80	114	112	71	146	74	553	438	334	31	89	200	237	20,160	297	-

Day Cruise

Depth (m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Mean	Stdev	Variance	Sample Size	Stratum Area (ha)
0-5	-	12	8	24	23	213	107	34	38	3	23	55	292	18	346	78	98	82	218	23	201	95	103	10,576	20	1202
5-10	-	0	1	0	0	0	7	0	2	0	0	9	0	2	0	0	0	0	5	0	0	1	3	7	20	1140
10-15	-	0	0	0	28	0	4	1	0	60	32	0	0	5	0	0	1	0	48	0	0	9	18	323	20	1030
15-20	-	0	0	0	1	0	21	2	39	19	37	0	0	1	0	0	2	0	0			7	13	169	18	932
20-25	-	0	0	0	1	8	3	7	0	0	12	0	4	0	0	0	74	0	0			6	17	296	18	869
25-30	-	0	0	0	0	8	27	27	0	1	29	0	1	54	0	44	0	0	0			11	17	305	18	834
30-35	-	0	0	0	1	1	1	1	0	4	0	0	0	0	0	0	1	0				1	1	1	17	802
35-40	-	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0				0	0	0	17	767
40-45	-	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0				0	0	0	17	735
45-50	-	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0					0	0	0	16	705
50-55	-	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1					0	0	0	16	672
55-60		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0					0	0	0	16	633
60-65		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	0	15	584
65-70		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0						0	0	0	15	545
70-75			0	0	0	1	0	0	0	0	0	0	0	0	0	0						0	0	0	14	519
75-80			0	0	0	1	0	0	0	0	0	0	0	0	0	0						0	0	0	14	493
80-85			0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	0	14	464
85-90																									0	436
90-95																									0	409
95-100																									0	384
100-105																									0	359
105-110																									0	336
Total	0	12	9	24	56	236	176	73	80	87	135	63	298	80	346	123	176	82	271	23	201	130	174	11,677	285	-

Appendix 21. Summary of catch using gillnetting at Coquitlam Reservoir, May 2005.

	Gear						Location						Catch[a]										CPUE[b]									
Start Date	Start Set (hh:mm:ss)	Completely Out (hh:mm:ss)	Start haul in (hh:mm:ss)	Completely hauled in (hh:mm:ss)	Hours Fishing (hh:mm:ss)	Depth (m)	Northing	Westing	Region	Area	Site #	Set (No.)	CT	KO	CO	SU	NSC	PCC	RSS	SC	TSSB	Total	CT	KO	CO	SU	NSC	PCC	RSS	SC	TSSB	Total
15/May/05	20:31:00	20:58:00	13:15:00	14:00:00	16:53:00	15	49°23.595	122°47.606	South	Limnetic	8	1	4	16	0	0	6	5	0	0	0	31	0.24	0.95	0.00	0.00	0.36	0.30	0.00	0.00	0.00	1.84
15/May/05	19:00:00	19:21:00	09:30:00	10:00:00	14:34:30	5	49°22.148	122°47.261	South	Littoral	4	1	5	16	0	0	7	0	0	0	0	28	0.34	1.10	0.00	0.00	0.48	0.00	0.00	0.00	0.00	1.92
15/May/05	20:02:00	20:25:00	10:30:00	11:00:00	14:31:30	5	49°22.074	122°47.726	South	Limnetic	3	1	3	17	0	0	3	5	0	0	0	28	0.21	1.17	0.00	0.00	0.21	0.34	0.00	0.00	0.00	1.93
15/May/05	19:32:00	19:50:00	12:00:00	12:45:00	16:41:30	10	49°23.323	122°48.202	South	Limnetic	7	1	1	32	0	0	6	0	0	0	0	39	0.06	1.92	0.00	0.00	0.36	0.00	0.00	0.00	0.00	2.34
16/May/05	09:30:00	10:00:00	09:30:00	10:00:00	24:00:00	5	49°22.148	122°47.261	South	Littoral	4	2	5	3	0	0	6	2	0	0	0	16	0.21	0.13	0.00	0.00	0.25	0.08	0.00	0.00	0.00	0.67
16/May/05	10:15:00	10:30:00	10:30:00	11:00:00	24:22:30	15	49°22.074	122°47.726	South	Limnetic	3	2	4	16	0	0	2	0	0	0	0	22	0.16	0.66	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.90
16/May/05	12:00:00	12:48:00	11:30:00	12:00:00	23:21:00	15	49°23.323	122°48.202	South	Limnetic	7	2	3	16	0	1	4	2	3	0	0	29	0.13	0.69	0.00	0.04	0.17	0.09	0.13	0.00	0.00	1.24
16/May/05	13:15:00	14:00:00	12:20:00	13:15:00	23:10:00	25	49°23.595	122°47.606	South	Limnetic	8	2	2	6	0	5	14	12	0	0	0	39	0.09	0.26	0.00	0.22	0.60	0.52	0.00	0.00	0.00	1.68
17/May/05	19:00:00	19:35:00	09:30:00	10:00:00	14:27:30	20	49°24.555	122°47.388	Central	Limnetic	5	1	0	2	0	0	0	0	0	0	0	2	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
17/May/05	20:00:00	20:25:00	10:50:00	11:45:00	15:05:00	20	49°26.803	122°46.225	North	Limnetic	16	1	1	13	0	1	7	1	0	0	0	23	0.07	0.86	0.00	0.07	0.46	0.07	0.00	0.00	0.00	1.52
				Total	187.1		-	-	-	-	-	Total	28	137	0	7	55	27	3	0	0	257	1.50	7.86	0.00	0.32	2.97	1.39	0.13	0.00	0.00	14.18
				Mean	18.71	14	-	-	-	-	-	Mean	3	14	-	1	6	3	0	-	-	26	0.15	0.79	0.00	0.03	0.30	0.14	0.01	0.00	0.00	1.42
				Median	16.78	15	-	-	-	-	-	Median	3	16	-	0	6	2	0	-	-	28	0.15	0.77	0.00	0.00	0.30	0.07	0.00	0.00	0.00	1.60
				Count	10	10	-	-	-	-	-	Count	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10

Appendix 22. Summary of catch using gee-minnow trapping at Coquitlam Reservoir, May 2005.

	Gear						Location						Catch[a]										CPUE[c]									
Start Date	Start Set (hh:mm:ss)	Completely Out (hh:mm:ss)	Start haul in (hh:mm:ss)	Completely hauled in (hh:mm:ss)	Hours Fishing (hh:mm:ss)	Depth (m)	Northing	Westing	Region	Area	Site #	No. traps (#)	CT	KO	CO	SU	NSC	PCC	RSS	SC	TSSB	Total	CT	KO	CO	SU	NSC	PCC	RSS	SC	TSSB	Total
15/May/05	20:31:00	20:58:00	13:15:00	14:00:00	16:53:00	2	49°23.595	122°47.606	South	Littoral	8	2	0	0	0	0	11	0	2	0	0	13	0.00	0.00	0.00	0.00	0.33	0.00	0.06	0.00	0.00	0.38
15/May/05	19:00:00	19:21:00	09:30:00	10:00:00	14:34:30	2	49°22.148	122°47.261	South	Littoral	4	2	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15/May/05	20:02:00	20:25:00	10:30:00	11:00:00	14:31:30	2	49°22.074	122°47.726	South	Littoral	3	2	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15/May/05	19:32:00	19:50:00	12:00:00	12:45:00	16:41:30	2	49°23.323	122°48.202	South	Littoral	7	2	0	0	0	0	5	0	3	0	0	8	0.00	0.00	0.00	0.00	0.15	0.00	0.09	0.00	0.00	0.24
16/May/05	09:30:00	10:00:00	09:30:00	10:00:00	24:00:00	2	49°22.148	122°47.261	South	Littoral	4	6	1	0	0	0	7	1	8	3	18	38	0.01	0.00	0.00	0.00	0.05	0.01	0.06	0.02	0.13	0.26
16/May/05	10:15:00	10:30:00	10:30:00	11:00:00	24:22:30	2	49°22.074	122°47.726	South	Littoral	3	2	0	0	0	0	1	0	4	1	2	8	0.00	0.00	0.00	0.00	0.02	0.00	0.08	0.02	0.04	0.16
16/May/05	12:00:00	12:48:00	11:30:00	12:00:00	23:21:00	2	49°23.323	122°48.202	South	Littoral	7	2	3	0	0	0	0	0	4	0	0	7	0.06	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.15
16/May/05	13:15:00	14:00:00	12:20:00	13:15:00	23:10:00	2	49°23.595	122°47.606	South	Littoral	8	2	0	0	0	0	1	0	8	2	0	11	0.00	0.00	0.00	0.00	0.02	0.00	0.17	0.04	0.00	0.24
17/May/05	19:00:00	19:35:00	09:30:00	10:00:00	14:27:30	2	49°24.555	122°47.388	Central	Littoral	5	2	1	0	0	0	5	0	0	1	5	12	0.03	0.00	0.00	0.00	0.17	0.00	0.00	0.03	0.17	0.42
17/May/05	20:00:00	20:25:00	10:50:00	11:45:00	15:05:00	2	49°26.803	122°46.225	North	Littoral	16	2	0	0	0	1	8	0	1	0	1	11	0.00	0.00	0.00	0.03	0.27	0.00	0.03	0.00	0.03	0.36
18/May/05	19:20:00	19:30:00	09:15:00	09:20:00	13:52:30	2	49°21.400	122°47.180	South	Limnetic	L-1	3	0	0	0	0	0	0	0	0	4	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10
18/May/05	19:45:00	19:50	08:55:00	09:00:00	13:10:00	2	49°22.560	122°47.960	South	Limnetic	L-2	3	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18/May/05	20:10:00	20:15	08:40:00	08:45:00	12:30:00	2	49°23.580	122°47.600	Central	Limnetic	L-3	3	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18/May/05	20:20:00	20:25	08:30:00	08:35:00	12:10:00	2	49°24.530	122°46.430	Central	Limnetic	L-4	3	0	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
				Total	238.8		-	-	-	-	-	Total	5	0	0	1	38	1	30	7	30	112	0.11	0.00	0.00	0.03	1.00	0.01	0.58	0.12	0.47	2.32
				Mean	17.06	2	-	-	-	-	-	Mean	0	0	0	0	3	0	2	1	2	8	0.01	0.00	0.00	0.00	0.07	0.00	0.04	0.01	0.03	0.17
				Median	14.83	2	-	-	-	-	-	Median	0	0	0	0	1	0	1	0	0	8	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.16
				Count	12	14	-	-	-	-	-	Count	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

[a] Fish abbreviations: Cutthroat Trout (CT), kokanee (KO), coho (CO), sucker (SU), peamouth chub (PCC), northern pikeminnow (NSC), redside shiner (RSS).

[b] Standardized to fish per hour using a 90 m^2 net.

[c] Standardized to fish per hour.

Appendix 23. Summary of catch using gillnetting at Coquitlam Reservoir, November 2005.

	Gear						Location						Catch [a]									CPUE [b]								
Start Date	Start Set (hh:mm:ss)	Completely Out (hh:mm:ss)	Start haul in (hh:mm:ss)	Completely hauled in (hh:mm:ss)	Hours Fishing (hh:mm:ss)	Depth (m)	Northing	Westing	Region	Area	Site #	Set (No.)	CT	KO	CO	SU	NSC	PCC	RSS	SC	Total	CT	KO	CO	SU	NSC	PCC	RSS	SC	Total
31/Oct/05	16:49:00	16:58:00	10:52:00	11:20:00	18:12:30	5	49°22.148	122°47.261	South	Littoral	4	1	3	4	0	0	2	1	0	0	10	0.16	0.22	0.00	0.00	0.11	0.05	0.00	0.00	0.55
31/Oct/05	16:20:00	16:30:00	13:40:00	13:55:00	21:22:30	25	49°23.595	122°47.606	South	Limnetic	8	1	1	4	0	0	1	0	0	0	6	0.05	0.19	0.00	0.00	0.05	0.00	0.00	0.00	0.28
31/Oct/05	15:50:00	16:00:00	14:40:00	16:00:00	23:25:00	15	49°23.323	122°48.202	South	Limnetic	7	1	5	36	0	1	3	3	0	0	48	0.21	1.54	0.00	0.04	0.13	0.13	0.00	0.00	2.05
31/Oct/05	15:20:00	15:30:00	16:45:00	17:40:00	24:27:30	15	49°24.555	122°47.388	Cetnral	Limnetic	5	1	9	11	0	4	6	11	0	0	41	0.36	0.44	0.00	0.16	0.24	0.44	0.00	0.00	1.65
2/Nov/05	11:15:00	11:20:00	12:40:00	12:50:00	01:27:30	15	49°25.520	122°46.320	Central	Limnetic	18	1	1	0	0	0	0	0	0	0	1	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69
2/Nov/05	11:30:00	11:35:00	13:15:00	13:30:00	01:50:00	5	49°25.470	122°45.340	Central	Littoral	17	1	1	4	0	0	0	0	0	0	5	0.55	2.18	0.00	0.00	0.00	0.00	0.00	0.00	2.73
2/Nov/05	12:05:00	12:10:00	13:40:00	14:00:00	01:42:30	20	49°26.610	122°46.229	North	Limnetic	15	1	0	1	0	0	0	0	0	0	1	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.59
2/Nov/05	12:40:00	12:50:00	14:10:00	14:20:00	01:30:00	15	49°25.520	122°46.320	Central	Limnetic	18	2	0	0	0	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2/Nov/05	13:15:00	13:30:00	14:35:00	14:50:00	01:20:00	5	49°25.470	122°45.340	Central	Littoral	17	2	1	2	0	0	0	0	0	0	3	0.75	1.50	0.00	0.00	0.00	0.00	0.00	0.00	2.25
2/Nov/05	14:10:00	14:20:00	00:50:00	01:50:00	11:05:00	15	49°25.520	122°46.320	Central	Limnetic	18	3	1	15	0	2	11	7	0	2	38	0.09	1.35	0.00	0.18	0.99	0.63	0.00	0.18	3.43
2/Nov/05	14:35:00	14:50:00	10:50:00	00:20:00	14:52:30	5	49°25.470	122°45.340	Central	Littoral	17	3	2	12	0	5	7	22	0	1	49	0.13	0.81	0.00	0.34	0.47	1.48	0.00	0.07	3.29
2/Nov/05	13:40:00	14:00:00	02:20:00	03:00:00	12:50:00	20	49°26.610	122°46.229	North	Limnetic	15	2	1	4	1	0	0	8	0	0	14	0.08	0.31	0.08	0.00	0.00	0.62	0.00	0.00	1.09
				Total	134.4		-	-	-	-	-	Total	25	93	1	12	30	52	0	3	216	3.07	9.13	0.08	0.72	1.99	3.36	0.00	0.25	18.60
				Mean	11.20	13	-	-	-	-	-	Mean	2	8	0	1	3	4	0	0	18	0.26	0.76	0.01	0.06	0.17	0.28	0.00	0.02	1.55
				Median	11.96	15	-	-	-	-	-	Median	1	4	0	0	1	1	0	0	8	0.15	0.51	0.00	0.00	0.02	0.03	0.00	0.00	1.37
				Count	12	12	-	-	-	-	-	Count	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12

Appendix 24 Summary of catch using gee-minnow trapping at Coquitlam Reservoir, November 2005.

	Gear						Location						Catch [a]									CPUE [c]								
Start Date	Start Set (hh:mm:ss)	Completely Out (hh:mm:ss)	Start haul in (hh:mm:ss)	Completely hauled in (hh:mm:ss)	Hours Fishing (hh:mm:ss)	Depth (m)	Northing	Westing	Region	Area	Site #	Set (No.)	CT	KO	CO	SU	NSC	PCC	RSS	SC	Total	CT	KO	CO	SU	NSC	PCC	RSS	SC	Total
31/Oct/05	16:55:00	17:15:00	12:00:00	12:20:00	19:05:00	2	49°22.148	122°47.261	South	Littoral	4	1	0	0	0	0	2	0	0	0	2	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.05
31/Oct/05	16:30:00	16:45:00	13:50:00	14:00:00	21:17:30	2	49°23.595	122°47.606	South	Littoral	8	2	0	0	0	0	2	0	0	1	3	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.02	0.05
31/Oct/05	16:05:00	16:20:00	15:30:00	15:45:00	23:25:00	2	49°23.323	122°48.202	South	Littoral	7	3	0	0	0	0	0	0	17	1	18	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.01	0.26
2/Nov/05	00:20:00	00:25:00	15:50:00	16:00:00	15:32:30	2	49°25.470	122°45.340	Central	Littoral	17	4	0	0	0	0	0	0	3	2	5	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.04	0.11
2/Nov/05	01:50:00	02:00:00	15:40:00	15:45:00	13:47:30	2	49°25.520	122°46.320	Central	Littoral	18	5	0	0	0	0	2	0	6	0	8	0.00	0.00	0.00	0.00	0.05	0.00	0.15	0.00	0.19
2/Nov/05	03:00:00	03:15:00	15:25:00	15:30:00	12:20:00	2	49°26.610	122°46.229	North	Littoral	15	6	0	0	0	0	3	0	1	0	4	0.00	0.00	0.00	0.00	0.08	0.00	0.03	0.00	0.11
				Total	98.7		-	-	-	-	-	Total	0	0	0	0	9	0	27	4	40	0.00	0.00	0.00	0.00	0.21	0.00	0.48	0.07	0.77
				Mean	16.45	2	-	-	-	-	-	Mean	0	0	0	0	2	0	5	1	7	0.00	0.00	0.00	0.00	0.04	0.00	0.08	0.01	0.13
				Median	14.67	2	-	-	-	-	-	Median	0	0	0	0	2	0	2	1	5	0.00	0.00	0.00	0.00	0.04	0.00	0.05	0.01	0.11
				Count	6	6	-	-	-	-	-	Count	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6

Appendix 25. Summary of catch using mid-water trawling at Coquitlam Reservoir, November 2005.

	Gear						Location						Catch [a]									CPUE [d]								
Start Date	Start set (hh:mm:ss)	Completely out (hh:mm:ss)	Start haul in (hh:mm:ss)	Completely hauled in (hh:mm:ss)	Hours Fishing (hh:mm:ss)	Depth (m)	Northing	Westing	Region	Area	Site #		CT	KO	CO	SU	NSC	PCC	RSS	SC	Total	CT	KO	CO	SU	NSC	PCC	RSS	SC	Total
24/Nov/05	17:52:00	17:53:00	18:08:00	18:10:00	00:16:30	10	49°24.754	122°46.564	Central	Limnetic	100		0	1	0	0	0	0	0	0	1	0	0.4	0	0	0	0	0	0	0.4
24/Nov/05	18:36:00	18:37:00	18:55:00	18:58:00	00:20:00	25	49°25.339	122°46.301	Central	Limnetic	100		0	2	0	0	0	0	0	0	2	0	0.9	0	0	0	0	0	0	0.9
				Total	00:36:30	-	-	-	-	-	-	Total	0	3	0	0	0	0	0	0	3	0	1.3	0	0	0	0	0	0	1.3
				Mean	00:18:00	18	-	-	-	-	-	Mean	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0	0.7	0	0	0	0	0	0	0.7

[a] Fish abbreviations: Cutthroat Trout (CT), kokanee (KO), coho (CO), sucker (SU), peamouth chub (PCC), northern pikeminnow (NSC), redside shiner (RSS).

[b] Standardized to fish per hour using a 90 m^2 net.

[c] Standardized to fish per hour.

[d] Standardized to fish per hectare using a multi-panel trawl with a 21 m^2 mouth.

Appendix 26. Summary of catch, catch-per-unit-effort, and biomass of fish collected using gillnets at Coquitlam Reservoir, May 2005.

	Catch (No.)				Proportion of Catch (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	1	0	27	28	0%	0%	11%	11%
Kokanee	13	2	122	137	5%	1%	47%	53%
Coho	0	0	0	0	0%	0%	0%	0%
Large scale sucker	1	0	6	7	0%	0%	2%	3%
Northern pikeminnow	7	0	48	55	3%	0%	19%	21%
Peamouth chub	1	0	26	27	0%	0%	10%	11%
Redside shiner	0	0	3	3	0%	0%	1%	1%
Sculpin	0	0	0	0	0%	0%	0%	0%
Three-spine stickleback	0	0	0	0	0%	0%	0%	0%
Total	23	2	232	257	9%	1%	90%	100%

	CPUE (No. / 90 m^2 •hr)				Proportion of CPUE (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0.07	0.00	0.18	0.25	2%	0%	6%	8%
Kokanee	0.86	0.14	0.86	1.86	27%	4%	27%	58%
Coho	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Large scale sucker	0.07	0.00	0.03	0.10	2%	0%	1%	3%
Northern pikeminnow	0.46	0.00	0.31	0.78	14%	0%	10%	24%
Peamouth chub	0.07	0.00	0.17	0.23	2%	0%	5%	7%
Redside shiner	0.00	0.00	0.02	0.02	0%	0%	0%	0%
Sculpin	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Three-spine stickleback	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Total	1.52	0.14	1.56	3.23	47%	4%	48%	100%

	Biomass (kg)				Proportion of Biomass (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0.183	0.000	6.231	6.414	0%	0%	15%	15%
Kokanee	1.141	0.114	9.698	10.953	3%	0%	23%	26%
Coho	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Large scale sucker	0.054	0.000	2.025	2.079	0%	0%	5%	5%
Northern pikeminnow	2.971	0.000	17.314	20.285	7%	0%	42%	49%
Peamouth chub	0.068	0.000	1.819	1.888	0%	0%	4%	5%
Redside shiner	0.000	0.000	0.050	0.050	0%	0%	0%	0%
Sculpin	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Three-spine stickleback	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Total	4.418	0.114	37.137	41.669	11%	0%	89%	100%

Appendix 27. Summary of catch, catch-per-unit-effort, and biomass of fish collected using minnow traps at Coquitlam Reservoir, May 2005.

	Catch (No.)				Proportion of Catch (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0	1	4	5	0%	1%	4%	4%
Kokanee	0	0	0	0	0%	0%	0%	0%
Coho	0	0	0	0	0%	0%	0%	0%
Large scale sucker	1	0	0	1	1%	0%	0%	1%
Northern pikeminnow	8	5	25	38	7%	4%	22%	34%
Peamouth chub	0	0	1	1	0%	0%	1%	1%
Redside shiner	1	0	29	30	1%	0%	26%	27%
Sculpin	0	1	6	7	0%	1%	5%	6%
Three-spine stickleback	1	5	24	30	1%	4%	21%	27%
Total	11	12	89	112	10%	11%	79%	100%

	CPUE (No. / trap •hr)				Proportion of CPUE (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0.00	0.01	0.01	0.02	0%	2%	1%	3%
Kokanee	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Coho	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Large scale sucker	0.03	0.00	0.00	0.03	5%	0%	0%	5%
Northern pikeminnow	0.27	0.06	0.06	0.38	40%	9%	9%	58%
Peamouth chub	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Redside shiner	0.03	0.00	0.05	0.09	5%	0%	8%	13%
Sculpin	0.00	0.01	0.01	0.02	0%	2%	1%	3%
Three-spine stickleback	0.03	0.06	0.03	0.12	5%	9%	4%	18%
Total	0.36	0.14	0.15	0.66	56%	21%	23%	100%

	Biomass (kg)				Proportion of Biomass (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0.000	0.010	0.055	0.065	0%	2%	12%	14%
Kokanee	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Coho	0.003	0.000	0.000	0.003	1%	0%	0%	1%
Large scale sucker	0.003	0.000	0.000	0.003	1%	0%	0%	1%
Northern pikeminnow	0.036	0.041	0.133	0.211	8%	9%	29%	46%
Peamouth chub	0.000	0.000	0.001	0.001	0%	0%	0%	0%
Redside shiner	0.002	0.000	0.067	0.069	0%	0%	15%	15%
Sculpin	0.000	0.007	0.064	0.071	0%	1%	14%	16%
Three-spine stickleback	0.001	0.004	0.027	0.032	0%	1%	6%	7%
Total	0.044	0.063	0.346	0.453	10%	14%	76%	100%

Appendix 28. Summary of catch, catch-per-unit-effort, and biomass of fish collected using gillnets at Coquitlam Reservoir, November 2005.

	Catch (No.)				Proportion of Catch (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	1	15	9	25	0%	7%	4%	12%
Kokanee	4	45	44	93	2%	21%	20%	43%
Coho	1	0	0	1	0%	0%	0%	0%
Large scale sucker	0	11	1	12	0%	5%	0%	6%
Northern pikeminnow	0	24	6	30	0%	11%	3%	14%
Peamouth chub	8	40	4	52	4%	19%	2%	24%
Redside shiner	0	0	0	0	0%	0%	0%	0%
Sculpin	0	3	0	3	0%	1%	0%	1%
Three-spine stickleback	0	0	0	0	0%	0%	0%	0%
Total	14	138	64	216	6%	64%	30%	100%

	CPUE (No. / 90 m^2 •hr)				Proportion of CPUE (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0.04	0.37	0.20	0.60	1%	9%	5%	15%
Kokanee	0.45	0.97	0.60	2.02	11%	24%	15%	50%
Coho	0.04	0.00	0.00	0.04	1%	0%	0%	1%
Large scale sucker	0.00	0.09	0.05	0.14	0%	2%	1%	3%
Northern pikeminnow	0.00	0.24	0.13	0.38	0%	6%	3%	9%
Peamouth chub	0.31	0.35	0.16	0.82	8%	9%	4%	20%
Redside shiner	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Sculpin	0.00	0.04	0.00	0.04	0%	1%	0%	1%
Three-spine stickleback	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Total	0.84	2.06	1.13	4.04	21%	51%	28%	100%

	Biomass (kg)				Proportion of Biomass (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0.115	3.488	4.980	8.582	0%	10%	14%	25%
Kokanee	0.375	6.243	6.003	12.621	1%	18%	17%	36%
Coho	0.016	0.000	0.000	0.016	0%	0%	0%	0%
Large scale sucker	0.000	2.006	0.441	2.447	0%	6%	1%	7%
Northern pikeminnow	0.000	5.058	1.581	6.638	0%	14%	5%	19%
Peamouth chub	0.581	3.486	0.495	4.562	2%	10%	1%	13%
Redside shiner	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Sculpin	0.000	0.139	0.000	0.139	0%	0%	0%	0%
Three-spine stickleback	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Total	1.086	20.419	13.499	35.005	3%	58%	39%	100%

Appendix 29. Summary of catch, catch-per-unit-effort, and biomass of fish collected using minnow traps at Coquitlam Reservoir, November 2005.

	Catch (No.)				Proportion of Catch (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0	0	0	0	0%	0%	0%	0%
Kokanee	0	0	0	0	0%	0%	0%	0%
Coho	0	0	0	0	0%	0%	0%	0%
Large scale sucker	0	0	0	0	0%	0%	0%	0%
Northern pikeminnow	3	2	4	9	8%	5%	10%	23%
Peamouth chub	0	0	0	0	0%	0%	0%	0%
Redside shiner	1	8	17	26	3%	21%	44%	67%
Sculpin	0	3	1	4	0%	8%	3%	10%
Three-spine stickleback	0	0	0	0	0%	0%	0%	0%
Total	4	13	22	39	10%	33%	56%	100%

	CPUE (No. / trap •hr)				Proportion of CPUE (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Kokanee	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Coho	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Large scale sucker	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Northern pikeminnow	0.08	0.02	0.03	0.13	21%	6%	8%	35%
Peamouth chub	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Redside shiner	0.03	0.10	0.08	0.21	7%	28%	21%	56%
Sculpin	0.00	0.02	0.01	0.03	0%	6%	3%	8%
Three-spine stickleback	0.00	0.00	0.00	0.00	0%	0%	0%	0%
Total	0.11	0.15	0.12	0.38	29%	40%	32%	100%

	Biomass (kg)				Proportion of Biomass (%)			
	North	Central	South	Total	North	Central	South	Total
Cutthroat trout	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Kokanee	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Coho	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Large scale sucker	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Northern pikeminnow	0.033	0.030	0.075	0.138	13%	12%	30%	55%
Peamouth chub	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Redside shiner	0.006	0.025	0.052	0.083	2%	10%	21%	33%
Sculpin	0.000	0.029	0.000	0.029	0%	12%	0%	12%
Three-spine stickleback	0.000	0.000	0.000	0.000	0%	0%	0%	0%
Total	0.039	0.085	0.127	0.250	15%	34%	51%	100%

Appendix 30. Biosample data for fish collected at Coquitlam Reservoir, May 2005.

Fish Id. (#)	Date dd-mm	Gear Type [a]	Site (#)	Species [b]	Sex [c]	Life Stage [d]	Fork Length (mm)	Weight (g)	K-factor (#)	Capture Type [e]	Gill Raker: Raker Id. (#)	Gill Raker Length: Raker 1 mm	Raker 2 mm	Raker 3 mm	Mean mm	Upper Count (#)	Lower Count (#)	Total Count (#)	Scale Book (#)	Scale Cell (#)	Age reading: Scale (#)	Annuli: 1st (#)	2nd (#)	3rd (#)	4th (#)	Total (#)	Distance to Seventh Circuli [f]	Distance to first annulus [f]	Otolith (#)	Stomach Sample (#)	Stomach Fullness [g]	DNA Vial (#)	Isotope Sample (#)	Comments
1	15-May-05	GN	8	PCC	U	1	125	18.9	0.94	W																								
2	15-May-05	GN	8	NSC	U	1				W																								Poor sample, length or weight not measured
3	15-May-05	GN	8	PCC	U	1	125	20.1	1.00	W																								
4	15-May-05	GN	8	NSC	U	1	220	125.4	1.17	G																								
5	15-May-05	GN	8	CT	U	1	308	281.8	0.96	E																								
6	15-May-05	GN	8	NSC	U	1	423	1236	1.63	G																								
7	15-May-05	GN	8	KO	M	1	178	59.9	1.05	W																			70					
8	15-May-05	GN	8	KO	M	1	220	123	1.15	W	32	6.4	6.2	6.2	6.3	16	21	39											40					
9	15-May-05	GN	8	KO	F	1	205	94.7	1.09	W	27	6.8	7.2	5.8	6.6	14	20	36											35					
10	15-May-05	GN	8	NSC	U	1	401	1119	1.73	E																								
11	15-May-05	GN	8	KO	M	1	212	106.9	1.12	S	20	7.1	6.7	6.3	6.7	13	18	33											28					
12	15-May-05	GN	8	KO	U	1	214	110	1.12	E																								
13	15-May-05	GN	8	PCC	U	1	206	99.5	1.13	G																								
14	15-May-05	GN	8	CT	U	1	250	143	0.91	G																								
15	15-May-05	GN	8	PCC	U	1	179	61.3	1.06	W																								
16	15-May-05	GN	8	KO	M	1	180	68.5	1.17	W	23	5.9	5.8	5.0	5.6	14	20	36											31					
17	15-May-05	GN	8	KO	U	1	210	104.6	1.12	S																								
18	15-May-05	GN	8	KO	U	1	217	108.5	1.06	G																								
19	15-May-05	GN	8	KO	M	1	205	99	1.14	G	28	7.6	7.0	6.4	7.0	14	20	36											36					
20	15-May-05	GN	8	KO	F	1	211	98.3	1.04	E	34	6.2	6.0	5.9	6.0	14	20	36											42					
21	15-May-05	GN	8	KO	M	1	155	50.4	1.34	W	22	4.5	3.8	4.5	4.3	12	20	34											30					
22	15-May-05	GN	8	KO	U	1	216	88.5	0.87	W																								
23	15-May-05	GN	8	KO	U	1	168	54.1	1.13	W																								
24	15-May-05	GN	8	KO	U	1	175	60.1	1.11	E																								
25	15-May-05	GN	8	KO	F	1	204	83.9	0.98	S	33	6.3	6.3	6.0	6.2	14	18	34											41					
26	15-May-05	GN	8	KO	F	1	210	102.4	1.10	G																			71					
27	15-May-05	GN	8	PCC	U	1	187	85.7	1.30	W																								
28	15-May-05	GN	8	NSC	U	1	351	519	1.20	G																								
29	15-May-05	GN	4	CT	F	1	294	229.1	0.90	W																				4	4			
30	15-May-05	GN	4	KO	F	1	182	59.3	0.98	W									2968	39-40	2+	12	20	4		36	28	39	109	2	1	2	2	
31	15-May-05	GN	4	KO	F	1	211	97.1	1.03	G									2968	37-38	3+	14	20	11	2	47	25	42	103	1	1	1	1	
32	15-May-05	GN	4	KO	F	1	199	85.4	1.08	G									2968	41-42	3+	14	13	14	2	43	23	37	95	3	1	3	3	
33	15-May-05	GN	4	KO	F	1	175	58.4	1.08	W									2968	43-44	2+	13	21	4		38	22	36	112	5	3	4	4	
34	15-May-05	GN	4	KO	M	1	173	52.7	1.01	W									2968	45-46	2+	13	21	4		38	23	38	93	6	3	5	5	
35	15-May-05	GN	4	KO	F	1	175	56.2	1.04	W									2968	47-48	2+	13	19	3		35	24	38	107	7	1	6	6	
36	15-May-05	GN	4	KO	F	1	174	58.4	1.10	W									2968	49-50	2+	12	18	3		33	25	38	106	8	2	7	7	
37	15-May-05	GN	4	KO	M	1	219	115.6	1.10	G									2969	1-2	3+	15	19	11	1	46	27	44	111	9	2			
38	15-May-05	GN	4	KO	M	1	194	66.2	0.90	W									2969	3-4	n/a						0	0	104	10	3			Head severed
39	15-May-05	GN	4	KO	F	1	197	90.4	1.18	W									2969	5-6	3+	13	18	11	4	46	23	36	105	11	2			
40	15-May-05	GN	4	KO	F	1	210	98	1.05	W									2969	7-8	3+	14	17	10	2	43	25	43	100	12	3			
41	15-May-05	GN	4	PCC	M	2	172	61.7	1.20	E																				13	2			
42	15-May-05	GN	4	PCC	M	1	189	81.7	1.20	W																				14	2			
43	15-May-05	GN	4	KO	F	1	204	90.2	1.06	W									2969	9-10	3+	11	17	12	2	42	25	34	108	15	1			
44	15-May-05	GN	4	KO	F	1	203	83.4	0.99	G									2969	11-12	3+	13	17	13	3	46	23	34	110	16	1			
45	15-May-05	GN	4	KO	U	1	184	65.8	1.05	W									2969	13-14	3+	7	22	13	1	43	22	22		17				Head missing, stomach and testes not present
46	15-May-05	GN	4	KO	M	1	180	65.4	1.11	W									2969	15-16	2+	15	21	4		40	25	44	96	18	3			
47	15-May-05	GN	4	KO	F	1	218	101.5	0.97	W									2969	17-18	3+	15	17	13	2	47	25	42	113	19	1			
48	15-May-05	GN	4	KO	F	1	174	56.9	1.07	W									2969	19-20	2+	14	21	2		37	23	41	114	20	1			
49	15-May-05	GN	4	PCC	M	2	195	79	1.06	W																				21	3			
50	15-May-05	GN	4	PCC	M	2	170	46.1	0.93	W																				22	2			
51	15-May-05	GN	4	CT	M	2	220	93.2	0.87	E																				23	4			
52	15-May-05	GN	4	PCC	M	2	178	61.7	1.09	W																				24	2			
53	15-May-05	GN	4	NSC	F	2	339	470.2	1.21	E																				25	4			
54	15-May-05	GN	4	NSC	M	2	301	295.8	1.08	G																				26	3			
55	15-May-05	GN	4	CT	M	2	349	395.9	0.93	E																				27	3			
56	15-May-05	GN	4	NSC	F	1	280	257.7	1.17	E																				28	3			
57	15-May-05	GN	3	CT	F	1	312	288.1	0.95	S																				8	4			
58	15-May-05	GN	3	KO	F	1	216	118.6	1.17	W									2969	33-34	3+	13	17	7	2	39	25	39	90	9	3			
59	15-May-05	GN	3	KO	F	1	179	66.4	1.15	S									2969	35-36	2+	11	22	3		36	24	34	91	10	1			
60	15-May-05	GN	3	CT	M	2	165	48.8	1.08	E																				23	4			
61	15-May-05	GN	3	NSC	M	2	223	130	1.17	G																				26	3			
62	15-May-05	GN	3	NSC	M	2	239	144	1.05	W																				24	2			Stomach removed before weighing
63	15-May-05	GN	3	NSC	F	2	433	1050	1.29	G																				25	4			
64	15-May-05	GN	3	KO	F	2	216	104.9	1.04	G									2970	1-2	3+	14	20	13	2	49	24	42	87	27	2			
65	15-May-05	GN	3	KO	F	1	176	54.6	0.99	W	30	5.7	4.0	4.3	4.7	15	20	37	2969	31-32	2+	12	18	3		33	25	37	38	7	1			

Fish Id. (#)	Date dd-mm	Gear Type [a]	Site (#)	Species [b]	Sex [c]	Life Stage [d]	Fork Length (mm)	Weight (g)	K-factor (#)	Capture Type [e]	Gill Raker: Raker Id. (#)	Length: Raker 1 mm	Raker 2 mm	Raker 3 mm	Mean mm	Upper Count (#)	Lower Count (#)	Total Count (#)	Age reading: Scale Book (#)	Scale Cell (#)	Scale (#)	Annuli: 1st (#)	2nd (#)	3rd (#)	4th (#)	Total (#)	Distance to Seventh Circuli [f]	Distance to first annulus [f]	Otolith (#)	Stomach Sample (#)	Stomach Fullness [g]	DNA Vial (#)	Isotope Sample (#)	Comments
66	15-May-05	GN	3	KO	F	1	210	102.4	1.10	G									2969	29-30	3+	13	18	11	1	43	27	42	102	6	2	5	5	
67	15-May-05	GN	3	KO	M	1	181	65	1.09	W									2969	21-22	2+	11	20	3		34	25	34		1	2	1	1	
68	15-May-05	GN	3	KO	F	1	214	112.2	1.14	G									2969	23-24	3+	14	17	9	1	41	25	42	101	2	3	2	2	
69	15-May-05	GN	3	CT	F	1	287	225.2	0.95	S																				3	4			
70	15-May-05	GN	3	KO	F	1	172	57.8	1.13	W									2969	25-26	2+	13	19	3		35	27	39		4	2	3	3	
71	15-May-05	GN	3	KO	F	1	205	95.1	1.10	W	19	5.4	5.0	4.5	5.0	12	20	34	2969	27-28	3+	12	19	9	1	41	23	36		5	1	4	4	
72	15-May-05	GN	3	NSC	M	2	344	524	1.29	E																				28	3			
73	15-May-05	GN	3	KO	F	1	175	57.4	1.06	W									2969	37-38	2+	12	18	3		33	24	33	94	11	1			
74	15-May-05	GN	3	KO	F	1	204	94.8	1.11	G									2969	39-40	3+	14	20	11	2	47	23	38	92	12	3			
75	15-May-05	GN	3	KO	F	1	178	57.1	1.00	W									2969	41-42	n/a						0	0	88	13	1			
76	15-May-05	GN	3	KO	M	1	169	52.2	1.07	W									2969	43-44	2+	12	20	3		35	24	36	97	14	1			
77	15-May-05	GN	3	KO	F	1	177	67.1	1.20	W									2969	45-46	2+	15	20	3		38	27	44	98	15	2			
78	15-May-05	GN	3	CT	F	1	275	218	1.05	S																				16	4			
79	15-May-05	GN	3	KO	M	1	185	60.1	0.94	W									2969	47-48	2+	13	19	4		36	25	37	89	17	0			
80	15-May-05	GN	3	KO	F	1	171	55.8	1.11	W									2969	49-50	n/a						0	0	99	18	0			
81	15-May-05	GN	3	NSC	M	1	190	71.4	1.03	W																				19	3			
82	15-May-05	GN	3	CT	M	2	349	392.5	0.92	S																				20	3			
83	15-May-05	GN	3	NSC	M	2	322	390.5	1.17	G																				21	4			Stomach infested with worms
84	15-May-05	GN	3	NSC	M	2	295	297.2	1.16	E																				22	4			
85	15-May-05	GN	7	KO	F	2	208	103.5	1.14	W									2968	35-36	3+	13	18	15	2	48	23	38	10	20	2		20	
86	15-May-05	GN	7	NSC	M	1	202	91.1	1.10	G																				19	3		19	
87	15-May-05	GN	7	KO	M	1	218	113.3	1.09	G									2968	33-34	3+	13	20	12	1	46	23	37	13	18	1		18	
88	15-May-05	GN	7	KO	F	1	180	58.2	0.99	W									2968	31-32	n/a						0	0	16	17	2		17	
89	15-May-05	GN	7	KO	M	1	178	65.6	1.15	W	1	5.2	4.8	4.9	5.0	11	9		2968	29-30	2+	10	21	2		33	25	32		16	4		16	
90	15-May-05	GN	7	KO	F	2	215	108.5	1.09	G									2968	27-28	3+	14	22	10	1	47	24	39	6	15	2		15	
91	15-May-05	GN	7	KO	M	1	193	77.7	1.07	G									2968	25-26	3+	7	17	16	2	42	18	18	14	14	1		14	
92	15-May-05	GN	7	KO	M	1	193	72.7	1.00	W									2968	23-24	3+	7	14	15	2	38	18	18	15	13	1		13	
93	15-May-05	GN	7	KO	F	1	200	85.6	1.06	G									2968	21-22	3+	12	17	11	2	42	22	32	5	12	1		12	
94	15-May-05	GN	7	KO	F	1	167	54.1	1.15	W									2968	19-20	2+	16	15	2		33	28	42	12	11	3		11	
95	15-May-05	GN	7	KO	F	2	214	112.3	1.14	G	4	5.8	5.6	5.4	5.6	10	13		2968	17-18	3+	15	20	11	1	47	24	41	2	10	1		10	
96	15-May-05	GN	7	KO	M	1	182	67.6	1.11	W									2968	15-16	2+	10	20	3		33	24	34		9	1		9	
97	15-May-05	GN	7	KO	M	2	200	78.2	0.97	G									2968	13-14	3+	12	18	11	1	42	23	34	9	8	1		8	
98	15-May-05	GN	7	KO	M	1	173	60.2	1.15	G																			7	2	1	2	2	
99	15-May-05	GN	7	KO	F	1	177	60.6	1.08	W									2968	11-12	2+	14	17	3		34	28	43	11	7	1		7	
100	15-May-05	GN	7	KO	M	1	179	70.3	1.22	W	2	4.9	4.4	4.5	4.6	10	19	31	2968	5-6	2+	14	21	2		37	25	39		4	2	4	4	Over burnt otolith
101	15-May-05	GN	7	KO	F	2	213	109.3	1.13	G	5	8.2	8.0	8.0	8.1	11	16	29	2968	7-8	3+	15	19	10	2	46	23	43	3	5	3	3	5	
102	15-May-05	GN	7	KO	F	1	214	99.6	1.01	G	6	6.5	6.3	6.3	6.4	12	17	31	2968	9-10	3+	11	19	13	2	45	23	32	4	6	1		6	
103	15-May-05	GN	7	KO	F	1	205	93.3	1.08	G	3	6.3	5.7	5.7	5.9	12	16	30	2968	3-4	3+	14	19	11	3	47	24	38	1	3	3	5	3	
104	15-May-05	GN	7	KO	F	1	207	96.8	1.09	G									2968	1-2	3+	12	16	10	2	40	23	33	8	1	1	1	1	
105	15-May-05	GN	7	KO	F	1	212	108.5	1.13	G	24	7.2	7.2	6.1	6.8	14	20	36											32					
106	15-May-05	GN	7	KO	M	1	210	101.4	1.09	G	29	6.2	5.4	5.8	5.8	12	21	35											37					
107	15-May-05	GN	7	KO	U	1	201	89.3	1.09	G	37	5.5	6.2	5.7	5.8	14	18	34																
108	15-May-05	GN	7	KO	U	1	165	56.3	1.24	W	36	5.2	4.4	4.3	4.6	14	19	35											44					
109	15-May-05	GN	7	KO	U	1	170	56.8	1.15	W	41	5..7	5.4	5.9	5.7	14	21	37											48					
110	15-May-05	GN	7	KO	U	1	177	60.8	1.09	W																			47					
111	15-May-05	GN	7	KO	U	1	215	111	1.11	W	39	7.0	6.9	6.3	6.7	14	21	37											46					
112	15-May-05	GN	7	KO	U	1	211	108.8	1.15	W	38	6.4	6.8	6.9	6.7	13	19	34											45					
113	15-May-05	GN	7	KO	U	1	218	110.9	1.07	W	40	6.5	5.5	6.4	6.1	14	22	38																
114	15-May-05	GN	7	NSC	U	1	332	417	1.14	W																								
115	15-May-05	GN	7	NSC	U	1	369	721	1.43	G																								
116	15-May-05	GN	7	KO	M	1	218	107.5	1.03	S	18	6.3	6.8	6.1	6.4	15	21	38											27					
117	15-May-05	GN	7	KO	F	1	218	108.6	1.04	S	21	6.5	6.3	6.3	6.4	12	20	34											29					
118	15-May-05	GN	7	KO	F	1	128	21.6	1.01	W	17	4.6	4.4	3.5	4.2	14	20	36											26					
119	15-May-05	GN	7	KO	U	1	165	48.7	1.07	G	31	6.0	5.4	4.9	5.4	14	19	35											39					
120	15-May-05	GN	7	NSC	U	1	135	25.5	1.02	G																								
121	15-May-05	GN	7	NSC	U	1	147	34.2	1.06	G																								
122	15-May-05	GN	7	NSC	U	1	138	25.7	0.96	G																								
123	15-May-05	GN	8	CT	M	2	397	639	1.02	E																				1	3			Day time set
124	15-May-05	GN	8	CT	F	1	252	158.8	0.99	W																				2	4			Day time set
125	15-May-05	GN	8	NSC	F	3	425	1329	1.73	G																				3	3			Day time set
126	15-May-05	GN	7	CT	U	1	220	124.9	1.17	W																				1	3			Day time set
127	16-May-05	GN	4	NSC	U	1	129	18.9	0.86	W																				16	1		16	
128	16-May-05	GN	4	NSC	M	1	270	222	1.13	E																				15	1		15	
129	16-May-05	GN	4	CT	F	1	298	294	1.11	G																				1	14		14	
130	16-May-05	GN	4	CT	M	1	285	210	0.91	G																				2	13		13	
131	16-May-05	GN	4	CT	F	1	330	289	0.80	E																				2	12		12	
132	16-May-05	GN	4	PCC	F	1	195	91.1	1.22	G																				2	11		11	

Fish Id. (#)	Date dd-mm	Gear Type [a]	Site (#)	Species [b]	Sex [c]	Life Stage [d]	Fork Length (mm)	Weight (g)	K-factor (#)	Capture Type [e]	Gill Raker: Raker Id. (#)	Gill Raker Length: Raker 1 mm	Gill Raker Length: Raker 2 mm	Gill Raker Length: Raker 3 mm	Gill Raker Length: Mean mm	Gill Raker: Upper Count (#)	Gill Raker: Lower Count (#)	Gill Raker: Total Count (#)	Age reading: Scale Book (#)	Age reading: Scale Cell (#)	Age reading: Scale (#)	Annuli: 1st (#)	Annuli: 2nd (#)	Annuli: 3rd (#)	Annuli: 4th (#)	Total (#)	Distance to Seventh Circuli [f]	Distance to first annulus [f]	Otolith (#)	Stomach Sample (#)	Stomach Fullness [g]	DNA Vial (#)	Isotope Sample (#)	Comments
133	16-May-05	GN	4	KO	M	1	218	111.1	1.07	G	59	7.5	6.9	6.9	7.1	14	20	36	2970	23-24	3+	11	22	8	3	44	23	34	66	1	10	3	10	
134	16-May-05	GN	4	CT	F	2	200	75.4	0.94	W																				2	9		9	
135	16-May-05	GN	4	KO	F	1	174	56.5	1.06	W	43	6.2	5.9	5.9	6.0	14	21	37	2970	21-22	2+	13	19	4		36	24	37	50	1	8	2	8	
136	16-May-05	GN	4	CT	F	1	198	85.2	1.09	W																				2	7		7	
137	16-May-05	GN	4	KO	F	1	199	75.3	0.95	W									2970	19-20	3+	12	13	8	2	35	25	36	72	3	6	1	6	
138	16-May-05	GN	4	PCC	U	1	179	63.4	1.10	W																				2	5		5	
139	16-May-05	GN	4	NSC	U	1	179	58.6	1.01	W																				1	4		4	
140	16-May-05	GN	4	NSC	M	1	314	324	1.04	G																				1	3		3	
141	16-May-05	GN	4	NSC	M	2	309	324	1.10	E																				1	2		2	
142	16-May-05	GN	4	NSC	F	2	300	352	1.30	G																				2	1		1	
143	16-May-05	GN	3	CT	U	1	323	316	0.94	E																				4	9		9	
144	16-May-05	GN	3	KO	M	1	215	114.4	1.15	W	16	6.5	6.3	6.3	6.4	12	20	34	2970	17-18	3+	14	18	9	2	43	23	37	25	2	10		10	
145	16-May-05	GN	3	NSC	F	1	215	128.2	1.28	G																				1	22		22	
146	16-May-05	GN	3	CT	F	1	290	233	0.95	W																				2	21		21	
147	16-May-05	GN	3	CT	M	1	201	82.2	1.01	S																				3	20		20	
148	16-May-05	GN	3	KO	M	1	180	58.6	1.00	W	58	5.6	5.5	5.5	5.5	14	20	36	2970	39-40	2+	13	21	3		37	23	36	65		19		19	
149	16-May-05	GN	3	KO	M	1	179	68.1	1.18	W									2970	37-38	2+	13	17	3		33	28	42	80	2	18		18	
150	16-May-05	GN	3	KO	M	1	178	53.4	0.94	G	57	4.7	4.6	4.6	4.6	14	21	37	2970	35-36	2+	14	18	2		34	25	41	64	1	17		17	
151	16-May-05	GN	3	KO	F	1	211	103.2	1.09	G	44	6.0	6.0	5.9	6.0	13	18	33	2970	33-34	3+	13	20	11	2	46	24	38	51	1	16		16	
152	16-May-05	GN	3	KO	F	1	215	101.5	1.02	G	45	6.2	6.3	6.0	6.2	12	18	32	2970	31-32	3+	11	16	11	1	39	25	37	52	1	15		15	
153	16-May-05	GN	3	KO	M	1	191	74.2	1.06	W	47	5.1	5.0	4.4	4.8	14	21	37	2970	29-30	2+	14	21	4		39	27	43	54	1	14		14	
154	16-May-05	GN	3	NSC	F	1	208	88.8	0.98	G																				2	13		13	
155	16-May-05	GN	3	KO	M	1	216	96.1	0.95	G	50	7.3	6.9	6.7	7.0	14	20	36	2970	27-28	3+	14	22	11	3	50	22	36	57	2	12		12	
156	16-May-05	GN	3	KO	F	1	211	103.8	1.10	G	49	7.0	6.9	6.1	6.7	14	18	34	2970	25-26	3+	16	22	13	2	53	24	43	56	3	11		11	
157	16-May-05	GN	3	KO	M	1	194	80.9	1.10	G	48	5.0	4.9	4.4	4.8	14	18	34	2970	15-16	n/a						0	0	55	3	8		8	
158	16-May-05	GN	3	KO	M	1	188	60.5	0.90	W									2970	13-14	3+	7	14	18	1	40	19	19	81	1	7		7	
159	16-May-05	GN	3	KO	F	1	183	65.5	1.06	W									2970	11-12	2+	12	20	3		35	24	36	85	1	6	5	6	
160	16-May-05	GN	3	KO	M	1	190	62.3	0.90	W									2970	9-10	n/a						0	0	86	1	5	4	5	
161	16-May-05	GN	3	KO	F	1	225	97.6	0.85	G									2970	7-8	3+	11	21	12	2	46	19	27	82	0	4	3	4	
162	16-May-05	GN	3	KO	F	1	193	68.6	0.95	W									2970	5-6	n/a						0	0	83	1	3	2	3	
163	16-May-05	GN	3	KO	M	1	176	65.5	1.19	W									2970	3-4	n/a						0	0	84	1	2	1	2	
164	16-May-05	GN	3	CT	M	1	338	391	1.01	G																				1	1		1	
165	16-May-05	GN	7	KO	M	1	183	57.9	0.94	W									2970	41-42	2+	12	19	3		34	20	36	73	1	1	1	1	
166	16-May-05	GN	7	KO	M	1	169	59.3	1.22	W									2970	43-44	2+	11	16	2		29	27	36	79	1	2	2	2	
167	16-May-05	GN	7	PCC	F	1	196	82.3	1.09	E																				1	18		18	
168	16-May-05	GN	7	KO	M	1	170	57.6	1.16	G									2970	45-46	2+	12	20	3		35	22	33	78	1	3	3	3	
169	16-May-05	GN	7	KO	F	1	174	62	1.17	W	51	5.6	5.6	5.3	5.5	14	19	35	2973	17-18	2+	12	20	3		35	23	37	58	2	16		16	
170	16-May-05	GN	7	KO	F	1	170	59	1.19	W	53	5.8	5.7	5.2	5.6	14	21	37	2973	15-16	2+	12	22	3		37	23	34	60	0	15		15	
171	16-May-05	GN	7	KO	M	1	173	59.2	1.13	W	54	4.6	4.5	4.4	4.5	14	22	38	2973	13-14	2+	11	22	4		37	25	34	61	1	14		14	
172	16-May-05	GN	7	KO	M	1	218	107.3	1.03	E	52	5.9	5.7	5.7	5.8	14	18	34	2973	11-12	3+	12	19	10	2	43	23	32	59	1	13		13	
173	16-May-05	GN	7	KO	F	1	203	105.3	1.25	G	42	6.3	6.3	6.2	6.3	14	21	37	2973	9-10	3+	11	17	14	2	44	23	32	49	1	12		12	
174	16-May-05	GN	7	KO	M	1	171	51.7	1.02	W	55	5.4	5.3	5.0	5.2	12	18	32	2973	7-8	2+	12	21	3		36	20	29	62	1	11		11	
175	16-May-05	GN	7	KO	M	1	179	66	1.14	G									2973	5-6	2+	12	21	3		36	28	41		2	10		10	
176	16-May-05	GN	7	KO	M	1	180	68.9	1.17	W									2973	3-4	2+	13	20	3		36	23	36	74	2	9		9	
177	16-May-05	GN	7	KO	F	1	188	71	1.06	W									2973	1-2	2+	13	21	2		36	24	38	75	1	8		8	
178	16-May-05	GN	7	KO	M	1	177	68.1	1.22	W									2970	49-50	2+	12	22	2		36	25	38	76	1	7	5	7	
179	16-May-05	GN	7	KO	F	1	178	63.1	1.11	W									2970	47-48	2+	12	20	3		35	24	36	77	1	6	4	6	
180	16-May-05	GN	7	NSC	U	1	215	99.4	1.00	G																				2	5		5	
181	16-May-05	GN	7	NSC	F	3	420	1100	1.48	G																				2	4		4	
182	16-May-05	GN	7	CT	F	1	267	190.6	1.00	W																				1	17		17	
183	16-May-05	GN	7	CT	F	1	240	125.4	0.90	E																				3	19		19	
184	16-May-05	GN	7	NSC	M	1	255	200.5	1.21	G																				3	20		20	
185	16-May-05	GN	7	NSC	M	1	263	197.3	1.08	G																				2	21		21	
186	16-May-05	GN	7	RSS	F	1	113	15.8	1.06	G																				1	22		22	
187	16-May-05	GN	7	KO	F	1	171	56.5	1.12	G	46	5.0	4.3	4.2	4.5	14	20	36	2973	19-20	2+	12	18	4		34	28	41	53	1	23		23	
188	16-May-05	GN	7	PCC	U	1	133	20.9	0.87	W																				1	24		24	
189	16-May-05	GN	7	RSS	M	2	130	19.6	0.87	W																				2	25		25	
190	16-May-05	GN	7	RSS	M	3	115	15.9	1.01	W																				2	26		26	
191	16-May-05	GN	7	CT	M	1	283	201.4	0.89	S																				3	27		27	
192	16-May-05	GN	7	LSU	U	1	120	17.8	1.00	W																				0	28		28	
193	16-May-05	GN	7	KO	M	1	202	89.7	1.08	S	35	6.0	6.1	6.0	6.0	14	18	34	2973	21-22	3+	14	17	9	2	42	23	44	43	2	29		29	
194	16-May-05	GN	8	KO	F	1	139	25.7	0.94	G	56	3.4	3.4	3.2	3.3	14	20	36	2973	23-24	2+	9	13	6		28	27	32	63	3	1	1	1	
195	16-May-05	GN	8	NSC	M	2	369	675	1.34	G																				4	2		2	Kokanee in stomach sample
196	16-May-05	GN	8	NSC	M	2	362	650	1.37	G																				3	3		3	
197	16-May-05	GN	8	KO	M	2	219	119.4	1.13	G	60	7.7	7.5	7.4	7.5	15	21	38	2973	25-26	n/a						0	0	67	3	4	2	4	
198	16-May-05	GN	8	CT	F	2	346	400	0.96	S																				3	5		5	
199	16-May-05	GN	8	KO	F	2	209	82.7	0.90	W									2973	27-28	3+	15	18	9	2	44	22	39	69	3	6	3	6	

Fish Id. (#)	Date dd-mm	Gear Type [a]	Site (#)	Species [b]	Sex [c]	Life Stage [d]	Fork Length (mm)	Weight (g)	K-factor (#)	Capture Type [e]	Gill Raker: Raker Id. (#)	Gill Raker Length: Raker 1 mm	Gill Raker Length: Raker 2 mm	Gill Raker Length: Raker 3 mm	Gill Raker Length: Mean mm	Gill Raker: Upper Count (#)	Gill Raker: Lower Count (#)	Gill Raker: Total Count (#)	Scale Book (#)	Scale Cell (#)	Age reading: Scale (#)	Annuli: 1st (#)	Annuli: 2nd (#)	Annuli: 3rd (#)	Annuli: 4th (#)	Total (#)	Distance to Seventh Circuli [f]	Distance to first annulus [f]	Otolith (#)	Stomach Sample (#)	Stomach Fullness [g]	DNA Vial (#)	Isotope Sample (#)	Comments
200	16-May-05	GN	8	KO	M	2	210	100.4	1.08	W	15	6.3	6.2	5.3	5.9	12	20	34											24	2	7	4	7	Partially eaten, no scales or adipose
201	16-May-05	GN	8	KO	M	2	216	102.7	1.01	E									2973	29-30	3+	12	20	10	3	45	23	34	68	2	8	5	8	
202	16-May-05	GN	8	NSC	M	2	432	1077	1.34	G																				2	9		9	
203	16-May-05	GN	8	LSU	M	3	392	951	1.58	W																				3	10		10	
204	16-May-05	GN	8	PCC	U	1	161	48.8	1.16	W																								
205	16-May-05	GN	8	NSC	U	1	245	167.8	1.14	G																								
206	16-May-05	GN	8	PCC	M	1	210	124.7	1.34	G																				1	11		11	
207	16-May-05	GN	8	PCC	U	1	183	72.4	1.17	G																								
208	16-May-05	GN	8	PCC	U	1	223	115	1.03	G																								
209	16-May-05	GN	8	CT	U	1	233	113.2	0.89	G																								
210	16-May-05	GN	8	PCC	U	1	220	120.8	1.13	G																								
211	16-May-05	GN	8	KO	U	1	209	95.3	1.04	G																								
212	16-May-05	GN	8	PCC	U	1	160	45.1	1.09	G																								
213	16-May-05	GN	8	PCC	U	1	204	109.3	1.28	G																								
214	16-May-05	GN	8	PCC	U	1	194	78.4	1.07	G																								
215	16-May-05	GN	8	PCC	U	1	171	59.6	1.18	W																								
216	16-May-05	GN	8	LSU	M	2	290	301	1.23	G																				3	12		12	
217	16-May-05	GN	8	NSC	U	1	173	59.3	1.14	G																								
218	16-May-05	GN	8	NSC	U	1	196	79.7	1.05	G																								
219	16-May-05	GN	8	PCC	U	1	167	52.1	1.11	W																								
220	16-May-05	GN	8	PCC	U	1	172	59.2	1.15	G																								
221	16-May-05	GN	8	NSC	U	1	194	77.6	1.06	G																								
222	16-May-05	GN	8	PCC	U	1	177	73.6	1.32	W																								
223	16-May-05	GN	8	NSC	U	1	198	81.1	1.04	G																								
224	16-May-05	GN	8	NSC	U	1	189	83.7	1.23	G																								
225	16-May-05	GN	8	NSC	U	1	302	355	1.29	G																								
226	16-May-05	GN	8	LSU	F	2	290	266	1.09	G																				1	13		13	
227	16-May-05	GN	8	NSC	U	1	341	481	1.21	G																								
228	16-May-05	GN	8	NSC	U	1	280	281	1.28	G																								
229	16-May-05	GN	8	LSU	M	1	287	267	1.13	G																				2	14		14	
230	16-May-05	GN	8	LSU	M	1	269	225	1.15	G																				2	15		15	
231	16-May-05	GN	8	NSC	U	1	343	450	1.11	G																								
232	16-May-05	GN	8	NSC	U	1	324	404	1.19	G																								
233	17-May-05	GN	5	KO	M	1	187	68.2	1.04	G	14	5.5	5.5	5.4	5.5	12	20	34	2973	33-34	2+	11	20	3		34	23	34		2	2		2	
234	17-May-05	GN	5	KO	M	1	167	46.8	0.99	W	13	6.1	5.8	5.9	5.9	12	20	34	2973	31-32	2+	12	25	3		40	24	36	23	1	1		1	
235	17-May-05	GN	16	KO	F	2	210	109.8	1.18	W	10	6.0	5.7	5.8	5.8	12	18	32	2973	41-42	3+	12	18	15	2	47	23	34	20	1	5		5	
236	17-May-05	GN	16	KO	F	2	210	101.6	1.09	W	9	6.2	6.2	6.1	6.2	11	19	32	2973	39-40	3+	13	16	15	2	46	23	36	19	3	4		4	
237	17-May-05	GN	16	KO	F	2	219	119.4	1.13	W	7	6.2	6.5	6.5	6.4	14	16	32	2973	43-44	3+	15	21	11	2	49	23	42	17	3	6		6	
238	17-May-05	GN	16	KO	U	1	215	103	1.03	G																								
239	17-May-05	GN	16	NSC	U	1	350	499	1.16	E																								
240	17-May-05	GN	16	NSC	U	1	404	1039	1.57	G																								
241	17-May-05	GN	16	KO	M	2	184	60	0.96	W	12	6.0	5.9	5.7	5.9	14	20	36	2973	45-46	2+	14	19	4		37	25	39	22	1	7		7	
242	17-May-05	GN	16	NSC	U	1	191	66.9	0.95	G																								
243	17-May-05	GN	16	KO	M	1	181	64.1	1.07	W	26	5.7	5.4	5.4	5.5	15	20	37	2973	49-50	2+	13	20	4		37	25	41	34	2	9		9	
244	17-May-05	GN	16	KO	U	1	222	113.6	1.03	G																								
245	17-May-05	GN	16	KO	U	1	217	105.7	1.03	G																								
246	17-May-05	GN	16	KO	U	1	178			W																								
247	17-May-05	GN	16	LSU	F	1	163	54.3	1.24	G																				2	1		1	
248	17-May-05	GN	16	KO	M	2	204	93.7	1.10	G	11	6.5	6.3	5.8	6.2	12	18	32	2973	35-36	3+	9	18	16	2	45	19	23	21	2	2		2	
249	17-May-05	GN	16	KO	U	1	179	57.4	0.99	W	8	5.6	5.2	5.2	5.3	11	18	31	2973	37-38	2+	12	17	4		33	24	37	18	3	3		3	
250	17-May-05	GN	16	PCC	U	1	181	68.9	1.15	G																								
251	17-May-05	GN	16	KO	U	1	218	110.2	1.06	G																								
252	17-May-05	GN	16	KO	M	1	167	48.9	1.04	G	25	5.7	5.6	5.6	5.6	14	21	37	2973	47-48	2+	13	15	3		31	28	41	33	0	8		8	
253	17-May-05	GN	16	NSC	U	1	282	281	1.25	G																								
254	17-May-05	GN	16	NSC	U	1	277	247	1.16	G																								
255	17-May-05	GN	16	NSC	U	1	300	337	1.25	G																								
256	17-May-05	GN	16	NSC	U	1	357	505	1.11	G																								
257	17-May-05	GN	16	CT	U	1	264	183.1	0.99	W																								
258	15-May-05	MT	7	NSC	U	1	89	7.6	1.08																									
259	15-May-05	MT	7	NSC	U	1	89	7	0.99																									
260	15-May-05	MT	7	NSC	U	1	99	9.7	1.00																									
261	15-May-05	MT	7	NSC	U	1	84	5.6	0.94																									
262	15-May-05	MT	7	RSS	U	1	64	3.3	1.26																									
263	15-May-05	MT	7	RSS	U	1	51	1.4	1.06																									
264	15-May-05	MT	7	RSS	U	1	49	1.1	0.93																									
265	15-May-05	MT	7	NSC	U	1	92	7.5	0.96																									
266	15-May-05	MT	8	NSC	U	1	89	7.2	1.02																									

Fish Id. (#)	Date dd-mm	Gear Type [a]	Site (#)	Species [b]	Sex [c]	Life Stage [d]	Fork Length (mm)	Weight (g)	K-factor (#)	Capture Type [e]	Gill Raker: Raker Id. (#)	Gill Raker Length: Raker 1 mm	Gill Raker Length: Raker 2 mm	Gill Raker Length: Raker 3 mm	Gill Raker: Mean mm	Gill Raker: Upper Count (#)	Gill Raker: Lower Count (#)	Gill Raker: Total Count (#)	Scale Book (#)	Scale Cell (#)	Age reading: Scale (#)	Age reading Annuli: 1st (#)	Age reading Annuli: 2nd (#)	Age reading Annuli: 3rd (#)	Age reading Annuli: 4th (#)	Age reading: Total (#)	Distance to Seventh Circuli [f]	Distance to first annulus [f]	Otolith (#)	Stomach Sample (#)	Stomach Fullness [g]	DNA Vial (#)	Isotope Sample (#)	Comments
267	15-May-05	MT	8	NSC	U	1	79	5.7	1.16																									
268	15-May-05	MT	8	NSC	U	1	69	5	1.52																									
269	15-May-05	MT	8	NSC	U	1	80	5.2	1.02																									
270	15-May-05	MT	8	NSC	U	1	75	4.2	1.00																									
271	15-May-05	MT	8	RSS	U	1	58	1.7	0.87																									
272	15-May-05	MT	8	RSS	U	1	48	1.1	0.99																									
273	15-May-05	MT	8	NSC	U	1	80	5.5	1.07																									
274	15-May-05	MT	8	NSC	U	1	74	4.1	1.01																									
275	15-May-05	MT	8	NSC	U	1	75	4.6	1.09																									
276	15-May-05	MT	8	NSC	U	1	80	5.2	1.02																									
277	15-May-05	MT	8	NSC	U	1	78	5	1.05																									
278	15-May-05	MT	8	NSC	U	1	73	3.4	0.87																									
279	16-May-05	MT	4	NSC	U	1	108	11.9	0.94																									
280	16-May-05	MT	4	NSC	U	1	86	6.4	1.01																									
281	16-May-05	MT	4	NSC	U	1	82	7	1.27																									
282	16-May-05	MT	4	PCC	U	1	47	1.3	1.25																									
283	16-May-05	MT	4	TSSB	U	1	60	2	0.93																									
284	16-May-05	MT	4	TSSB	U	1	60	2.3	1.06																									
285	16-May-05	MT	4	TSSB	U	1	63	2.3	0.92																									
286	16-May-05	MT	4	TSSB	U	1	62	2	0.84																									
287	16-May-05	MT	4	SC	U	1	90	9	1.23																									
288	16-May-05	MT	4	NSC	U	1	78	4.8	1.01																									
289	16-May-05	MT	4	SC	U	1	59	2.4	1.17																									
290	16-May-05	MT	4	RSS	U	1	49	1.4	1.19																									
291	16-May-05	MT	4	RSS	U	1	52	1.5	1.07																									
292	16-May-05	MT	4	RSS	U	1	53	1.3	0.87																									
293	16-May-05	MT	4	RSS	U	1	35	0.4	0.93																									
294	16-May-05	MT	4	TSSB	U	1	57	1.6	0.86																									
295	16-May-05	MT	4	TSSB	U	1	67	2.6	0.86																									
296	16-May-05	MT	4	TSSB	U	1	58	1.6	0.82																									
297	16-May-05	MT	4	TSSB	U	1	62	2	0.84																									
298	16-May-05	MT	4	TSSB	U	1	49	1	0.85																									
299	16-May-05	MT	4	TSSB	U	1	57	1.2	0.65																									
300	16-May-05	MT	4	TSSB	U	1	55	1.4	0.84																									
301	16-May-05	MT	4	TSSB	U	1	44	1.1	1.29																									
302	16-May-05	MT	4	RSS	U	1	98	12.2	1.30																									
303	16-May-05	MT	4	TSSB	U	1	62	1.9	0.80																									
304	16-May-05	MT	4	TSSB	U	1	65	2.1	0.76																									
305	16-May-05	MT	4	TSSB	U	1	42	0.6	0.81																									
306	16-May-05	MT	4	TSSB	U	1	48	0.9	0.81																									
307	16-May-05	MT	4	TSSB	U	1	39	0.5	0.84																									
308	16-May-05	MT	4	TSSB	U	1	64	1.9	0.72																									
309	16-May-05	MT	4	SC	U	1	120	17.6	1.02																									
310	16-May-05	MT	4	RSS	U	1	31	0.2	0.67																									
311	16-May-05	MT	4	RSS	U	1	55	1.8	1.08																									
312	16-May-05	MT	4	NSC	U	1	98	8.1	0.86																									
313	16-May-05	MT	4	NSC	U	1	88	6.7	0.98																									
314	16-May-05	MT	4	CT	U	1	135	20.2	0.82																									
315	16-May-05	MT	4	NSC	U	1	53	1.3	0.87																									
316	16-May-05	MT	4	RSS	U	1	46	1.2	1.23																									
317	16-May-05	MT	3	RSS	U	1	92	7.4	0.95																									
318	16-May-05	MT	3	RSS	U	1	64	2.8	1.07																									
319	16-May-05	MT	3	RSS	U	1	57	1.6	0.86																									
320	16-May-05	MT	3	RSS	U	1	59	1.7	0.83																									
321	16-May-05	MT	3	SC	U	1	91	7.5	1.00																									
322	16-May-05	MT	3	TSSB	U	1	62	1.7	0.71																									
323	16-May-05	MT	3	TSSB	U	1	55	1.3	0.78																									
324	16-May-05	MT	3	NSC	U	1	49	1	0.85																									
325	16-May-05	MT	7	CT	U	1	85	5.6	0.91																									
326	16-May-05	MT	7	CT	U	1	100	8.9	0.89																									
327	16-May-05	MT	7	RSS	U	1	102	10.6	1.00																									
328	16-May-05	MT	7	RSS	U	1	48	1.2	1.09																									
329	16-May-05	MT	7	CT	U	1	135	21.9	0.89																									
330	16-May-05	MT	7	RSS	U	1	52	1.6	1.14																									
331	16-May-05	MT	7	RSS	U	1	35	0.4	0.93																									
332	16-May-05	MT	8	RSS	U	1	103	12.5	1.14																									
333	16-May-05	MT	8	NSC	U	1	85	6.1	0.99																									

											Gill Raker										Age reading													
											Length											Annuli												
Fish Id. (#)	Date dd-mm	Gear Type [a]	Site (#)	Species [b]	Sex [c]	Life Stage [d]	Fork Length (mm)	Weight (g)	K-factor (#)	Capture Type [e]	Raker Id. (#)	Raker 1 mm	Raker 2 mm	Raker 3 mm	Mean mm	Upper Count (#)	Lower Count (#)	Total Count (#)	Scale Book (#)	Scale Cell (#)	Scale (#)	1st (#)	2nd (#)	3rd (#)	4th (#)	Total (#)	Distance to Seventh Circuli [f]	Distance to first annulus [f]	Otolith (#)	Stomach Sample (#)	Stomach Fullness [g]	DNA Vial (#)	Isotope Sample (#)	Comments
334	16-May-05	MT	8	RSS	U	1	59	2.1	1.02																									
335	16-May-05	MT	8	RSS	U	1	45	1.3	1.43																									
336	16-May-05	MT	8	RSS	U	1	53	1.6	1.07																									
337	16-May-05	MT	8	RSS	U	1	55	1.6	0.96																									
338	16-May-05	MT	8	RSS	U	1	55	1.8	1.08																									
339	16-May-05	MT	8	RSS	U	1	48	1.3	1.18																									
340	16-May-05	MT	8	SC	U	1	125	21.6	1.11																									
341	16-May-05	MT	8	RSS	U	1	63	2.7	1.08																									
342	16-May-05	MT	8	SC	U	1	98	8.7	0.92																									
343	17-May-05	MT	5	NSC	U	1	118	15.4	0.94																									
344	17-May-05	MT	5	NSC	U	1	79	5.9	1.20																									
345	17-May-05	MT	5	NSC	U	1	81	6.5	1.22																									
346	17-May-05	MT	5	NSC	U	1	88	6.3	0.92																									
347	17-May-05	MT	5	TSSB	U	1	62	1.4	0.59																									
348	17-May-05	MT	5	TSSB	U	1	63	2.1	0.84																									
349	17-May-05	MT	5	CT	U	1	106	10.8	0.91																									
350	17-May-05	MT	5	NSC	U	1	96	9.6	1.09																									
351	17-May-05	MT	5	SC	U	1	90	7.2	0.99																									
352	17-May-05	MT	5	TSSB	U	1	63	2.2	0.88																									
353	17-May-05	MT	5	TSSB	U	1	44	0.6	0.70																									
354	17-May-05	MT	5	TSSB	U	1	39	0.5	0.84																									
355	17-May-05	MT	16	NSC	U	1																												
356	17-May-05	MT	16	NSC	U	1																												
357	17-May-05	MT	16	NSC	U	1																												
358	17-May-05	MT	16	NSC	U	1																												
359	17-May-05	MT	16	NSC	U	1																												
360	17-May-05	MT	16	NSC	U	1																												
361	17-May-05	MT	16	LSU	U	1																												
362	17-May-05	MT	16	TSSB	U	1																												
363	17-May-05	MT	16	RSS	U	1																												
364	17-May-05	MT	16	NSC	U	1																												
365	17-May-05	MT	16	NSC	U	1																												
366	18-May-05	MT	L-1	TSSB	U	1	59	1.9	0.93																									
367	18-May-05	MT	L-1	TSSB	U	1	65	2.2	0.80																									
368	18-May-05	MT	L-1	TSSB	U	1	40	0.6	0.94																									
369	18-May-05	MT	L-1	TSSB	U	1	69	1.8	0.55																									

[a] Gear abbreviations: Gillnet (GN), Minnow Trap (MT), and Mid-Water Trawl (TRWL)

[b] Fish abbreviations: Cutthroat Trout (CT), kokanee (KO), coho (CO), sucker (SU), peamouth chub (PCC), northern pikeminnow (NSC), redside shiner (RSS), sculpin (SC); Threespine Stickleback (TSSB).

[c] Sex abbreviations: Male (M), Female (F), and Unknown (U)

[d] Life Stage abbreviations: Immature (1), Maturing (2), Mature (3), Spawning (4), and Spent (5).

[e] Capture type abbreviations: Entangled by snout (E), Gilled (G), Wedged (W), and Snagged by fin (S)

[f] The distance from the focus to the 7th circulus, and the distance from the focus to the first annulus are provided with measurements in mm at 100 power.

[g] Relative stomach fullness rating : Empty (0), 1-25 % full (1), 26-50 % full (2), 51-75 % full (3), 76-100 % full.

Appendix 31. Biosample data for fish collected at Coquitlam Reservoir, November 2005.

														Age reading	Annuli																				
Fish Id. (#)	Date dd-mm	Gear Type [a]	Site (#)	Species [b]	Sex [c]	Life Stage [d]	Fork Length (mm)	Weight (g)	K-factor (#)	Capture Type [e]	Gill Raker sample (#)	Scale Book (#)	Scale Cell (#)	Scale (#)	1st (#)	2nd (#)	3rd (#)	4th (#)	Total (#)	Distance to Seventh Circuli [f]	Distance to first annulus [f]	Otolith (#)	Stomach Sample (#)	Stomach Fullness [g]	Stoamch mass (g)	DNA Vial (#)	Isotope Sample (#)	Gonad Weight (g)	Total Gonad Weight (g)	Fecundity (#)	GSI (wt:wt) [h]	Egg Diam. (mm)	Caudal Frayed (Y/N)	Skin Colour	Comments
1	31-Oct-05	GN	4	CT	F	2	243	142.0	0.99	W		2991	1-2	n/a								1	3	4	4.10		3								
2	31-Oct-05	GN	4	KO	F	4	236	161.7	1.23	G	1	2986	1-2	3+	13	18	14	2	47	24	36	2		0	0.00	1	4	7.8	28.1	360	17.4	4.6	N	Olive Green	
3	31-Oct-05	GN	4	NSC	M	1	200	105.3	1.32	G													4	3	5.60		5								
4	31-Oct-05	GN	4	KO	M	4	239	156.1	1.14	G	2	2986	3-4	n/a								3	0	0		2	6						N	Olive Green	
5	31-Oct-05	GN	4	PCC	U	1	160	47.4	1.16	W													5	1	1.60		7								
6	31-Oct-05	GN	4	KO	M	4	241	173.1	1.24	W	3	2986	5-6	3+	12	23	13	2	50	24	36	4	0	0		3	8		7.6		4.4		N	Black	
7	31-Oct-05	GN	4	NSC	M	1	287	262.0	1.11	G													37	3	2.40		48								
8	31-Oct-05	GN	4	KO	M	4	228	146.0	1.23	W													0	0					9.1		6.2		N	Olive Green	
9	31-Oct-05	GN	4	CT	F	1	343	424.0	1.05	W		2991	13-14	5+								35	38	1	11.00		49								
10	31-Oct-05	GN	4	CT	F	1	491	1223.0	1.03	E		2991	15-16	n/a									39	1	1.10		50								
11	31-Oct-05	MT	4	NSC	U	1	89	7.3	1.04														1	4	0.90		1								
12	31-Oct-05	MT	4	NSC	F	1	132	25.6	1.11														2	4	3.00		2								
13	31-Oct-05	GN	8	KO	F	1	128	26.9	1.28	G		2993	39-40	1+	13	15			28	21	31			1	0.50								N	Silver	
14	31-Oct-05	GN	8	NSC	M	2	372	649.0	1.26	G													136	2	31.80		159								
15	31-Oct-05	GN	8	KO	F	1	200	97.2	1.22	W		2993	43-44	2+	13	18	11		42	25	38			1									N	Silver	
16	31-Oct-05	GN	8	CT	F	1	471	1189.0	1.14	E		2991	45-46	n/a									135	2	11.90				43.7		3.7	4.4			
17	31-Oct-05	GN	8	KO	M	1	145	45.3	1.49	W		2993	41-42	1+	13	17			30	22	33			0									N	Silver	
18	31-Oct-05	GN	8	KO	F	1	203	102.3	1.22	G		2993	45-46	3+	12	20	9	3	44	24	36			0									N	Silver	
19	31-Oct-05	MT	8	NSC	U	1	128	24.8	1.18														113	4	1.90		128								
20	31-Oct-05	MT	8	NSC	U	1	114	17.1	1.15														112	1	1.40		127								
21	31-Oct-05	MT	8	SC	U	1																													
22	31-Oct-05	GN	7	CT	F	3	391	605.0	1.01	G	12	2991	5-6	n/a								12	7	4	18.00		17								
23	31-Oct-05	GN	7	KO	M	5	210	103.2	1.11	E	13	2986	21-22	2+	12	20	17		49	23	36	13	8	1	3.20	13	18						Y	Black	
24	31-Oct-05	GN	7	KO	M	1	178	64.6	1.15	G	14	2986	23-24	2+	10	13	15		38	18	25	14	9	1	2.60	14	19						Y	Black	
25	31-Oct-05	GN	7	NSC	F	1	486	99.7	0.09	G													10	1	36.90		20								
26	31-Oct-05	GN	7	NSC	M	1	382	69.6	0.12	E													11	3	24.60		21								
27	31-Oct-05	GN	7	KO	M	3	214	128.5	1.31	E	15	2986	25-26	2+	12	23	10		45	23	34	15		0		15	22		4.1		3.2		Y	Olive Green	
28	31-Oct-05	GN	7	KO	M	3	233	133.8	1.06	W	16	2986	27-28	3+	15	22	9	3	49	21	40	16	12	1	1.00	16	23		2.2		1.6		Y	Olive Green	
29	31-Oct-05	GN	7	KO	M	4	228	149.1	1.26	E	17	2986	29-30	2+	13	22	8		43	25	39	17		0		17	24		6.0		4.0		Y	Olive Green	
30	31-Oct-05	GN	7	KO	M	4	238	167.0	1.24	E	18	2986	31-32	3+	13	19	10	3	45	28	42	18	13	1	1.30	18	25		4.7		2.8		Y	Olive Green	
31	31-Oct-05	GN	7	KO	M	4	217	129.8	1.27	G	19	2986	33-34	2+	13	20	7		40	26	41	19	14	1	0.60	19	26		7.0		5.4			Olive Green	
32	31-Oct-05	GN	7	KO	F	5	231	127.0	1.03	G	20	2986	35-36	3+								20	15	1	1.10	20	27						Y	Olive Green	
33	31-Oct-05	GN	7	KO	M	4	218	123.4	1.19	W	21	2986	37-38	2+	13	20	7		40	25	41	21	16	1	0.70	21	28		3.3		2.7		N	Red	
34	31-Oct-05	GN	7	KO	F	4	245	163.2	1.11	G	22	2986	39-40	3+	13	20	9	5	47	25	39	22		0		22	29	8.0	26.0	325	15.9	4.5	N	Olive Green	
35	31-Oct-05	GN	7	KO	M	4	233	147.8	1.17	G	23	2986	41-42	3+	12	20	10	4	46	22	37	23		0		23	30		2.7		1.8		N	Olive Green	
36	31-Oct-05	GN	7	CT	F	1	342	420.0	1.05	E	24	2991	7-8	4+								24	17	2	10.30		31								
37	31-Oct-05	GN	7	KO	M	4	178	70.2	1.24	G	25	2986	43-44	n/a								25	18	1	0.20	25	32		1.5		2.1		Y	Olive Green	
38	31-Oct-05	GN	7	KO	F	2	228	153.4	1.29	G	26	2986	45-46	n/a								26	19	1	0.40	26	33	6.9	28.7	416	18.7	4.5	N	Olive Green	
39	31-Oct-05	GN	7	KO	F	3	226	146.7	1.27	G	27	2986	47-48	3+	18	16	7	2	43	21	44	27	20	1	0.40	27	34	6.7	36.5	545	24.9	4.5	N	Olive Green	
40	31-Oct-05	GN	7	KO	M	4	237	150.0	1.13	G	28	2986	49-50	3+	16	22	10	5	53	26	44	28	21	1	0.80	28	35		4.2		2.8		N	Olive Green	
41	31-Oct-05	GN	7	KO	M	4	236	168.2	1.28	E	29	2992	1-2	3+	15	20	9	3	47	27	47	29		0		29	36		4.5		2.7		N	Olive Green	
42	31-Oct-05	GN	7	KO	M	4	237	173.0	1.30	G	30	2992	3-4	3+	12	14	13	2	41	24	40	30	22	1	1.50	30	37		7.3		4.2		Y	Olive Green	
43	31-Oct-05	GN	7	KO	M	4	242	181.8	1.28	G	31	2992	5-6	3+	14	18	9	2	43	26	42	31	23	1	1.50	31	38		6.3		3.5		N	Olive Green	
44	31-Oct-05	GN	7	PCC	U	1	232	152.5	1.22	G													24	2	2.70		39								
45	31-Oct-05	GN	7	PCC	U	1	223	127.1	1.15	W													25	2	2.50		40								
46	31-Oct-05	GN	7	KO	F	4	217	114.5	1.12	W	32	2992	7-8	3+	13	20	8	2	43	23	37	32	26	1	0.50	32	41	6.4	13.0	203	11.4	4.8			
47	31-Oct-05	GN	7	KO	M	4	232	157.6	1.26	W	33	2992	9-10	3+	15	21	12	2	50	23	41	33	27	1	0.90	33	42		3.1		2.0		N	Olive Green	
48	31-Oct-05	GN	7	KO	F	4	236	169.1	1.29	W													28	1	0.90			9.8	21.3	217	12.6	5.0	N	Olive Green	
49	31-Oct-05	GN	7	KO	M	4	222	131.5	1.20	G													29	1	0.90				3.8		2.9		Y	Olive Green	
50	31-Oct-05	GN	7	CT	F	1	267	180.0	0.95	W		2991	9-10	n/a								34	30	4	8.40		43								
51	31-Oct-05	GN	7	KO	M	4	239	145.9	1.07	W	34												31	1	1.20				2.9		2.0		N	Olive Green	
52	31-Oct-05	GN	7	KO	M	4	232	143.4	1.15	E														0					5.9		4.1		Y	Olive Green	
53	31-Oct-05	GN	7	KO	F	4	230	124.7	1.02	W														0								5.0	Y	Olive Green	
54	31-Oct-05	GN	7	KO	M	4	243	170.5	1.19	G														0					5.1		3.0		N	Red	
55	31-Oct-05	GN	7	KO	M	1	219	105.3	1.00	G														0					1.2		1.1		N	Olive Green	
56	31-Oct-05	GN	7	KO	M	4	217	115.6	1.13	E														0					5.2		4.5		N	Olive Green	
57	31-Oct-05	GN	7	PCC	F	1	235	168.1	1.30	W													32	4	3.60		44								
58	31-Oct-05	GN	7	CT	F	1	295	253.7	0.99	G		2991	11-12	5+									33	4	7.40		45								
59	31-Oct-05	GN	7	SU	M	1	341	441.0	1.11	G													34	4	7.20		46								
60	31-Oct-05	GN	7	NSC	F	1	325	395.0	1.15	G													35	4	18.00		47								
61	31-Oct-05	GN	7	KO	M	4	251	165.0	1.04	G	35												36	1	0.80	35			0.5		0.3		N	Olive Green	
62	31-Oct-05	GN	7	KO	M	4	233	149.2	1.18	W	8	2986	15-16	3+	13	17	12	2	44	25	38	9		0	0.00	8	13		2.8		1.9		N	Olive Green	
63	31-Oct-05	GN	7	KO	M	4	241	162.0	1.16	W	9	2986	17-18	3+	13	21	17	2	53	22	36	10		0	0.00	9	14		2.5		1.5		N	Olive Green	
64	31-Oct-05	GN	7	CT	M	1	372	543.0	1.05	W	10	2991	3-4	n/a										3	11.80		15								
65	31-Oct-05	GN	7	KO	F	4	235	132.6	1.02	W	4	2986	7-8	3+	13	18	9	2	42	24	37	5	6	0	0.00	4	9					4.3	N	Olive Green	
66	31-Oct-05	GN	7	KO	M	4	230	163.4	1.34	W	5	2986	9-10	3+	11	17	14	5	47	24	32	6		0	0.00	5	10		7.7		4.7		N	Olive Green	
67	31-Oct-05	GN	7	KO	M	4	225	155.7	1.37	E	6	2986	11-12	2+	15	20	10		45	26	44	7		0	0.00	6	11		8.8		5.7		N	Olive Green	
68	31-Oct-05	GN	7	KO	M	4	226	139.1	1.21	W	7	2986	13-14	2+	14	19	9		42	28	44	8		0	0.00	7	12		7.9		5.7		N	Black	
69	31-Oct-05	GN	7	KO	M	4	243	168.4	1.17	W	11	2986	19-20	3+	13	19	16	2	50	23	38	11		0	0.00	11	16		6.4		3.8		N	Olive Green	
70	31-Oct-05	MT	7	RSS	U	1	70	4.1	1.20																		129								

Fish Id.	Date	Gear Type	Site	Species	Sex	Life Stage	Fork Length	Weight	K-factor	Capture Type	Gill Raker sample	Scale Book	Scale Cell	Scale (Age reading)	Annuli 1st	Annuli 2nd	Annuli 3rd	Annuli 4th	Total	Distance to Seventh Circuli	Distance to first annulus	Otolith	Stomach Sample	Stomach Fullness	Stoamch mass	DNA Vial	Isotope Sample	Gonad Weight	Total Gonad Weight	Fecundity	GSI	Egg Diam.	Caudal Frayed	Skin Colour	Comments
(#)	dd-mm	a	(#)	b	c	d	(mm)	(g)	(#)	e	(#)	(#)	(#)	(#)	(#)	(#)	(#)	(#)	(#)	f	f	(#)	(#)	g	(g)	(#)	(#)	(g)	(g)	(#)	(wt:wt) h	(mm)	(Y/N)		
71	31-Oct-05	MT	7	RSS	U	1	55	3.1	1.86																		130								
72	31-Oct-05	MT	7	RSS	U	1	65	2.4	0.87																		131								
73	31-Oct-05	MT	7	RSS	U	1	69	3.3	1.00																		132								
74	31-Oct-05	MT	7	RSS	U	1	68	2.9	0.92																		133								
75	31-Oct-05	MT	7	RSS	U	1	65	3.2	1.17																		134								
76	31-Oct-05	MT	7	RSS	U	1	61	2.5	1.10																		135								
77	31-Oct-05	MT	7	RSS	U	1	59	2.5	1.22																		136								
78	31-Oct-05	MT	7	RSS	U	1	52	2.5	1.78																		137								
79	31-Oct-05	MT	7	RSS	U	1	59	4.0	1.95																		138								
80	31-Oct-05	MT	7	RSS	U	1	56	2.3	1.31																		139								
81	31-Oct-05	MT	7	RSS	U	1	58	2.2	1.13																		140								
82	31-Oct-05	MT	7	RSS	U	1	51	1.7	1.28																		141								
83	31-Oct-05	MT	7	RSS	U	1	98	12.1	1.29																		142								2 tapeworm
84	31-Oct-05	MT	7	RSS	U	1	48	1.0	0.90																										
85	31-Oct-05	MT	7	RSS	U	1	51	1.4	1.06																										
86	31-Oct-05	MT	7	RSS	U	1	49	1.1	0.93																										
87	31-Oct-05	GN	5	NSC	M	1	301	294.0	1.08	W													114	1			139								
88	31-Oct-05	GN	5	NSC	M	1	299	262.0	0.98	W													115	2	12.60		140								
89	31-Oct-05	GN	5	PCC	U	1	169	67.0	1.39	G														1											
90	31-Oct-05	GN	5	PCC	F	1	185	83.1	1.31	G														0											3 tapeworm
91	31-Oct-05	GN	5	PCC	U	1	150	36.1	1.07	W														0											
92	31-Oct-05	GN	5	PCC	M	1	165	46.3	1.03	W														0											
93	31-Oct-05	GN	5	PCC	M	1	153	42.0	1.17	W														0											1 tapeworm
94	31-Oct-05	GN	5	KO	M	1	199	97.4	1.24	G		2992	43-44	2+	12	17	10		39	25	39	52		0		45							N	Silver	
95	31-Oct-05	GN	5	KO	F	1	194	87.2	1.19	G		2992	45-46	2+	11	16	10		37	29	41	53		1	0.40	46							N	Silver	
96	31-Oct-05	GN	5	CT	U	1	193	70.3	0.98	G		2991	25-26	2+									120	2	3.90		145								
97	31-Oct-05	GN	5	NSC	F	3	438	1410.0	1.68	W													119	4	89.20		144								
98	31-Oct-05	GN	5	NSC	M	3	395	772.0	1.25	W													118	1	38.80		143								2 tapeworm
99	31-Oct-05	GN	5	SU	M	3	333	573.0	1.55	G													117	4	31.70		142								
100	31-Oct-05	GN	5	CT	F	1	242	153.2	1.08	G		2991	27-28	4+									121	3	10.10		146								
101	31-Oct-05	GN	5	PCC	U	1	195	105.5	1.42	W														0	0.00										3 tapeworm
102	31-Oct-05	GN	5	CT	M	3	295	276.7	1.08	G		2991	29-30	n/a									122	3	6.30										
103	31-Oct-05	GN	5	NSC	U	1	205	101.3	1.18	G													116	2	1.70		141								
104	31-Oct-05	GN	5	CT	F	1	236	134.8	1.03	W		2991	41-42	3+									131	3	4.70		156								
105	31-Oct-05	GN	5	KO	F	5	228	117.0	0.99	W	54	2992	47-48	2+	14	17	11		42	26	41	54		0		47						4.9	N	Olive Green	
106	31-Oct-05	GN	5	CT	U	1	292	224.3	0.90	W		2991	31-32	5+									124	1	7.70										
107	31-Oct-05	GN	5	KO	F	4	237	170.0	1.28	G	55	2993	49-50	2+	13	20	11		44	24	36	55		0		50		7.0	25.7	367	15.1	4.9	N	Olive Green	
108	31-Oct-05	GN	5	CT	M	1	252	156.1	0.98	W		2991	33-34	n/a									123	2	6.60										
109	31-Oct-05	GN	5	NSC	M	1	214	120.3	1.23	W													125	3	5.20		150								
110	31-Oct-05	GN	5	PCC	U	1	179	85.3	1.49	G														0											8 tapeworm
111	31-Oct-05	GN	5	CT	U	1	247	124.0	0.82	E		2991	35-36	2+									126	2	4.90		151								Head severed
112	31-Oct-05	GN	5	SU	U	1	210	99.0	1.07	G													127	3	4.90		152								
113	31-Oct-05	GN	5	KO	F	3	249	171.2	1.11	G	57	2993	1-2	3+	15	18	11	3	47	24	42	57		0		52		7.6	25.2	332	14.7	4.9	N	Olive Green	
114	31-Oct-05	GN	5	SU	U	1	220	123.5	1.16	G													128	3	3.30		153								
115	31-Oct-05	GN	5	PCC	F	1	225	145.0	1.27	G														1											
116	31-Oct-05	GN	5	KO	M	4	236	160.2	1.22	G		2993	3-4	3+	14	19	12	2	47	25	40	58		0		53			6.5		4.1		N	Olive Green	
117	31-Oct-05	GN	5	PCC	F	1	217	131.7	1.29	W														3											1 tapeworm
118	31-Oct-05	GN	5	SU	U	1	212	105.3	1.11	G													132	3	5.90		157								
119	31-Oct-05	GN	5	CT	M	1	250	157.8	1.01	G		2991	37-38	3+									129	1	4.80		154								
120	31-Oct-05	GN	5	PCC	U	1	179	73.5	1.28	W														1											11 tapeworm
121	31-Oct-05	GN	5	CT	M	1	215	94.3	0.95	W		2991	39-40	2+									130	3	2.60		155								
122	31-Oct-05	GN	5	KO	F	3	238	155.7	1.15	G		2993	7-8	3+	12	17	10	3	42	26	40	60		0		55		6.1	21.4	351	13.7	4.5	N	Olive Green	
123	31-Oct-05	GN	5	KO	M	4	228	155.3	1.31	G		2993	5-6	3+	18	18	8	2	46	27	50	59		0		54		5.6	21.4	382	13.8	4.5	N	Olive Green	Dorsal humpback
124	31-Oct-05	GN	5	KO	F	5	229	121.5	1.01	G	56	2992	49-50	3+	14	17	9	2	42	23	39	56		0		51							N	Olive Green	
125	31-Oct-05	GN	5	PCC	F	1	223	150.9	1.36	W														2											
126	31-Oct-05	GN	5	KO	F	3	222	133.9	1.22	G	60	2993	11-12	3+								62		0		57		6.4	18.4	288	13.7	4.4	N	Silver	
127	31-Oct-05	GN	5	KO	F	4	238	141.6	1.05	G	59	2993	9-10	3+	14	19	8	3	44	22	39	61		0		56						4.5	N	Olive Green	
128	2-Nov-05	GN	18	CT	M	1	242	148.2	1.05	W		2991	43-44	n/a									133	2	5.60		158								
129	2-Nov-05	GN	17	CT	F	1	226	109.2	0.95	G		2991	47-48	2+									134	2	5.80		160								
130	2-Nov-05	GN	17	KO	F	4	227	141.3	1.21	G														0				8.4	21.5	256	15.2	4.4	N	Red	
131	2-Nov-05	GN	17	KO	F	4	220	131.6	1.24	W		2993	47-48	3+	13	19	10	2	44	23	40			0				8.4	18.4	219	14.0	4.5	N	Red	
132	2-Nov-05	GN	17	KO	M	4	220	123.7	1.16	W														0					4.1		3.3		N	Red	
133	2-Nov-05	GN	17	KO	F	4	211	122.0	1.30	W														0				8.0	19.6	245	16.1	4.4	N	Red	
134	2-Nov-05	GN	15	KO	F	1	200	95.5	1.19	G														1		49								Silver	
135	2-Nov-05	GN	17	CT	U	1	290	270.0	1.11	W		2991	49-50	3+									137	4	5.00		161		14.1		5.2	5.0			3 stickleback in gut
136	2-Nov-05	GN	17	KO	M	5	228	151.7	1.28	E														0									N	Red	Dorsal humpback
137	2-Nov-05	GN	17	KO	F	3	228	156.8	1.32	E														0				7.4	24.2	327	15.4	4.6	N	Red	
138	2-Nov-05	GN	18	PCC	U	1	106	13.9	1.17	G														0											
139	2-Nov-05	GN	18	NSC	U	1	118	16.4	1.00	G													87	2	0.90		96								
140	2-Nov-05	GN	18	NSC	U	1	118	17.2	1.05	G														0			97								
141	2-Nov-05	GN	18	NSC	M	1	133	34.9	1.48	G														0			112								
142	2-Nov-05	GN	18	NSC	M	1	147	31.6	0.99	G													102	1	0.30		113								

														Age reading																					
															Annuli																				
Fish Id.	Date	Gear Type	Site	Species	Sex	Life Stage	Fork Length	Weight	K-factor	Capture Type	Gill Raker sample	Scale Book	Scale Cell	Scale	1st	2nd	3rd	4th	Total	Distance to Seventh Circuli	Distance to first annulus	Otolith	Stomach Sample	Stomach Fullness	Stoamch mass	DNA Vial	Isotope Sample	Gonad Weight	Total Gonad Weight	Fecundity	GSI (wt:wt)	Egg Diam.	Caudal Frayed	Skin Colour	Comments
(#)	dd-mm	a	(#)	b	c	d	(mm)	(g)	(#)	e	(#)	(#)	(#)	(#)	(#)	(#)	(#)	(#)	(#)	f	f	(#)	(#)	g	(g)	(#)	(#)	(g)	(g)	(#)	h	(mm)	(Y/N)		
143	2-Nov-05	GN	18	NSC	M	1	129	23.2	1.08	G														0			114								
144	2-Nov-05	GN	18	NSC	M	1	121	17.6	0.99	W														0			115								
145	2-Nov-05	GN	18	KO	F	3	212	137.3	1.44	G		2993	15-16	2+	11	22	9		42	24	34	64		0				8.3	28.1	339	20.5	4.3	N	Olive Green	Collected for Broodstock test
146	2-Nov-05	GN	18	KO	M	4	215	125.9	1.27	G		2993	13-14	2+	12	21	6		39	26	38	63		0		58			5.7		4.5		N	Olive Green	Collected for Broodstock test
147	2-Nov-05	GN	18	SC	M	1	171	61.0	1.22	G														0			116								
148	2-Nov-05	GN	18	KO	F	4	234	154.7	1.21	G	48	2992	31-32	n/a								45		0		39			22.9		14.8	4.8	N	Olive Green	Collected for Broodstock test
149	2-Nov-05	GN	18	SU	U	1	201	92.4	1.14	G													103	2	4.10		117								
150	2-Nov-05	GN	18	NSC	M	1	222	108.7	0.99	W													104	1	4.40		118								
151	2-Nov-05	GN	18	KO	F	4	245	164.2	1.12	W	45	2992	25-26	3+	14	19	9	1	43	26	42	42		0		36		7.5	31.3	417	19.1	4.2	N	Olive Green	
152	2-Nov-05	GN	18	SC	M	1	161	53.9	1.29	E													105	3	3.00		119								
153	2-Nov-05	GN	18	NSC	F	1	211	104.7	1.11	G													106	2	4.70		120								
154	2-Nov-05	GN	18	PCC	F	1	231	139.2	1.13	W													107	3	2.40		121								2 tapeworm
155	2-Nov-05	GN	18	KO	F	4	249	172.0	1.11	W	46	2992	27-28	3+	14	20	10	3	47	25	41	43		0		37		7.4	29.1	393	16.9	4.7	N	Olive Green	
156	2-Nov-05	GN	18	KO	M	4	223	116.6	1.05	G		2993	17-18	2+	15	19	8		42	28	46	65		0	2.20									Olive Green	Collected for Broodstock test
157	2-Nov-05	GN	18	KO	M	4	228	141.2	1.19	G	47	2992	29-30	n/a								44		0		38			4.8		3.4		N	Olive Green	Dorsal humpback
158	2-Nov-05	GN	18	PCC	U	1	207	103.9	1.17	W													108	1	2.30										4 tapeworm
159	2-Nov-05	GN	18	KO	M	5	222	122.4	1.12	G	49	2992	33-34	2+	13	19	6		38	26	39	46		0		40			2.1		1.7		N	Olive Green	Dorsal humpback
160	2-Nov-05	GN	18	KO	M	5	230	152.2	1.25	G	50	2992	35-36	3+	18	20	9	1	48	26	45	47		0		41			4.8		3.2		N	Olive Green	
161	2-Nov-05	GN	18	KO	F	3	235	157.0	1.21	G		2993	23-24	3+	15	17	11	4	47	25	42	67		0				6.2	29.5	476	18.8	4.5	N	Olive Green	Collected for Broodstock test
162	2-Nov-05	GN	18	KO	M	5	233	173.3	1.37	W		2993	19-20	3+	13	17	11	2	43	23	36	66		0					2.1		1.2		N	Olive Green	Collected for Broodstock test
163	2-Nov-05	GN	18	KO	F	4	230	148.3	1.22	W	52	2992	39-40	3+	13	21	8	2	44	25	40	49		0		43		6.4	23.1	361	15.6	4.5	N	Olive Green	Collected for Broodstock test
164	2-Nov-05	GN	18	KO	M	4	213	116.2	1.20	W	51	2992	37-38	2+	12	17	7		36	26	37	48		0		42			3.7		3.2		N	Olive Green	Dorsal humpback
165	2-Nov-05	GN	18	PCC	F	1	205	108.1	1.25	W														2											
166	2-Nov-05	GN	18	PCC	M	1	188	81.5	1.23	G														2											
167	2-Nov-05	GN	18	PCC	M	1	175	63.3	1.18	G														3											
168	2-Nov-05	GN	18	NSC	M	1	195	83.2	1.12	G													109	1	2.00		122								
169	2-Nov-05	GN	18	NSC	M	1	159	50.0	1.24	G														0			124								
170	2-Nov-05	GN	18	NSC	M	1	191	73.3	1.05	G														0			123								
171	2-Nov-05	GN	18	PCC	M	1	158	44.9	1.14	G														2											
172	2-Nov-05	GN	18	CT	F	1	297	294.7	1.12	W		2991	23-24	n/a									111	1	4.80		126		16.8		5.7	3.4			
173	2-Nov-05	GN	18	SU	U	1	282	52.8	0.24	G												51	110	4	14.30		125								
174	2-Nov-05	GN	18	KO	F	3	245	179.4	1.22	S	53	2992	41-42	3+	15	18	8	3	44	25	43			0				8.1	29.9	369	16.7	4.5	N	Olive Green	
175	2-Nov-05	GN	18	KO	M	4	239	145.6	1.07	G		2993	21-22	3+	14	20	9	4	47	23	41	50		1		44	67		3.8		2.6		N	Olive Green	Collected for Broodstock test
176	2-Nov-05	GN	17	NSC	U	1	294	289.0	1.14	G													53	3	6.30		60								
177	2-Nov-05	GN	17	SU	U	1	258	196.0	1.14	G													54	4	10.50		61								
178	2-Nov-05	GN	17	KO	M	1	236	149.5	1.14	W		2993	25-26	3+	14	21	13	4	52	21	40	68		0					3.0		2.0		N	Olive Green	Collected for Broodstock test
179	2-Nov-05	GN	17	NSC	U	4	310	345.0	1.16	G													55	2	5.80		62								
180	2-Nov-05	GN	17	SU	U	1	271	232.0	1.17	G													56	1	9.80		63								
181	2-Nov-05	GN	17	PCC	U	1	164	46.2	1.05	W													57	1	1.20		64								
182	2-Nov-05	GN	17	PCC	U	1	165	51.2	1.14	W													58	2	2.00		65								2 tapeworm
183	2-Nov-05	GN	17	SC	U	1	126	24.2	1.21	G													59	3	1.70		66								Live ectoparasite observed pec. fin
184	2-Nov-05	GN	17	PCC	U	1	155	44.7	1.20	W													60	2	2.40		67								
185	2-Nov-05	GN	17	PCC	U	1	190	80.5	1.17	G													61	2	4.10		68								
186	2-Nov-05	GN	17	PCC	U	1	168	60.1	1.27	W													62	1	2.10		69								5 tapeworm
187	2-Nov-05	GN	17	NSC	U	1	172	53.9	1.06	G													63	1	2.40		70								
188	2-Nov-05	GN	17	PCC	U	1	193	88.8	1.24	G													64	2	2.80		71								2 tapeworm
189	2-Nov-05	GN	17	PCC	U	1	190	85.8	1.25	G													65	2	3.30		72								
190	2-Nov-05	GN	17	PCC	U	1	187	77.1	1.18	W														0			73								
191	2-Nov-05	GN	17	PCC	U	1	169	57.3	1.19	G													66	3	3.50		74								1 tapeworm
192	2-Nov-05	GN	17	PCC	U	1	198	92.6	1.19	G													67	2	2.10		75								
193	2-Nov-05	GN	17	NSC	U	1	184	70.6	1.13	G													68	2	3.50		76								
194	2-Nov-05	GN	17	PCC	U	1	158	44.4	1.13	G													69	2	1.70		77								
195	2-Nov-05	GN	17	SU	U	1	167	51.3	1.10	G													70	4	3.90		78								
196	2-Nov-05	GN	17	PCC	F	1	216	121.0	1.20	G													71	2	3.00		79								
197	2-Nov-05	GN	17	KO	F	4	230	145.0	1.19	G		2993	31-32	3+	14	19	8	2	43	26	42	71		0				9.2	26.2	285	18.1	5.0	N	Olive Green	Collected for Broodstock test
198	2-Nov-05	GN	17	KO	F	4	231	134.9	1.09	G	38	2992	15-16	3+	13	21	13	3	50	24	39			0		10		6.6	18.7	283	13.9	4.5	Y	Olive Green	
199	2-Nov-05	GN	17	KO	F	5	224	106.8	0.95	G	39	2992	17-18	3+	13	19	11	2	45	24	40	38		0		12						4.6	Y	Olive Green	
200	2-Nov-05	GN	17	PCC	U	1	205	109.2	1.27	W													72	2	2.50		80								
201	2-Nov-05	GN	17	PCC	F	1	217	129.6	1.27	G													73	2	4.80		81								
202	2-Nov-05	GN	17	PCC	U	1	204	99.3	1.17	G													74	1	4.00		82								1 tapeworm
203	2-Nov-05	GN	17	KO	F	4	233	139.1	1.10	S	40	2992	19-20	3+	13	16	19	3	51	25	42			0		24		6.8	13.3	196	9.6	4.5	Y	Olive Green	
204	2-Nov-05	GN	17	KO	M	4	227	133.0	1.14	E	41	2992	21-22	3+	14	21	10	5	50	23	38	39		0		34			2.6		2.0		N	Olive Green	
205	2-Nov-05	GN	17	KO	M	4	230	157.3	1.29	W		2993	27-28	n/a										0			69		7.9		5.0		N	Olive Green	Collected for Broodstock test
206	2-Nov-05	GN	17	NSC	U	1	234	149.2	1.16	G													75	2	5.60		83								
207	2-Nov-05	GN	17	PCC	F	1	192	90.3	1.28	W													76	3	3.90		84								
208	2-Nov-05	GN	17	KO	M	4	237	149.0	1.12	W		2993	29-30	3+	12	22	8	2	44	22	36			0					3.7		2.5		N	Olive Green	Collected for Broodstock test
209	2-Nov-05	GN	17	SU	U	1	238	152.5	1.13	G													77	4	11.40		85								
210	2-Nov-05	GN	17	SU	M	1	306	328.0	1.14	G													78	4	4.00		86								
211	2-Nov-05	GN	17	PCC	U	1	196	93.1	1.24	W														0			87								
212	2-Nov-05	GN	17	PCC	U	1	213	124.4	1.29	W													79	1	3.80		88								1 tapeworm
213	2-Nov-05	GN	17	NSC	U	1	266	224.7	1.19	G													80	3	8.50		89								
214	2-Nov-05	GN	17	PCC	M	1	215	114.0	1.15	G													81	3	4.10		90								

Fish Id.	Date	Gear Type	Site	Species	Sex	Life Stage	Fork Length	Weight	K-factor	Capture Type	Gill Raker sample	Age reading: Scale Book	Scale Cell	Scale	Annuli: 1st	2nd	3rd	4th	Total	Distance to Seventh Circuli	Distance to first annulus	Otolith	Stomach Sample	Stomach Fullness	Stoamch mass	DNA Vial	Isotope Sample	Gonad Weight	Total Gonad Weight	Fecundity	GSI (wt:wt)	Egg Diam.	Caudal Frayed	Skin Colour	Comments
(#)	dd-mm	a	(#)	b	c	d	(mm)	(g)	(#)	e	(#)	(#)	(#)	(#)	(#)	(#)	(#)	(#)	(#)	f	f	(#)	(#)	g	(g)	(#)	(#)	(g)	(g)	(#)	h	(mm)	(Y/N)		
215	2-Nov-05	GN	17	KO	F	4	226	149.0	1.29	G		2992	23-24	n/a								40		0				7.1	29.7	418	19.9	4.5	Y	Olive Green	
216	2-Nov-05	GN	17	PCC	U	1	212	115.9	1.22	G													82	3	3.50		91								
217	2-Nov-05	GN	17	PCC	U	1	208	105.4	1.17	G													83	1	3.30		92								
218	2-Nov-05	GN	17	KO	M	4	213	103.8	1.07	G		2993	33-34	2+	13	22	6		41	25	40			0					1.7		1.6		N	Olive Green	Collected for Broodstock test
219	2-Nov-05	GN	17	NSC	U	1	335	404.9	1.08	G													84	2	17.10		93								
220	2-Nov-05	GN	17	PCC	F	1	234	133.8	1.04	W																									
221	2-Nov-05	GN	17	KO	F	4	232	133.0	1.07	W		2993	37-38	n/a										0				7.2	17.1	238	12.9	4.4	N	Olive Green	Collected for Broodstock test
222	2-Nov-05	GN	17	CT	M	1	402	797.0	1.23	G	43	2991	19-20	4+									85	4	31.40		94								Whole kokanee in gut
223	2-Nov-05	GN	17	CT	F	1	370	477.0	0.94	W	44	2991	21-22	5+								41	86	4	14.90		95								Fish in gut
224	2-Nov-05	GN	17	KO	M	5	210	102.9	1.11	G		2993	35-36	2+	14	19	6		39	26	43			0					1.4		1.4		N	Olive Green	Collected for Broodstock test
225	2-Nov-05	GN	15	KO	M	1	214	115.0	1.17	G													40	2	0.90								N	Silver	
226	2-Nov-05	GN	15	CO	U	1	203	16.3	0.19	G																									Acoustic tag 1201
227	2-Nov-05	GN	15	KO	F	1	192	87.9	1.24	W													41	3	2.30								N		
228	2-Nov-05	GN	15	CT	M	1	261	114.5	0.64	W		2991	17-18	n/a									42	4	9.30		51								
229	2-Nov-05	GN	15	KO	F	1	217	108.0	1.06	G	36	2992	11-12	3+	14	17	11	2	44	27	44	36	43	3	0.90								N		
230	2-Nov-05	GN	15	PCC	F	1	179	82.4	1.44	G													44	1	0.60		52								2 tapeworm
231	2-Nov-05	GN	15	PCC	F	1	224	132.8	1.18	G													45	1	1.70		53								1 tapeworm
232	2-Nov-05	GN	15	PCC	F	1	174	61.5	1.17	G													46	1	0.90		54								1 tapeworm
233	2-Nov-05	GN	15	PCC	F	1	161	51.2	1.23	W													47	3	2.60		55								
234	2-Nov-05	GN	15	PCC	U	1	173	63.4	1.22	W													48	3	3.60		56								1 tapeworm
235	2-Nov-05	GN	15	PCC	U	1	167	57.7	1.24	G													49	3	2.50		57								
236	2-Nov-05	GN	15	PCC	U	1	169	60.8	1.26	G													50	3	3.20		58								
237	2-Nov-05	GN	15	PCC	U	1	179	70.8	1.23	G													51	2	1.70		59								3 tapeworm
238	2-Nov-05	GN	15	KO	F	1	184	63.9	1.03	G	37	2992	13-14	2+	13	20	8		41	23	39	37	52	2	1.30	48							N		
239	2-Nov-05	MT	17	RSS	U	1	70	4.1	1.20														88	4	0.30		98								
240	2-Nov-05	MT	17	RSS	U	1	55	1.7	1.02															0											
241	2-Nov-05	MT	17	SC	U	1	111	15.2	1.11														89	4	1.30		99								
242	2-Nov-05	MT	17	SC	U	1	65	2.5	0.91																										
243	2-Nov-05	MT	17	SC	U	1	93	11.3	1.40														90	2	0.30		100								2 tapeworm
244	2-Nov-05	MT	18	RSS	U	1	77	5.2	1.14														91	2	0.10		101								
245	2-Nov-05	MT	18	RSS	U	1	66	2.3	0.80														92	1	0.10		102								
246	2-Nov-05	MT	18	RSS	U	1	63	2.7	1.08														93	2	0.20		103								
247	2-Nov-05	MT	18	RSS	U	1	53	1.7	1.14														94	4	0.10		104								
248	2-Nov-05	MT	18	NSC	U	1	120	17.0	0.98														95	4	0.10		105								
249	2-Nov-05	MT	18	RSS	U	1	80	6.0	1.16														96	2	0.10		106								
250	2-Nov-05	MT	18	NSC	U	1	109	13.3	1.03														97	3	1.00		107								
251	2-Nov-05	MT	18	RSS	U	1	55	1.7	1.02																										
252	2-Nov-05	MT	15	NSC	U	1	95	9.2	1.07														98	2	0.30		108								
253	2-Nov-05	MT	15	NSC	U	1	115	12.3	0.81														99	4	1.20		109								
254	2-Nov-05	MT	15	NSC	U	1	115	11.4	0.75														100	4	0.80		110								
255	2-Nov-05	MT	15	RSS	U	1	80	5.7	1.11														101	3	0.30		111								
256	24-Nov-05	TRWL	100	KO	U	0	49	1.2	1.02																										
257	24-Nov-05	TRWL	100	KO	U	0	50	1.0	0.80																										
258	24-Nov-05	TRWL	100	KO	U	0	59	1.9	0.93																										

[a] Gear abbreviations: Gillnet (GN), Minnow Trap (MT), and Mid-Water Trawl (TRWL)

[b] Fish abbreviations: Cutthroat Trout (CT), kokanee (KO), coho (CO), sucker (SU), peamouth chub (PCC), northern pikeminnow (NSC), redside shiner (RSS), sculpin (SC); Threespine Stickleback (TSSB).

[c] Sex abbreviations: Male (M), Female (F), and Unknown (U)

[d] Life Stage abbreviations: Immature (1), Maturing (2), Mature (3), Spawning (4), and Spent (5).

[e] Capture type abbreviations: Entangled by snout (E), Gilled (G), Wedged (W), and Snagged by fin (S)

[f] The distance from the focus to the 7th circulus, and the distance from the focus to the first annulus are provided with measurements in mm at 100 power.

[g] Relative stomach fullness rating : Empty (0), 1-25 % full (1), 26-50 % full (2), 51-75 % full (3), 76-100 % full.

[h] Proportional mass of gonad-to-somatic tissue

Appendix 32. Summary of biological characteristics of fishes, by sex, collected using gillnetting at Coquitlam Reservoir, May 2005.

		CT			KO			CO			SU			NSC			PCC			SC		
		M	F	All	M	F	All	M	F	All	M	F	All	M	F	All	M	F	All	M	F	All
Sample size (#)		9	13	28	53	62	137	-	-	-	4	2	7	16	8	54	6	2	27	-	-	-
Length (mm)	Mean	287.4	276.1	277.6	190.1	194.9	193.5	-	-	-	309.5	226.5	258.7	293.1	327.5	283.2	185.7	195.5	179.7	-	-	-
	StdDev	78.4	44.8	55.6	17.8	20.4	19.6	-	-	-	55.8	89.8	90.4	65.1	92.0	84.7	15.4	0.7	24.9	-	-	-
	Min	165.0	198.0	165.0	155.0	128.0	128.0	-	-	-	269.0	163.0	120.0	190.0	208.0	129.0	170.0	195.0	125.0	-	-	-
	Max	397.0	346.0	397.0	220.0	225.0	225.0	-	-	-	392.0	290.0	392.0	432.0	433.0	433.0	210.0	196.0	223.0	-	-	-
Mass (g)	Mean	272.7	216.3	229.6	76.1	82.4	80.6	-	-	-	436.0	160.2	297.4	350.9	597.0	375.6	75.8	86.7	70.4	-	-	-
	StdDev	195.4	91.3	131.8	21.8	23.4	23.1	-	-	-	344.7	149.7	308.7	265.9	487.5	347.5	27.3	6.2	28.5	-	-	-
	Min	48.8	75.4	48.8	46.8	21.6	21.6	-	-	-	225.0	54.3	17.8	71.4	88.8	18.9	46.1	82.3	18.9	-	-	-
	Max	639.0	400.0	639.0	123.0	119.4	123.0	-	-	-	951.0	266.0	951.0	1077.0	1329.0	1329.0	124.7	91.1	124.7	-	-	-
K-factor	Mean	0.96	0.97	639.00	0.97	1.08	1.07	-	-	-	1.27	1.17	1.20	1.17	1.31	1.19	1.14	1.15	1.13	-	-	-
	StdDev	0.07	0.08	0.97	0.08	0.09	0.08	-	-	-	0.21	0.11	0.18	0.11	0.22	0.18	0.14	0.10	0.12	-	-	-
	Min	0.87	0.80	0.08	0.80	0.90	0.85	-	-	-	1.13	1.09	1.00	1.03	0.98	0.86	0.93	1.09	0.87	-	-	-
	Max	1.08	1.11	0.80	1.17	1.34	1.34	-	-	-	1.58	1.24	1.58	1.37	1.73	1.73	1.34	1.22	1.34	-	-	-

[a] Includes fish classified as sex 'unknown'.

Appendix 33. Summary of biological characteristics of fishes collected using minnow trapping at Coquitlam Reservoir, May 2005.

		CT	NCC	PCC	RSS	SC	TSSB
Sample size (#)		5	30	1	29	7	29
Length (mm)	Mean	112.2	83.1	47.0	57.9	96.1	56.4
	StdDev	22.2	13.7	-	18.5	21.9	9.1
	Min	85.0	49.0	47.0	31.0	59.0	39.0
	Max	135.0	118.0	47.0	103.0	125.0	69.0
Mass (g)	Mean	13.5	6.3	1.3	2.8	10.6	1.6
	StdDev	7.2	2.8	-	3.4	6.6	0.6
	Min	5.6	1.0	1.3	0.2	2.4	0.5
	Max	21.9	15.4	1.3	12.5	21.6	2.6
K-factor	Mean	0.88	1.03	1.25	1.04	1.06	0.83
	StdDev	0.04	0.14	-	0.16	0.11	0.14
	Min	0.82	0.85	1.25	0.67	0.92	0.55
	Max	0.91	1.52	1.25	1.43	1.23	1.29

Appendix 34. Summary of biological characteristics of fishes, by sex, collected using gillnetting at Coquitlam Reservoir, November 2005.

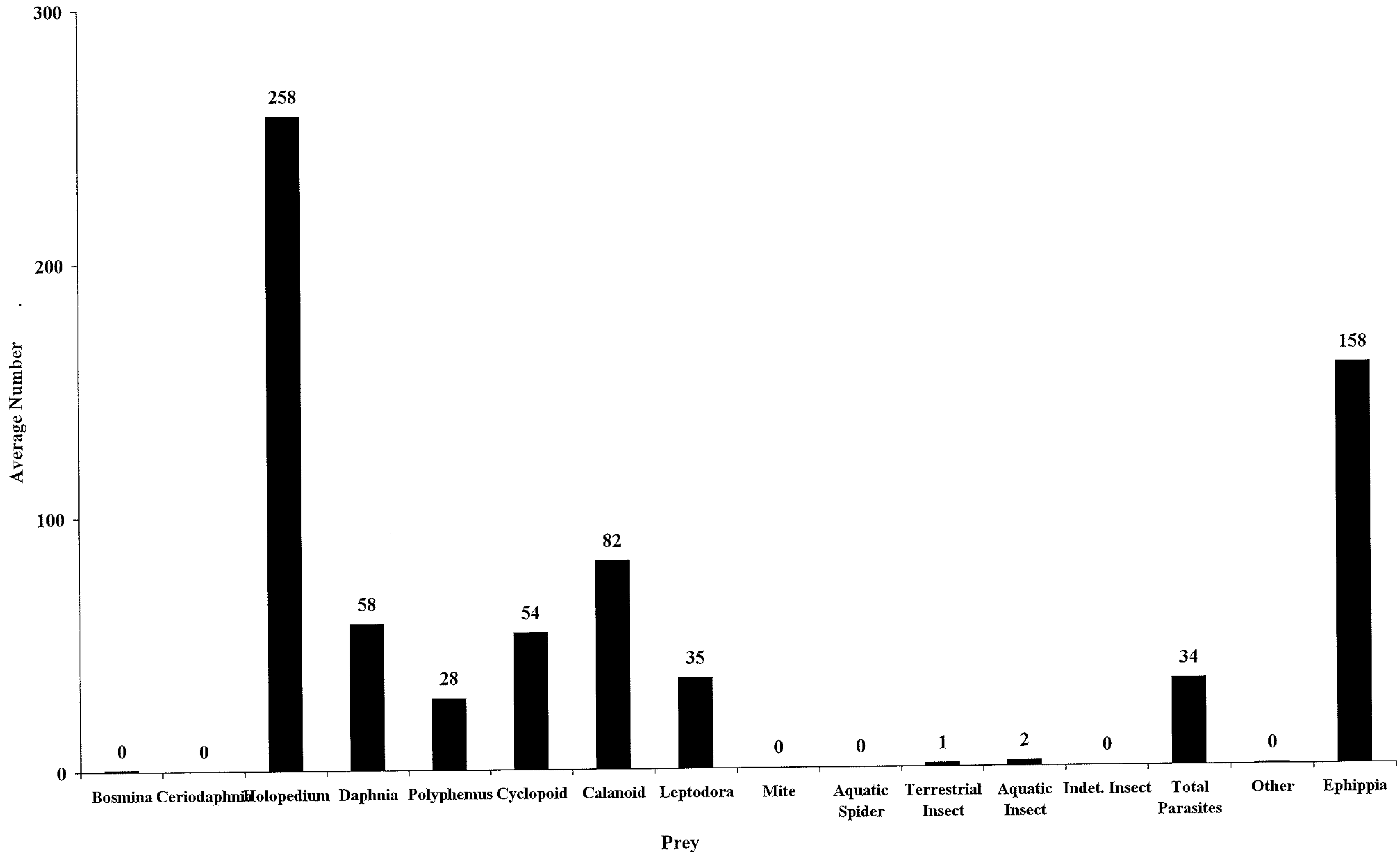
		CT			KO			CO			SU			NSC			PCC			SC		
		M	F	All	M	F	All	M	F	All	M	F	All	M	F	All	M	F	All	M	F	All
Sample size (#)		8	13	25	52	41	93	-	-	1	3	-	12	16	4	30	6	15	52	2	-	3
Length (mm)	Mean	286.1	324.2	301.0	224.7	223.3	224.1	-	-	203.0	326.7	-	253.3	234.2	365.0	248.1	175.7	207.9	189.1	166.0	-	152.7
	StdDev	66.5	87.7	78.2	18.3	21.8	19.8	-	-		18.3	-	75.9	93.3	122.9	100.6	23.0	23.8	27.2	7.1	-	23.6
	Min	215.0	226.0	193.0	145.0	128.0	128.0	-	-	203.0	306.0	-	167.0	121.0	211.0	118.0	153.0	161.0	106.0	161.0	-	126.0
	Max	402.0	491.0	491.0	251.0	249.0	251.0	-	-	203.0	341.0	-	341.0	395.0	486.0	486.0	215.0	235.0	235.0	171.0	-	171.0
Mass (g)	Mean	286.0	431.2	343.3	138.0	132.8	135.7	-	-	16.3	447.3	-	203.9	184.8	502.4	221.3	65.3	115.2	87.7	57.5	-	46.4
	StdDev	252.3	376.3	317.1	29.0	31.7	30.1	-	-		122.6	-	255.7	224.3	620.6	291.0	28.1	34.3	35.9	5.0	-	19.5
	Min	94.3	109.2	70.3	45.3	26.9	26.9	-	-	16.3	328.0	-	51.3	17.6	99.7	16.4	42.0	51.2	13.9	53.9	-	24.2
	Max	797.0	1223.0	1223.0	181.8	179.4	181.8	-	-	16.3	573.0	-	573.0	772.0	1410.0	1410.0	114.0	168.1	168.1	61.0	-	61.0
K-factor	Mean	1.00	1.03	1.00	1.20	1.17	1.19	-	-	0.19	1.27	-	1.09	1.08	1.01	1.08	1.15	1.25	1.22	1.26	-	1.24
	StdDev	0.17	0.06	0.11	0.10	0.11	0.10	-	-		0.24	-	0.98	0.29	0.67	0.30	0.07	0.10	0.09	0.05	-	0.04
	Min	0.64	0.94	0.64	1.00	0.95	0.95	-	-	0.19	1.11	-	0.24	0.12	0.09	0.09	1.03	1.04	1.03	1.22	-	1.21
	Max	1.23	1.14	1.23	1.49	1.44	1.49	-	-	0.19	1.55	-	1.55	1.48	1.68	1.68	1.23	1.44	1.49	1.29	-	1.29

[a] Includes fish classified as sex 'unknown'.

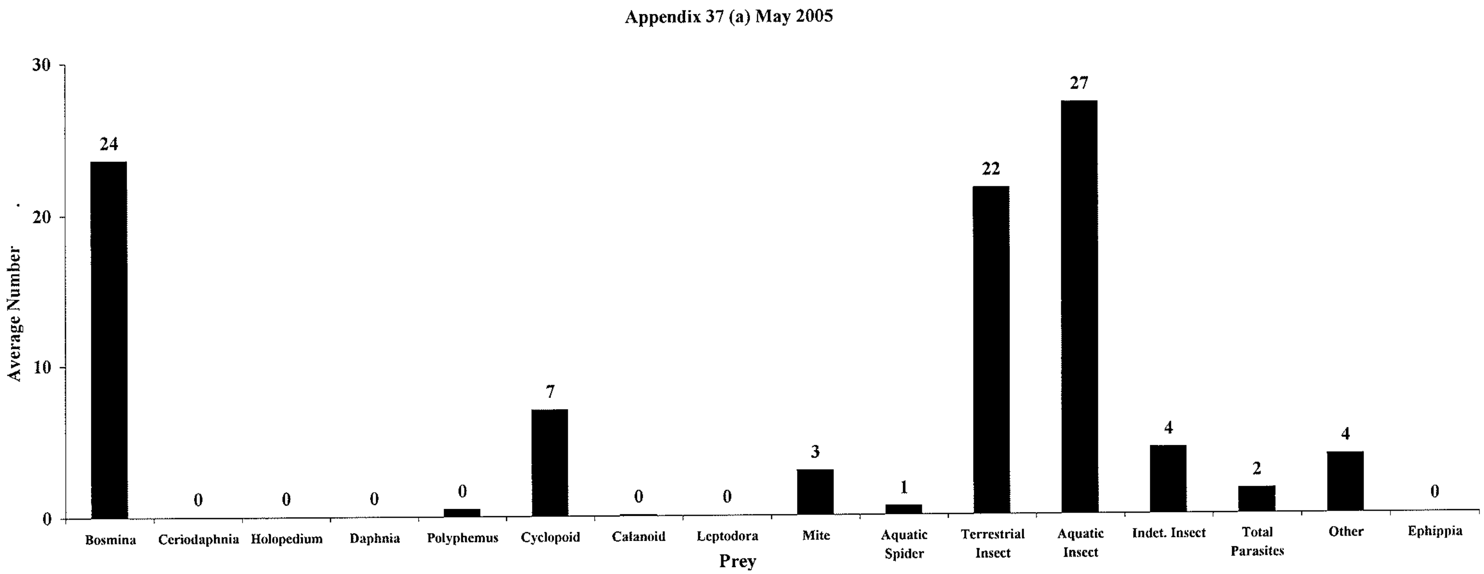
Appendix 35. Summary of biological characteristics of fishes collected using minnow trapping at Coquitlam Reservoir, November 2005.

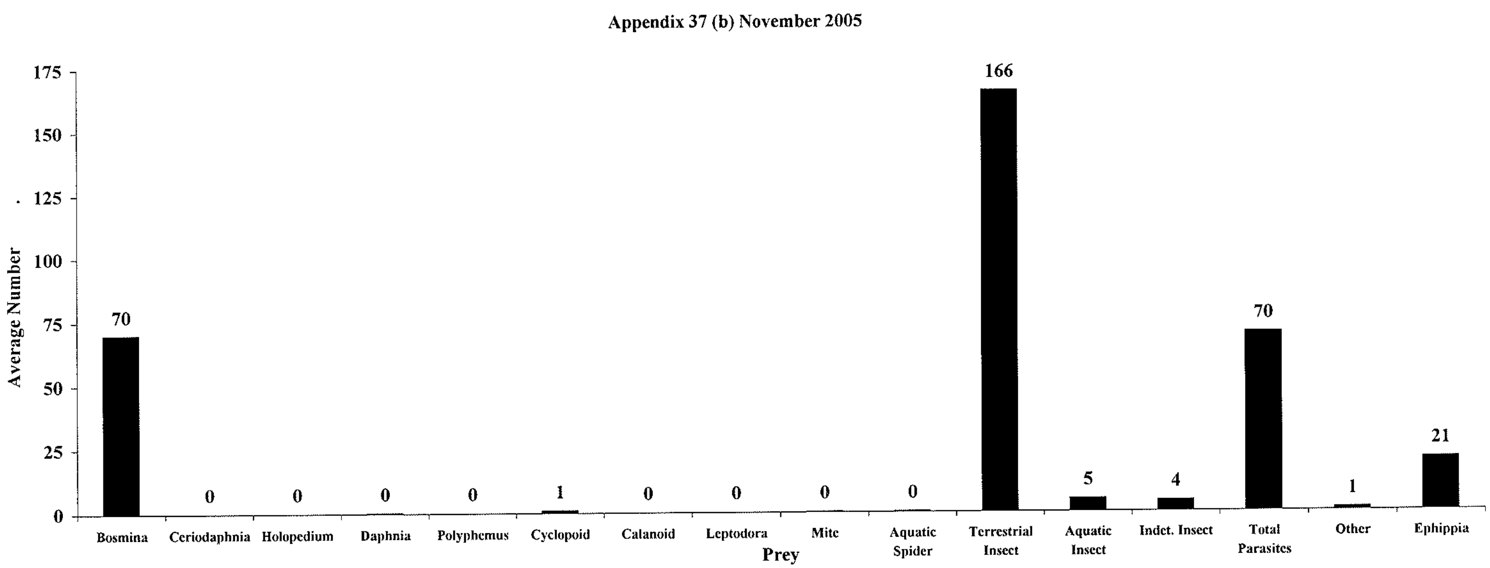
		NSC	RSS	SC
Sample size (#)		9	26	3
Length (mm)	Mean	113.00	62.81	89.67
	StdDev	13.96	11.67	23.18
	Min	89.00	48.00	65.00
	Max	132.00	98.00	111.00
Mass (g)	Mean	15.34	3.21	9.67
	StdDev	6.44	2.24	6.51
	Min	7.30	1.00	2.50
	Max	25.60	12.10	15.20
K-factor	Mean	1.01	1.18	-
	StdDev	0.15	0.28	-
	Min	0.75	0.80	-
	Max	1.18	1.95	-

Appendix 36 (b) November 2005



Appendix 37. Stomach contents of cutthroat trout at Coquitlam Reservoir, 2005.





Appendix 38a. Estimated number of fish in the North Basin at Coquitlam Reservoir, May 2005.

Depth (m)	Mean	Variance	Sample Size	Stratum Area (ha)	Population Estimate	SE of Population Estimate	Lower 95% Confidence Level	Upper 95% Confidence Level
0-5	75	3,938	2	140	10,507	6,213	-	23,617
5-10	46	1,049	2	133	6,143	3,041	-	12,559
10-15	27	1,078	2	120	3,212	2,784	-	9,086
15-20	65	409	2	109	7,075	1,553	3,799	10,351
20-25	28	450	2	101	2,841	1,517	-	6,043
25-30	2	0	2	97	185	28	126	243
30-35	3	12	2	93	326	229	-	809
35-40	4	0	2	89	362	33	293	431
40-45	6	6	2	86	521	153	199	843
45-50	1	1	2	82	102	61	-	231
50-55	0	0	2	78	8	8	-	25

Appendix 38b. Estimated number of fish in the Central Basin at Coquitlam Reservoir, May 2005.

Depth (m)	Mean	Variance	Sample Size	Stratum Area (ha)	Population Estimate	SE of Population Estimate	Lower 95% Confidence Level	Upper 95% Confidence Level
0-5	185	10,804	20	602	111,351	13,911	82,235	140,467
5-10	82	6,685	20	571	46,527	10,430	24,697	68,358
10-15	110	7,949	20	516	56,769	10,231	35,356	78,183
15-20	65	1,454	20	467	30,110	4,192	21,337	38,883
20-25	49	1,344	20	435	21,513	3,589	14,000	29,025
25-30	8	187	20	418	3,145	1,276	475	5,816
30-35	8	312	20	402	3,089	1,587	-	6,411
35-40	1	17	20	384	517	349	-	1,248
40-45	2	5	20	368	730	192	329	1,131
45-50	2	24	20	353	705	387	-	1,515
50-55	1	6	20	336	352	190	-	749
55-60	0	1	20	317	146	56	28	264
60-65	1	1	20	292	173	76	14	333
65-70	0	0	20	273	92	35	19	166
70-75	0	0	20	260	54	35	-	127
75-80	0	0	20	247	45	20	4	86
80-85	0	0	20	232	5	5	-	17
85-90	0	-	20	218	-	-	-	-
90-95	0	-	20	205	-	-	-	-
95-100	0	-	20	192	-	-	-	-
100-105	0	-	20	180	-	-	-	-
105-110	0	-	20	168	-	-	-	-

Appendix 38c. Estimated number of fish in the South Basin at Coquitlam Reservoir, May 2005.

Depth (m)	Mean	Variance	Sample Size	Stratum Area (ha)	Population Estimate	SE of Population Estimate	Lower 95% Confidence Level	Upper 95% Confidence Level
0-5	64	2,414	20	462	29,684	5,070	19,072	40,296
5-10	65	14,875	20	438	28,471	11,934	3,494	53,448
10-15	45	2,506	20	395	17,768	4,425	8,507	27,030
15-20	26	1,488	20	358	9,312	3,087	2,850	15,773
20-25	27	1,944	20	333	8,923	3,288	2,041	15,805
25-30	6	160	20	320	2,011	907	113	3,909
30-35	0	0	20	308	108	43	17	199
35-40	2	35	20	295	458	392	-	1,278
40-45	2	13	16	282	441	258	-	982
45-50	1	5	16	271	157	156	-	484
50-55	0	0	16	258	6	4	-	14
55-60	0	0	14	243	46	28	-	106
60-65	1	4	14	224	122	122	-	376
65-70	0	0	14	209	2	2	-	6
70-75	0	-	14	199	-	-	-	-
75-80	0	1	11	189	63	44	-	155
80-85	0	-	11	178	-	-	-	-
85-90	0	-	11	167	-	-	-	-
90-95	0	-	11	157	-	-	-	-
95-100	0	-	11	147	-	-	-	-
100-105	0	-	11	138	-	-	-	-
105-110	0	-	11	129	-	-	-	-

Appendix 38d. Estimated number of fish at Coquitlam Reservoir, May 2005.

Region	Population Estimate	SE of Population Estimate	Lower 95% Confidence Level	Upper 95% Confidence Level
North	31,281	7,772	15,069	47,493
Central	275,323	21,022	228,485	322,161
South	97,573	14,461	65,353	129,792
Whole Lake	404,177	26,673	348,136	460,218

Appendix 39 a. Estimated number of fish in the North Basin at Coquitlam Reservoir, November 2005.

Depth (m)	Mean	Variance	Sample Size	Stratum Area (ha)	Population Estimate	SE of Population Estimate	Lower 95% Confidence Level	Upper 95% Confidence Level
0-5	19	-	1	140	2,713	-	-	-
5-10	40	-	1	133	5,285	-	-	-
10-15	16	-	1	120	1,885	-	-	-
15-20	23	-	1	109	2,487	-	-	-
20-25	12	-	1	101	1,219	-	-	-
25-30	2	-	1	97	234	-	-	-
30-35	1	-	1	93	69	-	-	-
35-40	0	-	1	89	-	-	-	-
40-45	0	-	1	86	-	-	-	-
45-50	0	-	1	82	0	-	-	-
50-55	0	-	1	78	1	-	-	-

Appendix 39 b Estimated number of fish in the Central Basin at Coquitlam Reservoir, November2005.

Depth (m)	Mean	Variance	Sample Size	Stratum Area (ha)	Population Estimate	SE of Population Estimate	Lower 95% Confidence Level	Upper 95% Confidence Level
0-5	56	6,571	10	602	33,806	15,515	1,333	66,280
5-10	6	44	10	571	3,391	1,533	183	6,600
10-15	6	44	10	516	2,964	1,724	-	6,571
15-20	42	573	10	467	19,571	3,522	12,199	26,943
20-25	54	764	10	435	23,503	4,510	14,064	32,942
25-30	14	54	10	418	5,728	978	3,681	7,775
30-35	14	759	10	402	5,716	3,497	-	13,036
35-40	0	0	10	384	72	55	-	187
40-45	0	0	10	368	78	65	-	215
45-50	0	0	10	353	82	53	-	193
50-55	0	0	10	336	77	42	-	165
55-60	0	1	10	317	143	89	-	330
60-65	0	0	10	292	18	6	6	31
65-70	0	0	10	273	9	6	-	22
70-75	0	0	10	260	39	31	-	104
75-80	0	0	10	247	10	7	-	24
80-85	0	0	10	232	6	5	-	16
85-90	0	-	10	218	-	-	-	-
90-95	0	-	10	205	-	-	-	-
95-100	0	-	10	192	-	-	-	-
100-105	0	-	10	180	-	-	-	-
105-110	0	-	10	168	-	-	-	-

Appendix 39 c. Estimated number of fish in the South Basin at Coquitlam Reservoir, November 2005.

Depth (m)	Mean	Variance	Sample Size	Stratum Area (ha)	Population Estimate	SE of Population Estimate	Lower 95% Confidence Level	Upper 95% Confidence Level
0-5	145	28,613	10	462	66,991	33,289	-	136,664
5-10	9	63	10	438	4,005	1,729	387	7,624
10-15	7	115	10	395	2,633	1,603	-	5,988
15-20	13	196	10	358	4,517	2,186	-	9,092
20-25	13	117	10	333	4,355	1,847	488	8,221
25-30	3	15	10	320	959	509	-	2,024
30-35	6	95	10	308	1,803	1,124	-	4,156
35-40	0	0	10	295	49	34	-	121
40-45	1	1	8	282	161	132	-	438
45-50	0	0	8	271	3	2	-	8
50-55	0	0	8	258	0	0	-	1
55-60	0	-	7	243	-	-	-	-
60-65	0	0	7	224	20	23	-	68
65-70	0	0	7	209	0	0	-	1
70-75	0	-	7	199	-	-	-	-
75-80	0	0	6	189	2	2	-	6
80-85	0	-	6	178	-	-	-	-
85-90	0	-	6	167	-	-	-	-
90-95	0	-	6	157	-	-	-	-
95-100	0	-	6	147	-	-	-	-
100-105	0	-	6	138	-	-	-	-
105-110	0	-	6	129	-	-	-	-

Appendix 39 d Estimated number of fish at Coquitlam Reservoir, November 2005.

Region	Population Estimate	SE of Population Estimate	Lower 95% Confidence Level	Upper 95% Confidence Level
North	13,893	-	-	-
Central	95,213	17,088	57,141	133,285
South	85,498	33,517	10,821	160,175
Whole Lake	194,604	37,622	115,560	273,648

Appendix 40. Distribution of population and biomass, by size, using hydroacoustics at Coquitlam Reservoir, May 2005.

Length (mm)	% tracked	Predicted weight (g)	Population Estimate Expected	Population Estimate Lower 95%	Population Estimate Upper 95%	Biomass Estimate (kg) Expected	Biomass Estimate (kg) Lower 95%	Biomass Estimate (kg) Upper 95%
10	1.8%	0.01	7,411	6,384	8,439	0.1	0.1	0.1
20	22.6%	0.1	91,446	78,766	104,125	5.4	4.7	6.2
30	19.8%	0.2	80,078	68,974	91,181	15.4	13.3	17.5
40	12.7%	0.4	51,156	44,063	58,249	22.6	19.5	25.8
50	7.4%	0.8	30,092	25,919	34,264	25.4	21.9	29.0
60	4.2%	1.4	16,996	14,640	19,353	24.4	21.0	27.8
70	3.3%	2.2	13,263	11,424	15,102	29.7	25.6	33.9
80	2.3%	3.3	9,362	8,064	10,660	30.9	26.6	35.2
90	1.8%	4.6	7,077	6,096	8,058	32.9	28.3	37.5
100	1.6%	6.3	6,408	5,520	7,297	40.4	34.8	46.0
110	1.4%	8.3	5,517	4,752	6,282	45.9	39.5	52.3
120	0.9%	10.7	3,622	3,120	4,124	38.8	33.4	44.2
130	1.0%	13.5	3,957	3,408	4,505	53.4	46.0	60.8
140	0.7%	16.7	2,786	2,400	3,173	46.6	40.2	53.1
150	0.8%	20.4	3,176	2,736	3,617	65.0	55.9	74.0
160	0.6%	24.7	2,452	2,112	2,792	60.5	52.1	68.8
170	0.6%	29.4	2,508	2,160	2,855	73.7	63.5	83.9
180	0.6%	34.7	2,508	2,160	2,855	87.0	74.9	99.1
190	0.8%	40.6	3,065	2,640	3,490	124.4	107.1	141.6
200	0.6%	47.1	2,452	2,112	2,792	115.5	99.5	131.5
210	0.8%	54.3	3,288	2,832	3,744	178.4	153.6	203.1
220	0.6%	62.1	2,396	2,064	2,728	148.8	128.2	169.4
230	0.7%	70.6	2,898	2,496	3,300	204.7	176.3	233.1
240	0.8%	79.9	3,065	2,640	3,490	244.9	211.0	278.9
250	0.6%	90.0	2,285	1,968	2,602	205.5	177.0	234.0
260	0.6%	100.8	2,285	1,968	2,602	230.3	198.4	262.2
270	0.8%	112.4	3,288	2,832	3,744	369.7	318.4	421.0
280	0.7%	125.0	2,675	2,304	3,046	334.2	287.9	380.6
290	0.7%	138.3	2,675	2,304	3,046	370.0	318.7	421.3
300	0.6%	152.6	2,619	2,256	2,982	399.8	344.3	455.2
310	0.7%	167.9	2,842	2,448	3,236	477.1	410.9	543.2
320	0.5%	184.0	1,839	1,584	2,094	338.5	291.5	385.4
330	0.6%	201.2	2,508	2,160	2,855	504.6	434.6	574.6
340	0.5%	219.4	1,950	1,680	2,221	428.0	368.6	487.3
350	0.5%	238.7	1,839	1,584	2,094	438.9	378.0	499.8
360	0.5%	259.0	1,895	1,632	2,157	490.7	422.7	558.7
370	0.4%	280.4	1,560	1,344	1,777	437.5	376.9	498.2
380	0.3%	303.0	1,226	1,056	1,396	371.4	319.9	422.9
390	0.2%	326.7	947	816	1,079	309.4	266.5	352.4
400	0.3%	351.5	1,059	912	1,206	372.2	320.6	423.8
410	0.3%	377.6	1,059	912	1,206	399.8	344.4	455.3
420	0.3%	405.0	1,059	912	1,206	428.8	369.3	488.2
430	0.2%	433.6	669	576	761	289.9	249.7	330.1
440	0.2%	463.5	1,003	864	1,142	464.9	400.4	529.3
450	0.2%	494.7	724	624	825	358.4	308.7	408.0
460	0.2%	527.2	780	672	888	411.3	354.3	468.4
470	0.2%	561.2	669	576	761	375.2	323.2	427.3
480	0.1%	596.5	446	384	508	265.9	229.0	302.8
490	0.2%	633.2	836	720	952	529.3	455.9	602.7
500	0.1%	671.4	502	432	571	336.8	290.1	383.4
510	0.2%	711.1	669	576	761	475.5	409.6	541.5
520	0.2%	752.3	613	528	698	461.2	397.2	525.1
530	0.1%	795.1	279	240	317	221.5	190.8	252.2
540	0.1%	839.3	390	336	444	327.4	282.0	372.8
550	0.1%	885.2	557	480	635	493.3	424.9	561.7
560	0.1%	932.7	279	240	317	259.9	223.8	295.9
570	0.2%	981.8	613	528	698	601.8	518.4	685.3
580	0.1%	1032.6	446	384	508	460.3	396.5	524.2
590	0.1%	1085.1	279	240	317	302.3	260.4	344.3
600	0.0%	1139.3	167	144	190	190.5	164.1	216.9
610	0.0%	1195.2	167	144	190	199.8	172.1	227.5
620	0.0%	1253.0	111	96	127	139.6	120.3	159.0
630	0.0%	1312.5	167	144	190	219.4	189.0	249.8
640	0.1%	1373.8	279	240	317	382.8	329.7	435.9
650	0.0%	1437.0	167	144	190	240.2	206.9	273.5
660	0.0%	1502.0	167	144	190	251.1	216.3	285.9
670	0.0%	1569.0	111	96	127	174.9	150.6	199.1
680	0.0%	1637.9	167	144	190	273.8	235.8	311.8
690	0.0%	1708.7	56	48	63	95.2	82.0	108.4
700	0.0%	1781.5	-	-	-	0.0	0.0	0.0
710	0.0%	1856.3	56	48	63	103.4	89.1	117.8
720	0.0%	1933.1	56	48	63	107.7	92.8	122.7
730	0.0%	2012.0	-	-	-	0.0	0.0	0.0
740	0.0%	2093.0	56	48	63	116.6	100.5	132.8
750	0.0%	2176.1	56	48	63	121.3	104.5	138.1
760	0.0%	2261.3	-	-	-	0.0	0.0	0.0
770	0.0%	2348.7	-	-	-	0.0	0.0	0.0
780	0.0%	2438.2	-	-	-	0.0	0.0	0.0
790	0.0%	2530.0	56	48	63	141.0	121.4	160.5
800	0.0%	2624.0	-	-	-	0.0	0.0	0.0
	100.0%		404,177	348,136	460,218	18,014	15,516	20,511

Appendix 41. Distribution of population and biomass, by size, using hydroacoustics at Coquitlam Reservoir, November 2005.

		Predicted	Population Estimate			Biomass Estimate (kg)		
Length (mm)	% tracked	weight (g)	Expected	Lower 95%	Upper 95%	Expected	Lower 95%	Upper 95%
10	0.4%	0.01	855	508	1,202	0.0	0.0	0.0
20	6.6%	0.1	12,876	7,646	18,106	0.8	0.5	1.1
30	6.8%	0.2	13,178	7,825	18,531	2.5	1.5	3.6
40	5.1%	0.4	9,858	5,854	13,863	4.4	2.6	6.1
50	3.6%	0.8	6,991	4,152	9,831	5.9	3.5	8.3
60	2.8%	1.4	5,432	3,226	7,639	7.8	4.6	11.0
70	2.5%	2.2	4,929	2,927	6,931	11.1	6.6	15.5
80	2.1%	3.3	4,074	2,419	5,729	13.5	8.0	18.9
90	1.8%	4.6	3,571	2,121	5,022	16.6	9.9	23.3
100	1.6%	6.3	3,018	1,792	4,244	19.0	11.3	26.8
110	1.6%	8.3	3,068	1,822	4,314	25.5	15.2	35.9
120	1.3%	10.7	2,616	1,553	3,678	28.0	16.6	39.4
130	1.4%	13.5	2,716	1,613	3,819	36.7	21.8	51.6
140	1.1%	16.7	2,213	1,314	3,112	37.0	22.0	52.1
150	1.2%	20.4	2,314	1,374	3,254	47.3	28.1	66.5
160	1.6%	24.7	3,018	1,792	4,244	74.4	44.2	104.6
170	0.9%	29.4	1,811	1,075	2,546	53.2	31.6	74.9
180	1.3%	34.7	2,565	1,523	3,607	89.0	52.9	125.2
190	1.1%	40.6	2,163	1,284	3,041	87.8	52.1	123.4
200	1.2%	47.1	2,364	1,404	3,324	111.3	66.1	156.6
210	1.4%	54.3	2,766	1,643	3,890	150.1	89.1	211.1
220	2.1%	62.1	4,175	2,479	5,870	259.2	153.9	364.5
230	1.6%	70.6	3,118	1,852	4,385	220.3	130.8	309.7
240	1.9%	79.9	3,672	2,180	5,163	293.4	174.2	412.6
250	1.6%	90.0	3,169	1,882	4,456	285.0	169.3	400.8
260	1.6%	100.8	3,118	1,852	4,385	314.3	186.6	442.0
270	2.1%	112.4	4,074	2,419	5,729	458.1	272.1	644.2
280	2.3%	125.0	4,426	2,628	6,224	553.1	328.4	777.7
290	1.8%	138.3	3,521	2,091	4,951	487.1	289.2	684.9
300	2.1%	152.6	4,124	2,449	5,800	629.5	373.8	885.2
310	2.3%	167.9	4,477	2,658	6,295	751.4	446.2	1056.7
320	2.1%	184.0	4,175	2,479	5,870	768.4	456.3	1080.5
330	2.5%	201.2	4,879	2,897	6,861	981.8	583.0	1380.6
340	1.7%	219.4	3,269	1,941	4,597	717.4	426.0	1008.8
350	2.0%	238.7	3,873	2,300	5,446	924.4	548.9	1299.8
360	1.7%	259.0	3,370	2,001	4,739	872.8	518.3	1227.3
370	1.5%	280.4	2,867	1,702	4,032	803.9	477.4	1130.5
380	1.6%	303.0	3,118	1,852	4,385	944.8	561.0	1328.5
390	1.6%	326.7	3,118	1,852	4,385	1018.7	604.9	1432.4
400	1.3%	351.5	2,515	1,493	3,536	884.1	525.0	1243.2
410	1.4%	377.6	2,666	1,583	3,749	1006.7	597.8	1415.6
420	1.1%	405.0	2,163	1,284	3,041	875.9	520.1	1231.6
430	1.2%	433.6	2,263	1,344	3,183	981.4	582.7	1380.0
440	1.0%	463.5	1,962	1,165	2,758	909.1	539.9	1278.4
450	0.7%	494.7	1,308	777	1,839	646.9	384.1	909.7
460	0.6%	527.2	1,107	657	1,556	583.4	346.4	820.4
470	0.8%	561.2	1,509	896	2,122	846.8	502.8	1190.7
480	0.6%	596.5	1,107	657	1,556	660.0	392.0	928.1
490	0.6%	633.2	1,207	717	1,697	764.4	453.9	1074.9
500	0.4%	671.4	855	508	1,202	574.1	340.9	807.3
510	0.8%	711.1	1,509	896	2,122	1073.1	637.2	1508.9
520	0.4%	752.3	704	418	990	529.8	314.6	745.0
530	0.6%	795.1	1,107	657	1,556	879.8	522.4	1237.1
540	0.5%	839.3	1,056	627	1,485	886.6	526.5	1246.7
550	0.5%	885.2	1,006	597	1,415	890.5	528.8	1252.2
560	0.3%	932.7	604	358	849	563.0	334.3	791.6
570	0.5%	981.8	956	567	1,344	938.3	557.2	1319.4
580	0.4%	1032.6	855	508	1,202	883.0	524.3	1241.6
590	0.5%	1085.1	956	567	1,344	1037.0	615.8	1458.2
600	0.3%	1139.3	654	388	919	745.0	442.4	1047.6
610	0.3%	1195.2	654	388	919	781.5	464.1	1099.0
620	0.4%	1253.0	704	418	990	882.3	523.9	1240.7
630	0.3%	1312.5	654	388	919	858.2	509.6	1206.8
640	0.3%	1373.8	654	388	919	898.3	533.4	1263.2
650	0.2%	1437.0	402	239	566	578.2	343.4	813.1
660	0.2%	1502.0	453	269	637	679.9	403.8	956.1
670	0.1%	1569.0	251	149	354	394.6	234.3	554.9
680	0.3%	1637.9	553	329	778	906.2	538.1	1274.3
690	0.1%	1708.7	251	149	354	429.7	255.2	604.3
700	0.2%	1781.5	402	239	566	716.8	425.7	1008.0
710	0.2%	1856.3	453	269	637	840.3	499.0	1181.6
720	0.2%	1933.1	453	269	637	875.1	519.7	1230.6
730	0.1%	2012.0	101	60	141	202.4	120.2	284.6
740	0.1%	2093.0	201	119	283	421.1	250.1	592.1
750	0.1%	2176.1	151	90	212	328.4	195.0	461.7
760	0.1%	2261.3	101	60	141	227.5	135.1	319.9
770	0.1%	2348.7	101	60	141	236.3	140.3	332.2
780	0.1%	2438.2	101	60	141	245.3	145.7	344.9
790	0.1%	2530.0	151	90	212	381.8	226.7	536.8
800	0.4%	2624.0	805	478	1,132	2111.7	1254.0	2969.4
	100.0%		194,604	115,560	273,648	42,260	25,095	59,425

Appendix 42. Population, biomass, and production estimates of kokanee, by age and region, at Coquitlam Reservoir, May 2005.

		Population (#)				Biomass (kg)				Production (# / ha)				Standing Crop (kg / ha)			
Age	Region	Estimate	SE	Lower 95% C.I	Upper 95% C.I	Estimate	SE	Lower 95% C.I	Upper 95% C.I	No. / ha	SE	Lower 95% C.I	Upper 95% C.I	kg/ha	SE	Lower 95% C.I	Upper 95% C.I
Age-0	North	1,005	308	362	1,648	1	0	1	2	7.2	2.2	2.6	11.8	0.0	0.0	0.0	0.0
	Central	53,163	4,797	42,475	63,851	74	7	59	89	88.3	8.0	70.6	106.1	0.1	0.0	0.1	0.1
	South	16,220	17,036	-	54,176	23	24	-	76	35.1	36.9	-	117.4	0.0	0.1	-	0.2
	Whole Lake	70,388	17,701	33,198	107,578	99	25	46	151	58.5	14.7	27.6	89.4	0.1	0.0	0.1	0.1
Age-1	North	1,250	344	532	1,967	30	8	13	47	8.9	2.5	3.8	14.0	0.2	0.1	0.1	0.3
	Central	29,120	2,344	23,897	34,342	702	56	576	828	48.4	3.9	39.7	57.1	1.2	0.1	1.0	1.4
	South	10,325	17,423	-	49,142	249	420	-	1,184	22.4	37.7	-	106.5	0.5	0.9	-	2.6
	Whole Lake	40,694	17,583	3,752	77,636	981	424	90	1,871	33.8	14.6	3.1	64.5	0.8	0.4	0.1	1.6
Age-2 and Age-3	North	629	140	337	920	85	19	46	124	4.5	1.0	2.4	6.6	0.6	0.1	0.3	0.9
	Central	39,304	3,839	30,750	47,857	5,306	518	4,151	6,461	65.3	6.4	51.1	79.5	8.8	0.9	6.9	10.7
	South	5,898	17,700	-	45,334	796	2,390	-	6,120	12.8	38.4	-	98.2	1.7	5.2	-	13.3
	Whole Lake	45,830	18,112	7,776	83,884	6,187	2,445	1,050	11,324	38.1	15.1	6.5	69.7	5.1	2.0	-	9.4
Total		156,912	53,396	44,726	269,098	7,266	2,894	4,334	13,346	130	44	84	224	6.0	2.4	0.5	11.1

Appendix 43. Population, biomass, and production estimates of kokanee, by age and region, at Coquitlam Reservoir, November 2005.

		Population (#)				Biomass (kg)				Production (# / ha)				Standing Crop (kg / ha)			
Age	Region	Estimate	SE	Lower 95% C.I	Upper 95% C.I	Estimate	SE	Lower 95% C.I	Upper 95% C.I	No. / ha	SE	Lower 95% C.I	Upper 95% C.I	kg/ha	SE	Lower 95% C.I	Upper 95% C.I
Age-0	North	2,070	-	-	-	3	-	-	-	14.8	-	-	-	0.0	-	-	-
	Central	10,936	2,872	4,538	17,335	15	4	6	24	18.2	4.8	7.5	28.8	0.0	0.0	0.0	0.0
	South	11,215	31,694	-	81,830	16	44	-	115	24.3	68.7	-	177.3	0.0	0.1	-	0.2
	Whole Lake	24,221	31,824	4,538	91,084	34	45	6	128	20.1	26.5	3.8	75.7	0.0	0.0	0.0	0.1
Age-1	North	2,617	-	-	-	63	-	-	-	18.7	-	-	-	0.5	-	-	-
	Central	9,018	952	6,897	11,138	217	23	166	268	15.0	1.6	11.5	18.5	0.4	0.0	0.3	0.4
	South	18,879	37,797	-	103,090	455	911	-	2,484	40.9	81.9	-	223.4	1.0	2.0	-	5.4
	Whole Lake	30,514	37,809	6,897	109,950	735	911	166	2,650	25.4	31.4	5.7	91.4	0.6	0.8	0.1	2.2
Age-2 and Age-3	North	1,516	-	-	-	205	-	-	-	10.8	-	-	-	1.5	-	-	-
	Central	14,687	1,622	11,073	18,301	1,983	219	1,495	2,471	24.4	2.7	18.4	30.4	3.3	0.4	2.5	4.1
	South	1,221	33,502	-	75,865	165	4,523	-	10,242	2.6	72.6	-	164.4	0.4	9.8	-	22.2
	Whole Lake	17,424	33,542	11,073	87,895	2,352	4,528	1,495	11,866	14.5	27.9	9.2	73.1	2.0	3.8	2.5	9.9
Total		72,159	103,175	22,508	288,929	3,122	5,484	1,667	14,643	60	86	19	240	2.6	4.6	2.6	12.2