# Water Quality
and
# Fish Population Assessment
of
# Unnamed Tributary of Mohun Creek
# (locally known as Coho Creek)

# Summary Report
## 2001 - 2002

prepared for the

**Campbell River and District**
**Fish and Wildlife Association**

and

**Quinsam Fish Hatchery**
**Fisheries and Oceans Canada**

By

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## Summary

Water quality and fish assessments were conducted in Coho Creek, a tributary of Mohun Creek, between July 1, 2001 and March 6, 2001. This information was gathered in order to compile more information on the general quality of the habitat in this system, and the status of the fish population during this period.

Water quality parameters were measured during three field tests and one lab test in the mainstem. No critical areas of concern were identified with regards to water quality. The results of the tests for aluminum, copper, iron, potassium, sodium and fecal coliform require additional sampling or information in order to determine their significance to this stream.

Water temperature was recorded hourly over the period of the project using an instream temperature logger. This data was used to calculate monthly average, high and low temperatures. Water temperatures ranged from a low of 0.0 degrees Celsius to a high of 16.7 degrees Celsius over the nine-month period. The range of temperatures recorded in Coho Creek is within the range of acceptable temperatures for salmonid growth and survival.

The presence of coho fry in Coho Creek prior to the release of 2500 marked coho fry by the Quinsam Hatchery (Fisheries and Oceans Canada) confirmed that adult coho are returning to spawn in this stream. Based on the results of an intensive sample prior to stocking, it was estimated that there were 1600 juvenile coho and 6100 juvenile and adult cutthroat trout in the first 11 reaches of Coho Creek. Most of the juvenile fish (coho and cutthroat trout) were captured in or immediately downstream of Reach 8, previously identified as one of two significant spawning reaches (the other being Reach 9) in Coho Creek.

Fish sampling in the fall (October – November) and winter (March) was less intensive, and resulted in fewer fish captures. The results of the fall fish sample suggest that there is little interaction between the “natural” coho fry and marked, hatchery fry, as all of the marked fry were captured in the second reach, and none were captured in the next site upstream in Reach 8.

The relative abundance of coho and cutthroat trout in Reach 8 was still high compared to the other two reaches, particularly Reach 11. There appeared to be an overall reduction in the ratio of coho and cutthroat trout to other fish species (stickleback and sculpins) between the summer and fall data, but the difference in sample methods and capture rate does not allow for an absolute conclusion about this observation.

Fish captured in all three samples appeared to be in good health, and no physical signs of stress where observed. Coho young-of-the-year were estimated to experience a 2.4 times increase in weight between the summer sample and the fall sample. A 1.6 times increase in the weight of the marked hatchery fry was calculated. However, the small sample size in the fall sample may have resulted in an under or overestimate of the average weight for either or both of the coho groups, and the actual difference between the two may have been less pronounced.

Further data collected on the water quality parameters and fish population would provide a good database of background information, against which all future data could be compared.

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# 1.0 Introduction

Coho Creek is an ungazetted tributary of Mohun Creek, and has also been referred to as “Miller” Creek and “East Snowden” Creek. The Mohun watershed is located on the east coast of Vancouver Island, approximately 12km northeast of Campbell River.

Since the mid-1980’s, the Campbell River and District Fish and Wildlife Association (CRFWA) has had an active interest in Coho Creek, conducting small restoration projects and monitoring fish use. In 2000, the club funded an Overview and Level 1 Fish Habitat Assessment of Coho Creek (Stewardson, M. 2000), which resulted in the most complete record of information on the watershed to date.

This report summarizes the water quality monitoring and fish population assessment information gathered on behalf of the CRFWA between July 2001 and March 6, 2002. Partial funding for this project was contributed by Fisheries Renewal British Columbia (FsRBC). The remainder of the funding was contributed by the CRFWA, and volunteers from the club participated in the collection of field data.

The Coho Creek watershed has the potential to be impacted by several types of activities, including forestry, agriculture and urban development. Water quality data was collected over the course of the study period in an attempt to identify any potential contaminants being introduced into the water due to these activities. Water temperature was also monitored.

Fish sampling conducted for the Overview and Level 1 Fish Habitat Assessment confirmed the presence of coho fry, cutthroat and rainbow trout, coastrange sculpins, threespine stickleback and lamprey in the Coho Creek watershed. The focus of the sampling conducted in 2001 and 2002 was to collect additional information on the fish population characteristics prior to stocking, and over the course of the year. This information was used to assess the fish density prior to stocking, as well as the growth rate, relative abundance and distribution of natural and stocked coho fry.

# 2.0 Methods

## 2.1 Water Quality

Water quality was assessed using three field testing sessions, one lab test and continual temperature recording.

Field testing was conducted at two sites in the mainstem. The first site was located in lower portion of the mainstem in Reach 2, downstream of the confluences of both major tributaries (Figure 1). The second site was situated in the Reach 12, upstream of both of the major tributaries to Coho Creek. These two sites were chosen so that variations to water quality as a result of the tributaries inflow would be observable. The tests occurred in August (summer low water), October (fall high water) and February (winter low water) to identify differences related to variances in water levels.

Field tests were conducted using a Hanna HI 3817 Water Quality Test Kit. Titration tests were conducted for alkalinity ($CaCO_3$), chloride ($Cl^-$), hardness ($CaCO_3$) and sulfite ($Na_2SO_3$). A hand held electronic meter was used to measure pH, and a colormetric test was conducted to measure iron content.

One water sample was collected at the site in Reach 2 on November 19, 2001 and sent to North Island Laboratories (Courtenay, BC) for analysis. The following parameters were tested using the sample:

- alkalinity
- ammonia
- conductivity
- trace metals scan
- fecal coliforms
- nitrate
- organochlorine pesticides
- pH
- sulfate
- total dissolved phosphate
- total phosphate
- total suspended solids

The results from the lab analysis were then compared with the results from the field tests, federal and provincial water quality guidelines (CCREM, 2001;Ministry of Water, Land and Air Protection, 2001; Resources Inventory Committee) and results from similar

tests conducted on three other local drainages (Cold Creek, Quinsam River and Campbell River).

A temperature logger (Optic StowAway TidbiT) was installed in Coho Creek on July 6, 2001 in the pool immediately downstream of the Iron River Main culvert (Reach 1). The logger was left in place until March 4, 2002, and the data was downloaded monthly. The monthly average, minimum and maximum water temperatures were determined from this data.

## 2.2 Fish Assessment

Three sessions of fish sampling (summer, fall and winter) were conducted in Coho Creek from July 2001 – March 2002. The most extensive survey took place in early July 2001 (summer sample). This survey consisted of a two pass electroshocking sample in one representative site within each of the first eleven reaches of the Coho Creek mainstem. A complete description of the methods used for the July survey can be found in Appendix 1 (Preliminary Results of the Fish Population Assessment, Summer 2001).

At the conclusion of the summer survey, 2500 marked coho fry (clipped adipose) were released into the ponded section of Reach 2, immediately upstream of the Iron River Main culvert crossing by Quinsam Hatchery staff (Fisheries and Oceans Canada). An estimate of the average size (weight only) of the stocked fry was provided.

Sampling in the fall (October) and winter (March) was less extensive in order to minimize disruption during spawning and incubation. Three reaches (Reaches 2,8 and 11) were pre-selected for sampling based on accessibility, fish distribution and fish abundance during the summer sample. Baited gee minnow traps (3 – 5) were set at a representative section in each of the three reaches, and left overnight. Fish captured in the traps were identified to species, weighed and measured using a Plexiglas box with an embedded ruler and a battery powered digital scale. Marked coho fry were distinguished from unmarked fry.

A fourth sample location, the ponded section immediately upstream of the culvert crossing on the Iron River Main (Reach 2), was added due to the results of the fall sample in the other three locations. Very few marked coho (stocked) were captured in

the first three locations, so traps were set in the pond (where the fry had originally been released) to attempt to gather more data on the stocked coho fry.

Scales samples were collected from a selection of coho fry captured in all three samples. The scales were aged by two independent observers, and then compared for age agreement. One scale sample was taken from a marked coho to use for comparison with the unmarked coho scale samples.

Figure 1. The location of fish sampling and water quality test points in the Coho Creek mainstem, between July 2001 and March 2002.

# 3.0 Results

## 3.1 Water Quality

Table 1 contains a summary of the water test results compared with the results of tests on the same parameters completed in the lab.

Table 1. Results from three field tests and one lab test of selected water quality parameters.

| | Aug 11/01 | | Oct 31/01 | | Feb 20/02 | | Nov 19/01 (lab test) |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Site 1** | **Site 2** | **Site 1** | **Site 2** | **Site 1** | **Site 2** | **Site 1** |
| pH | 7.7 | 7.1 | 7.5 | 7.4 | 7.6 | 7.3 | 6.4 |
| Chloride (ppm) | 9 | 8 | 9 | 7 | 8 | 8 | not tested |
| Total Alkalinity (ppm) | 36 | 9.9 | 30 | 9.9 | 23 | 21 | 10 |
| Sulfite (ppm) | no reading | 1.4 | 2 | 2 | 5 | 4 | not tested |
| Iron (ppm) | 0 | 0 | 0 | 0 | 0 | 0 | 0.331 |
| Hardness (ppm) | 33 | 25.5 | 30 | 30 | 30 | 30 | 20.3 |

The list of results from the lab tests run on the water sample collected on November 19, 2001 is found in Appendix 2. The values in Appendix 2 are presented in comparison to provincial and federal guidelines for the protection of aquatic life, and to three other local watercourses (Cold Creek, Quinsam River, Campbell River) when no guidelines were found. While there are no immediate areas of concern with regards to water quality in Coho Creek, six parameters warrant further investigation due to their deviation from recommended guidelines (Table 2) or values reported in other local watercourses.

Table 2. Water quality parameters that require further study or analysis in Coho Creek.

| Parameter | Coho Creek result | Guidelines | Comments |
|---|---|---|---|
| aluminum | 0.232 mg/L | 0.005 – 0.100 mg/L | Coho Creek value above recommended 30-day average and maximum values |
| copper | 0.003 mg/L | 0.002 – 0.0039 mg/L | Near maximum acceptable value |
| iron | 0.331 mg/L | 0.300 mg/L | Slightly higher than guideline value |
| potassium | 2.9 mg/L | - | No guidelines located, but value was significantly higher than other local watercourses |
| sodium | 6.7 mg/L | - | No guidelines available, but significantly higher than other local watercourses |
| fecal coliforms | 77 CFU / 100mL | - | Source likely wildlife (elk, deer, beaver) but potential urban contamination should be ruled out. |

The water temperature data for Coho Creek is summarized in Figure 2. Between July 2001 and March 2002, water temperature in Coho Creek ranged from a low of 0.0 degrees Celsius to a high of 16.7 degrees Celsius. Monthly average temperatures varied from 2.9 degrees Celsius in February to 14.1 degrees Celsius in July.

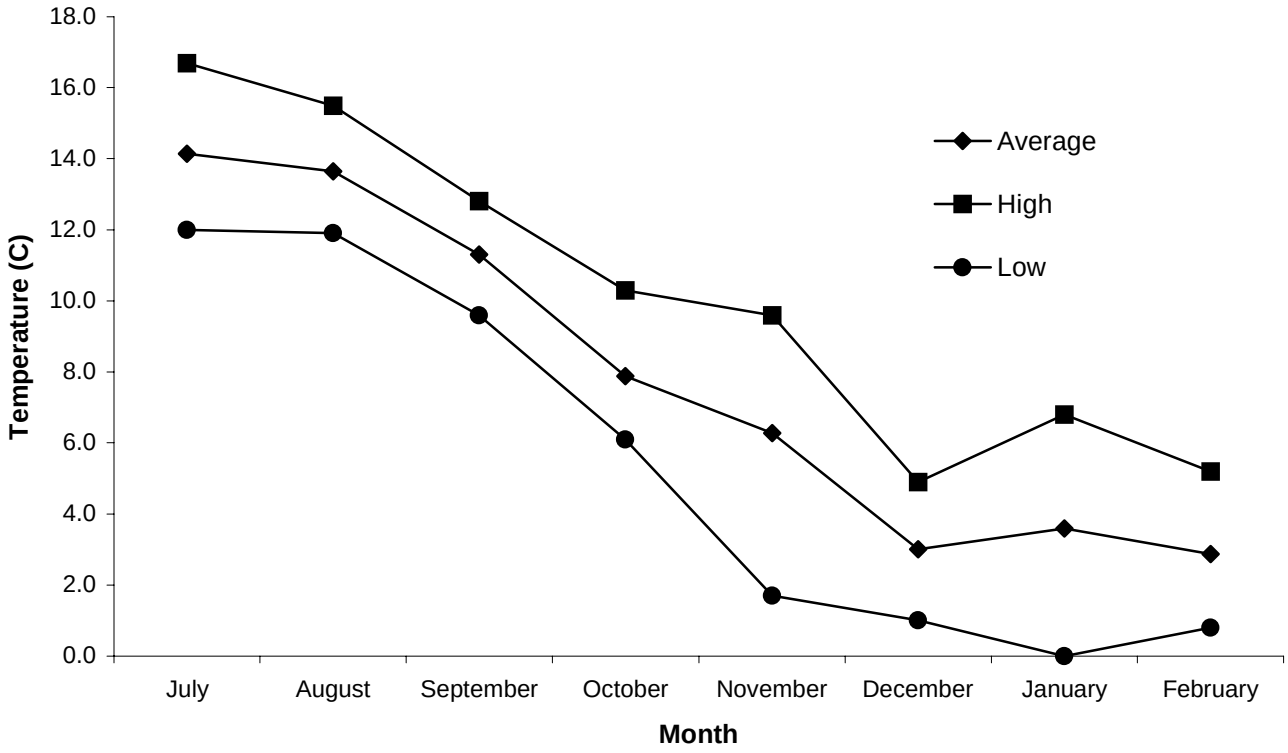


Figure 2. The monthly average, high and low temperatures recorded in Coho Creek from July 2001 to February 2002.

The optimum temperature range guidelines for salmonids are presented in Table 3. This information provides some comparative values to assess the impact of the water temperature on the coho population in Coho Creek.

Table 3. The optimum temperature ranges of specific life history stages of salmonids. Adapted from Oliver, G.G and L.E. Fidler, 2001.

| Species | Incubation | Rearing | Migration | Spawning |
|---|---|---|---|---|
| Chinook | 5.0 – 14.0 | 10.0 – 15.5 | 3.3 – 19.0 | 5.6 – 13.9 |
| Chum | 4.0 – 13.0 | 12.0 – 14.0 | 8.3 – 15.6 | 7.2 – 12.8 |
| Coho | 4.0 – 13.0 | 9.0 – 16.0 | 7.2 – 15.6 | 4.4 – 12.8 |
| Pink | 4.0 – 13.0 | 9.3 – 15.5 | 7.2 – 15.6 | 7.2 – 12.8 |
| Sockeye | 4.0 – 13.0 | 10.0 – 15.0 | 7.2 – 15.6 | 10.6 – 12.8 |

## 3.2 Fish Assessment

The results from the summer fish sample (July) are summarized in the preliminary report (Appendix 1). A complete list of the fish data from all three samples (summer, fall and winter) is in Appendix 3. Fish and habitat photos taken during the summer and winter surveys are in Appendix 4.

Sampling conditions and methods varied for each sample (Table 4). The summer sample was the most extensive completed. In this sample, a two-pass electrofishing method was used within a pool-riffle sequence enclosed by stopnets, in each of the first eleven reaches. The least successful capture rate occurred during the winter sample, which may be due to the low water temperature (3.5 degrees Celsius) at the time of the sample.

Table 4. Stream conditions and sample methods during the summer, fall and winter assessments conducted on Coho Creek in 2001 – 2002.

| | Summer | Fall | Winter |
|---|---|---|---|
| Sample dates | July 2 - 5 / 2001 | Oct 22-23 & Oct 31-Nov 1/2001 | March 4 - 6 / 2002 |
| No. of sample sites | 11 | 4 | 4 |
| Water level | low | high | moderate - low |
| Avg. water temp. | 12.7 | 8.0 | 3.5 |
| sample method | electrofishing | minnow traps | minnow traps |
| Comments | prior to release of marked coho fry on July 6, 2001 | majority of coho and cutthroat captured in Reach 8 site | fish very scarce |

The average lengths and weights of unmarked coho fry and marked coho fry from the summer and fall surveys are presented in Table 5. Only one coho fry (unmarked) was captured in the winter sample, therefore it was not possible to provide similar data for this sample. While no marked coho were present in the creek during the summer sample, the average weight and range of weights were determined prior to their release into Coho Creek (pers. comm., Joan Bennett, Quinsam Hatchery, July 6, 2001).

Data on cutthroat trout was obtained in all three samples, however the number of individuals captured in the winter sample was very low (n = 8).

Table 5. Fish length and weight data collected from July 2001 to March 2002 in Coho Creek (n = number captured).

| Species | Weight (g) - avg(range)n | | | Length (mm) - avg(range)n | | |
|---|---|---|---|---|---|---|
| | Summer | Fall | Winter | Summer | Fall | Winter |
| coho unmarked | 2.2 (0.5-5.5) 113 | 5.9 (2.8-13.2) 18 | - | 54 (36-74) 113 | 79 (64-112) 18 | - |
| coho marked[1] | 2.5 (1.5-3.0) 2500 | 4.0 (3.2-4.8) 10 | - | n/a | 71 (65-78) 10 | - |
| Cutthroat | 2.1 (0.2-28.8) 268 | 12.4 (1.8-26.9) 30 | 10.9 (4.2-23.5) 8 | 43 (26-140)268 | 103 (55-145) 30 | 101 (69-138) 8 |

1 – weight data and number of marked coho in summer sample provided by Quinsam Hatchery staff

The result of the age analysis conducted from the scales collected during sampling is presented in Table 6. The time of year that the fish were captured was considered during aging. For example, the fry aged as “0” in the summer sample are the same year class as the “0+” fish captured in the fall sample and the “1” fish captured in the winter sample. Although rare (approximately 1.5% of coho captured), it was found that some coho did remain in Coho Creek for more than one winter.

Table 6. Coho age and length data from scale samples collected in Coho Creek from July 2001 to March 2002.

| **Sample** | **length** | **Age** | **comment** |
|---|---|---|---|
| summer | 57 | 0 | unmarked |
| summer | 56 | 0 | unmarked |
| summer | 63 | 0 | unmarked |
| summer | 55 | 0 | unmarked |
| summer | 64 | 0 | unmarked |
| summer | 50 | 0 | unmarked |
| summer | 60 | 0 | unmarked |
| summer | 45 | 0 | unmarked |
| summer | 59 | 0 | unmarked |
| summer | 64 | 0 | unmarked |
| summer | 40 | 0 | unmarked |
| summer | 66 | 0 | unmarked |
| summer | 74 | 0 | unmarked |
| summer | 68 | 0 | unmarked |
| fall | 78 | 0+ | unmarked |
| fall | 100 | 1+ | unmarked |
| fall | 65 | 0+ | marked |
| fall | 112 | 1+ | unmarked |
| winter | 73 | 1 | unmarked |

The total number of each species captured at each sample site during the three surveys is summarized in Table 7. The relative abundance of coho and cutthroat in the

summer sample was relatively similar in Reaches 1 and 8 (coho = 44% and 48% of all fish respectively, cutthroat = 48 and 39% of all fish respectively). The proportion of coho (including marked coho) and cutthroat stayed even in Reach 1 in the fall sample but dropped to almost half of the summer levels. (27 and 23% respectively). The proportion of cutthroat trout in Reach 8 was found to be nearly 2.5 times greater than coho during the fall sample. While these decreases in abundance are expected due to fry mortalities, the differences seen between the summer and fall abundances may be partially explained by the different sample methods and sampling intensities.

Table 7. The number and distribution of fish captured in Coho Creek between July 2001 and March 2002. $CO_u$ = unmarked coho, $CO_m$ = marked coho, CT = cutthroat trout, other = threespine stickleback + coastrange sculpin

| | Number captured | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Summer | | | | Fall | | | | | Winter | | | | |
| Sample site location | CO | CT | Other | Total | $Co_u$ | $Co_m$ | CT | Other | Total | $Co_u$ | $Co_m$ | CT | Other | Total |
| Reach 1 | 8 | 9 | 1 | 18 | 4 | 2 | 5 | 11 | 22 | 0 | 0 | 1 | 1 | 2 |
| Reach 2 - site a | - | - | - | - | 5 | 8 | 2 | 5 | 20 | 0 | 0 | 0 | 6 | 6 |
| Reach 2 - site b | 4 | 11 | 30 | 45 | - | - | - | - | - | - | - | - | - | - |
| Reach 3 | 0 | 26 | 6 | 32 | - | - | - | - | - | - | - | - | - | - |
| Reach 4 | 9 | 36 | 30 | 73 | - | - | - | - | - | - | - | - | - | - |
| Reach 5 | 5 | 15 | 34 | 54 | - | - | - | - | - | - | - | - | - | - |
| Reach 6 | 6 | 38 | 24 | 68 | - | - | - | - | - | - | - | - | - | - |
| Reach 7 | 29 | 71 | 2 | 102 | - | - | - | - | - | - | - | - | - | - |
| Reach 8 | 38 | 31 | 11 | 79 | 8 | 0 | 20 | 2 | 30 | 1 | 0 | 4 | 0 | 5 |
| Reach 9 | 7 | 15 | 1 | 23 | - | - | - | - | - | - | - | - | - | - |
| Reach 10 | 4 | 7 | 0 | 11 | - | - | - | - | - | - | - | - | - | - |
| Reach 11 | 3 | 13 | 1 | 17 | 1 | 0 | 3 | 4 | 8 | 0 | 0 | 1 | 0 | 1 |
| Totals | 113 | 268 | 137 | 518 | 18 | 10 | 30 | 22 | 80 | 1 | 0 | 6 | 7 | 14 |

In the summer sample, the majority of coho were captured in Reaches 7 and 8. The distribution of cutthroat trout in the creek was more even, however the peak abundance also occurred in Reach 7 (Figure 3).

While it is not possible to make conclusions on the distribution of fish during the fall and winter samples, some observations can be made from the data. Of the three reaches sampled in the fall, fish were most abundant in Reach 8 and least abundant in Reach 11. This was similar to the results noted in the summer sample, however there was a more significant difference between Reaches 2 and 11 in the fall sample.

Marked coho were captured in Reach 2 in the fall sample, and accounted for 53% of the coho captured in that reach. None of the coho captured in Reaches 8 and 11 during the fall and winter surveys were marked.

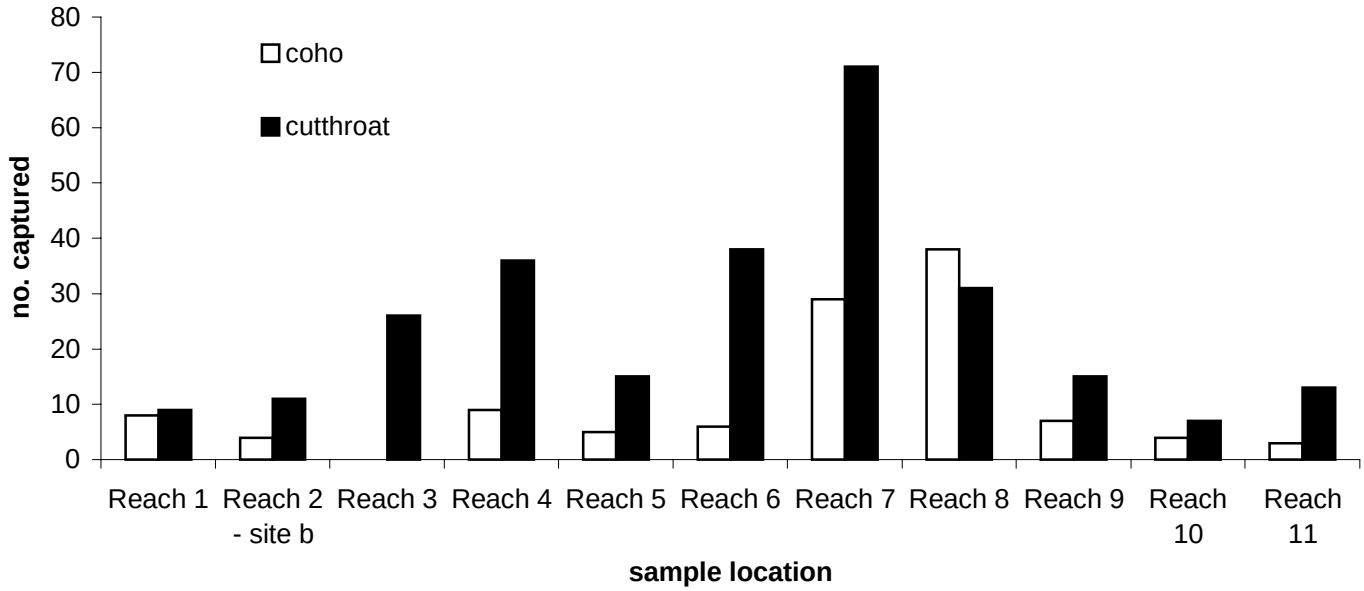


Figure 3. The relative abundance and distribution of coho and cutthroat trout captured in Coho Creek in July 2001.

# 4.0 Discussion

## 4.1 Water Quality

When comparing the results of four of the six water quality parameters tested in the field to results obtained following lab analysis significant differences in three parameters (pH, total alkalinity and hardness) were observed. This may be due to several factors, including human error during field tests and / or collecting the water sample for the lab test, normal temporal deviations in parameter values and / or parameter values changing due to the time lapse between when the sample was collected and when the lab analysis took place.

The results of all the water quality tests revealed few areas of concern with regards to water quality in Coho Creek. However, the data provided by the lab sample has limited usefulness as it only shows values at one particular time. Continued data collection at several times of the year, over several years, would provide the best data on the water quality of this system, and provide a complete set of background values against which future data could be compared. While lab tests provide more detailed information, even the information collected during the field tests should highlight unusual water conditions if compared to several tests.

Three water quality parameters were noted to have levels at or above the federal or provincial guidelines for the protection of aquatic life (aluminum, copper and iron). The level of aluminum measured in Coho Creek was significantly higher than both the provincial and federal recommended levels for the protection of aquatic life. However, the value was well below 1.0 mg/L, the level typically found in fresh water (BCMELP). Aluminum contamination generally occurs due to the introduction of industrial effluents or from mining activities within a watershed. As these types of activities are not known to occur in the Coho Creek watershed, it is unlikely that the levels of aluminum are a concern. Additional sampling would provide more data on the natural levels and variations of aluminum in Coho Creek.

Copper is an essential element for plant and animal health, but can be acutely toxic to aquatic life at relatively low concentrations (BCMELP). The level of copper in Coho Creek (0.003 mg/L) is higher than the federal guideline (0.002) and slightly lower than the provincial guideline of a maximum level of 0.0039 mg/L. Again, copper is most

commonly introduced into watercourses via industrial effluents or mining activities, but can also be present as a result of urban development. Additional data is needed to properly assess the levels and potential sources of copper in Coho Creek.

The provincial guideline for iron content is currently being developed, but federal guidelines recommend iron levels of 0.3 mg/L or less. The level of iron measured in Coho Creek (0.331 mg/L) was slightly above the federal guideline, which may or may not suggest contamination from industrial or urban activities. Again, repeated samples over time will provide better data for assessing the impact of this metal.

The levels of three other variables were of interest. No provincial or federal guidelines were found for potassium or sodium, which suggests that there are no toxicity levels associated with these elements. However it was noted that the values measured in Coho Creek were in general, significantly higher than levels measured in Cold Creek, the Quinsam River and the Campbell River at the same time of year. More study is required to determine the significance, if any, of the levels of these two parameters.

Finally, fecal coliform counts were measured at 77 mL/ 100 mL at the time the sample was collected. This level of contamination is probably due to heavy use of the riparian area of this watershed by wildlife, in particular elk, deer and beaver. Continued monitoring in the lower part of the drainage (where the water sample was collected) would reveal temporal variation in the fecal coliform levels. Samples taken at other areas of the watershed, i.e. in the two main tributaries (Tributaries 2 and 4) and the headwaters areas may pinpoint specific areas where contamination may be occurring. This information could be used to rule out the possibility of anthropogenic contamination.

Water temperatures in Coho Creek ranged from 0.0 to 16.7 degrees Celsius in the period from July 6, 2001 to February 28, 2001. For coho salmon, the optimum range of temperatures is 4.0 to 16.0. The highest water temperature, recorded in July 2001, was just slightly above the maximum optimum value, and therefore is not considered detrimental to the fish population. The extreme low temperatures were recorded in December, January and February (1.0, 0.0 and 0.8 degrees Celsius respectively), when the average temperatures ranged from 2.9 degrees Celsius (February) to 3.6 degrees Celsius (January). These low temperatures are also not cause for alarm as it was found in a study conducted in 1952 that, “prolonged exposure to water temperature close to 0

degrees Celsius was tolerated by coho, but a sharp drop in temperature from 5 degrees to almost 0 degrees resulted in mortality" (Sandercock, F.K, in Groot, C. and L. Margolis, 1998). A sharp drop in temperature in Coho Creek did not occur within the three-month period.

## 4.2 Fish Assessment

At the completion of the summer sample, and prior to the release of 2500 marked coho fry into Coho Creek, the combined density of coho fry and juvenile cutthroat trout ranged from 0.1 fish / $m^2$ (Reach 5) to 1.4 fish / $m^2$ (Reach 7). Several areas (Reaches 4, 5, 8 and 9) of the stream had deeply undercut banks, which may have provided fish refuge from the electroshocker and resulted in a low estimate of fish density for those areas.

Using the calculated densities, it was estimated that there were approximately 1600 coho fry and 6100 cutthroat trout in Coho Creek at the time of the summer sample. Using average widths and reach lengths to calculate the area of potential habitat in this stream, these figures translate to 0.12 coho / $m^2$ and 0.47 cutthroat trout / $m^2$.

Due to a change in sampling methods and intensity, it was not possible to calculate population or density estimates from the fall or winter samples. However, a look at the relative abundance of fish species present suggests that the ratio of coho and cutthroat trout to other species (stickleback and sculpins) decreased between the summer and fall samples. As there is no data on coho survival from summer to fall when stocking has not occurred, it was also not possible to determine if the addition of coho fry to the stream had resulted in an overall increase or decrease in the number of coho present in the fall.

When considering the observed decrease in relative abundance between the summer and fall surveys, the difference is sample methods and sample intensity most be considered as one explanation. Alternately, the distribution of fish may have shifted between the two seasons, and the areas of the highest fish abundance may not have sampled during the fall sample. However, some drop in fish abundance is expected due to fry mortality.

The results of the summer sample showed the highest density of coho and cutthroat trout in Reaches 6-8. Recently emerged cutthroat and coho fry were abundant in Reaches 6 through 8, with the occasional larger cutthroat trout captured (75 – 150mm). These fry had most likely emerged from the spawning habitat located in Reaches 8 and 9, and migrated or been swept downstream to Reaches 6 and 7. The relatively even distribution of cutthroat compared to coho may be a function of two factors; the presence of several age classes of cutthroat trout which had migrated throughout the stream, and the ability of trout to utilize smaller patches of gravel for spawning therefore increasing the distribution of emerging fry.

The fall fish sample occurred in Reaches 2 (two sites), 8 and 11. No marked fish were captured upstream of Reach 2, which indicates that the hatchery fish are not migrating that far upstream in significant numbers. Marked coho made up just over half of the coho captured in Reach 2, but the majority (80%) of the marked coho were captured in the pond (site a) where they had been released. These results suggest that there is little interaction in the stream habitat upstream of the pond between the “natural” (those spawned in the stream) and hatchery (marked) fry. Additional sampling conducted between Reaches 1 and 8 would provide more data on how far the hatchery coho migrate from the pond into the other areas of the watershed, and in what numbers.

The average weight of the natural coho fry appeared to have increased approximately 2.6 times between the summer and fall samples. This increase is lowered to 2.4 times if the coho fry determined to be 1+ fish are removed from the sample. The marked coho fry showed an increase of 1.6 times their average summer weight. However, the number of fish captured in the fall sample was low when compared to the summer sample, therefore the difference is size increase between the natural and hatchery fry may be exaggerated. Also, the average weight of the hatchery fry at the time of their release was based on an estimate from hatchery staff, and may not have represented the “true” average of all 2500 fry released. Overall, all fish captured appeared to be in good health, and were not showing evidence of stress (i.e. stunted growth or abnormal body proportions).

# 5.0 Recommendations

## 5.1 Water Quality

The following are recommendations regarding the monitoring of water quality in Coho Creek:

1. While the results of this year's tests indicate that there are no areas of immediate concern with regards to water quality in Coho Creek, this information is limited in its usefulness as it only provides a "snapshot" of information on this creek. Additional data would help with the analysis of the importance of the aluminum, copper, iron, potassium, sodium and fecal coliform levels detected. Ideally, lab tests should be run four times a year (to coincide with seasonal changes in water level) over a period of several years to allow for better identification of natural variations and any incidence of contamination due to natural or anthropogenic impacts.

2. Continue to conduct the field water quality tests several times a year to coincide with seasonal changes in water level. Other sample locations could be added (i.e. above the upper road crossing, in the two main tributaries) to identify specific sources of elements and spatial differences in parameters throughout the drainage.

## 5.2 Fish Assessment

The following recommendations are made for future fish sampling and the monitoring of fish stocks in Coho Creek:

1. Conduct spring smolt sampling to gather data on smolt size and relative abundance as they migrate downstream. This sampling could be focused on the downstream reaches (particularly around the ponded area above the Iron River Main culverts, and the pool immediately downstream of the culvert). Smolt migration is related to several factors and therefore predicting the exact time to sample is difficult. Consider conducting repeated samples weekly beginning in mid to late April and ending in mid to late May. Electrofishing is not permitted at this time of year, so sampling must be conducted using traps or nets. Also, the migrating fish are under considerable stress so minimal handling of the captured fish should occur.

2. As with the water quality testing, continued seasonal sampling over several years would provide a good database of information on the fish population in Coho Creek. Once a background amount of information has been compiled, it becomes much easier to observe changes in fish abundance and health than if there are no comparative values. This sampling does not need to be intensive, but consistent sampling techniques are necessary to gather data that is comparable.

3. While the return of adult coho was confirmed by the capture of emergent fry, there is still no information on the number of returning adults, and what areas of the stream they tend to use for holding during their upstream migration. This

type of information could be gathered during a fall snorkel survey. Again, snorkels may need to occur over several weeks in order to gather adequate data. This information would be useful for ensuring that any preferred habitats receive adequate protection from potential impacts.

# 6.0 References

British Columbia Ministry of Environment, Land and Parks (BCMELP), LandData BC, Geographic Data BC. Guidelines for Interpreting Water Quality Data. Prepared for the Land Use Task Force, Resources Inventory Committee.

British Columbia Ministry of Water, Land and Air Protection (BCWLAP), Water Protection Branch. 2001. British Columbia Approved Water Quality Guidelines (Criteria). 1998 Edition, updated August 24, 2001.

Canadian Council of Ministers of the Environment (CCREM). 2001 Canadian Water Quality Guidelines for the protection of aquatic life: Summary table. Updated. In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Ministers of the Environment.

Oliver, G.G. and L.E. Fidler. 2001. Towards a Water Quality Guideline for Temperature in the Province of British Columbia. Prepared for the BC Ministry of Environment, Land and Parks, Water Management Branch, Water Quality Section.

Sandercock, F.K. 1991. Life History of Coho Salmon (Oncorhynchus kisutch). In Pacific Salmon Life Histories. Ed. C. Groot and L. Margolis, 396-445. Vancouver, UBC Press.

**Appendix 1 – Preliminary Report**

# Preliminary Results of the Fish Population Assessment Summer 2001

of

# Unnamed Tributary of Mohun Creek (locally known as Coho Creek)

**Please see accompanying file (Cohoprelim.pdf)**

# Appendix 2 – Water Quality Data

| Parameter | Units | Coho Creek | BCWQG | CWQG | Comments |
|---|---|---|---|---|---|
| alkalinity (CaCO3) | mg/L | 10 | | | BCWGQ indicates that at this level of alkalinity, the creek has a moderate sensitivity to acidic inputs |
| ammonium | mg/L | 0.02 | | | well below total ammonia levels for aquatic life |
| conductivity | µS | 57.2 | | | typical of coastal streams, and consistent with field testing in 2000 and 2001 |
| hardness (CaCO3) | mg/L | 20.3 | | | less than 60 mg/L is considered "soft" water (BCWGQ) |
| aluminum | mg/L | 0.232 | max 0.1, avg 0.05 | 0.005 - 0.100 | dependant on pH at time of sample, generally found in concentrations of 1.0mg/L or less |
| arsenic | mg/L | <0.01 | | 0.005 | not detectable in lab test, assumed to be near or below CWQG guideline |
| barium | mg/L | 0.0037 | | | no guidelines located |
| boron | mg/L | 0.004 | | | no guidelines located |
| cadmium | mg/L | <0.0006 | | 0.0171 | not detectable in lab test, below guideline |
| calcium | mg/L | 4.6 | | | no guidelines located, lower than values for Cold Creek (16.5), Quinsam River (8.0) and Campbell River (11.5) for that time period |
| chromium | mg/L | <0.0009 | | 0.001 (hexavalent), 0.0089 (trivalent) | below detectable limit, and CWQG guidelines |
| copper | mg/L | 0.003 | max 0.0039 | 0.002 | near or slightly above guideline |
| iron | mg/L | 0.331 | | 0.3 | slightly above guideline |
| lead | mg/L | 0.002 | 0.0029 | 0.001 | between guidelines |
| magnesium | mg/L | 2.13 | | | no guidelines located, similar to values for Cold Creek (2.62) and the Quinsam River (1.61) for that time period |

| Parameter | Units | Coho Creek | BCWQG | CWQG | Comments |
|---|---|---|---|---|---|
| manganese | mg/L | 0.0087 | max 0.8, mean 0.7 | | similar to value for Quinsam River (0.0087) for that time period |
| mercury | mg/L | <0.0001 | max 0.0001 | 0.0001 | below detectable limit and guidelines |
| potassium | mg/L | 2.9 | | | no guidelines, higher than values for Cold Creek (0.3) and Quinsam River (0.4) for that time period |
| selenium | mg/L | <0.004 | 0.002 | 0.001 | below detectable limit |
| sodium | mg/L | 6.7 | | | no guidelines, values for Cold Creek = 1.5, Campbell River = 0.78, Quinsam River = 4.49 for that time period |
| zinc | mg/L | 0.004 | max 0.019, mean 0.0075 | 0.03 | dependant on water hardness, similar to Cold Creek (0.003), Quinsam River (0.003) and Campbell River (0.004) |
| fecal coliforms | CFU/100ml | 77 | | | probably due to wildlife (elk, deer, beaver) |
| nitrate | mg/L | 0.49 | max 200, mean 40 | | well below guidelines, most surface water have levels of 0.3 without anthropogenic inputs |
| aldrin | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| BHC (alpha isomer) | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| 2,4' - DDT | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| 4,4' - DDD | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| 4,4' - DDE | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| 4,4' - DDT | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| chlordane - cis | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| chlordane - trans | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| chlorothalonil | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| dieldrin | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| endosulfan I | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| endosulfan II | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| endosulfan sulfate | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| endrin | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |

| Parameter | Units | Coho Creek | BCWQG | CWQG | Comments |
|---|---|---|---|---|---|
| heptachlor | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| heptachlor epoxide | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| hexachlorobenzene | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| iprodione | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| lindane | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| methoxychlor | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| mirex | ppb | <0.05 | | | organochlorine pesticide - below min. detectable limit |
| pH | pH units | 6.4 | | | typical of coastal streams, more acidic reading than field tests |
| sulphate | mg/L | 2.18 | alert level 50, max 100 | | |
| total dissolved phosphate | mg/L | <0.05 | | | below detectable limit |
| total phosphate | mg/L | 1.21 | | | no guidelines located |
| total suspended solids | mg/L | <1.0 | mean 30 | | low |

BCWQG = British Columbia Water Quality Guidelines (BCMELP and BCWLAP)
CWQG = Canadian Water Quality Guidelines (CCREM, 2001).

# Appendix 3 – Fish Sample Data

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 1 (site b) | CO | 53 | 1.9 | |
| summer | 1 (site b) | CO | 56 | 3.3 | |
| summer | 1 (site b) | CO | 57 | 2.6 | voucher |
| summer | 1 (site b) | CO | 57 | 3 | |
| summer | 1 (site b) | CO | 58 | 2.5 | |
| summer | 1 (site b) | CO | 59 | 2.7 | voucher |
| summer | 1 (site b) | CO | 59 | 3.7 | |
| summer | 1 (site b) | CO | 63 | 3.3 | |
| summer | 1 (site b) | CT | 72 | 4.6 | |
| summer | 1 (site b) | CT | 81 | 5.8 | |
| summer | 1 (site b) | CT | 86 | 5.8 | |
| summer | 1 (site b) | CT | 92 | 8.3 | |
| summer | 1 (site b) | TR | 35 | 0.8 | assumed CT |
| summer | 1 (site b) | TR | 36 | 1.4 | assumed CT |
| summer | 1 (site b) | TR | 38 | 0.6 | assumed CT |
| summer | 1 (site b) | TR | 40 | 1.5 | assumed CT |
| summer | 1 (site b) | TR | 43 | 1.2 | assumed CT |
| summer | 1 (site b) | TSB | 37 | | |
| summer | 2 | CAL | 99 | | |
| summer | 2 | CO | 55 | 2.2 | |
| summer | 2 | CO | 55 | 2 | |
| summer | 2 | CO | 58 | 2.5 | |
| summer | 2 | CO | 64 | 3.1 | |
| summer | 2 | CT | 78 | 4.3 | |
| summer | 2 | CT | 95 | 9 | |
| summer | 2 | TR | 30 | 0.2 | assumed CT |
| summer | 2 | TR | 31 | 0.8 | assumed CT |
| summer | 2 | TR | 33 | 0.8 | assumed CT |
| summer | 2 | TR | 35 | 0.4 | assumed CT |
| summer | 2 | TR | 35 | 1.3 | assumed CT |
| summer | 2 | TR | 36 | 0.6 | assumed CT |
| summer | 2 | TR | 40 | 0.5 | assumed CT |
| summer | 2 | TR | 42 | 1.2 | assumed CT |
| summer | 2 | TR | 45 | 0.9 | assumed CT |
| summer | 2 | TSB | 29 | | |
| summer | 2 | TSB | 31 | | |
| summer | 2 | TSB | 34 | | |
| summer | 2 | TSB | 34 | | |
| summer | 2 | TSB | 35 | | |
| summer | 2 | TSB | 35 | | |
| summer | 2 | TSB | 37 | | |
| summer | 2 | TSB | 37 | | |
| summer | 2 | TSB | 38 | | |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 2 | TSB | 40 | | |
| summer | 2 | TSB | 41 | | |
| summer | 2 | TSB | 42 | | |
| summer | 2 | TSB | 42 | | |
| summer | 2 | TSB | 43 | | |
| summer | 2 | TSB | 44 | | |
| summer | 2 | TSB | 44 | | |
| summer | 2 | TSB | 45 | | |
| summer | 2 | TSB | 46 | | |
| summer | 2 | TSB | 50 | | |
| summer | 2 | TSB | 50 | | |
| summer | 2 | TSB | 51 | | |
| summer | 2 | TSB | 51 | | |
| summer | 2 | TSB | 51 | | |
| summer | 2 | TSB | 52 | | |
| summer | 2 | TSB | 53 | | |
| summer | 2 | TSB | 55 | | |
| summer | 2 | TSB | 57 | | |
| summer | 3 | CAL | 64 | | |
| summer | 3 | CAL | 65 | | |
| summer | 3 | CAL | 65 | | |
| summer | 3 | CT | 81 | 5.6 | |
| summer | 3 | CT | 96 | 8.7 | |
| summer | 3 | TR | 31 | 0.4 | assumed CT |
| summer | 3 | TR | 31 | 0.3 | assumed CT |
| summer | 3 | TR | 32 | 0.4 | assumed CT |
| summer | 3 | TR | 32 | 0.8 | assumed CT |
| summer | 3 | TR | 32 | 1 | assumed CT |
| summer | 3 | TR | 33 | 0.5 | assumed CT |
| summer | 3 | TR | 33 | 0.5 | assumed CT |
| summer | 3 | TR | 33 | 0.4 | assumed CT |
| summer | 3 | TR | 34 | 0.8 | assumed CT |
| summer | 3 | TR | 34 | 0.8 | assumed CT |
| summer | 3 | TR | 34 | 0.4 | assumed CT |
| summer | 3 | TR | 34 | 1 | assumed CT |
| summer | 3 | TR | 36 | 0.6 | assumed CT |
| summer | 3 | TR | 36 | 1.9 | assumed CT |
| summer | 3 | TR | 37 | 0.6 | assumed CT |
| summer | 3 | TR | 37 | 0.6 | assumed CT |
| summer | 3 | TR | 37 | 0.9 | assumed CT |
| summer | 3 | TR | 38 | 0.8 | assumed CT |
| summer | 3 | TR | 38 | 0.6 | assumed CT |
| summer | 3 | TR | 39 | 1 | assumed CT |
| summer | 3 | TR | 41 | 2.1 | assumed CT |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 3 | TR | 45 | 0.9 | assumed CT |
| summer | 3 | TR | 48 | 1.2 | assumed CT |
| summer | 3 | TR | 82 | 0.4 | assumed CT |
| summer | 3 | TSB | 30 | | |
| summer | 3 | TSB | 34 | | |
| summer | 3 | TSB | 55 | | |
| summer | 4 | CAL | 77 | | |
| summer | 4 | CAL | 80 | | |
| summer | 4 | CAL | 112 | | |
| summer | 4 | CO | 50 | 1.6 | |
| summer | 4 | CO | 50 | 1.9 | |
| summer | 4 | CO | 52 | 1.6 | |
| summer | 4 | CO | 53 | 2.7 | |
| summer | 4 | CO | 55 | 2.2 | |
| summer | 4 | CO | 55 | 2.4 | |
| summer | 4 | CO | 55 | 1.6 | |
| summer | 4 | CO | 60 | 2.8 | |
| summer | 4 | CO | 65 | 2.8 | |
| summer | 4 | CT | 98 | 10.9 | |
| summer | 4 | TR | 26 | 0.3 | assumed CT |
| summer | 4 | TR | 26 | 0.2 | assumed CT |
| summer | 4 | TR | 28 | 0.2 | assumed CT |
| summer | 4 | TR | 30 | 0.3 | assumed CT |
| summer | 4 | TR | 30 | 0.4 | assumed CT |
| summer | 4 | TR | 30 | 0.3 | assumed CT |
| summer | 4 | TR | 31 | 0.5 | assumed CT |
| summer | 4 | TR | 31 | 0.4 | assumed CT |
| summer | 4 | TR | 32 | 0.3 | assumed CT |
| summer | 4 | TR | 34 | 0.6 | assumed CT |
| summer | 4 | TR | 34 | 0.6 | assumed CT |
| summer | 4 | TR | 34 | 0.5 | assumed CT |
| summer | 4 | TR | 35 | 0.4 | assumed CT |
| summer | 4 | TR | 35 | 0.4 | assumed CT |
| summer | 4 | TR | 35 | 0.4 | assumed CT |
| summer | 4 | TR | 36 | 0.6 | assumed CT |
| summer | 4 | TR | 36 | 0.8 | assumed CT |
| summer | 4 | TR | 36 | 0.7 | assumed CT |
| summer | 4 | TR | 36 | 0.4 | assumed CT |
| summer | 4 | TR | 36 | 2.4 | assumed CT |
| summer | 4 | TR | 37 | 0.7 | assumed CT |
| summer | 4 | TR | 38 | 0.9 | assumed CT |
| summer | 4 | TR | 38 | 0.8 | assumed CT |
| summer | 4 | TR | 38 | 0.6 | assumed CT |
| summer | 4 | TR | 38 | 0.9 | assumed CT |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 4 | TR | 42 | 0.7 | assumed CT |
| summer | 4 | TR | 43 | 1.1 | assumed CT |
| summer | 4 | TR | 43 | 1.4 | assumed CT |
| summer | 4 | TR | 45 | 1 | assumed CT |
| summer | 4 | TR | 45 | 1.2 | assumed CT |
| summer | 4 | TR | 45 | 0.8 | assumed CT |
| summer | 4 | TR | 47 | 1.1 | assumed CT |
| summer | 4 | TSB | 14 | | |
| summer | 4 | TSB | 14 | | |
| summer | 4 | TSB | 20 | | |
| summer | 4 | TSB | 29 | | |
| summer | 4 | TSB | 30 | | |
| summer | 4 | TSB | 30 | | |
| summer | 4 | TSB | 32 | | |
| summer | 4 | TSB | 32 | | |
| summer | 4 | TSB | 34 | | |
| summer | 4 | TSB | 34 | | |
| summer | 4 | TSB | 35 | | |
| summer | 4 | TSB | 35 | | |
| summer | 4 | TSB | 35 | | |
| summer | 4 | TSB | 35 | | |
| summer | 4 | TSB | 36 | | |
| summer | 4 | TSB | 36 | | |
| summer | 4 | TSB | 37 | | |
| summer | 4 | TSB | 38 | | |
| summer | 4 | TSB | 38 | | |
| summer | 4 | TSB | 40 | | |
| summer | 4 | TSB | 40 | | |
| summer | 4 | TSB | 42 | | |
| summer | 4 | TSB | 43 | | |
| summer | 4 | TSB | 48 | | |
| summer | 4 | TSB | 57 | | |
| summer | 4 | TSB | 60 | | |
| summer | 5 | CAL | 70 | | |
| summer | 5 | CAL | 70 | | |
| summer | 5 | CAL | 80 | | |
| summer | 5 | CAL | 88 | | |
| summer | 5 | CAL | 100 | | |
| summer | 5 | CO | 45 | 1 | |
| summer | 5 | CO | 51 | 1.9 | |
| summer | 5 | CO | 55 | 2.1 | |
| summer | 5 | CO | 64 | 2.9 | |
| summer | 5 | CO | 70 | 4.9 | |
| summer | 5 | CT | 80 | 6.3 | |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 5 | CT | 82 | 10 | |
| summer | 5 | CT | 89 | 8.2 | |
| summer | 5 | TR | 28 | 0.3 | assumed CT |
| summer | 5 | TR | 30 | 0.4 | assumed CT |
| summer | 5 | TR | 30 | 0.2 | assumed CT |
| summer | 5 | TR | 34 | 0.5 | assumed CT |
| summer | 5 | TR | 37 | 0.5 | assumed CT |
| summer | 5 | TR | 37 | 0.5 | assumed CT |
| summer | 5 | TR | 38 | 0.6 | assumed CT |
| summer | 5 | TR | 42 | 0.7 | assumed CT |
| summer | 5 | TR | 42 | | assumed CT |
| summer | 5 | TR | 44 | 0.7 | assumed CT |
| summer | 5 | TR | 45 | 0.8 | assumed CT |
| summer | 5 | TR | 46 | 1.1 | assumed CT |
| summer | 5 | TSB | 27 | | |
| summer | 5 | TSB | 30 | | |
| summer | 5 | TSB | 32 | | |
| summer | 5 | TSB | 34 | | |
| summer | 5 | TSB | 34 | | |
| summer | 5 | TSB | 34 | | |
| summer | 5 | TSB | 35 | | |
| summer | 5 | TSB | 37 | | |
| summer | 5 | TSB | 38 | | |
| summer | 5 | TSB | 38 | | |
| summer | 5 | TSB | 39 | | |
| summer | 5 | TSB | 40 | | |
| summer | 5 | TSB | 40 | | |
| summer | 5 | TSB | 40 | | |
| summer | 5 | TSB | 40 | | |
| summer | 5 | TSB | 42 | | |
| summer | 5 | TSB | 42 | | |
| summer | 5 | TSB | 42 | | |
| summer | 5 | TSB | 42 | | |
| summer | 5 | TSB | 44 | | |
| summer | 5 | TSB | 44 | | |
| summer | 5 | TSB | 45 | | |
| summer | 5 | TSB | 45 | | |
| summer | 5 | TSB | 45 | | |
| summer | 5 | TSB | 45 | | |
| summer | 5 | TSB | 49 | | |
| summer | 5 | TSB | 50 | | |
| summer | 5 | TSB | 56 | | |
| summer | 5 | TSB | 63 | | |
| summer | 6 | CAL | 60 | | |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 6 | CAL | 67 | | |
| summer | 6 | CO | 50 | 2 | |
| summer | 6 | CO | 50 | 1.9 | |
| summer | 6 | CO | 52 | 1.3 | |
| summer | 6 | CO | 55 | 1.9 | |
| summer | 6 | CO | 55 | 2 | |
| summer | 6 | CO | 58 | 2.5 | |
| summer | 6 | CT | 60 | 2.8 | |
| summer | 6 | CT | 65 | 3.7 | |
| summer | 6 | CT | 74 | 4.1 | |
| summer | 6 | CT | 74 | 4.7 | |
| summer | 6 | CT | 75 | 6.2 | |
| summer | 6 | CT | 75 | 5.5 | |
| summer | 6 | CT | 75 | 4.8 | |
| summer | 6 | CT | 97 | 9.2 | |
| summer | 6 | TR | 28 | 0.2 | assumed CT |
| summer | 6 | TR | 30 | 0.7 | assumed CT |
| summer | 6 | TR | 31 | 0.2 | assumed CT |
| summer | 6 | TR | 33 | 0.4 | assumed CT |
| summer | 6 | TR | 33 | 0.4 | assumed CT |
| summer | 6 | TR | 33 | 0.5 | assumed CT |
| summer | 6 | TR | 34 | 0.4 | assumed CT |
| summer | 6 | TR | 34 | 0.5 | assumed CT |
| summer | 6 | TR | 34 | 0.3 | assumed CT |
| summer | 6 | TR | 35 | 0.5 | assumed CT |
| summer | 6 | TR | 35 | 0.4 | assumed CT |
| summer | 6 | TR | 35 | 0.6 | assumed CT |
| summer | 6 | TR | 36 | 0.4 | assumed CT |
| summer | 6 | TR | 36 | 0.3 | assumed CT |
| summer | 6 | TR | 36 | 0.5 | assumed CT |
| summer | 6 | TR | 36 | 0.6 | assumed CT |
| summer | 6 | TR | 37 | 0.9 | assumed CT |
| summer | 6 | TR | 37 | 0.5 | assumed CT |
| summer | 6 | TR | 37 | 0.7 | assumed CT |
| summer | 6 | TR | 38 | 0.7 | assumed CT |
| summer | 6 | TR | 42 | 0.8 | assumed CT |
| summer | 6 | TR | 44 | 0.5 | assumed CT |
| summer | 6 | TR | 44 | 0.8 | assumed CT |
| summer | 6 | TR | 44 | 0.9 | assumed CT |
| summer | 6 | TR | 45 | 1.1 | assumed CT |
| summer | 6 | TR | 45 | 0.7 | assumed CT |
| summer | 6 | TR | 45 | 0.9 | assumed CT |
| summer | 6 | TR | 45 | 1 | assumed CT |
| summer | 6 | TR | 57 | 0.9 | assumed CT |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 6 | TR | 57 | 1.5 | assumed CT |
| summer | 6 | TSB | 30 | | |
| summer | 6 | TSB | 30 | | |
| summer | 6 | TSB | 30 | | |
| summer | 6 | TSB | 34 | | |
| summer | 6 | TSB | 34 | | |
| summer | 6 | TSB | 34 | | |
| summer | 6 | TSB | 35 | | |
| summer | 6 | TSB | 35 | | |
| summer | 6 | TSB | 35 | | |
| summer | 6 | TSB | 39 | | |
| summer | 6 | TSB | 40 | | |
| summer | 6 | TSB | 40 | | |
| summer | 6 | TSB | 40 | | |
| summer | 6 | TSB | 45 | | |
| summer | 6 | TSB | 45 | | |
| summer | 6 | TSB | 45 | | |
| summer | 6 | TSB | 46 | | |
| summer | 6 | TSB | 47 | | |
| summer | 6 | TSB | 47 | | |
| summer | 6 | TSB | 48 | | |
| summer | 6 | TSB | 48 | | |
| summer | 6 | TSB | 50 | | |
| summer | 7 | CAL | 100 | | |
| summer | 7 | CO | 40 | 0.8 | |
| summer | 7 | CO | 40 | 1.7 | |
| summer | 7 | CO | 48 | 1.7 | |
| summer | 7 | CO | 48 | 1.8 | |
| summer | 7 | CO | 48 | 1.4 | |
| summer | 7 | CO | 50 | 1.5 | |
| summer | 7 | CO | 52 | 1.9 | |
| summer | 7 | CO | 52 | 1.5 | |
| summer | 7 | CO | 52 | 1.8 | |
| summer | 7 | CO | 54 | 2 | |
| summer | 7 | CO | 54 | 1.9 | |
| summer | 7 | CO | 54 | 2.5 | |
| summer | 7 | CO | 55 | 2.1 | |
| summer | 7 | CO | 55 | 2 | |
| summer | 7 | CO | 55 | 2.3 | |
| summer | 7 | CO | 56 | 2.4 | |
| summer | 7 | CO | 58 | 2.6 | |
| summer | 7 | CO | 58 | 2.4 | |
| summer | 7 | CO | 58 | 2.6 | |
| summer | 7 | CO | 58 | 2.7 | |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 7 | CO | 58 | 2.8 | |
| summer | 7 | CO | 60 | 2.8 | |
| summer | 7 | CO | 60 | 3.4 | |
| summer | 7 | CO | 60 | 2.8 | |
| summer | 7 | CO | 62 | 3.2 | |
| summer | 7 | CO | 64 | 4 | |
| summer | 7 | CO | 64 | 3.4 | |
| summer | 7 | CO | 64 | 3.3 | |
| summer | 7 | CO | 64 | 3 | |
| summer | 7 | CT | 64 | 4.1 | |
| summer | 7 | CT | 68 | 3.6 | |
| summer | 7 | CT | 74 | 5.2 | |
| summer | 7 | CT | 78 | 5.2 | |
| summer | 7 | CT | 78 | 6.7 | |
| summer | 7 | TR | 28 | 0.2 | assumed CT |
| summer | 7 | TR | 28 | 0.5 | assumed CT |
| summer | 7 | TR | 28 | 0.3 | assumed CT |
| summer | 7 | TR | 28 | 0.2 | assumed CT |
| summer | 7 | TR | 30 | 0.4 | assumed CT |
| summer | 7 | TR | 30 | 0.4 | assumed CT |
| summer | 7 | TR | 30 | 0.3 | assumed CT |
| summer | 7 | TR | 30 | 0.4 | assumed CT |
| summer | 7 | TR | 30 | 0.1 | assumed CT |
| summer | 7 | TR | 30 | 0.1 | assumed CT |
| summer | 7 | TR | 30 | 0.2 | assumed CT |
| summer | 7 | TR | 32 | 0.6 | assumed CT |
| summer | 7 | TR | 32 | 0.3 | assumed CT |
| summer | 7 | TR | 32 | 0.2 | assumed CT |
| summer | 7 | TR | 32 | 0.3 | assumed CT |
| summer | 7 | TR | 32 | 0.2 | assumed CT |
| summer | 7 | TR | 32 | 0.4 | assumed CT |
| summer | 7 | TR | 32 | 0.2 | assumed CT |
| summer | 7 | TR | 32 | 0.4 | assumed CT |
| summer | 7 | TR | 32 | 0.3 | assumed CT |
| summer | 7 | TR | 32 | 0.5 | assumed CT |
| summer | 7 | TR | 33 | 0.5 | assumed CT |
| summer | 7 | TR | 33 | 0.3 | assumed CT |
| summer | 7 | TR | 34 | 0.6 | assumed CT |
| summer | 7 | TR | 34 | 0.4 | assumed CT |
| summer | 7 | TR | 34 | 0.6 | assumed CT |
| summer | 7 | TR | 34 | 0.4 | assumed CT |
| summer | 7 | TR | 34 | 0.4 | assumed CT |
| summer | 7 | TR | 34 | 0.6 | assumed CT |
| summer | 7 | TR | 34 | 0.3 | assumed CT |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 7 | TR | 35 | 0.5 | assumed CT |
| summer | 7 | TR | 35 | 0.6 | assumed CT |
| summer | 7 | TR | 35 | 0.5 | assumed CT |
| summer | 7 | TR | 35 | 0.5 | assumed CT |
| summer | 7 | TR | 35 | 0.5 | assumed CT |
| summer | 7 | TR | 35 | 0.1 | assumed CT |
| summer | 7 | TR | 36 | 0.7 | assumed CT |
| summer | 7 | TR | 36 | 0.4 | assumed CT |
| summer | 7 | TR | 36 | 0.5 | assumed CT |
| summer | 7 | TR | 36 | 0.6 | assumed CT |
| summer | 7 | TR | 36 | 0.5 | assumed CT |
| summer | 7 | TR | 36 | 0.5 | assumed CT |
| summer | 7 | TR | 36 | 0.4 | assumed CT |
| summer | 7 | TR | 36 | 0.5 | assumed CT |
| summer | 7 | TR | 36 | 0.5 | assumed CT |
| summer | 7 | TR | 36 | 0.3 | assumed CT |
| summer | 7 | TR | 36 | 0.6 | assumed CT |
| summer | 7 | TR | 36 | 0.5 | assumed CT |
| summer | 7 | TR | 38 | 0.5 | assumed CT |
| summer | 7 | TR | 38 | 0.5 | assumed CT |
| summer | 7 | TR | 38 | 0.5 | assumed CT |
| summer | 7 | TR | 38 | 0.8 | assumed CT |
| summer | 7 | TR | 38 | 0.6 | assumed CT |
| summer | 7 | TR | 40 | 0.9 | assumed CT |
| summer | 7 | TR | 40 | 0.7 | assumed CT |
| summer | 7 | TR | 40 | 0.6 | assumed CT |
| summer | 7 | TR | 41 | 0.9 | assumed CT |
| summer | 7 | TR | 42 | 0.9 | assumed CT |
| summer | 7 | TR | 42 | 0.5 | assumed CT |
| summer | 7 | TR | 43 | 0.9 | assumed CT |
| summer | 7 | TR | 44 | 1 | assumed CT |
| summer | 7 | TR | 46 | 1.2 | assumed CT |
| summer | 7 | TR | 46 | 1.5 | assumed CT |
| summer | 7 | TR | 50 | 1 | assumed CT |
| summer | 7 | TR | 58 | 2.3 | assumed CT |
| summer | 7 | TR | 65 | 2 | assumed CT |
| summer | 7 | TSB | 58 | | |
| summer | 8 | CO | 36 | 0.6 | |
| summer | 8 | CO | 38 | 0.7 | |
| summer | 8 | CO | 40 | 1 | |
| summer | 8 | CO | 40 | 0.8 | |
| summer | 8 | CO | 42 | 1.2 | |
| summer | 8 | CO | 43 | 0.5 | |
| summer | 8 | CO | 43 | 0.9 | |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 8 | CO | 45 | 1.2 | |
| summer | 8 | CO | 45 | 1.1 | |
| summer | 8 | CO | 46 | 1.2 | |
| summer | 8 | CO | 46 | 1.1 | |
| summer | 8 | CO | 46 | 1.4 | |
| summer | 8 | CO | 46 | 1.3 | |
| summer | 8 | CO | 48 | 1.9 | |
| summer | 8 | CO | 48 | 1.4 | |
| summer | 8 | CO | 48 | 1.7 | |
| summer | 8 | CO | 48 | 1.5 | |
| summer | 8 | CO | 50 | 2.1 | |
| summer | 8 | CO | 50 | 1.3 | |
| summer | 8 | CO | 50 | 1.6 | |
| summer | 8 | CO | 50 | 1.2 | |
| summer | 8 | CO | 50 | 1.4 | |
| summer | 8 | CO | 52 | 1.5 | |
| summer | 8 | CO | 52 | 1.8 | |
| summer | 8 | CO | 53 | 1.6 | |
| summer | 8 | CO | 53 | 2 | |
| summer | 8 | CO | 54 | 1.9 | |
| summer | 8 | CO | 55 | 2 | |
| summer | 8 | CO | 55 | 1.7 | |
| summer | 8 | CO | 56 | 2.6 | |
| summer | 8 | CO | 56 | 2.5 | |
| summer | 8 | CO | 58 | 2.9 | |
| summer | 8 | CO | 58 | 2.2 | |
| summer | 8 | CO | 60 | 2.8 | |
| summer | 8 | CO | 62 | 2.5 | |
| summer | 8 | CO | 62 | 3.1 | |
| summer | 8 | CO | 64 | 3 | |
| summer | 8 | CO | 66 | 3.9 | |
| summer | 8 | CT | 140 | 28.8 | |
| summer | 8 | TR | 28 | 0.2 | assumed CT |
| summer | 8 | TR | 30 | 0.3 | assumed CT |
| summer | 8 | TR | 32 | 0.4 | assumed CT |
| summer | 8 | TR | 32 | 0.2 | assumed CT |
| summer | 8 | TR | 34 | 0.2 | assumed CT |
| summer | 8 | TR | 34 | 0.3 | assumed CT |
| summer | 8 | TR | 34 | 0.4 | assumed CT |
| summer | 8 | TR | 34 | | assumed CT |
| summer | 8 | TR | 34 | 0.3 | assumed CT |
| summer | 8 | TR | 34 | 0.2 | assumed CT |
| summer | 8 | TR | 35 | 0.6 | assumed CT |
| summer | 8 | TR | 35 | 0.5 | assumed CT |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 8 | TR | 35 | 0.6 | assumed CT |
| summer | 8 | TR | 35 | 0.5 | assumed CT |
| summer | 8 | TR | 40 | 0.4 | assumed CT |
| summer | 8 | TR | 40 | 1 | assumed CT |
| summer | 8 | TR | 40 | 0.6 | assumed CT |
| summer | 8 | TR | 40 | 0.7 | assumed CT |
| summer | 8 | TR | 40 | 0.6 | assumed CT |
| summer | 8 | TR | 42 | 0.7 | assumed CT |
| summer | 8 | TR | 43 | | assumed CT |
| summer | 8 | TR | 44 | 1.5 | assumed CT |
| summer | 8 | TR | 45 | 0.8 | assumed CT |
| summer | 8 | TR | 45 | 1 | assumed CT |
| summer | 8 | TR | 45 | 0.4 | assumed CT |
| summer | 8 | TR | 46 | 1.2 | assumed CT |
| summer | 8 | TR | 46 | 0.5 | assumed CT |
| summer | 8 | TR | 48 | 1.3 | assumed CT |
| summer | 8 | TR | 48 | 1.7 | assumed CT |
| summer | 8 | TSB | 36 | | |
| summer | 8 | TSB | 38 | | |
| summer | 8 | TSB | 38 | | |
| summer | 8 | TSB | 40 | | |
| summer | 8 | TSB | 40 | | |
| summer | 8 | TSB | 40 | | |
| summer | 8 | TSB | 40 | | |
| summer | 8 | TSB | 42 | | |
| summer | 8 | TSB | 44 | | |
| summer | 8 | TSB | 45 | | |
| summer | 8 | TSB | 46 | | |
| summer | 9 | CO | 48 | 1.5 | |
| summer | 9 | CO | 54 | 1.8 | |
| summer | 9 | CO | 55 | 1.9 | |
| summer | 9 | CO | 56 | 2.2 | |
| summer | 9 | CO | 60 | 3.1 | |
| summer | 9 | CO | 64 | 4.1 | |
| summer | 9 | CO | 74 | 5.5 | |
| summer | 9 | CT | 85 | 6.3 | |
| summer | 9 | CT | 88 | 7.7 | |
| summer | 9 | CT | 90 | 7.5 | |
| summer | 9 | CT | 98 | 8 | |
| summer | 9 | TR | 30 | 0.3 | assumed CT |
| summer | 9 | TR | 30 | 0.3 | assumed CT |
| summer | 9 | TR | 32 | 0.4 | assumed CT |
| summer | 9 | TR | 33 | 0.3 | assumed CT |
| summer | 9 | TR | 35 | 0.4 | assumed CT |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| summer | 9 | TR | 35 | 0.5 | assumed CT |
| summer | 9 | TR | 35 | 0.4 | assumed CT |
| summer | 9 | TR | 36 | 0.6 | assumed CT |
| summer | 9 | TR | 38 | 0.6 | assumed CT |
| summer | 9 | TR | 38 | 0.5 | assumed CT |
| summer | 9 | TR | 48 | 0.5 | assumed CT |
| summer | 9 | TSB | 45 | | |
| summer | 10 | CO | 58 | 2.4 | |
| summer | 10 | CO | 60 | | |
| summer | 10 | CO | 64 | 2.9 | |
| summer | 10 | CO | 65 | 3.7 | |
| summer | 10 | CT | 74 | 5.6 | |
| summer | 10 | CT | 76 | 4.6 | |
| summer | 10 | CT | 79 | 5.1 | |
| summer | 10 | CT | 84 | 7.9 | |
| summer | 10 | CT | 90 | 8.9 | |
| summer | 10 | TR | 36 | 0.5 | assumed CT |
| summer | 10 | TR | 42 | 0.7 | assumed CT |
| summer | 11 | CAL | 102 | | |
| summer | 11 | CO | 56 | 2.9 | |
| summer | 11 | CO | 64 | 3.7 | |
| summer | 11 | CO | 68 | 4.1 | |
| summer | 11 | CT | 78 | 5.3 | |
| summer | 11 | CT | 104 | 12.4 | |
| summer | 11 | TR | 33 | 0.3 | assumed CT |
| summer | 11 | TR | 33 | 0.4 | assumed CT |
| summer | 11 | TR | 34 | 0.3 | assumed CT |
| summer | 11 | TR | 34 | 0.5 | assumed CT |
| summer | 11 | TR | 34 | 0.4 | assumed CT |
| summer | 11 | TR | 35 | 0.5 | assumed CT |
| summer | 11 | TR | 35 | 0.7 | assumed CT |
| summer | 11 | TR | 35 | 0.5 | assumed CT |
| summer | 11 | TR | 36 | 0.6 | assumed CT |
| summer | 11 | TR | 48 | 0.8 | assumed CT |
| summer | 11 | TR | 48 | 1.2 | assumed CT |
| fall | 1 (site a) | CO | 66 | 3.2 | marked |
| fall | 1 (site a) | CO | 67 | 3.3 | marked |
| fall | 1 (site a) | CO | 68 | 4.1 | marked |
| fall | 1 (site a) | CO | 70 | 4.1 | marked |
| fall | 1 (site a) | CO | 73 | 4.3 | marked |
| fall | 1 (site a) | CO | 74 | 4.5 | marked |
| fall | 1 (site a) | CO | 74 | 4.3 | marked |
| fall | 1 (site a) | CO | 78 | 4.8 | marked |
| fall | 1 (site a) | CO | 65 | 3.2 | |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| fall | 1 (site a) | CO | 79 | 6.7 | |
| fall | 1 (site a) | CO | 80 | 6.3 | |
| fall | 1 (site a) | CO | 87 | 7.3 | |
| fall | 1 (site a) | CO | 112 | 13.2 | |
| fall | 1 (site a) | CT | 97 | 10.2 | |
| fall | 1 (site a) | CT | 117 | 15.9 | |
| fall | 1 (site a) | TSB | 40 | | |
| fall | 1 (site a) | TSB | 44 | | |
| fall | 1 (site a) | TSB | 54 | | |
| fall | 1 (site a) | TSB | 54 | | |
| fall | 1 (site a) | TSB | 54 | | |
| fall | 1 (site b) | CAL | 85 | | |
| fall | 1 (site b) | CAL | 88 | | |
| fall | 1 (site b) | CO | 65 | 3.2 | marked |
| fall | 1 (site b) | CO | 70 | 3.8 | marked |
| fall | 1 (site b) | CO | 78 | 5.1 | |
| fall | 1 (site b) | CO | 85 | 6.7 | |
| fall | 1 (site b) | CO | 86 | 6.7 | |
| fall | 1 (site b) | CO | 100 | 9.4 | |
| fall | 1 (site b) | CT | 88 | 9.3 | |
| fall | 1 (site b) | CT | 100 | 10.1 | |
| fall | 1 (site b) | CT | 116 | 16.5 | |
| fall | 1 (site b) | CT | 125 | 20.3 | |
| fall | 1 (site b) | CT | 145 | 26.9 | |
| fall | 1 (site b) | TSB | 45 | | |
| fall | 1 (site b) | TSB | 48 | | |
| fall | 1 (site b) | TSB | 50 | | |
| fall | 1 (site b) | TSB | 50 | | |
| fall | 1 (site b) | TSB | 50 | | |
| fall | 1 (site b) | TSB | 50 | | |
| fall | 1 (site b) | TSB | 50 | | |
| fall | 1 (site b) | TSB | 52 | | |
| fall | 1 (site b) | TSB | 55 | | |
| fall | 8 | CO | 71 | 4.1 | |
| fall | 8 | CO | 80 | 5.8 | |
| fall | 8 | CT | 55 | 1.8 | |
| fall | 8 | CT | 58 | 2.0 | |
| fall | 8 | CT | 67 | 3.0 | |
| fall | 8 | CT | 91 | 8.3 | |
| fall | 8 | CT | 98 | 10.6 | |
| fall | 8 | CT | 99 | 10.6 | |
| fall | 8 | CT | 99 | 9.4 | |
| fall | 8 | CT | 101 | 11.8 | |
| fall | 8 | CT | 101 | 11.9 | |

| Sample | Reach | Species | Length | Weight | Comments |
|---|---|---|---|---|---|
| fall | 8 | CT | 101 | 11.5 | |
| fall | 8 | CT | 102 | 10.5 | |
| fall | 8 | CT | 104 | 11.6 | |
| fall | 8 | CT | 104 | 10.6 | |
| fall | 8 | CT | 113 | 12.9 | |
| fall | 8 | CT | 113 | 12.7 | |
| fall | 8 | CT | 114 | 15.6 | |
| fall | 8 | CT | 124 | 20.1 | |
| fall | 8 | CT | 125 | 19.9 | |
| fall | 8 | CT | 128 | 19.0 | |
| fall | 8 | CT | 130 | 19.9 | |
| fall | 8 | TSB | 54 | | |
| fall | 8 | TSB | 56 | | |
| fall | 11 | CO | 64 | 3.2 | |
| fall | 11 | CO | 66 | 2.8 | |
| fall | 11 | CO | 67 | 4.5 | |
| fall | 11 | CO | 68 | 3.5 | |
| fall | 11 | CO | 70 | 4.9 | |
| fall | 11 | CO | 74 | 6.2 | |
| fall | 11 | CO | 82 | 7.3 | |
| fall | 11 | CT | 67 | 3.4 | |
| fall | 11 | CT | 74 | 4.6 | |
| fall | 11 | CT | 127 | 22.2 | |
| winter | 1 (site a) | TSB | 30 | | |
| winter | 1 (site a) | TSB | 30 | | |
| winter | 1 (site a) | TSB | 30 | | |
| winter | 1 (site a) | TSB | 30 | | |
| winter | 1 (site a) | TSB | 30 | | |
| winter | 1 (site a) | TSB | 30 | | |
| winter | 1 (site b) | CT | 138 | 23.5 | |
| winter | 8 | CT | 88 | 6.2 | |
| winter | 8 | CT | 69 | 4.2 | |
| winter | 8 | CT | 107 | 11.5 | |
| winter | 8 | CT | 98 | 9.7 | |
| winter | 8 | CO | 73 | 4.8 | |
| winter | 11 | CT | 106 | 10.4 | |

CO = coho salmon
CT = cutthroat trout
TR = unidentified trout
TSB = threespine stickleback
CAL = coastrange sculpin

# Appendix 4 – Photographs

**Photo 1**

Downstream view where fish sampling occurred in Reach 1 during the summer sample.

**Photo 2**

Processing fish captured in Reach 1.

**Photo 3**

95mm cutthroat trout captured in Reach 2 during the summer sample.

**Photo 4**

Upstream view of the sample site in Reach 2 during the summer sample.

**Photo 5**

A downstream view of the section of Reach 3 sampled during the summer sample. Note the soft, mucky substrate in this reach.

**Photo 6**

A downstream view of the sampled portion of Reach 4 from the summer survey.

**Photo 7**

A 64mm coho fry captured in Reach 4 during the summer sample.

**Photo 8**

A 98mm cutthroat trout captured in Reach 4 during the summer sample.

**Photo 9**

An upstream view of the sampled portion of Reach 5, summer sample.

**Photo 10**

This male, threespine stickleback is vibrantly colored for spawning season. Captured in Reach 5 during the summer sample.

**Photo 11**

An upstream view of the sample site in Reach 6 from the summer survey. The substrate is becoming gradually coarser.

**Photo12**

A downstream view of Reach 7, where the summer fish sample occurred. The transition between the forested reach and the wetland reach downstream can be seen in the background.

**Photo 13**

A 74mm cutthroat trout and 52mm coho fry captured during the summer sample in Reach 7.

**Photo 14**

This 150mm cutthroat trout was captured in Reach 8 during the summer survey.

**Photo 15**

An upstream view of the sampled section of Reach 9 from the summer survey. Some of the best gravel for spawning is found in this reach.

**Photo 16**

A 74mm coho fry captured in Reach 9 during the summer sample.

**Photo 17**

A downstream view in Reach 10, where fish sampling was conducted in the summer. The substrate is now pre-dominantly boulder and cobbles.

**Photo 18**

A downstream view of the section of Reach 11 where fish sampling occurred in the summer sample.

**Photo 19**

A 64mm and 68mm coho fry captured during the summer sample in Reach 11.

**Photo 20**

The release of 2500 marked coho fry from the Quinsam Hatchery on July 6, 2001, into the ponded area immediately upstream of the Iron River Main culverts in Reach 2.

**Photo 21**

The installation of the water temperature logger in the pool immediately downstream of the Iron River Main culverts, Reach 1 on July 6, 2001.

**Photo 22**

The fish sampling area of Reach 2 during the winter sample.

**Photo 23**

A downstream view of the section of Reach 8 where fish trapping occurred during the winter survey.

**Photo 24**

An upstream view of the confluence of Tributary 4 (on the left) and Coho Creek (not visible, on the right) taken during the winter survey. The amount of water flowing from Tributary 4 equals the amount of water in the mainstem. Tributary 4 was observed to be nearly dry in the summer months.