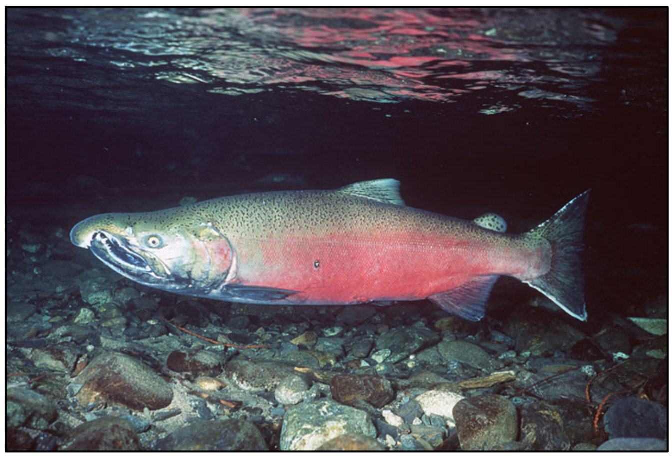
Inventory of two Salmonid Enhancement Sites within the Lower Seymour Conservation Reserve



Submitted to:
Bob Gunn
Project Supervisor
Fish, Wildlife and Recreation Program
British Columbia Institute of Technology
Burnaby, BC

Submitted by:
Angela Negenman and Kathleen Churcher
FWR Students
British Columbia Institute of Technology
Burnaby, BC

May 2005

SUMMARY

The Greater Vancouver Regional District (GVRD), in partnership with the Seymour Salmonid Society, has created four off-channel salmonid enhancement sites of over 45 000m^2 of habitat within the Lower Seymour Conservation Reserve (LSCR) located in North Vancouver in the Seymour River watershed. Little data have been available to date on the productivity of the enhancement habitat, as it has yet to be regularly monitored. This poses a problem for the GVRD and Department of Fisheries and Oceans Canada (DFO) in evaluating their projects and planning future enhancement in this watershed. In order to rectify this deficiency, from September 2004 to January 2005 two of the four enhancement sites were assessed for abundance of juvenile fish, adult salmon escapement and water quality. Juvenile coho (*Oncorhynchus kisutch*) abundance was estimated using mark-recapture techniques, while adult coho escapement was estimated by means of a foot survey. Both enhancement sites supported spawning adult coho salmon and over-wintering juvenile salmonid populations, including coho salmon and bull/Dolly Varden char (*Salvelinus confluentus* or *S. malma*). Cutthroat trout (*Oncorhynchus clarki*) were present in the Midvalley site. Estimated population of the Midvalley enhancement site was 691 juvenile coho in the upstream pond and 1531 juvenile coho in the downstream pond from November 21 to 28, 2004. Estimated population in Junior Creek site was 1701 juvenile coho in the upstream pond and 2796 in the downstream pond from December 17 to 21, 2004. The total coho adult escapement was 122 at the Midvalley site and 80 at Junior Creek. Juvenile coho length distributions at Junior Creek and Midvalley sites each showed two modes, indicating there were two age classes present: coho aged 0^+ and 1^+. Junior Creek was more established habitat and has existed for a greater period of time; therefore, it sustained a higher population of juvenile salmonids than Midvalley enhancement site. Large woody debris structures were observed in each site which provided juvenile and adult salmonids with escape cover from predators and high velocity water flow, and also trapped spawned out salmon carcasses. The total escapement and proportion of wild fish observed in Midvalley were greater than in Junior Creek, while more hatchery fish were found within Junior Creek.

Although pH was lower than Canadian Environmental Quality Guidelines and the dissolved oxygen was greater than these guidelines, all were acceptable for aquatic life. Based on the results of this study and field observations, we recommend using similar methods for future salmonid enhancement efforts and promoting similar student projects. Also, juvenile lengths and weights from both enhancement sites should be used for GVRD's spring 2005 pre-smolt enumeration study. We further recommend planting riparian vegetation and implementing an integrated approach of boulders, large woody debris and vegetation.

ACKNOWLEDGEMENTS

We would especially like to thank Heidi Walsh, Lower Seymour Conservation Reserve Field Technician for the Greater Vancouver Regional District (GVRD), since without her guidance and dedication this project would not have been possible. Special thanks go to Brian Smith, the Hatchery Manager with the Seymour Salmonid Society, for providing overall guidance and documents on past hatchery work, fish identification and journals on juvenile salmonids. We would also like to thank James Weger and Marc Guimond of the Seymour Salmonid Society for demonstrating the sampling techniques, providing equipment and guidance along the way. Many thanks to Bob Gunn for assisting us in developing our objectives and lending support over the course of the project and to Marvin Rosenau for providing extensive editorial direction assistance with data analysis.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

1.1 Background

The Seymour River is located on the North side of Burrard Inlet (Fig. 1), and is a vital water course for Pacific salmonids, wildlife and humans. However, this stream was dammed in 1961 approximately 19 km from the mouth by the Greater Vancouver Water District (GVWD) to create a 780 ha reservoir within the steep-walled glacial valley (Blackwell *et al*. 2000). The reservoir provides roughly 40 percent of the entire water supply for the GVRD (Blackwell *et al*. 2000). The dam also blocked access to or flooded more than 30 km of valuable fish habitat, including crucial over-wintering areas for juvenile salmonids. Cover, in the form of large woody debris, is now unavailable to the downstream portion of the Seymour River due to blockage from the dam. Salmonids have been adversely affected due to decreased water flow by removal of water for domestic use (GVRD 2004). The Seymour River watershed provides essential habitat, ranging from rearing to spawning, for several salmonid species (GVRD 2004), including:

- coho salmon (*Oncorhynchus kisutch*)
- chinook salmon (*O. tshawytscha*)
- chum salmon (*O. keta*)
- steelhead trout (*O. mykiss*)
- Dolly Varden char (*Salvelinus malma*)
- Bull Trout (*S. confluentus*)
- anadromous cutthroat trout (*O. clarki*)

The Lower Seymour Conservation Reserve (LSCR) contains the Seymour River, as well as alpine meadows, forested slopes and flood plains (GVRD 2004). Close to the city core of Vancouver, British Columbia (BC), the reserve is easily accessible from many Lower Mainland areas for the purposes of recreation, environmental education, and special events, such as races and ceremonies. Recreational activities involve hiking, biking, angling, and other outdoor activities (GVRD 2004).

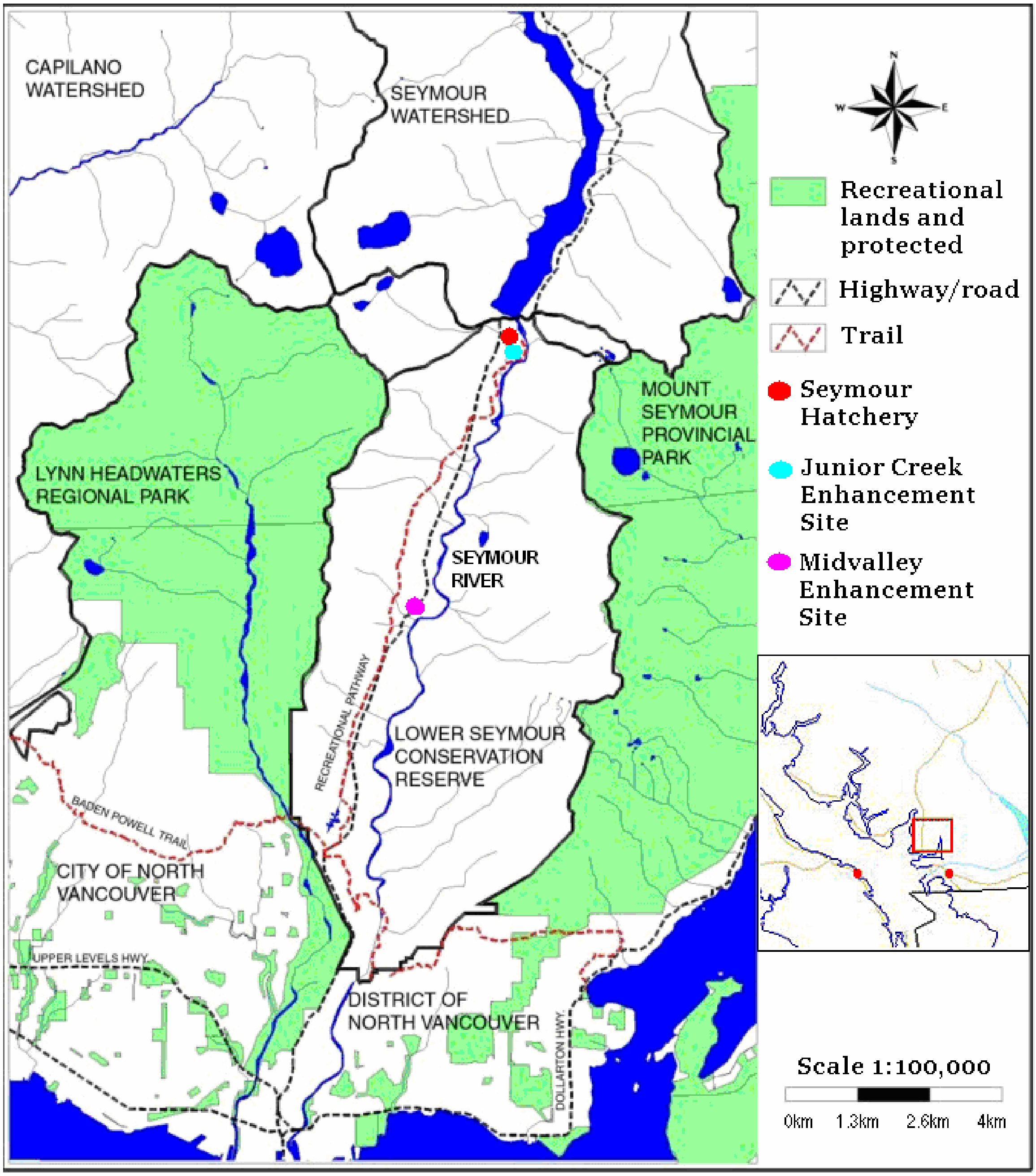


Figure 1. Location of the study sites and the Seymour River within the Lower Seymour Conservation Reserve. (source: GVRD (2004) and Greater Georgia Basin Steelhead Recovery Plan (2005)).

The LSCR is habitat to a plethora of wildlife species, ranging from small mammals to large ungulates and carnivores. Commonly seen vertebrates include black bears (*Ursus americanus*), black-tailed deer (*Odocoileus hemionus*), pine martens (*Martes Americana*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*) (Williams and Jessop 1996).

Many of the salmonids found in the Seymour River can be attributed to the fish-culture and habitat-restoration efforts of the Seymour Hatchery, managed by the Seymour Salmonid Society. The Seymour Salmonid Society is not only responsible for the culture of salmonid stocks, but helps to sustain a viable sport fishery, takes an active role in educating the public, and provides a voice for conservation and preservation of fish and habitat. Located 0.25 km below the Seymour Falls Dam, the hatchery is accessible to the general public for education and enjoyment.

The Seymour Salmonid Society, in partnership with GVRD, has created four salmonid enhancement sites in the LSCR as part of a habitat enhancement strategy. These off-channel sites have resulted in over 45 000m^2 of enhanced habitat but minimal monitoring has occurred since the creation of these sites and little is known regarding their effectiveness. The lack of monitoring has limited the GVRD, Seymour Salmonid Society and Department of Fisheries and Oceans Canada (DFO) in evaluating the success of these projects and, thus, planning future enhancement projects within the watershed.

Indeed, the only assessment that has been undertaken was an initial evaluation conducted by BCIT on Junior Creek in 1996 (Williams and Jessop 1996). There have been no additional inventories since then, nor has the more recent Midvalley enhancement site been assessed. Williams and Jessop (1996) confirmed that Junior Creek provided juvenile coho over-wintering areas and served as spawning habitats for 70 adults. They also found small numbers of steelhead, cutthroat trout, and Dolly Varden char juveniles utilizing these habitats.

The evaluation of habitat should include biological, physical and economic aspects (Everest *et al*. 1991). Biologically, enhancement can be evaluated through finding a salmonid's abundance in an area and determining changes through time. Also, establishing the movement of fish into an area indicates improved if not more favourable habitat. Physical changes are the least complicated characteristics to measure in enhancement sites, especially when viewed in lieu of the rest of the watershed. With difficulties in attaching economic value of enhancement projects, it is best to focus assessments on physical and biological characteristics, such as water quality testing, fish trapping, and carcass recovery methods.

In order to provide an assessment of fish utilization in the Junior and Midvalley enhancement sites, this study was initiated:

1. To assess the presence and abundance of juvenile salmonids within the Junior Creek and Midvalley enhancement sites.
2. To determine juvenile length and weight data of the various fish species in the enhancement locations.
3. To review data from the 1996 study conducted by Williams and Jessop and compare to 2004/2005 study data.
4. To conduct a carcass recovery to estimate the presence and abundance of spawning adults.
5. To determine the proportion of wild versus hatchery adult salmonids.
6. To assess water quality within the two study sites.

1.2 Life Histories of Salmonids Found in the Study Area

1.2.1 Coho Salmon

During spring, coho eggs hatch and fry grow quickly to the parr stage by summer to early fall. After spending one or two years rearing in fresh water, they migrate to the ocean as smolts in March through June. Most fish spend 18 months in the ocean before returning to their natal stream to spawn as adults. Most returning coho are three years old, however about 20% of males mature at age 2 and are known as “jacks”. Adult coho will then begin their migration back to coastal streams and rivers when the first freshet occurs in fall (Lawson *et al*. 2004).

1.2.2 Steelhead Trout

Steelhead spawn and rear in streams between southern California to the Alaska Panhandle, but the distribution is concentrated between northern Oregon and northern British Columbia (Catt pers. comm. 2004). Steelhead spend most of their time at sea, entering rivers in the 3rd, 4th or 5th year of life. They can enter freshwater in any month of the year; however, they do not spawn until winter or spring where 30 to 60 percent will repeat spawn. Young steelhead will go to sea once they have spent 1 or 2 years in fresh water (Richardson (1836) in Clemens and Wilby 1961).

1.2.3 Cutthroat Trout

Cutthroat can be found in almost all streams and lakes of the coastal region of northern California to southeastern Alaska. Coastal, or sea-run, cutthroat frequently utilize small streams close to cities and towns. Because of this, they are at risk due to extensive urbanization in south western BC. Cutthroat usually spawn from February to May in small streams, however in Cowichan they have been known to spawn as early as December. Juveniles remain in freshwater for one to five years, before smolting, although some individuals stay in freshwater throughout their lives (Richardson (1836) in Clemens and Wilby 1961). Spawning generally occurs for the first time at three to four years of age; however some males can mature sexually at two years of age. Cutthroat trout are also capable of repeat spawning (Catt pers. comm. 2004).

1.2.4 Dolly Varden Char

Dolly Varden char are found throughout BC and occurs in both fresh and salt water. Spawning occurs from August to December in streams. Those found north of Vancouver Island tend to have faint vermiculations on the back (Walbaun 1792 in Clemens and Wilby 1961). Dolly Varden char have four main life strategies: Anadromous, fluvial, adfluvial, and resident. Anadromous are sea-run Dolly Varden, whereas resident fish spend their entire life in tributaries. Fluvial Dolly Varden will live in river mainstems, spawn in tributaries and return to their natal mainstem while adfluvial Dolly Varden live in lakes, spawn in tributaries, and return to their lake or mainstem river. The same fish could possibly change strategies over the period of its life. Some Dolly Varden can live to be 12 years of age (Western Washington University 2005)

1.2.5 Bull Trout

Bull Trout are found throughout the western mountains and foothills of Canada and United States. In northwestern British Columbia, they do not extend to the coast; however, in Puget Sound area, Washington, and Fraser River, BC, they do reach the coast. Bull Trout begin to migrate from late-May and August depending on distance they must travel. Spawning occurs from mid-August to late-October. Bull Trout eggs incubate in gravel and hatch in spring from March to April. Juveniles migrate to rivers and lakes from one to four years of age depending among systems (Haas and McPhail 1991 in Government of Alberta).

2.0 STUDY AREA

2.1 Seymour Watershed

The Seymour River watershed is located within the district of North Vancouver, is bordered by Lynn Creek (Fig. 1) and Indian River watersheds, and discharges into Burrard Inlet. The main tributaries found within the Seymour Watershed include: Maplewood, Paton, Gibbens, Hydraulic, Burwell, Orchid, Boulder, Fannin, Clipper, Belfour and Sheba creeks. Three Biogeoclimatic Zones are found within the LSCR, including the Coastal Western Hemlock (CWH), Mountain Hemlock (MH), and Alpine Tundra (AT) zones. The CWH is on average the rainiest biogeoclimatic zone in BC. The CWH occupies elevations from sea-level to 900m. The MH zone is usually the subalpine zone above the CWH and occurs at elevations of 900 to 1800m in the south and 400 to 1000m in the north. It is characterized by cool, short summers, and long, wet winters. The AT zone occurs on high mountains throughout BC, above 2250m. This zone is mainly cold, windy, and snowy (Meidinger and Pojar 1991).

The study area is located in the Seymour River watershed in an area known as the LSCR (Fig. 1). The LSCR is located between Lynn Headwaters Regional Parks and Mount Seymour Provincial Park and covers an area of 5668ha (GVRD 2004). It comprises roughly one third of the whole 18, 000ha Seymour Watershed. The LSCR was formerly known as the Seymour Demonstration Forest and was renamed in the spring of 1999. There are close to 40km of roads and recreational multi-use trails that run through the LSCR (GVRD 2004).

To access the LSCR from Highway #1, take exit 22 eastbound and stay on Lillooet Road until Rice Lake Gates are reached (Fig. 2).

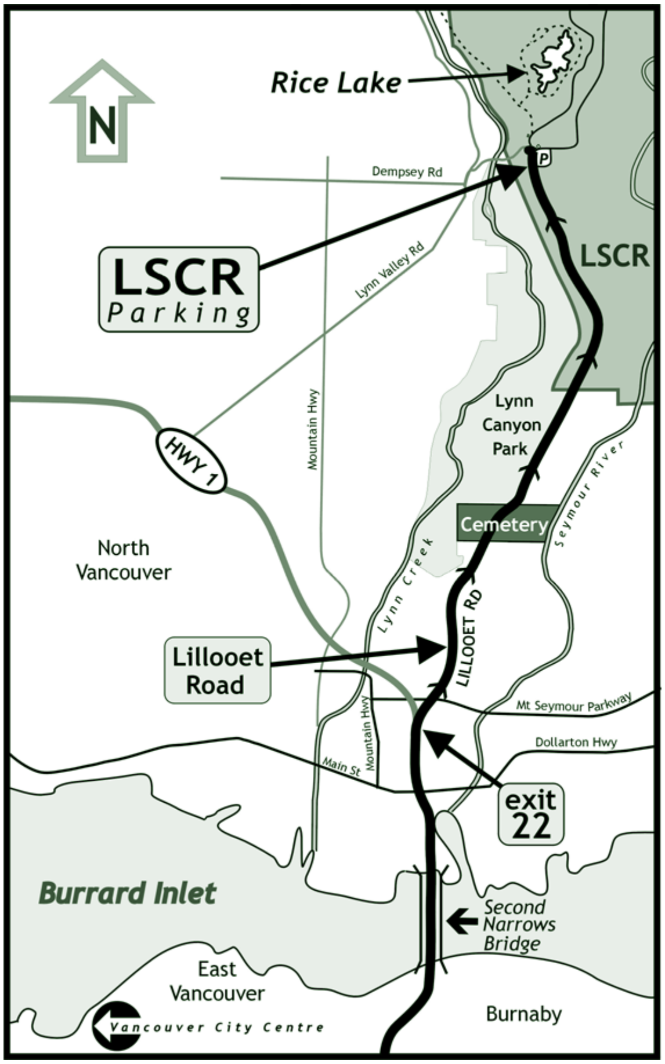


Figure 2. Access route from Highway 1 to the Lower Seymour Conservation Reserve (source: GVRD website, 2004).

2.2 Junior Creek Enhancement Site Description

Junior Creek enhancement site (Figs. 1, 3) is an addition to Junior Creek, a tributary to the Seymour River and is located 10km along the mainline road northeast of the Rice Lake Gate in the LSCR. Enhancement work to Junior Creek was completed in 1994 and consisted of constructing 10,000m^2 of rearing habitat and 800m^2 of spawning habitat. Entirely ground water fed, Junior Creek originates within in five metres of the GVRD water pipeline (Williams and Jessop 1996) and is also the closest enhancement site to the Seymour Hatchery (Fig. 1). The site contains five bridges and access to several trails including the Old Growth Trail. The predominant streamside vegetation is salmonberry (*Rubus spectabilis*), vine maple (*Acer cercinatum*), elderberry (*Sambucus racemosa*), and deer fern (*Blechnum spicant*). Over-hanging branches surround parts of the stream and large woody debris is found within the watercourse. Substrate in the creek consists mainly of cobbles, gravels and sands.

The upper pond is characterized by shallow pools, some large woody debris and streamside vegetation including: western hemlock (*Tsuga heterophylla*), swordfern (*Polystichum munitum*), salmonberry (*Rubus spectabilis*) and red alder (*Alnus rubra*). Figure 4 represents characteristics of the upper pond. The lower pond is characterized by shallow pools, over-hanging vegetation, predominately western red cedar (*Thuja plicata*), large woody debris and streamside vegetation including: western hemlock, swordfern, salmonberry, and red alder. Figure 5 represents characteristics of the lower pond.

Sample location descriptions are outlined in Appendix I and a GIS map is presented in Appendix II; however, due to dense canopy cover all station within the Junior Creek enhancement site could not be collected.

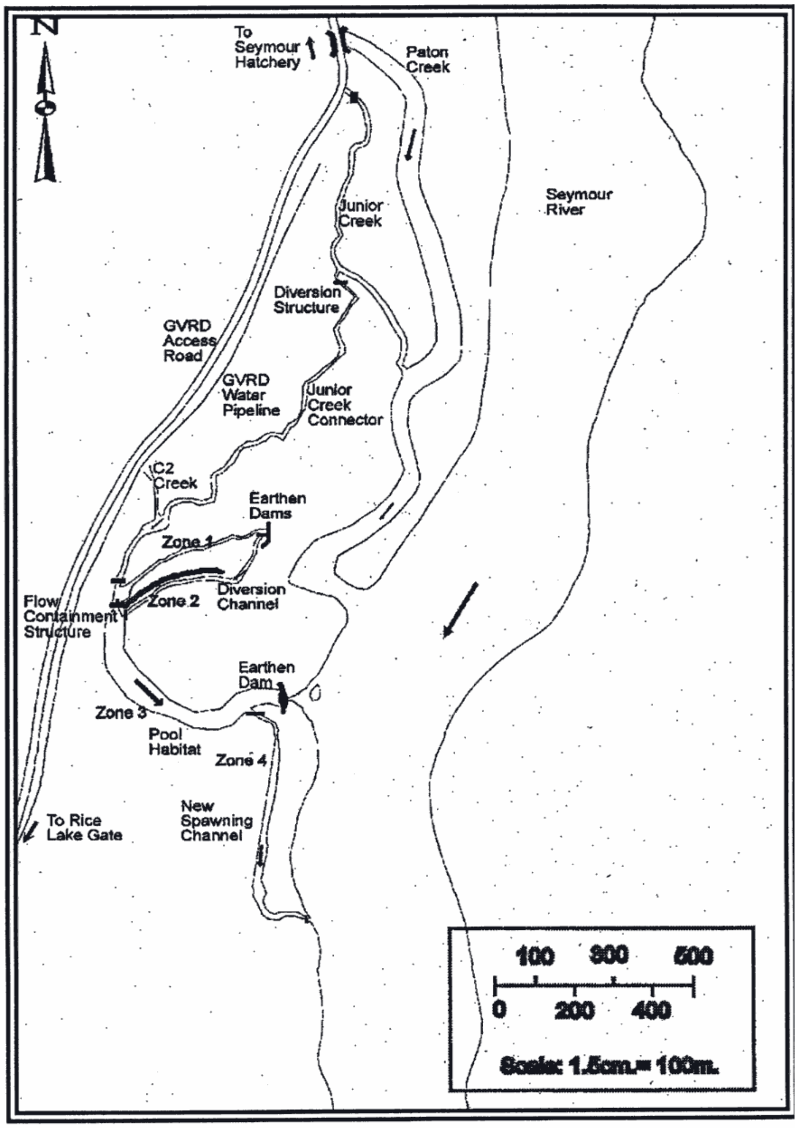


Figure 3. Junior Creek enhancement site map (source: Foy (1995) in Williams and Jessop, 1996).

Figure 4. Photograph representing upper pond juvenile salmonid sampling stations of Junior Creek enhancement site (station 3 and water quality station 1) December 2004.

Figure 5. Photograph representing lower pond juvenile salmonid sampling stations of Junior Creek enhancement site (station 12) December 2004.

2.3 Midvalley Enhancement Site

Midvalley Enhancement site (Fig. 1) was primarily completed in 2001, while the last addition (aside from bridges) was completed in August 2004. In 2001, a containment berm and a rough spawning channel were created. The last addition was the conversion of a road into a berm, which created a second upstream pond fed by mountain streams. Midvalley Enhancement site is located upstream of Hydraulic Creek on the Seymour River off the mainline road on Spur Four. This site consists of 500m^2 of spawning channel, 4 metres wide by 125 metres long, and approximately 6500m^2 of wetted area

(Fig. 6). Both the spawning channel and the wetted area are fed by an intake from the Seymour River. Included in the site are two containment berms, the river intake and a large pond outlet that leads to Seymour River (Landiak 2001). Streamside vegetation at Midvalley consisted of salal (*Gaultheria shallon*), red huckleberry (*Rubus parvifolium*), salmonberry, and vine maple. Marsh-like habitat was predominant through the lower half of the site, where as sands, gravels and cobbles were placed in constructed riffles in the upper half. There was also considerable large woody debris which was used by juvenile salmonids for cover and habitat. Scattered remains from past logging activities include rebar and cables.

The upper pond is characterized by cover in the form of red alder and western hemlock, large dead trees and no streamside vegetation. Figure 7 is a representative picture of stations within the upper pond. The lower pond is characterized by considerable large woody debris, fallen trees and some streamside vegetation including: vine maple, salmonberry, common horsetail (*Equisitum arvense*) and large-leaved avens (*Genum macrophyllum*). Figure 8 represents characteristics of the upper pond. Sample site descriptions are outlined in Appendix III and a GIS map of all sample sites are attached in Appendix IV.

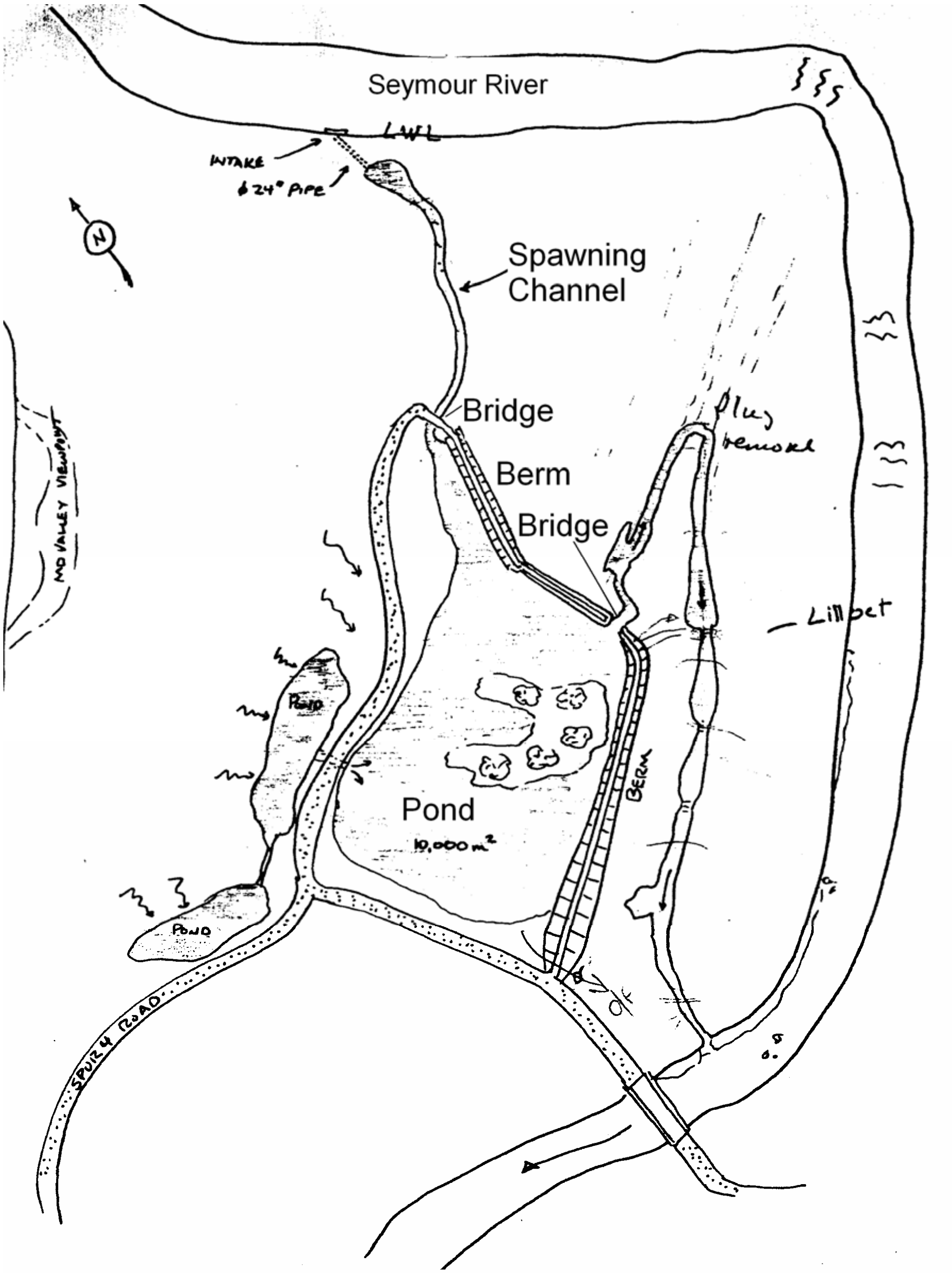


Figure 6. Midvalley enhancement site sketch map (source: Landiak, 2001).

Figure 7. Photograph representing upper pond juvenile salmonid sampling stations of Midvalley enhancement site (station 12) November 2004.

Figure 8. Photograph representing lower pond juvenile salmonid sampling stations of Midvalley enhancement site (station 7) November 2004.

3.0 METHODS AND MATERIALS

3.1 Juvenile Enumeration

3.1.1 Mark and Recapture for Abundance

Gee-type minnow traps were distributed throughout the ponds within each site baited with canned sardines or salmon wrapped in tinfoil. Traps were submerged underwater adjacent to woody debris and left for 24 hours (Ministry of Sustainable Resource Management 1997). Fish caught in the traps were anaesthetized with half a tablet of Alka-Seltzer in two litres of water, measured for fork length, weighed with a digital scale and marked with an upper caudal fin clip. Once recovered from anaesthetization, fish were released at the same capture location.

For each enhancement site, three mark and recapture sessions were conducted. Recaptures occurred within a fixed time period not exceeding eight days and at the same stations where fish were marked. These sessions were conducted between November 21 and 28, 2004 at Midvalley enhancement site, and December 17 to 21, 2004 at Junior Creek enhancement site. Fish were enumerated in two categories: marked and unmarked. Fish were released in their original capture areas.

3.1.2 Data Analyses

The adjusted Petersen formula was used to estimate the over-wintering juvenile population for each enhancement site. Within each site, populations were separated into downstream and upstream ponds, as well as by recapture session. The adjusted Petersen formula is as follows (Ricker 1975):

$$N= (M+1)(C+1)/(R+1)$$

where N is the population estimate, M is the number of initially marked fish released back into the system, C is the number of recaptured fish, and R is the number of marked fish recaptured from the recapture-sampling sessions. For each pond, the final population estimate was derived from the mean of each day's population estimates, whereas the standard error of the mean (SE) was determined by the differences between each day's estimate and the mean (Ricker 1975).

3.2 Adult Enumeration

A weekly foot survey and dead pitch was conducted from October 20, 2004 to January 12, 2005 on both sites to enumerate the number of spawning salmon. The surveys commenced at the Seymour River and were conducted upstream until the water source was reached. The two ponds located in each site were not surveyed. During the surveys, all dead spawned adult salmon were counted, sexed, checked for hatchery marks and measured for post orbital-hypural length (POHL). Hatchery marks on these fish potentially included adipose clips, left ventral fin clips, and operculum punches, including left, right or two right punches. Female carcasses were also assessed for spawning condition or percentage spawned. To prevent further enumeration, carcasses were cut in two and placed back in the water. All adult data collected was given to the Seymour Salmonid Society for their database purposes.

To calculate a total escapement population, the following formula was applied to the results of the foot survey (Williams and Jessop 1996).

Peak Live Count + Number of Dead = Total Population

3.3 Water Quality Sampling

Water quality measurements were taken at two pre-determined stations within each site. Parameters measured included dissolved oxygen, pH, temperature, and conductivity. Dissolved oxygen and temperature were measured with a Cellox 325 DO meter, pH was measured using a pH-Electrode SenTix 41-3 meter, and conductivity was measured using a Tetracon 325 sensor. All readings were compared to the Canadian Environmental Quality Guidelines for Freshwater Aquatic Life (CEQG) (Table 1). Also, the environmental quality criteria and guidelines review for the Fraser River Basin specified a minimum dissolved oxygen level of 7.75mg/L for all stems of the Fraser River (Swain and Holms 1985 in MacDonald 1994), while maximum weekly water temperatures for juvenile and adult salmonids ranged from 18-19^{o}C (Pommen 1989 in MacDonald 1994).

Table 1. Canadian Environmental Quality Guidelines for Freshwater Aquatic Life, for dissolved oxygen, pH, and conductivity. Temperature guidelines for salmonids were from the City of Burnaby (source: Canadian Environmental Quality Guidelines and the City of Burnaby).

ATTRIBUTE	GUIDELINE
Dissolved Oxygen	5.5-9.5mg/L
pH	6.5-9.0
Temperature	4-13^{o}C
Conductivity	N/A

4.0 RESULTS

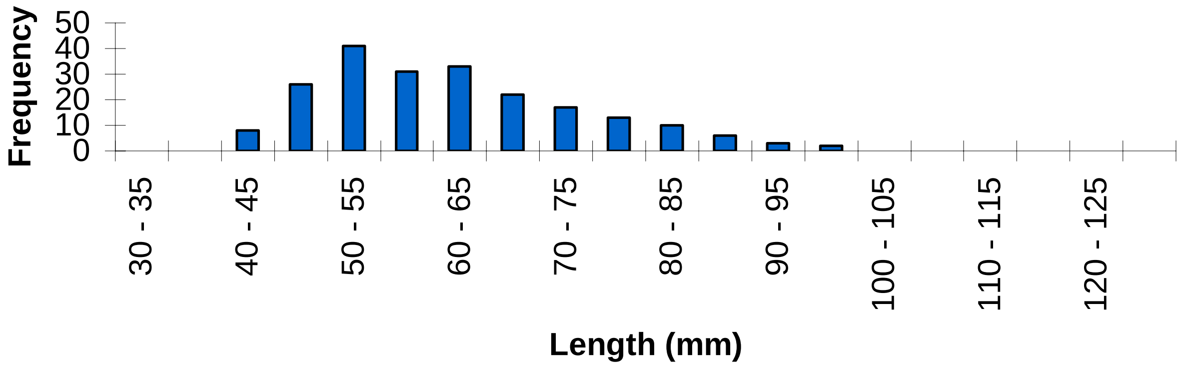
4.1 Juvenile Enumeration, Length and Weight

4.1.1 Junior Creek

Based on the average between the two recapture session's population estimates, total abundance for coho in the upstream pond was estimated to be 1701 fish ±171, while that for the downstream pond was estimated to be 2796 fish ±33 (Appendix V). One captured and one recaptured Dolly Varden or bull trout were found in the upstream pond, while five were found in the downstream pond. As juveniles, bull trout and Dolly Varden char are difficult to accurately distinguish between; therefore, we could not identify them to species. No population estimate was obtained for bull/Dolly Varden char due to the statistical bias associated with one recapture. The number of captured and recaptured cutthroat and bull/Dolly Varden char in each trap per session is in Appendix VI, while that of coho is in Appendix VII.

Juvenile coho captured had a length range of 41-100mm in the upstream pond and 39-98mm in the downstream pond (Fig. 9). All raw data for mark recapture sessions are presented in Appendix VIII.

(a)



(b)

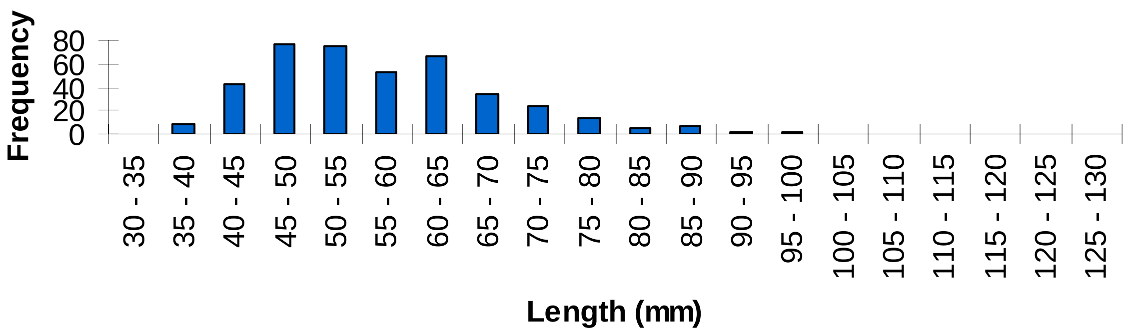
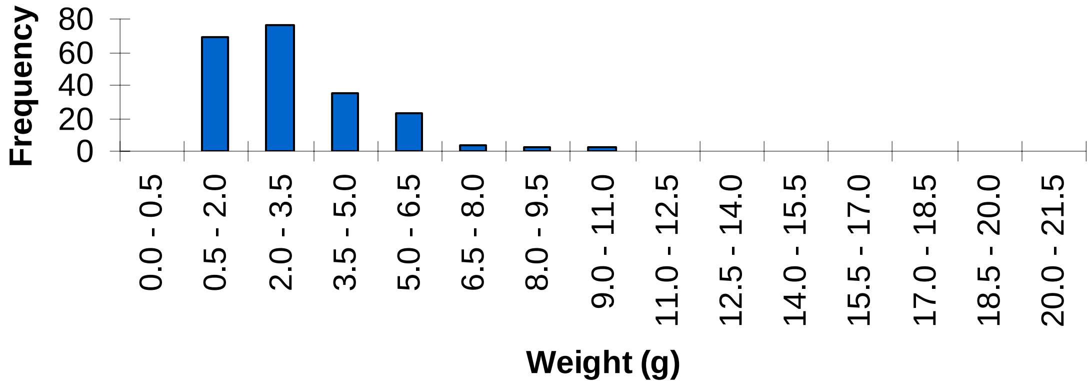


Figure 9. Length distribution of juvenile coho trapped at Junior Creek in the (a) upstream pond, stations 1-6 and (b) downstream pond, stations 7-15, December, 2004.

Juvenile coho captured had a weight range of 0.85-9.97g in the upstream pond and 0.69-10.18g in the downstream pond (Fig. 10).

(a)



(b)

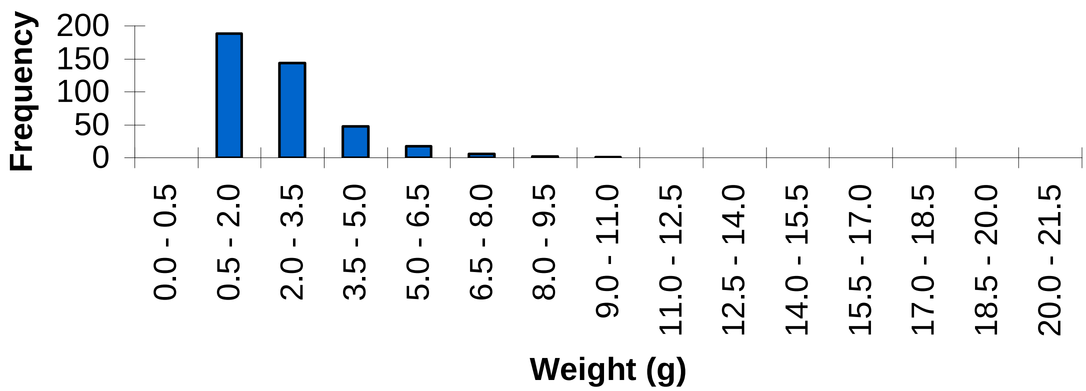


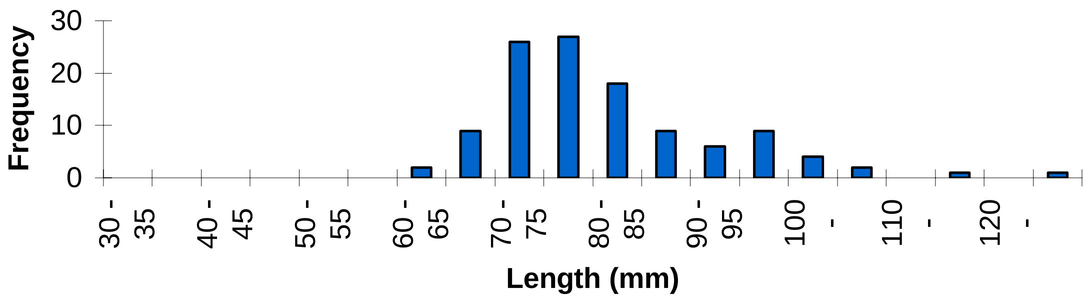
Figure 10. Weight distribution of juvenile coho trapped at Junior Creek in the (a) upstream pond, stations 1-6 and (b) downstream pond, stations 7-15, December, 2004.

4.1.2 Midvalley

The abundance for coho in the upstream pond was estimated to be 691 fish ±316, while that of the downstream pond was estimated to be 1531 fish ±321 (Appendix V). Five cutthroat trout were found in the upstream pond, while one was found in the downstream pond. One bull/Dolly Varden char was found in the downstream pond. Since no recaptures were found, no population estimate was made. The number of captured and recaptured cutthroat and bull/Dolly Varden char is in Appendix VI, while that of coho in each trap for each trap session is in Appendix IX.

Juvenile coho captured had a length range of 61-128mm in the upstream pond and 49-106mm in the downstream pond (Fig. 11). All raw data for mark recapture sessions are presented in Appendix X.

(a)



(b)

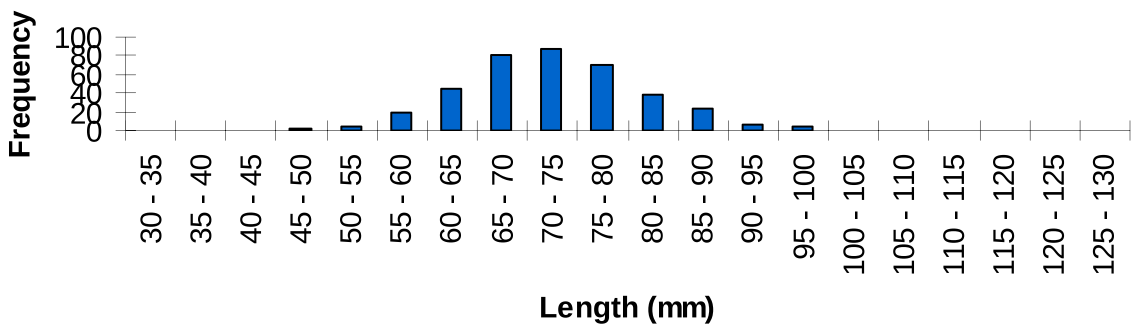
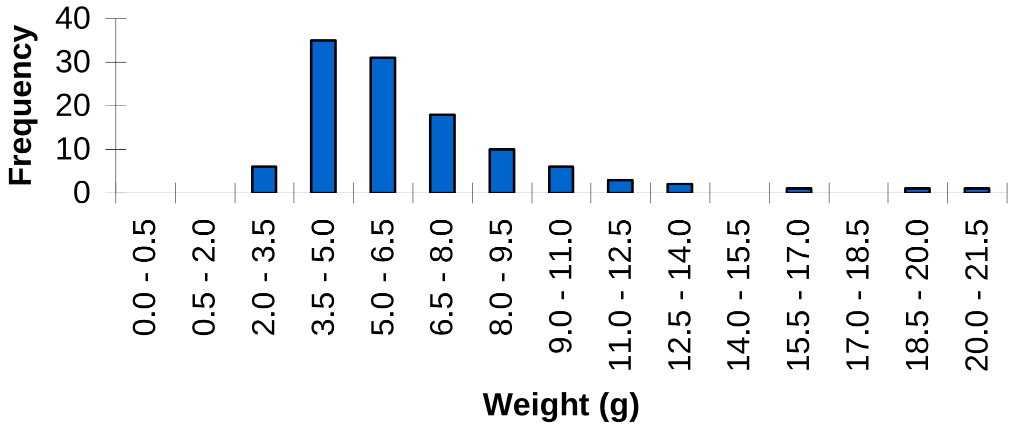


Figure 11. Length distribution of juvenile coho trapped at Midvalley Enhancement Site in the (a) upstream pond, stations 11-15 and (b) downstream pond, stations 1-10, November, 2004.

Juvenile coho captured had a weight range of 2.40-20.62g in the upstream pond and 1.36-12.62g in the downstream pond (Fig. 12).

(a)



(b)

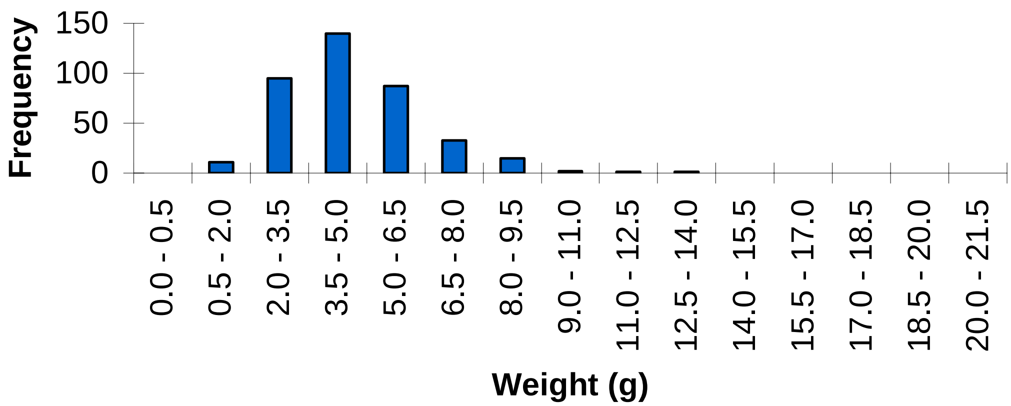


Figure 12. Weight distribution of juvenile coho trapped in Midvalley Enhancement Site at the (a) upstream pond, stations 11-15 and (b) downstream pond, stations 1-10, November, 2004.

4.2 Adult Coho Enumeration

4.2.1 Junior Creek

The peak live count of coho was 36, and the number of coho carcasses was 44, therefore the total escapement was 80 (Table 2). The number of wild fish observed was 21, and hatchery fish was 23. Fewer wild fish than hatchery fish were observed in Junior Creek.

Table 2. Foot survey results including the number of wild, hatchery, recovered carcasses, and live fish found at Junior Creek enhancement site, October- November, 2004, and December- January 2005. Carcass recovery for November 5, 12, 23, 25, 29 and December 1, 2, 5, 2004 conducted by the Seymour Salmonid Society.

DATE	CARCASS COUNT	LIVE COUNT	WILD	HATCHERY
20-Oct	0	12	0	0
27-Oct	0	15	0	0
3-Nov	N/A	N/A	N/A	N/A
5-Nov	2	N/A	1	1
10-Nov	3	31	2	1
12-Nov	1	N/A	1	0
19-Nov	4	36	3	1
23-Nov	1	N/A	1	0
25-Nov	1	N/A	1	0
29-Nov	1	N/A	0	1
1-Dec	1	N/A	1	0
2-Dec	1	N/A	1	0
5-Dec	10	N/A	3	7
19-Dec	12	13	3	9
30-Dec	6	2	3	3
3-Jan	1	1	1	0
12-Jan	0	0	0	0
TOTAL	**44**	**110**	**21**	**23**

4.2.2 Midvalley

The peak live count of coho was 51 and the number of coho carcasses was 71, therefore the total escapement was calculated to be 122 (Table 3). The total number of wild fish was 57 and hatchery fish was 14.

Table 3. Foot survey results including the number of wild, hatchery, recovered carcasses, and live fish found at Midvalley enhancement site, October- November, 2004, and December- January 2005. Carcass recovery for November 8, 13, 17, 28, 29 and December 1, 3, 11, 2004 conducted by the Seynour Salmonid Society.

DATE	CARCASS COUNT	LIVE COUNT	WILD	HATCHERY
20-Oct	0	0	0	0
27-Oct	0	0	0	0
3-Nov	N/A	N/A	N/A	N/A
8-Nov	5	N/A	0	5
10-Nov	1	17	1	0
13-Nov	3	N/A	3	0
17-Nov	2	N/A	2	0
19-Nov	8	43	4	4
26-Nov	8	51	6	2
28-Nov	7	N/A	6	1
29-Nov	1	N/A	1	0
1-Dec	3	N/A	3	0
3-Dec	2	N/A	2	0
11-Dec	1	N/A	1	0
19-Dec	13	13	12	1
30-Dec	17	2	16	1
3-Jan	0	1	0	0
12-Jan	N/A	N/A	N/A	N/A
TOTAL	**71**	**127**	**57**	**14**

4.3 Water Quality

4.3.1 Junior Creek

Water quality attributes were measured on December 21, 2004 (Table 4).

Table 4. Comparison of Junior Creek enhancement site water quality measurements to Canadian Environmental Quality Guidelines (CEQG) for Freshwater Aquatic Life and City of Burnaby temperature guidelines. Measurements were taken in upstream and downstream ponds, including dissolved oxygen, pH, and conductivity, December 21, 2004.

ATTRIBUTE	UPSTREAM POND (Station 3)	DOWNSTREAM POND (Station 15)	GUIDELINES
Dissolved Oxygen	12.4mg/L	12.5mg/L	5.5-9.5mg/L
pH	5.50	5.22	6.5-9.0
Temperature	5.5^{o}C	5.3^{o}C	1-13^{o}C
Conductivity	9µs/cm	9µs/cm	N/A

All measured attributes were similar between ponds. Temperatures in the ponds were within the CEQG for Freshwater Aquatic Life, while the pH was below the guidelines and thus more acidic. The dissolved oxygen levels of both the upstream and downstream ponds were 1.3 times greater than minimum standards set by the CEQG.

4.3.2 Midvalley

Water quality attributes were measured on November 27, 2004 (Table 5).

Table 5. Comparison of Midvalley enhancement site water quality measurements to Canadian Environmental Quality Guidelines (CEQG) for Freshwater Aquatic Life and City of Burnaby temperature guidelines. Measurements were taken in upstream and downstream ponds, including dissolved oxygen, and pH, November 27, 2004.

ATTRIBUTE	UPSTREAM POND (Station 13)	DOWNSTREAM POND (Station 7)	GUIDELINES
Dissolved Oxygen	11.4mg/L	10.3mg/L	5.5-9.5mg/L
PH	6.90	6.08	6.5-9.0
Temperature	5.9^{o}C	5.1^{o}C	1-13^{o}C

5.0 Discussion

5.1 Juvenile Enumeration, Length and Weight

Within Junior Creek, a population difference was found in juvenile coho between the upstream and downstream ponds. Within Midvalley, a population difference was also found. For Junior Creek and Midvalley enhancement sites, there was little variation among lengths and weights in both sets of ponds; however, both occurred over a large range.

Juvenile coho length and weight distributions at Junior Creek and Midvalley sites each showed two modes. This indicated there were two age classes present: coho aged 0^+ and 1^+. Based on the life history of coho salmon, this habitat will be used for over-wintering salmonids for up to two years (Lawson *et al*. 2004).

Junior Creek was an older project which had more time to become established rearing habitat. This was evident through the presence of more vegetation along the banks of the ponds and through less signs of erosion and disturbance. As it was more established habitat and has existed for a greater period of time, it sustained a higher population of juvenile salmonids than Midvalley enhancement site. Also, bank erosion is likely to have impacted juvenile salmonids at the Midvalley site through: infilled pools, reduced nutrients, minimal protective cover and smothered spawning grounds (Koning and Keeley in Slaney and Zaldokas 1997).

Coniferous vegetation and red alder found at each enhancement site provided heavy riparian shade (Hu *et al*. 2001 in Wilzbach *et al*. 2005) which was beneficial for salmonid growth. Invertebrate inputs could be higher where alder is more abundant (Allan *et al*. 2003) which supplied food for juvenile coho growth. Junior Creek consisted of more planted trees and shrubs which provided shade, organics, food, and overhanging cover for fish (Koning and Keeley in Slaney and Zaldokas 1997).

Although there was no formal assessment of large woody debris in either enhancement site, such structures were distinctly present. According to the Ministry of Water, Land and Air Protection (formerly Ministry of Environment, Lands and Park) and Ministry of Forests' Fish Habitat Rehabilitation Procedures, large woody debris structures are required for salmonid smolt production. Adding these structures provide habitat for spawning and rearing fish (Murphy 1995 in Koning and Keeley in Slaney and Zaldokas). It also provides juveniles with escape cover from predators and protection from high velocity water flow (Cederholm, Dominquez, and Bumstead in Slaney and Zaldokas 1997). An extensive six year study at Porter Creek near Olympia, Washington concluded that coho smolts increased four-fold where large woody debris structures were found (Slaney and Martin in Slaney and Zaldokas 1997).

At Midvalley enhancement site, the study was limited by the first recapture session (Nov 24, 2004) having only one recapture in the upper pond. There should be a minimum of three to four recaptures per population estimate should be three to four to reduce systematic bias (Ricker 1975). Aside from this session, each site, pond, and session fulfilled the minimum requirement for recaptures.

5.2 Adult Coho Enumeration

Carcasses at Junior Creek and Midvalley enhancement sites were mostly found downstream of riffles, in slower moving water, frequently against large woody debris in the water. As stated by Cederholm *et al*. (1985) and Bilby *et al*. (1996), cited in Slaney and Zaldokas 1997, large woody debris traps spawned out salmon carcasses and organic materials. Live coho were located primarily in shallow, fast flowing riffles.

The total escapement and proportion of wild fish observed in Midvalley were greater than in Junior Creek. More hatchery fish were found within Junior Creek, which may be attributed to its close proximity to the Seymour Hatchery. Although there is potential for hatchery fish to impact the productivity of wild stocks through genetic effects from interbreeding and ecological interactions (Lawson *et al*. 2004), the Midvalley site sustained a healthy population of wild fish, and therefore this did not seem to be a factor. As noted with juveniles, large woody debris improves quality of habitat and could have promoted an increased density of adult salmonids.

Williams and Jessop (1996) found a peak live count of 58 in Junior Creek, whereas we found 36 live fish. We found 44 dead, while William and Jessop (1996) recorded a total of 12 dead. Williams and Jessop conducted dead pitches from October 18, 1995 to January 17, 1996, bi-weekly, whereas we carried out these surveys from October 20, 2004 to January 12, 2005 once a week. This could indicate there were more fish in the system in 2005 than 1996, or there was more sampling effort in this study than that of Williams and Jessop.

Total escapement may have been potentially affected by poor access, poor visibility, and the frequency of dead pitch surveys (once per week). Limited access due to water depth, fallen trees, sinking stream substrate, water turbidity and rainy weather conditions may all have limited the accuracy of carcass counts.

5.3 Water Quality

Water temperature controlled an array of processes in the early life stages of salmonids, such as, number of days to hatch and emerge, feeding and growth rate (Beacham and Murray 1990 in Petersen and Kitchell 2001) therefore it was important for temperature in both ponds to be within the guidelines for juvenile growth. Temperatures in both ponds, and within each enhancement site, were within the CEQG, however they exceeded 18-19^{o}C as suggested by the environmental quality criteria and guidelines review for the Fraser River Basin for juvenile and adult salmonids.

Dissolved oxygen levels were just above CEQG and environmental quality criteria and guidelines review for the Fraser River Basin within both enhancement sites. Dissolved oxygen was higher in the Midvalley upstream pond than the downstream pond. The upstream pond was fed by well aerated mountain streams, while the downstream pond was fed by the Seymour River. pH in Junior Creek was just below the guidelines, whereas, Midvalley was within the guidelines. pH in the Midvalley downstream pond was slightly more acidic due to a greater volume of decaying organic matter.

6.0 Recommendations

Based on the results of this study and field observations, recommendations include:

1. Using similar methods for future salmonid enhancement efforts.
2. Promoting similar student projects to observe enhancement progress.
3. Using juvenile lengths and weights from both enhancement sites for GVRD's spring 2005 pre-smolt enumeration study to estimate growth rates.
4. Increasing planting of riparian vegetation (including coniferous vegetation and red alder) to support higher densities of invertebrates, which will provide juvenile salmonids with an abundant food source.
5. Implementing an integrated approach of boulders, large woody debris and vegetation to provide erosion control and increased benefits to fish habitat (Slaney pers. comm. 2005).
6. Conducting one more mark/recapture session for both enhancement sites.
7. Conducting carcass recoveries at a minimum of twice per week on both enhancement sites.
8. Surveying vegetation and percentage of large woody debris.

An important part of all restoration work is monitoring, without this it would be impossible to determine the success of projects. These evaluations will provide an adaptive management tool which will enable the success of future endeavours (Koning and Slaney cited in Streamline, B.C.'s Watershed Restoration Technical Bulletin). Continuing to search for new methodologies and approaches to watershed restoration work is imperative if future projects are to improve (Wilson, Slaney and Deal cited in Streamline, Watershed Restoration Technical Bulletin).

7.0 References Cited

Allan, J.D., M.S. Wipfli, J.P Caouette, A. Prussian, and J. Rodgers. 2003. Influence of Streamside Vegetation on Inputs of Terrestrial Invertebrates to Salmonid Food Webs. Canadian Journal of Fisheries and Aquatic Science. 60: 309-320.

Blackwell, R., L. Cunningham, and M. Mckibbon. 2000. Final Report: Evaluation of Coho Creek Habitat & Salmonid Usage, 1999-2000. Projects Course Final Report. Forestry Program. British Columbia Institute of Technology. Burnaby. BC. pp. 1-30.

Canadian Environmental Quality Guidelines. 2003. http://www.ccme.ca/assets.pdf/e1_062.pdf. Accessed January 30, 2005.

City of Burnaby. 2003. Strategic Overview of Fisheries Resources in Burnaby. http://www.city.burnaby.bc.ca/cityhall/departments_planning/_pdf. Accessed January 30, 2004.

Clemens, W.A. and G.V. Wilby. 1961. Fishes of the Pacific Coast of Canada. Fisheries Research Board of Canada. Bulletin No. 68.

Everest, F.H., Sedell, J.R., and G.H. Reeves. 1991. Planning and Evaluating Habitat Projects for Anadromous Salmonids. American Fisheries Society Symposium. Oregon, USA. 10: 68-77.

Government of Alberta. http://www3.gov.ab.ca/srd/fw/status/reports/btrout/cons.html. Accessed April 2, 2005.

Greater Georgia Basin Steelhead Recovery Plan. 2005. Lower Mainland (Region 2) Focus Watersheds. http://www.bccf.com/steelhead/r2-focus3.htm#top. Accessed April 3, 2005.

[GVRD] Greater Vancouver Regional District. 2004. Lower Seymour Section, Water Services. http://www.gvrd.bc.ca/water/maps.htm. Accessed November 2, 2004.

Koning, C.W. and P.A. Slaney. Streamline, B.C's Watershed Restoration Technical Bulletin. Vol. 3 No.3.

Landiak, M. 2001. Construction Reports for Review. Habitat and Enhancement Branch, Department of Fisheries and Oceans.

Lawson, P.W., E.A. Logerwell, N.J. Mantua, R.C. Franxis, and V.N. Agostini. 2004. Environmental factors influencing freshwater survival and smolt production in Pacific Northwest coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Science. 61: 360-374.

MacDonald, D.D. 1994. A Review of Environmental Quality Criteria and Guidelines for Priority Substances in the Fraser River Basin. Environment Canada. http://wvlc.uwaterloo.ca/biology447/modules/module1/1g_t3.htm. Accessed April 3, 2005.

Meidinger, D. and J. Pojar. 1991. Ecosystems of British Columbia. Ministry of Forests. Crown Publications. Victoria. pp.81-95, 263-274.

Ministry of Sustainable Resource Management. 1997. Fish Inventory Unit for the Aquatic Ecosystems taskforce, Resource Inventory Committee. Fish Collection Methods and Standards. http://srmwww.gov.bc.ca/risc/pubs/aquatic/index.htm. Accessed November 28, 2004.

Ministry of Sustainable Resource Management. 2004. Resource Inventory Committee. Stream Inventory Standards and Procedures Chapter 4.

Petersen, J.H and J.F. Kitchell. 2001. Climate Regimes and Water Temperature Changes in the Columbia River: Bioenergetic Implications for Predators of Juvenile Salmon. Canadian Journal of Fisheries and Aquatic Science. 58: 1838-1841.

Ricker, W.E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Department of the Environment Fisheries and Marine Service.

Slaney, P.A. and D. Zaldokas. 1997. Fish Habitat Rehabilitation Procedures. Ministry of Water Land and Air Protection.

Western Washington University. 2005. http://www.ac.wwu.edu/~jmcl/NatHist/salmon_NR_green.pdf. Accessed April 3, 2005.

Williams, W. and M. Jessop. 1996. Final Report: Junior Creek Habitat Enhancement Evaluation Project, 1995-1996. Projects Course Final Report. Fish, Wildlife and Recreation Program. British Columbia Institute of Technology. Burnaby. BC. pp. 1-33.

Wilson, A., Slaney, P., and D. Heather. Evaluating the performance of channel and fish habitat restoration projects in British Columbia's watershed restoration program. B.C.'s Watershed Restoration Technical Bulletin. Vol. 4 No. 3.

Wilzbach, M.A., B.C. Harvey, J.L. White, and R. J. Nakamoto. 2005. Effects of Riparian Canopy Opening and Salmon Carcass Addition on the Abundance and Growth of Resident Salmonids. Canadian Journal of Fisheries and Aquatic Science. 62: 58-67.

Personal Communication

Catt, D. J. Instructor. British Columbia Institute of Technology. Fish, Wildlife and Recreation. Personal Communication. April 2004. Contact: Danny_Catt@bcit.ca

Slaney, P. Fisheries Scientist. PSlaney Aquatic Science Ltd. Personal Communication. April 2005. Contact: pslaney@shaw.ca

APPENDICES

Appendix I

Junior Creek Sample Sites

Station 1 was situated in the most northwest portion of the upper pond. The location was shallow pond habitat with an abundance of large woody debris both in and out of the water. Streamside vegetation consisted of western hemlock (*Tsuga heterophylla*), swordfern (*Polystichum munitum*), and salmonberry (*Rubus spectabilis*). Station 2 also consisted of shallow pond habitat with many downed trees and large woody debris. Vegetation at this station was the same as in station 1.

Junior Creek juvenile sampling station 1, February 2005.

Junior Creek juvenile sampling station 2, February 2005.

Station 3 was the most northerly sample site and the location for the first water quality testing. This station was in an open area closer to the main trail, and also consisted of a shallow pond. The vegetation was also the same as stations 1 and 2.

Junior Creek juvenile sampling station 3 and water quality station 1, February 2005.

Station 4 was located along the Old Growth Trail, directly upstream of the spawning channel. There was some large woody debris and also consisted of a shallow pond. Streamside vegetation consisted of salmonberry and western hemlock.

Junior Creek juvenile sampling station 4, February 2005.

Station 5 was also located along the Old Growth trail across from the spawning channel and contained no downed wood. This portion of the pond was also fairly shallow. Streamside vegetation consisted of red alder (*Alnus rubra*), salmonberry and sword fern.

Junior Creek juvenile sampling station 5, February 2005.

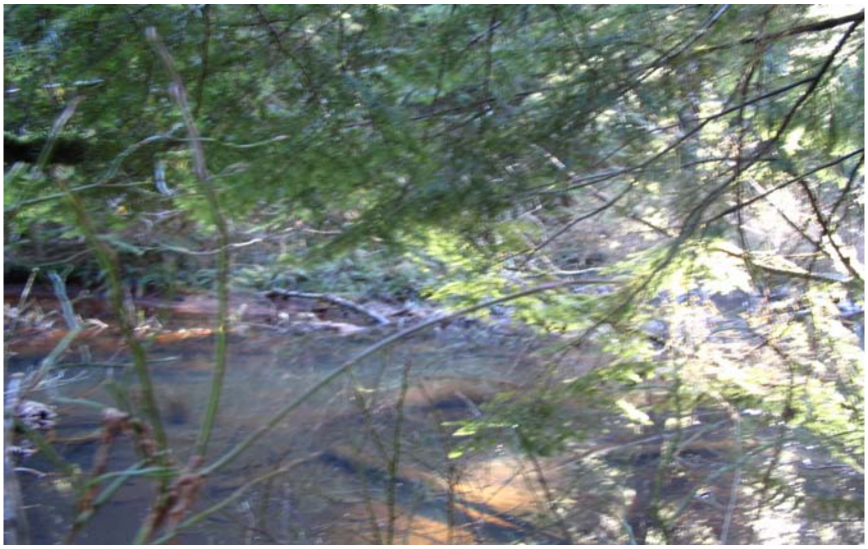
Station 6 was situated beside the stairs which was the main access for the Old Growth Trail within the Junior Creek Enhancement Site. Vegetation within this site was the same as station 5.

Junior Creek juvenile sampling station 6, February 2005.

Station 7 was located along the spawning channel upstream of the bridge crossing. There was some large woody debris present, and the substrate found within this part of the channel was consisted of fine silty sediments. Primary streamside vegetation found at this station was salmonberry and vine maple.

Junior Creek juvenile sampling station 7, February 2005.

Station 8 was the first station of the second pond which was also found alongside the stairs. This station had considerable shade, large woody debris and over-hanging vegetation, predominately hemlock and vine maple.



Junior Creek juvenile sampling station 8, February 2005.

Station 9 consisted of over-hanging branches and the same vegetation found at station 8. There was one large downed tree situated in this portion of the pond.

Junior Creek juvenile sampling station 9, February 2005.

Station 10 was also shaded and had a significant amount of over-hanging red cedar (*Thuja plicata*). This portion of the pond was also shallow.

Junior Creek juvenile sampling station 10, February 2005.

Station 11 was situated in a more open area and also had less over-hanging vegetation. Vegetation found in the portion of the pond consisted of western hemlock (*Tsuga heterphylla*), vine maple (*Acer cercinatum*) and salmonberry.

Junior Creek juvenile sampling station 11, February 2005.

Station 12 was located in the lower portion of the lower pond just off the Old Growth Trail. It consisted of marsh like habitat with predominately over-hanging hemlock.

Junior Creek juvenile sampling station 12, February 2005.

Station 13 was located at the path junction of the Spruce Loop and Seymour Hatchery in a more open portion of the pond. The primary streamside vegetation consisted of salmonberry.

Junior Creek juvenile sampling station 13, February 2005.

Station 14 was situated along the Old Growth Trail directly across from the drainage pipe which was used to maintain a higher level of pond water. The vegetation consisted of salmonberry and vine maple. Station 15 was situated just upstream of the lower spawning channel and was the location of the second water quality testing. Vegetation in this portion of the pond also consisted of salmonberry and vine maple.

Junior Creek juvenile sampling station 14, February 2005

Junior Creek juvenile sampling station 15, February 2005.

APPENDIX II

GIS Map of Junior Creek Enhancement Site

Appendix III

Midvalley Sample Sites

Station 1 was the most northern sample site and was located downstream of the spawning channel. This station consisted of a deep pool and contained considerable large woody debris. Station 2 was situated on the south eastern portion of the lower pond. It was located upstream of the newly constructed bridge, and contained a significant amount of large woody debris.

Midvalley juvenile sample station 1, November 2004.

Midvalley juvenile sample station 2, November 2004.

Station 3 was located on the south eastern corner of the older pond. One log had been placed in the water to provide cover and habitat for juvenile salmonids. Station 4 was positioned southwest of station 3, which is mid-channel of the main older pond. This station was located in a more open area; however, there was one fallen tree in the water. Vegetation along the bank was the same for both station 3 and 4, and consisted of: vine maple (*Acer cercinatum*), salmonberry (*Rubus spectabilis*), common horsetail (*Equisitum arvense*) and large-leaved avens (*Genum macrophyllum*).

Midvalley juvenile sample station 3, November 2004.

Midvalley juvenile sample station 4, November 2004.

Station 5 was located south east of station 4. There were several fallen trees within the site as well as large woody debris. Station 6 was located south of station 5. There was also a considerable amount of large woody debris and fallen trees within the site.

Midvalley juvenile sample station 5, November 2004.

Midvalley juvenile sample station 6, November 2004.

Station 7 was the southern-most sample station in the older pond. It contained a significant amount of large woody debris and fallen trees. This station was also the location for one of the water quality testing sites.

Midvalley juvenile sample station 7, November 2004.

Station 8 was located on the western corner of the older pond, immediately off the main access road and recent berm. Vegetation along this part of the bank consisted of red alder (*Alnus rubra*), and sword fern (*Polystichum munitum*). Station 9 was northeast of station 8. A significant amount of fallen trees and large woody debris was found within station 9. Erosion along the bank was occurring and fine substrates containing silts, sands and small gravels were entering the pond.

Midvalley juvenile sample station 8, November 2004.

Midvalley juvenile sample station 9, November 2004.

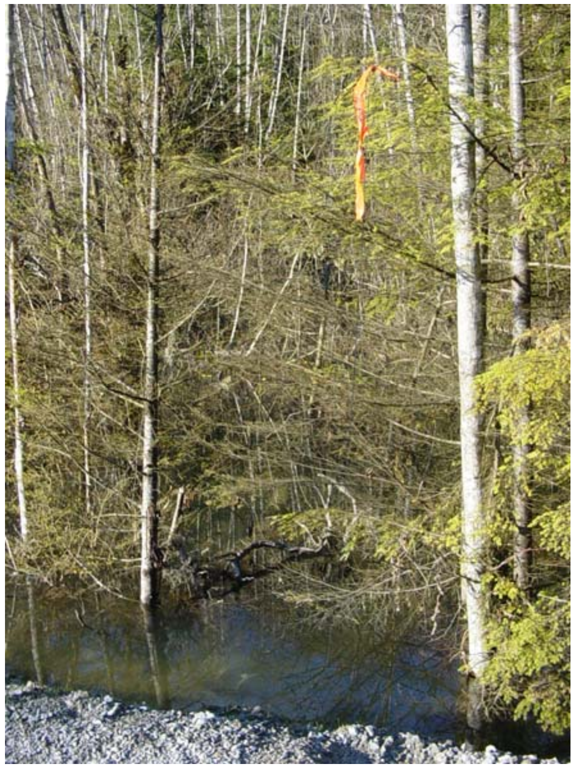
Located north east of station 9, station 10 provided considerable cover by means of large woody debris and overhanging vegetation. This station was adjacent to the riffle from the upper pond. Station 11 was located on the north side of the berm across the road from station 10, and was within a more open area where there was no streamside vegetation.

Midvalley juvenile sample station 10, November 2004.

Midvalley juvenile sample station 11, November 2004.

Station 12 was located west of station 11. This station had considerable cover in the form of one large western hemlock (*Tsuga herterophylla*), and fallen trees. At station 12 and 13, there was no streamside vegetation but vegetation that existed before the pond was built. Station 13 was located west of station 12, and consisted of several standing trees and large woody debris. There was also significant cover in the form of red alder and western hemlock at this station.

Midvalley juvenile sample station 12, November 2004.



Midvalley juvenile sample station 13, November 2004.

Within Station 14 there were western hemlock, red alder, sword fern and salmonberry standing in the water. Station 14 was situated at the bottom of a riffle below steep steps across the berm from Station 8 and included several downed trees. Station 15 was located within a shallow pool and consisted of large woody debris. The streamside vegetation at this site was sword fern and red alder.

Midvalley juvenile sample station 14, November 2004.

Midvalley juvenile sample station 15, November 2004.

APPENDIX IV

GIS Map of Midvalley Enhancement Site

Appendix V

Population Estimates per site, pond and day

		Junior Creek		Midvalley	
		Session 2 (Dec.20, 2004)	Session 3 (Dec.21, 2004)	Session 2 (Nov.24, 2004)	Session 3 (Nov.27,2004)
Upper pond	R	3	3	1	5
	M	116	179	52	89
	C	63	33	37	24
	N	1872	1530	1007	375
	Mean	1701		691	
	SE	171		316	
Lower pond	R	10	7	9	19
	M	181	347	111	218
	C	166	64	107	168
	N	2763	2828	1210	1851
	Mean	2795.5		1531	
	SE	32.5		321	

R = number of recaptured marked fish per sample session
M = number of previously marked fish at the start of the session
C = total sample taken at session
N = population estimate for session
Mean = average of both sessions = (Session 1 + Session 2)/2
SE = difference of each day’s session from the mean = N - Mean

*Note: For both sites, Session 1 was the original capture session.

Appendix VI

Junior Creek and Midvalley Habitat Juvenile Trapping Result (Excluding Coho)

Number of juvenile salmonids (excluding coho) caught in a Gee trap for each 24 hour soak trapping session and number of recaptures for Junior Creek and Midvalley sites, in November 2004. All caught salmonids had upper caudal fin clips.

Site	Date	Station	Species	Weight (g)	Length (mm)	Recapture
Junior Cr.	17-Dec	4	Dolly Varden/bull trout	18.2	119	0
Junior Cr.	17-Dec	9	Dolly Varden/bull trout	10.6	103	0
Junior Cr.	20-Dec	6	Dolly Varden/bull trout	15.55	119	1
Junior Cr.	20-Dec	14	Dolly Varden/bull trout	22.36	129	0
Junior Cr.	20-Dec	14	Dolly Varden/bull trout	14.02	119	0
Junior Cr.	20-Dec	14	Dolly Varden/bull trout	8.59	95	0
Junior Cr.	20-Dec	14	Dolly Varden/bull trout	23.47	131	0
Midvalley	21-Nov	4	Dolly Varden/bull trout	20.29	124	0
Midvalley	21-Nov	9	cutthroat	2.44	60	0
Midvalley	21-Nov	15	cutthroat	9.34	95	0
Midvalley	21-Nov	15	cutthroat	12.23	108	0
Midvalley	21-Nov	15	cutthroat	12.89	107	0
Midvalley	21-Nov	15	cutthroat	13.42	115	0
Midvalley	27-Nov	15	cutthroat	18.6	128	0

Appendix VII

Junior Creek Juvenile Coho Trapping Results

Number of coho caught in each Gee trap for each 24 hour soak trapping session and number of recaptures, in November 2004.

Station	Number caught				
	21-Nov	24-Nov	Recapture	27-Nov	Recapture
1	19	11	0	4	1
2	16	6	1	0	0
3	24	19	2	6	0
4	5	0	0	1	0
5	32	10	0	11	1
6	20	17	0	11	1
7	14	9	1	3	0
8	16	12	0	4	0
9	27	36	2	18	4
10	32	4	0	6	0
11	0	18	1	6	0
12	38	56	0	12	1
13	28	17	4	12	1
14	23	4	0	1	0
15	4	5	2	2	0

Appendix VIII

Data for Junior Creek Juvenile Lengths and Weights

Upstream Pond

17-Dec

Station	Species	Weight (g)	Length (mm)	Clip
1	Coho	1.56	53	UC
1	Coho	1.82	55	UC
1	Coho	2.55	60	UC
1	Coho	2.1	61	UC
1	Coho	2.84	61	UC
1	Coho	2.94	62	UC
1	Coho	3.02	63	UC
1	Coho	2.83	65	UC
1	Coho	2.98	65	UC
1	Coho	3.28	65	UC
1	Coho	2.74	66	UC
1	Coho	3.83	68	UC
1	Coho	3.67	70	UC
1	Coho	4.64	75	UC
1	Coho	4.87	80	UC
1	Coho	5.18	80	UC
1	Coho	5.32	82	UC
1	Coho	5.83	89	UC
1	Coho	9.76	98	UC
2	Coho	0.86	44	UC
2	Coho	1.02	45	UC

20-Dec

Station	Species	Weight (g)	Length (mm)	Clip	Recapture
1	Coho	2.28	55	UC	
1	Coho	5.05	71	UC	
1	Coho	1.78	52	UC	
1	Coho	1.33	41	UC	
1	Coho	4.22	75	UC	
1	Coho	4.25	70	UC	
1	Coho	2.9	63	UC	
1	Coho	2.31	58	UC	
1	Coho	1.32	46	UC	
1	Coho	2.32	56	UC	
1	Coho	2.54	60	UC	
2	Coho	2.95	63	UC	
2	Coho	2.89	64	UC	R
2	Coho	4.68	49	UC	
2	Coho	3	64	UC	
2	Coho	1.84	53	UC	
2	Coho	3.38	71	UC	
3	Coho	1.7	52	UC	
3	Coho	5.52	80	UC	
3	Coho	2.53	60	UC	
3	Coho	2.47	59	UC	

21-Dec

Station	Species	Weight (g)	Length (mm)	Clip	Recapture
1	Coho	1.24	50	UC	
1	Coho	3.08	67	UC	R
1	Coho	1.82	56	UC	
1	Coho	3.04	49	UC	
3	Coho	2.58	59	UC	
3	Coho	3.84	71	UC	
3	Coho	1.82	54	UC	
3	Coho	3.5	63	UC	
3	Coho	2.15	53	UC	
3	Coho	1.03	44	UC	
4	Coho	1.32	50	UC	
5	Coho	3.27	61	UC	
5	Coho	1	46	UC	R
5	Coho	1.64	52	UC	
5	Coho	1.11	45	UC	
5	Coho	1.84	56	UC	
5	Coho	1.22	48	UC	
5	Coho	1.57	49	UC	
5	Coho	1.54	51	UC	
5	Coho	1.73	54	UC	
5	Coho	2.79	62	UC	

2	Coho	1.18	48	UC	3	Coho	2.02	55	UC		5	Coho	1.67	54	UC	
2	Coho	1.38	51	UC	3	Coho	2.02	56	UC		6	Coho	4.44	77	UC	
2	Coho	1.8	54	UC	3	Coho	3.65	66	UC		6	Coho	1.24	50	UC	
2	Coho	2.08	58	UC	3	Coho	2.48	59	UC		6	Coho	5.29	83	UC	
2	Coho	2.15	59	UC	3	Coho	5.45	85	UC		6	Coho	3.24	69	UC	
2	Coho	2.68	61	UC	3	Coho	3.22	65	UC		6	Coho	2.43	60	UC	
2	Coho	2.31	62	UC	3	Coho	3.06	62	UC		6	Coho	4.14	76	UC	
2	Coho	3.22	64	UC	3	Coho	1.94	52	UC		6	Coho	4.41	72	UC	
2	Coho	3.17	65	UC	3	Coho	1.1	45	UC	R	6	Coho	1.44	50	UC	R
2	Coho	3.08	66	UC	3	Coho	1.53	49	UC	R	6	Coho	4.2	74	UC	
2	Coho	2.67	71	UC	3	Coho	1.78	52	UC		6	Coho	1.86	57	UC	
2	Coho	3.98	74	UC	3	Coho	1.6	49	UC		6	Coho	1.54	53	UC	
2	Coho	4.5	75	UC	3	Coho	1.03	47	UC							
2	Coho	5.75	86	UC	3	Coho	2.01	54	UC							
3	Coho	1.09	46	UC	3	Coho	0.85	41	UC							
3	Coho	1.06	47	UC	5	Coho	4.9	66	UC							
3	Coho	1.53	49	UC	5	Coho	6.17	82	UC							
3	Coho	1.72	50	UC	5	Coho	3	51	UC							
3	Coho	1.35	51	UC	5	Coho	4.47	78	UC							
3	Coho	1.36	51	UC	5	Coho	6.28	81	UC							
3	Coho	1.59	51	UC	5	Coho	4.01	73	UC							
3	Coho	2.98	51	UC	5	Coho	3.89	64	UC							
3	Coho	1.85	53	UC	5	Coho	1.44	49	UC							
3	Coho	1.71	55	UC	5	Coho	2.04	56	UC							
3	Coho	1.92	55	UC	5	Coho	0.97	47	UC							
3	Coho	2.17	57	UC	6	Coho	2.8	64	UC							
3	Coho	2.2	57	UC	6	Coho	6.29	88	UC							
3	Coho	2.81	63	UC	6	Coho	6.18	84	UC							
3	Coho	2.86	63	UC	6	Coho	9.97	95	UC							
3	Coho	3.7	66	UC	6	Coho	1.61	53	UC							
3	Coho	3.52	68	UC	6	Coho	3.37	72	UC							
3	Coho	3.98	69	UC	6	Coho	3.74	71	UC							

3	Coho	3.98	70	UC	
3	Coho	4.13	70	UC	
3	Coho	4.67	75	UC	
3	Coho	5.07	79	UC	
3	Coho	5.27	79	UC	
3	Coho	6.21	84	UC	
4	Coho	2.96	59	UC	
4	Coho	4.62	76	UC	
4	Coho	5.2	81	UC	
4	Coho	9.65	92	UC	
4	Coho	9.26	100	UC	
4	DV/bull char	18.2	119	UC	
5	Coho	0.96	44	UC	
5	Coho	1.34	48	UC	
5	Coho	1.23	49	UC	
5	Coho	1.67	51	UC	
5	Coho	1.62	52	UC	
5	Coho	1.8	53	UC	
5	Coho	1.94	53	UC	
5	Coho	1.23	54	UC	
5	Coho	1.77	54	UC	
5	Coho	1.9	54	UC	
5	Coho	1.9	54	UC	
5	Coho	1.84	55	UC	
5	Coho	2.2	55	UC	
5	Coho	2.08	57	UC	
5	Coho	2.35	57	UC	
5	Coho	4.92	57	UC	
5	Coho	2.29	59	UC	
5	Coho	2.56	59	UC	
6	Coho	5.11	79	UC	
6	Coho	1.22	50	UC	
6	Coho	2.35	63	UC	
6	Coho	1.24	49	UC	
6	Coho	5.04	82	UC	
6	Coho	4.39	76	UC	
6	Coho	1.89	58	UC	
6	Coho	5.52	83	UC	
6	Coho	2.16	60	UC	
6	Coho	1.48	52	UC	
6	DV/bull char	15.55	119	UC	R

5	Coho	2.59	61	UC
5	Coho	3.43	62	UC
5	Coho	2.34	63	UC
5	Coho	2.67	63	UC
5	Coho	2.51	64	UC
5	Coho	3.11	64	UC
5	Coho	3.06	66	UC
5	Coho	3.32	69	UC
5	Coho	3.98	69	UC
5	Coho	4.05	70	UC
5	Coho	6.04	75	UC
5	Coho	4.55	78	UC
5	Coho	4.65	79	UC
5	Coho	7.52	90	UC
6	Coho	1.48	49	UC
6	Coho	1.75	50	UC
6	Coho	1.71	52	UC
6	Coho	2.46	54	UC
6	Coho	2.12	56	UC
6	Coho	2.47	58	UC
6	Coho	2.1	59	UC
6	Coho	2.62	59	UC
6	Coho	3.72	60	UC
6	Coho	2.89	63	UC
6	Coho	2.64	64	UC
6	Coho	4.14	68	UC
6	Coho	6.23	68	UC
6	Coho	3.44	69	UC
6	Coho	5.99	69	UC
6	Coho	5.66	72	UC
6	Coho	6.54	72	UC
6	Coho	7.76	86	UC

6	Coho	7.29	89	UC
6	Coho	8.98	93	UC

Downstream Pond

17-Dec

Station	Species	Weight (g)	Length (mm)	Clip
7	Coho	1.18	40	UC
7	Coho	1.11	45	UC
7	Coho	1.18	45	UC
7	Coho	1.14	47	UC
7	Coho	1.67	50	UC
7	Coho	1.74	50	UC
7	Coho	1.95	51	UC
7	Coho	1.63	54	UC
7	Coho	2.89	63	UC
7	Coho	3.21	65	UC
7	Coho	3.19	66	UC
7	Coho	3.08	67	UC
7	Coho	4.49	72	UC
7	Coho	9.2	98	UC
8	Coho	2.35	59	UC
8	Coho	1.58	50	UC
8	Coho	3.13	65	UC
8	Coho	1.21	48	UC
8	Coho	3.49	65	UC
8	Coho	6.46	82	UC
8	Coho	1.47	47	UC
8	Coho	2391	54	UC
8	Coho	1.65	46	UC

20-Dec

Station	Species	Weight (g)	Length (mm)	Clip	Recapture
7	Coho	3.72	62	UC	
7	Coho	0.87	42	UC	R
7	Coho	0.93	49	UC	
7	Coho	1.17	47	UC	
7	Coho	1.95	57	UC	
7	Coho	1.76	55	UC	
7	Coho	1.69	55	UC	
7	Coho	2.85	51	UC	
7	Coho	2.52	47	UC	
8	Coho	2.69	62	UC	
8	Coho	3.78	67	UC	
8	Coho	2.14	58	UC	
8	Coho	0.94	43	UC	
8	Coho	1.25	50	UC	
8	Coho	1.79	58	UC	
8	Coho	1.09	48	UC	
8	Coho	3.3	67	UC	
8	Coho	3.36	69	UC	
8	Coho	3.84	71	UC	
8	Coho	2.45	59	UC	
8	Coho	7.15	90	UC	
9	Coho	2.74	63	UC	
9	Coho	2.2	59	UC	

21-Dec

Station	Species	Weight (g)	Length (mm)	Clip	Recapture
7	Coho	0.94	44	UC	
7	Coho	1.85	56	UC	
7	Coho	2.94	62	UC	
8	Coho	2.62	62	UC	R
8	Coho	1.26	49	UC	
8	Coho	1.55	45	UC	
8	Coho	1.05	39	UC	
9	Coho	3.81	70	UC	
9	Coho	6.84	86	UC	R
9	Coho	3.03	62	UC	
9	Coho	7.49	88	UC	
9	Coho	6.71	84	UC	
9	Coho	6.01	75	UC	R
9	Coho	1.08	46	UC	
9	Coho	2.75	61	UC	
9	Coho	3.08	63	UC	
9	Coho	1.67	52	UC	
9	Coho	1.14	48	UC	
9	Coho	2.05	57	UC	R
9	Coho	1.1	46	UC	
9	Coho	1.2	46	UC	
9	Coho	1.68	52	UC	
9	Coho	3.69	68	UC	R

8	Coho	1.52	50	UC	9	Coho	1.38	50	UC		9	Coho	2.92	64	UC	
8	Coho	1	44	UC	9	Coho	1.93	57	UC	R	9	Coho	5.11	80	UC	
8	Coho	3.93	69	UC	9	Coho	0.92	45	UC		10	Coho	1.06	45	UC	
8	Coho	1.02	47	UC	9	Coho	1.6	53	UC		10	Coho	1.33	48	UC	
8	Coho	1.07	42	UC	9	Coho	3.24	69	UC		10	Coho	0.94	46	UC	
8	Coho	1.23	43	UC	9	Coho	1.15	47	UC		10	Coho	1.97	55	UC	
8	Coho	1.92	47	UC	9	Coho	3.76	72	UC		10	Coho	1.13	45	UC	
9	Coho	1.43	52	UC	9	Coho	3.91	74	UC		10	Coho	1.81	55	UC	
9	Coho	1.59	47	UC	9	Coho	0.95	45	UC		11	Coho	1.98	57	UC	
9	Coho	1.98	50	UC	9	Coho	5.86	84	UC		11	Coho	3.06	65	UC	
9	Coho	1.83	52	UC	9	Coho	0.92	41	UC		11	Coho	3.71	72	UC	
9	Coho	1.72	54	UC	9	Coho	2.12	57	UC		11	Coho	4.88	78	UC	
9	Coho	0.93	44	UC	9	Coho	1.93	57	UC		11	Coho	1.09	44	UC	
9	Coho	1.15	45	UC	9	Coho	5.69	80	UC		11	Coho	10.18	95	UC	
9	Coho	4.8	72	UC	9	Coho	1.35	51	UC		12	Coho	3.28	62	UC	
9	Coho	4.6	47	UC	9	Coho	1.52	52	UC		12	Coho	3.7	70	UC	
9	Coho	2.39	57	UC	9	Coho	1.61	50	UC		12	Coho	2.69	65	UC	
9	DV/bull char	10.6	103	UC	9	Coho	1.82	55	UC		12	Coho	1.55	52	UC	
9	Coho	1.87	51	UC	9	Coho	3.34	67	UC		12	Coho	1.69	52	UC	
9	Coho	3.26	62	UC	9	Coho	3.59	70	UC		12	Coho	2.64	57	UC	
9	Coho	3.25	64	UC	9	Coho	1.48	53	UC		12	Coho	3.28	67	UC	
9	Coho	0.88	41	UC	9	Coho	1.92	54	UC		12	Coho	1.77	53	UC	R
9	Coho	1.95	53	UC	9	Coho	4.74	76	UC		12	Coho	1.86	53	UC	
9	Coho	1.75	47	UC	9	Coho	0.77	40	UC		12	Coho	1.6	51	UC	
9	Coho	1.69	52	UC	9	Coho	1.67	53	UC		12	Coho	1	44	UC	
9	Coho	1.15	44	UC	9	Coho	6.46	87	UC		12	Coho	1.69	49	UC	
9	Coho	5.31	78	UC	9	Coho	1.61	52	UC		13	Coho	3.97	65	UC	
9	Coho	1.64	54	UC	9	Coho	1.12	45	UC		13	Coho	2.89	66	UC	
9	Coho	1.3	46	UC	9	Coho	1.57	53	UC		13	Coho	3.4	66	UC	
9	Coho	4.91	75	UC	9	Coho	3.45	64	UC	R	13	Coho	0.99	46	UC	
9	Coho	1.35	47	UC	9	Coho	1.64	53	UC		13	Coho	2.99	64	UC	R

9	Coho	4.76	74	UC	9	Coho	1.78	54	UC		13	Coho	2.11	58	UC
9	Coho	3.66	72	UC	9	Coho	0.89	44	UC		13	Coho	1.36	49	UC
9	Coho	1.08	45	UC	9	Coho	2.47	62	UC		13	Coho	2.1	57	UC
9	Coho	3.36	62	UC	10	Coho	1.04	52	UC		13	Coho	3.71	72	UC
10	Coho	0.84	40	UC	10	Coho	1.23	49	UC		13	Coho	2.63	62	UC
10	Coho	0.87	42	UC	10	Coho	0.98	45	UC		13	Coho	2.65	62	UC
10	Coho	2.14	53	UC	10	Coho	1.35	47	UC		13	Coho	2.49	60	UC
10	Coho	0.99	43	UC	11	Coho	7.87	88	UC		14	Coho	1.77	57	UC
10	Coho	2.08	54	UC	11	Coho	3.02	62	UC		15	Coho	2.88	63	UC
10	Coho	6.29	84	UC	11	Coho	5.95	82	UC	R	15	Coho	1.09	46	UC
10	Coho	1.99	57	UC	11	Coho	3.25	66	UC						
10	Coho	2.67	62	UC	11	Coho	3.45	68	UC						
10	Coho	1.52	51	UC	11	Coho	6.66	87	UC						
10	Coho	5.18	78	UC	11	Coho	6.37	80	UC						
10	Coho	1.64	52	UC	11	Coho	2.61	59	UC						
10	Coho	3.53	70	UC	11	Coho	2.64	60	UC						
10	Coho	2.19	51	UC	11	Coho	3.16	63	UC						
10	Coho	1.53	52	UC	11	Coho	2.85	63	UC						
10	Coho	1.37	48	UC	11	Coho	2.43	57	UC						
10	Coho	3.19	64	UC	11	Coho	2.38	59	UC						
10	Coho	1.21	46	UC	11	Coho	1.39	44	UC						
10	Coho	1.7	53	UC	11	Coho	2.16	52	UC						
10	Coho	3.4	66	UC	11	Coho	1.99	47	UC						
10	Coho	1.03	44	UC	11	Coho	1.68	46	UC						
10	Coho	1.55	50	UC	11	Coho	1.06	39	UC						
10	Coho	2.7	62	UC	12	Coho	1.19	48	UC						
10	Coho	1.29	43	UC	12	Coho	2.9	62	UC						
10	Coho	0.89	44	UC	12	Coho	1.63	53	UC						
10	Coho	2.12	57	UC	12	Coho	4.76	75	UC						
10	Coho	1.35	50	UC	12	Coho	3.81	71	UC						
10	Coho	1.25	48	UC	12	Coho	1.43	50	UC						
10	Coho	1.46	46	UC	12	Coho	3.06	64	UC						

10	Coho	3.45	65	UC	12	Coho	2.79	65	UC
10	Coho	1.22	46	UC	12	Coho	1.82	53	UC
10	Coho	1.35	39	UC	12	Coho	3.02	65	UC
10	Coho	8.01	89	UC	12	Coho	2.13	56	UC
12	Coho	1.85	54	UC	12	Coho	3.19	71	UC
12	Coho	3.21	69	UC	12	Coho	5.32	80	UC
12	Coho	2.6	62	UC	12	Coho	3.43	65	UC
12	Coho	2.04	59	UC	12	Coho	2.47	61	UC
12	Coho	2.14	61	UC	12	Coho	3.79	70	UC
12	Coho	3.75	66	UC	12	Coho	3.06	64	UC
12	Coho	2.83	63	UC	12	Coho	2.08	57	UC
12	Coho	1.66	51	UC	12	Coho	2.65	64	UC
12	Coho	4.55	75	UC	12	Coho	2.69	63	UC
12	Coho	2.17	58	UC	12	Coho	1.19	45	UC
12	Coho	2.75	63	UC	12	Coho	4.29	72	UC
12	Coho	3.63	62	UC	12	Coho	1.49	45	UC
12	Coho	3.4	61	UC	12	Coho	2.53	61	UC
12	Coho	2.2	54	UC	12	Coho	3.45	68	UC
12	Coho	1.99	57	UC	12	Coho	1.68	51	UC
12	Coho	3.47	57	UC	12	Coho	2.74	60	UC
12	Coho	2.79	59	UC	12	Coho	1.65	48	UC
12	Coho	4.13	73	UC	12	Coho	2.85	62	UC
12	Coho	2.51	60	UC	12	Coho	2.32	55	UC
12	Coho	0.69	39	UC	12	Coho	1.54	46	UC
12	Coho	1.57	54	UC	12	Coho	2.03	55	UC
12	Coho	1.8	54	UC	12	Coho	2.24	51	UC
12	Coho	1.21	48	UC	12	Coho	2.38	57	UC
12	Coho	5.28	75	UC	12	Coho	3.91	67	UC
12	Coho	2.17	55	UC	12	Coho	2.18	58	UC
12	Coho	2.36	58	UC	12	Coho	1.85	55	UC
12	Coho	2.9	55	UC	12	Coho	2.19	55	UC
12	Coho	2.09	59	UC	12	Coho	1.54	49	UC

12	Coho	2.8	59	UC	12	Coho	3.26	62	UC	
12	Coho	2.59	60	UC	12	Coho	3.57	77	UC	
12	Coho	2.94	58	UC	12	Coho	1.63	50	UC	
12	Coho	1.3	45	UC	12	Coho	2.45	58	UC	
12	Coho	3.97	65	UC	12	Coho	1.94	52	UC	
12	Coho	3.82	66	UC	12	Coho	1.74	53	UC	
12	Coho	1.07	44	UC	12	Coho	2.7	59	UC	
12	Coho	3.31	67	UC	12	Coho	1.65	49	UC	
12	Coho	3.05	50	UC	12	Coho	1.88	51	UC	
12	Coho	3.36	67	UC	12	Coho	1.73	50	UC	
13	Coho	3.43	66	UC	12	Coho	3.59	67	UC	
13	Coho	2.75	62	UC	12	Coho	2.08	55	UC	
13	Coho	2.66	62	UC	12	Coho	2.23	58	UC	
13	Coho	1.33	49	UC	12	Coho	2.72	63	UC	
13	Coho	3.67	51	UC	12	Coho	2.71	61	UC	
13	Coho	1.45	49	UC	12	Coho	1.65	50	UC	
13	Coho	4.95	79	UC	12	Coho	1.54	48	UC	
13	Coho	3.48	69	UC	13	Coho	4.71	76	UC	
13	Coho	5.83	70	UC	13	Coho	3.27	65	UC	R
13	Coho	0.98	46	UC	13	Coho	2.42	49	UC	R
13	Coho	2.2	51	UC	13	Coho	2	57	UC	
13	Coho	3.53	65	UC	13	Coho	3.42	56	UC	
13	Coho	0.8	41	UC	13	Coho	2.27	59	UC	R
13	Coho	1.39	51	UC	13	Coho	1.63	55	UC	
13	Coho	2.1	58	UC	13	Coho	5.29	79	UC	
13	Coho	1.26	48	UC	13	Coho	2.97	52	UC	
13	Coho	0.81	43	UC	13	Coho	3.4	64	UC	
13	Coho	1.18	49	UC	13	Coho	3.49	69	UC	
13	Coho	0.79	39	UC	13	Coho	2.18	47	UC	
13	Coho	1.04	47	UC	13	Coho	1.44	51	UC	
13	Coho	1.12	47	UC	13	Coho	4.13	66	UC	
13	Coho	2.28	52	UC	13	Coho	1.11	47	UC	

13	Coho	1.23	49	UC	13	Coho	1.43	50	UC	R
13	Coho	1.26	46	UC	13	Coho	4.48	59	UC	
13	Coho	4.37	77	UC	14	DV/bull char	22.36	129	UC	
13	Coho	3.96	75	UC	14	DV/bull char	14.02	119	UC	
14	Coho	1.87	47	UC	14	DV/bull char	8.59	95	UC	
14	Coho	2.26	58	UC	14	DV/bull char	23.47	131	UC	
14	Coho	2.9	65	UC	14	Coho	1.4	48	UC	
14	Coho	5.18	61	UC	14	Coho	4.59	75	UC	
14	Coho	2.17	42	UC	14	Coho	4.81	75	UC	
14	Coho	1.46	47	UC	14	Coho	1.63	52	UC	
14	Coho	4.75	67	UC	15	Coho	3.28	65	UC	
14	Coho	4.67	73	UC	15	Coho	0.73	40	UC	R
14	Coho	1.8	55	UC	15	Coho	1.72	52	UC	R
14	Coho	2.24	56	UC	15	Coho	1.15	41	UC	
14	Coho	3.11	65	UC	15	Coho	2.69	58	UC	
14	Coho	1.32	48	UC	15	Coho	1.42	45	UC	
14	Coho	1.01	43	UC						
14	Coho	5.29	76	UC						
14	Coho	2.94	58	UC						
14	Coho	1.04	44	UC						
14	Coho	2.89	64	UC						
14	Coho	1.89	55	UC						
14	Coho	1.67	51	UC						
14	Coho	3.28	65	UC						
14	Coho	4.68	75	UC						
14	Coho	3.07	65	UC						
14	Coho	1.89	55	UC						
15	Coho	2.52	64	UC						

15	Coho	1.81	54	UC
15	Coho	1.2	46	UC
15	Coho	1.07	44	UC

Appendix IX

Midvalley Habitat Juvenile Coho Trapping Results

Number of coho caught in each Gee trap for each 24 hour soak trapping session and number of recaptures, in November 2004.

Station	Number caught				
	21-Nov	24-Nov	Recapture	27-Nov	Recapture
1	0	0	0	3	0
2	13	16	2	26	3
3	0	0	0	18	1
4	19	7	0	20	3
5	23	29	2	24	2
6	12	9	2	22	7
7	12	3	2	15	1
8	8	0	0	0	0
9	23	20	0	8	1
10	0	23	1	32	1
11	2	0	0	6	0
12	24	25	1	5	2
13	0	9	0	8	1
14	22	3	0	3	1
15	4	0	0	3	1

Appendix X

Data for Midvalley Juvenile Lengths and Weights

Upstream Pond

21-Nov

Station	Species	Weight (g)	Length (mm)	Clip
11	Coho	5.5	78	UC
11	Coho	6.14	83	UC
12	Coho	7.44	78	UC
12	Coho	6.27	84	UC
12	Coho	3.91	72	UC
12	Coho	7.64	90	UC
12	Coho	3.45	67	UC
12	Coho	4.32	74	UC
12	Coho	3.3	69	UC
12	Coho	4.58	74	UC
12	Coho	5.61	79	UC
12	Coho	4.99	75	UC
12	Coho	8.16	83	UC
12	Coho	5.58	76	UC
12	Coho	5.36	77	UC
12	Coho	4.53	73	UC
12	Coho	2.4	61	UC
12	Coho	4.81	74	UC
12	Coho	2.97	74	UC
12	Coho	3.96	72	UC
12	Coho	3.57	70	UC

24-Nov

Station	Species	Weight (g)	Length (mm)	Clip	Recapture
11	N/A	N/A	N/A	N/A	
12	Coho	9.8	98	UC	
12	Coho	5.65	77	UC	
12	Coho	7.08	84	UC	
12	Coho	6.53	82	UC	
12	Coho	4.64	75	UC	
12	Coho	6.5	79	UC	
12	Coho	9.75	97	UC	
12	Coho	4.59	75	UC	R
12	Coho	4.97	80	UC	
12	Coho	6.9	84	UC	
12	Coho	7.41	86	UC	
12	Coho	5.02	78	UC	
12	Coho	7.59	88	UC	
12	Coho	8.04	90	UC	
12	Coho	4.02	68	UC	
12	Coho	5.22	76	UC	
12	Coho	4.86	73	UC	
12	Coho	6.01	80	UC	
12	Coho	5.08	75	UC	
12	Coho	5.45	77	UC	

27-Nov

Station	Species	Weight (g)	Length (mm)	Clip	Recapture
11	Coho	4.87	75	UC	
11	Coho	5.97	79	UC	
11	Coho	4.82	76	UC	
11	Coho	6.75	85	UC	
11	Coho	6.17	84	UC	
11	Coho	3.88	74	UC	4 escapes
12	Coho	6.49	89	UC	
12	Coho	7.87	82	UC	R
12	Coho	3.59	71	UC	
12	Coho	5.34	81	UC	
12	Coho	5.07	75	UC	R
13	Coho	3.03	67	UC	
13	Coho	5.21	80	UC	
13	Coho	6.04	84	UC	
13	Coho	6.51	77	UC	
13	Coho	4.08	72	UC	
13	Coho	4.86	77	UC	R
13	Coho	5.58	81	UC	
13	Coho	4.34	72	UC	
14	Coho	5.83	84	UC	
14	Coho	3.94	71	UC	R

12	Coho	5.58	77	UC
12	Coho	4.92	66	UC
12	Coho	4.67	70	UC
12	Coho	8.47	85	UC
12	Coho	6.78	76	UC
13	N/A	N/A	N/A	N/A
14	Coho	6.4	89	UC
14	Coho	9.88	98	UC
14	Coho	11.33	105	UC
14	Coho	3.81	74	UC
14	Coho	10.72	99	UC
14	Coho	4.87	75	UC
14	Coho	4.75	108	UC
14	Coho	20.86	128	UC
14	Coho	9.98	102	UC
14	Coho	10.6	95	UC
14	Coho	3.8	69	UC
14	Coho	5.62	79	UC
14	Coho	7.93	94	UC
14	Coho	4	72	UC
14	Coho	4.32	75	UC
14	Coho	12.74	105	UC
14	Coho	9.35	99	UC
14	Coho	8.86	98	UC
14	Coho	5.5	78	UC
14	Coho	8.94	95	UC
14	Coho	7.89	85	UC
14	Coho	6.84	72	UC
15	Coho	3.13	65	UC
15	Coho	4.2	95	UC
15	Coho	7.58	87	UC
15	Coho	7.34	89	UC

12	Coho	6.8	84	UC
12	Coho	4.29	73	UC
12	Coho	5.7	80	UC
12	Coho	4.82	76	UC
12	Coho	6.42	83	UC
13	Coho	8.18	90	UC
13	Coho	5.78	79	UC
13	Coho	13.87	105	UC
13	Coho	4.49	77	UC
13	Coho	6.81	84	UC
13	Coho	5.84	78	UC
13	Coho	4.41	69	UC
13	Coho	11.73	100	UC
13	Coho	5.7	78	UC
14	Coho	16.22	110	UC
14	Coho	9.32	93	UC
14	Coho	19.26	117	UC
15	N/A	N/A	N/A	N/A

14	Coho	4.28	74	UC	
15	Cutthroat	18.6	128	UC	
15	Coho	8.85	96	UC	
15	Coho	9.18	95	UC	R
15	Coho	11.14	100	UC	

15	Cutthroat	9.34	95	UC
15	Cutthroat	12.23	108	UC
15	Cutthroat	12.89	107	UC
15	Cutthroat	13.42	115	UC

Downstream Pond

21-Nov

Station	Species	Weight (g)	Length (mm)	Clip
1	N/A	N/A	N/A	N/A
2	Coho	10.61	96	UC
2	Coho	6.05	83	UC
2	Coho	4.84	75	UC
2	Coho	4.27	72	UC
2	Coho	2.29	64	UC
2	Coho	3.09	68	UC
2	Coho	4.2	70	UC
2	Coho	2.22	61	UC
2	Coho	3.21	71	UC
2	Coho	2.86	64	UC
2	Coho	6.12	85	UC
2	Coho	3.28	73	UC
2	Coho	4.38	76	UC
3	N/A	N/A	N/A	N/A
4	DV/bull char	20.29	124	UC
4	Coho	6.86	90	UC
4	Coho	4.38	66	UC
4	Coho	4.72	72	UC
4	Coho	8.18	100	UC

24-Nov

Station	Species	Weight (g)	Length (mm)	Clip	Recapture
1	N/A	N/A	N/A	N/A	
2	Coho	5.49	66	UC	
2	Coho	1.66	52	UC	
2	Coho	4.6	63	UC	
2	Coho	3.79	71	UC	
2	Coho	2.69	65	UC	
2	Coho	4.77	67	UC	
2	Coho	2.29	62	UC	R
2	Coho	2.74	62	UC	
2	Coho	3.07	60	UC	
2	Coho	3.22	65	UC	
2	Coho	2.7	58	UC	R
2	Coho	5.89	80	UC	
2	Coho	3.96	70	UC	
2	Coho	2.39	60	UC	
2	Coho	4.18	72	UC	
2	Coho	4.36	74	UC	
3	N/A	N/A	N/A	N/A	
4	Coho	8.84	86	UC	
4	Coho	8.27	86	UC	

27-Nov

Station	Species	Weight (g)	Length (mm)	Clip	Recapture
1	Coho	3.63	72	UC	
1	Coho	4.69	77	UC	
1	Coho	1.65	54	UC	
2	Coho	3.27	75	UC	
2	Coho	3.3	69	UC	
2	Coho	5.44	82	UC	
2	Coho	5.13	79	UC	
2	Coho	6.5	81	UC	
2	Coho	3.57	68	UC	
2	Coho	5.15	79	UC	
2	Coho	4.74	78	UC	
2	Coho	3.78	70	UC	
2	Coho	3.64	68	LC	R
2	Coho	3.29	65	UC	
2	Coho	7.11	89	UC	
2	Coho	4.56	74	UC	
2	Coho	8.18	87	UC	
2	Coho	2.95	64	UC	
2	Coho	3.8	71	UC	
2	Coho	6.09	80	UC	

4	Coho	4.96	80	UC	
4	Coho	4.77	75	UC	
4	Coho	4.93	78	UC	
4	Coho	5.58	79	UC	
4	Coho	7.43	86	UC	
4	Coho	9.19	98	UC	
4	Coho	3.94	72	UC	
4	Coho	5.19	82	UC	
4	Coho	5.39	78	UC	
4	Coho	4.62	74	UC	
4	Coho	4.5	75	UC	
4	Coho	3.2	72	UC	
4	Coho	3.35	68	UC	
4	Coho	4.34	75	UC	
4	Coho	5.32	77	UC	
5	Coho	4.87	78	UC	
5	Coho	5.86	81	UC	
5	Coho	5.88	79	UC	
5	Coho	3.2	67	UC	
5	Coho	4.14	74	UC	
5	Coho	4.63	77	UC	
5	Coho	5.05	78	UC	
5	Coho	4.52	76	UC	
5	Coho	4.16	74	UC	
5	Coho	2.94	65	UC	
5	Coho	6.84	87	UC	
5	Coho	4.72	76	UC	
5	Coho	7.1	89	UC	
5	Coho	5.1	78	UC	
5	Coho	3.07	65	UC	
5	Coho	3.84	66	UC	
5	Coho	4.56	77	UC	
4	Coho	5.23	76	UC	
4	Coho	8.01	89	UC	
4	Coho	7.61	86	UC	
4	Coho	3.79	70	UC	
4	Coho	4.42	64	UC	
5	Coho	5.04	76	UC	R
5	Coho	4.07	72	UC	
5	Coho	4.3	71	UC	
5	Coho	4.35	72	LC	R
5	Coho	4.66	74	UC	
5	Coho	4.06	69	UC	
5	Coho	5.67	80	UC	
5	Coho	5.14	74	UC	
5	Coho	5.5	80	UC	
5	Coho	6.21	81	UC	
5	Coho	6.58	85	UC	
5	Coho	8.29	89	UC	
5	Coho	4.26	68	UC	
5	Coho	5.53	78	UC	
5	Coho	2.42	58	UC	
5	Coho	6.82	87	UC	
5	Coho	5.12	76	UC	
5	Coho	3.95	69	UC	
5	Coho	2.31	69	UC	
5	Coho	3.52	68	UC	
5	Coho	5.22	77	UC	
5	Coho	3.79	71	UC	
5	Coho	5.39	75	UC	
5	Coho	3.45	68	UC	
5	Coho	2.91	63	UC	
5	Coho	7.32	85	UC	
5	Coho	6.18	80	UC	
2	Coho	3.62	69	UC	R
2	Coho	3.09	59	UC	
2	Coho	5.06	64	UC	
2	Coho	4.51	78	UC	
2	Coho	3.15	69	UC	
2	Coho	2.28	64	UC	
2	Coho	2.62	62	UC	R
2	Coho	1.49	60	UC	
2	Coho	3.78	70	UC	
3	Coho	3.17	68	UC	
3	Coho	3.06	71	UC	
3	Coho	4.15	72	UC	
3	Coho	3.82	69	UC	
3	Coho	6.4	84	UC	
3	Coho	6.61	84	UC	
3	Coho	3.39	67	UC	
3	Coho	2.11	58	UC	
3	Coho	2.74	64	UC	
3	Coho	3.44	66	UC	
3	Coho	4.23	79	UC	
3	Coho	4.03	71	UC	R
3	Coho	3.66	73	UC	
3	Coho	3.47	69	UC	
3	Coho	6.36	85	UC	
3	Coho	3.14	62	UC	
3	Coho	4.27	72	UC	
3	Coho	6.23	82	UC	
4	Coho	3.98	74	UC	
4	Coho	5.12	79	UC	
4	Coho	2.64	62	UC	
4	Coho	4.94	81	UC	
4	Coho	5.01	69	UC	

5	Coho	6.1	75	UC
5	Coho	4.34	74	UC
5	Coho	3.39	70	UC
5	Coho	5.39	79	UC
5	Coho	3.05	67	UC
5	Coho	4.3	75	UC
6	Coho	3.48	68	UC
6	Coho	3.55	64	UC
6	Coho	4.1	71	UC
6	Coho	4.16	68	UC
6	Coho	5.79	80	UC
6	Coho	2.94	61	UC
6	Coho	6.97	84	UC
6	Coho	4.3	68	UC
6	Coho	3.51	69	UC
6	Coho	6.75	84	UC
6	Coho	4.49	75	UC
6	Coho	7.4	87	UC
7	Coho	4.1	71	UC
7	Coho	4.15	73	UC
7	Coho	1.89	57	UC
7	Coho	2.98	65	UC
7	Coho	2.45	61	UC
7	Coho	4.24	74	UC
7	Coho	4.4	72	UC
7	Coho	5.07	77	UC
7	Coho	3.58	68	UC
7	Coho	6.72	85	UC
7	Coho	3.64	69	UC
7	Coho	3.5	68	UC
8	Coho	6.48	75	UC
8	Coho	1.99	58	UC

5	Coho	3.69	73	UC	
5	Coho	4.02	69	UC	
6	Coho	3.67	69	UC	R
6	Coho	5.07	76	UC	
6	Coho	3.72	68	UC	
6	Coho	2.91	65	UC	
6	Coho	4.24	72	UC	
6	Coho	3.45	67	UC	R
6	Coho	5.13	70	UC	
6	Coho	3.65	68	UC	
6	Coho	4.57	74	UC	
7	Coho	4.83	75	UC	R
7	Coho	3.92	71	UC	R
7	Coho	3.73	71	UC	
8	N/A	N/A	N/A	N/A	
9	Coho	4.17	65	UC	
9	Coho	3.5	69	UC	
9	Coho	4.96	79	UC	
9	Coho	8.6	71	UC	
9	Coho	6.95	86	UC	
9	Coho	6.42	81	UC	
9	Coho	4.32	72	UC	
9	Coho	5	75	UC	
9	Coho	7.83	86	UC	
9	Coho	2.13	55	UC	
9	Coho	5.93	82	UC	
9	Coho	6.62	83	UC	
9	Coho	6.64	86	UC	
9	Coho	5.31	77	UC	
9	Coho	4.78	75	UC	
9	Coho	5.42	79	UC	
9	Coho	7.78	87	UC	

4	Coho	4.37	70	UC	R
4	Coho	4.4	75	UC	R
4	Coho	4.03	69	UC	
4	Coho	5.51	79	UC	
4	Coho	3.77	65	UC	
4	Coho	5.2	76	UC	
4	Coho	5.64	73	UC	R
4	Coho	4.49	74	UC	
4	Coho	4.44	74	UC	
4	Coho	3	64	UC	
4	Coho	2.85	62	UC	
4	Coho	4.61	74	UC	
4	Coho	2.52	59	UC	
4	Coho	5.4	72	UC	
4	Coho	3.79	68	UC	
5	Coho	2.81	67	UC	
5	Coho	4.06	74	UC	
5	Coho	5.06	77	UC	
5	Coho	9.13	92	UC	
5	Coho	5.4	80	UC	
5	Coho	12.62	106	UC	
5	Coho	10.42	88	UC	
5	Coho	3.61	69	UC	
5	Coho	5.74	84	UC	
5	Coho	8.58	95	UC	
5	Coho	8.08	96	UC	
5	Coho	2.78	64	UC	
5	Coho	3.59	70	UC	R
5	Coho	3.74	67	UC	
5	Coho	3.59	71	UC	
5	Coho	4.12	73	UC	
5	Coho	5.96	75	UC	

8	Coho	4.07	72	UC
8	Coho	5.72	80	UC
8	Coho	3.27	68	UC
8	Coho	5.54	79	UC
8	Coho	6.42	78	UC
8	Coho	4.13	72	UC
9	Coho	2.2	59	UC
9	Coho	3.45	67	UC
9	Coho	2.9	68	UC
9	Coho	4.36	77	UC
9	Coho	4.82	78	UC
9	Coho	2.85	61	UC
9	Coho	3.06	67	UC
9	Coho	1.36	50	UC
9	Coho	7.25	82	UC
9	Coho	3.64	73	UC
9	Coho	6.67	84	UC
9	Coho	4.55	75	UC
9	Coho	4	72	UC
9	Coho	5.63	78	UC
9	Coho	5.3	77	UC
9	Coho	2.75	63	UC
9	Coho	7.82	87	UC
9	Coho	4.28	71	UC
9	Coho	5.34	80	UC
9	Cutthroat	2.44	60	UC
9	Coho	3.74	74	UC
9	Coho	1.84	56	UC
9	Coho	6.32	82	UC
9	Coho	3.07	65	UC
10	N/A	N/A	N/A	N/A

9	Coho	5.44	78	UC	
9	Coho	4.4	74	UC	
9	Coho	5.22	80	LC	
10	Coho	5.62	80	UC	
10	Coho	3.04	65	UC	
10	Coho	3.4	70	UC	
10	Coho	6.31	83	UC	
10	Coho	3.74	71	UC	
10	Coho	9.38	95	UC	
10	Coho	5.39	80	UC	
10	Coho	5.65	77	UC	
10	Coho	7.47	85	UC	
10	Coho	7.52	86	UC	
10	Coho	6.61	82	UC	
10	Coho	5.4	82	UC	R
10	Coho	4.89	75	UC	
10	Coho	6.09	83	UC	
10	Coho	7.53	87	UC	
10	Coho	4.07	72	UC	
10	Coho	4.13	67	UC	
10	Coho	2.75	63	UC	
10	Coho	6.13	80	UC	
10	Coho	8.57	90	UC	
10	Coho	11.02	93	UC	
10	Coho	3.46	62	UC	
10	Coho	3.74	69	UC	

5	Coho	4.09	74	UC	
5	Coho	4.79	77	UC	R
5	Coho	2.82	66	UC	
5	Coho	3.64	72	UC	
5	Coho	4.16	74	UC	
5	Coho	3.07	68	UC	
5	Coho	3.7	72	UC	
6	Coho	6.19	83	UC	
6	Coho	6.98	84	UC	R
6	Coho	6.55	82	UC	R
6	Coho	5.67	80	UC	
6	Coho	7.07	83	UC	R
6	Coho	7.35	87	UC	R
6	Coho	4.78	79	UC	R
6	Coho	4.8	75	UC	
6	Coho	3.8	69	UC	R
6	Coho	4.02	71	UC	
6	Coho	7.3	88	UC	
6	Coho	4.57	76	UC	
6	Coho	4.54	73	UC	
6	Coho	5.76	79	UC	
6	Coho	4.51	74	UC	R
6	Coho	3.61	67	UC	
6	Coho	3.75	69	UC	
6	Coho	2.91	57	UC	
6	Coho	8.02	91	UC	
6	Coho	5.14	79	UC	
6	Coho	2.92	66	UC	
6	Coho	2.21	59	UC	
7	Coho	7.92	94	UC	
7	Coho	5.49	81	UC	
7	Coho	5.4	78	UC	

7	Coho	4.5	75	UC	
7	Coho	1.97	56	UC	R
7	Coho	5.01	79	UC	
7	Coho	5.04	77	UC	
7	Coho	6.28	85	UC	
7	Coho	5.51	82	UC	
7	Coho	3.08	67	UC	
7	Coho	3.23	68	UC	
7	Coho	2.37	56	UC	
7	Coho	3.95	73	UC	
7	Coho	2.91	65	UC	
7	Coho	6.92	82	UC	
8	Coho	N/A	N/A	N/A	N/A
9	Coho	5.63	82	UC	
9	Coho	2.96	68	UC	
9	Coho	8.6	92	UC	
9	Coho	3.23	68	UC	
9	Coho	3.71	69	UC	R
9	Coho	5.09	76	UC	
9	Coho	5.33	79	UC	
9	Coho	3.4	67	UC	
10	Coho	4.16	66	UC	
10	Coho	1.61	52	UC	
10	Coho	6.16	76	UC	
10	Coho	3.57	69	UC	
10	Coho	4.1	76	UC	
10	Coho	5.66	71	UC	
10	Coho	2.7	59	UC	
10	Coho	2.85	63	UC	
10	Coho	4.32	74	UC	
10	Coho	3.13	67	UC	

10	Coho	4	75	UC	
10	Coho	2.61	63	UC	
10	Coho	3.54	71	UC	
10	Coho	3.17	67	UC	
10	Coho	3.37	69	UC	
10	Coho	1.48	49	UC	
10	Coho	6.19	80	UC	
10	Coho	2.11	59	UC	
10	Coho	4.74	70	UC	
10	Coho	2.74	61	UC	
10	Coho	3.63	69	UC	
10	Coho	5.88	81	UC	
10	Coho	5.08	68	UC	R
10	Coho	2.6	63	UC	
10	Coho	3	59	UC	
10	Coho	2.57	64	UC	
10	Coho	2.95	62	UC	
10	Coho	2.86	64	UC	
10	Coho	2.7	63	UC	
10	Coho	1.75	53	UC	
10	Coho	2.96	67	UC	
10	Coho	3.41	70	UC	