LUCKIAMUTE
RAPID BIO-ASSESSMENT 2010

PREPARED FOR:

Luckiamute Watershed Council

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INTRODUCTION

The 2010 Rapid Bio-Assessment inventory of the Luckiamute Watershed was a replicate inventory that attempted to target the most productive salmonid habitat in the basin. This was the third consecutive inventory in the basin designed to describe the distribution and relative abundance of coho, cutthroat trout and winter steelhead. The entire basin (214 stream miles) was inventoried in 2008 utilizing the RBA protocol which included many miles of dysfunctional aquatic habitats that currently exhibit deep channel entrenchment, elevated summer temperature profiles and provide limited summer production potential. Survey efforts were reduced to 96.6 stream miles in 2009 and covered only the highest quality habitat reaches. Surveys were further refined in 2010 to a subset of the highest quality habitats (90.2 stream miles). Some streams in the basin were also surveyed in 2002 and 2003 in a separate effort funded by Boise Cascade the previous owner of the current Forest Capital holdings. These included Beaver, Boulder, Clayton, Cougar, Miller, Pedee, Ritner, Sheythe, West Fork Luckiamute, Wolf, and approximately 7 miles of the upper Luckiamute mainstem. Results and comparisons to those surveys are included below in the Site Specific observations.

The intent of the RBA inventory was to gather information on the status of juvenile salmonid summer distributions and summer rearing densities. The inventory consisted of extensive snorkel surveys that began at the mouth of each stream and continued to the end of significant salmonid rearing potential (not to the end of cutthroat distribution). These surveys will be used to develop a base line for understanding how juvenile salmonids are currently utilizing habitats within the basin during summer flow regimes. Replicates of this inventory in high priority stream reaches (streams exhibiting residual system function) will be critical for identifying trends in the distribution and abundance of juvenile coho, steelhead and cutthroat in response to watershed restoration and management.

The Rapid Bio-Assessment (RBA) survey method was designed to sub-sample 20 percent of the pool habitats using a Rapid Assay technique that could cover large distances and succeed in describing the current distribution of juvenile salmonids in all of the surveyed streams and their tributaries. Beaver dam frequency and knotweed presence was also recorded.

METHODS

The basins and sub-basins surveyed were selected and prioritized by the Luckiamute Watershed Council (LWC). Survey crews were concentrated within a sub-basin to complete the sampling activity within a concise window of time. This approach led to transportation efficiency and eliminated any possibility of population shifts in response to changes in flow or temperature. Land owner contacts were made for all of the private, industrial and public ownerships that existed on both sides of every stream reach surveyed. Contacts were conducted by students from Western Oregon University. Developing these contacts involved extensive research in the county tax assessor's office and then a personal contact to describe the survey and request permission for access. The land owner information was recorded (name, contact #, tax lot # and location).

Most surveys were initiated by randomly selecting any one of the first five pools encountered. The protocol however was altered for small tributaries (2^{nd} and 3^{rd} order) where salmonid presence or absence was undetermined. In these tributaries, the first pool above the confluence was selected as unit number one. This alteration in protocol was adopted to identify minor upstream temperature dependant migrations that may not have extended more than a few

hundred feet. The identification of this type of migratory pattern in juvenile salmonids is critical for understanding potential limiting factors within the basin (temperature, passage, etc.). Some surveys by necessity were initiated at a point above agricultural influence where visibility conditions shifted from poor to good. In these surveys the start point of the survey will be indicated separately on the USGS quads (project deliverables).

The survey continued sampling at a 20% frequency (every fifth pool) until at least two units without cutthroat were observed or when the surveyor determined that the end of significant production potential for cutthroat had been reached

In sub-basins with low rearing densities, there were situations where cutthroat were not detected for more than two sampled units. These conflicting situations were left to the surveyor's discretion, whether to continue or terminate the survey.

Pools had to meet minimum criteria of being at least as long as the average stream width. They also had to exhibit a scour element (this factor eliminates most glide habitats) and a hydraulic control at the downstream end. There were no minimum criteria established for depth. Only main channel pools were sampled. Side channel pools, back waters and alcoves were not incorporated into the surveyed pool habitats. The primary reasons for not including these secondary and off channel pools is that they compromise the consistency of measuring, summarizing and reporting lineal stream distances. Given this fact, the method tends to underestimate total abundance in complex stream channels.

The lineal distances represented in the database were estimated by pacing from the beginning of one sampled unit to the beginning of the next sampled unit. The length of the sampled pool is an independent quantity, which was always measured and not estimated.

Total distances represented in the database are consistently greater than mapped distances using USGS 1:24,000 series maps. This is related to the level of sinuosity within the floodplain that is not incorporated in topographic map layers. If you are attempting to overlay this database on existing stream layer information there would be a need to justify lineal distances with known tributary junctions (these can often be found in the comments column).

Pool widths were generally estimated. Because pool widths vary significantly within a single unit, a visual estimate of the average width was considered adequate. Pool widths were typically measured at intervals throughout the survey to calibrate the surveyor's ability to judge distance.

The snorkeler entered the pool from the downstream end and proceeded to the transition from pool to riffle at the head of the pool. In pools with large numbers of juveniles of different species, multiple passes were completed to enumerate by species. (cutthroat first pass, 0+ trout second pass, etc.). This allowed the surveyor to concentrate on a single species and is important to the collection of an accurate value. In addition, older age class steelhead and cutthroat were often easier to enumerate on the second pass because they were concentrating on locating food items stirred up during the surveyor's first pass and appeared to exhibit less of their initial avoidance behavior.

In large order stream corridors two snorkelers surveyed parallel to each other, splitting the difference to the center from each bank.

A cover/complexity rating was attributed to each pool sampled. This rating was an attempt to qualify the habitat sampled within the reach. The 1 - 5 rating is based on the abundance of multiple cover components within a sampled unit (wood, large substrate, undercut bank, overhanging vegetation). Excessive depth (>3 ft) was not considered a significant cover component. The following criteria were utilized:

1 0 cover present
2 1-25 % of the pool surface area is associated with cover
3 26-50 % of the pool surface area is associated with cover
4 51-75 % of the pool surface area is associated with cover
5 > 75 % of the pool surface area is associated with cover

A point to consider here is that the frequency of higher complexity pools increases with a decrease in stream order. This inverse relationship is primarily a function of average channel width and the resultant ability of narrow channels to retain higher densities of migratory wood. Channel morphology begins to play a much more significant role in this relationship during winter flow regimes where increases in floodplain interaction and the abundance of low velocity habitat may become as significant as wood complexity.

A numerical rating was given to each sampled unit for the surveyor's estimate of visibility. The following criteria were utilized:

Visibility
1 excellent
2 moderate
3 poor

This variable appends a measure of confidence to the collected data. Survey segments with a visibility value of 1 can assume normal probabilities of detection (the observed is within 20 percent of the actual for coho). Segments with a measure of 2 suggest that less confidence can be applied to the observed number (uncalibrated) and segments with a visibility rating of 3 suggest that the observation can probably be used for only an assessment of presence or absence.

Beaver dam presence was recorded during this inventory. Beaver dams were simply counted along the survey and given a sum total at the end of each stream. Only intact full spanning dams were counted. This variable may then be sorted in the database for presence, absence, total number and trend within each sub basin.

There was also commentary recorded within each of the surveyed reaches that included information on temperature, tributary junctions, culvert function, the abundance of other species and adjacent land use. This commentary is included in only the raw Access database under the "comments" field and not in the Excel workbook.

The database contains a field designed to facilitate the development of a GIS data layer. These LLID location numbers are unique for each stream segment. Latitude and longitude values were not collected for start points because these values already exist in the actual LLID number used to initiate a surveyed reach.

GENERAL OBSERVATIONS

The 201,738 acre Luckiamute Watershed is located on the west side of the Willamette Valley 62 miles south of Portland in Benton and Polk counties. The Luckiamute River and its tributaries drain coast range sub-basins dominated by low elevation headwaters that range primarily between 100 and 1,000 ft. This general morphology is very significant in predisposing the system to some of the aquatic dysfunction observed within this inventory. The combination of low gradients and simplification within the channel from the historic impacts of agriculture have resulted in deep channel entrenchment that has isolated many miles of Luckiamute Basin stream corridors from their floodplains. This has resulted in the trickle down effect of reducing summer base flows and degrading water quality (temperature). Many upper basin tributaries such as Boulder, Ritner, Pedee, and Teal begin as steep rocky streams flowing through boulder gorges and rapids and over large waterfalls. Portions of these upper basin tributaries maintain a higher level of functionality as a result of higher gradients that sustain higher water quality well into the summer pinch period.

Steep stream gradients and cool summer flows become less abundant as the wide valley floors of the Luckiamute and Little Luckiamute converge. Channel morphologies and the resultant aquatic habitats shift rapidly toward the predominant characteristics of the basin: slack water habitats, low summer flows, high solar exposure, elevated summer stream temperatures, heavy silt depositions and a transition from cold to warm water aquatic species. Water withdrawals and a sedimentary geology throughout the majority of the watershed compound the low flow / high temperature condition that in general does not facilitate summer salmonid rearing. These extensive low gradient aquatic habitats provide abundant winter habitat for resident, fluvial and anadromous salmonid juveniles. Winter habitat, however, is not the seasonal limitation for the production and survival of salmonids within the basin.

Expanded estimates for anadromous salmonids have remained very low during each of the last three inventoried years: 2008, 2009, and 2010. Tables #1-3, below, summarize these estimates for each of the 5 sub-watersheds surveyed. Table #4, under "Site Specific Observations", contains totals for each individual stream. A surprising appearance of juvenile coho occurred during the summer of 2010 throughout the basin.. No coho were observed in the basin in 2009 and only a very minor presence was detected in 2008. Expanded juvenile coho estimates for just the 90.2 miles surveyed reached 45,858 in 2010 (expansion includes 20% visual bias). Juveniles were observed in almost every surveyed reach and tributary downstream of RM 58 on the Luckiamute mainstem. A relatively insignificant 5 ft. bedrock falls at RM 58, between the confluences of Cougar and WF Luckiamute, appears to have terminated the upstream migration of adult coho during the winter of 2009 and therefore some of the most productive stream reaches in the Luckiamute Watershed remained unutilized by coho (Boulder, Miller, Wolf, and WF Luckiamute). The continuous presence of juvenile 1+ steelhead throughout the upper Luckiamute Basin upstream of RM 58 indicates that adult steelhead have passed this barrier during all years surveyed (2002, 2003, 2008, 2009, and 2010).

Pedee, Teal, the Luckiamute mainstem (below RM 58), and Ritner represented the four highest production totals for coho in 2010. These four stream reaches accounted for 29.2%, 25.9%, 19.4%, and 14.2%, respectively (and 88.7% combined), of the inventory-wide coho population at the time of survey. The highest average rearing densities for juvenile coho were observed in SF Pedee (0.8 coho/sq.m.), Teal (0.6 coho/sq.m.), Pedee (0.5 coho/sq.m.), and Ritner

(0.4 coho/sq.m.). These reaches appear to have supported the highest levels of adult spawning activity during the 2009 winter brood. These average densities suggest a relatively low adult escapement or poor egg / fry survival rates (undetermined) for the coho. Average rearing densities in coastal watersheds for juvenile coho have been observed at levels approaching three times greater than those observed in the Luckiamute in 2010. Based on a back-calculation from the expanded juvenile coho estimate for 2010, a minimum adult escapement value for the streams surveyed would have been 417 adult coho for the 2009 winter brood (based on a 10% egg / summer parr survival rate and 1:1 male/female escapement ratio). This estimate is not a complete basin estimate with only 90.2 miles of habitat surveyed. No juvenile inventories were conducted in the basin during the summer of 2007 which would have been the parents of the adults that returned in 2009 / 2010. Therefore no assessment of trends in abundance can be established for the 2006 / 2009 coho cohort.

Production estimates for 1+ steelhead in the Luckiamute Basin decreased significantly in 2010 by 37% compared to estimates from 2009. The expanded estimate of 1,105 1+ steelhead observed in 2010 (for pool habitats only) was the lowest estimate to date in this three year inventory. The highest expanded estimate, 1,750 1+ steelhead, was observed in 2009. Some portion of the 2010 decline resulted from the restricted access in key stream reaches that had been accessible in previous years. These data gaps appeared in Price, Plunkett, Maxfield, Ritner, and Pedee. These streams, however, were relatively low producers for 1+ steelhead during all survey years. Considerable declines in 1+ steelhead production were most notable in the primary steelhead anchor habitats for this species: the upper Luckiamute mainstem (down 17%), Boulder (down 79%), WF Luckiamute (down 83%), and Teal (down 14%).

Cutthroat abundance has exhibited a minor 13% decline over the survey period which may be within the range of the normal variation inherent within the methodology. Expanded estimates for this species within the upper 5 sub-watersheds of the basin fell from 14,650 cutthroat in 2008 to 12,410 cutthroat in 2009 and 12,770 cutthroat in 2010. Again, the fact that access was denied on more private property parcels in 2010 than in 2009 suggests that the inter annual comparison of trend suffers from the lack of inter annual replicability in the case of Price, Plunkett, Maxfield, Ritner, and Pedee. The directly comparable surveys between years for the upper mainstem Luckiamute observed a 90% increase in cutthroat abundance, a 26% increase in Boulder, a 5% decline in the lower Luckiamute mainstem, a 12% decline in the WF Luckiamute and it's tributaries, a 44% decline in Vincent, a 24% decline in Teal, and a 36% decline in Waymire.

Sampling biases have not been developed for 1+ steelhead and cutthroat but are significant because of their avoidance behavior. Steelhead, cutthroat and 0+ numbers from this analysis can only be utilized to identify key rearing reaches and monitor inter-annual trends, not for basin or reach scale population estimates.

1+ steelhead distribution in the Luckiamute Basin most accurately highlights the habitats within the basin that exhibit residual system function. Consecutive survey years have observed this residual function in the uppermost sub-watershed of the Luckiamute mainstem, which included Boulder and the West Fork Luckiamute (including Miller and Cougar). These reaches exhibit prime stream gradients for sorting anadromous spawning gravels and high quality summer rearing habitat. Again, underlying gradient and channel morphology in this upper portion of the watershed drives the abundance of high quality habitat for salmonids. In addition, the transition from agriculture to industrial forest use in these upper basin reaches has preserved the riparian canopies that are required to support higher wood complexity, greater floodplain

interaction, higher water quality and the development of a complex food web for juvenile salmonid survival. Higher elevations surrounding these headwaters result in numerous cold water tributaries that mitigate for elevated summer temperature profiles. Many restoration prescriptions have been implemented in this sub-watershed which has also contributed to maintaining and enhancing salmonid production potential.

These reaches represent critical anchor habitats for the survival of anadromous salmonids within the Luckiamute Watershed. They are characterized by significant summer flows, cool water temperatures, and low rates of sedimentation. Both steelhead and cutthroat production rates have been highest within the uppermost sub-watershed during the last three survey years. 80% of all 1+ steelhead and 51% of all cutthroat were found there in 2008, 62% and 36%, respectively, in 2009, and 63% and 52%, respectively, in 2010. Coho have not been observed above the 5 ft bedrock falls between Cougar Cr and the WF Luckiamute reducing the potential for competitive interactions with the wild winter steelhead rearing in headwater reaches. The distribution of juvenile coho throughout the Pedee, Ritner, and Teal sub-basins during the 2010 inventory suggests that system function persists in these habitats also. The lower gradient habitats and finer gravel substrates of Pedee, Ritner, and Teal are well suited for coho production and their location lower in the basin make them easier targets for recolonization. Heavy sediment loading and low summer flows are both factors limiting the current capacity of the habitat in both Pedee and Ritner. Adult anadromous escapement (coho and steelhead) within the Little Luckiamute is currently the primary limiting factor for Teal Cr.

0+ trout estimates in 2009 increased 213% from the previous year's inventory. Every sub-watershed in the 2009 inventory experienced an increase in 0+trout abundance, from 81% in Maxfield-Plunket-Price to 320% in Pedee-Ritner. The largest sub-watershed abundance of the 0+ age class was observed in Pedee-Ritner (31% of inventory total) and Teal-Little Luckiamute (26% of inventory total). These increases were likely the result of the later survey timing in 2009 which clearly occurred post fry emergence. In the case of Ritner the inventory was conducted 2 months later. In the case of Teal Cr, inventories were conducted one month later.

Overall 0+trout production appeared to decrease during the 2010 inventory by 25%, despite the fact that most surveys occurred even later in the season (between 4-6 weeks later) than in 2009. The observed declines in abundance for the Pedee and Maxfield sub-watersheds were likely the result of the data gaps that appeared in 2010 resulting from spotty access for Price, Plunkett, Maxfield, Ritner, Sheythe, and Pedee. 0+ trout abundance for 2010 increased 134% in the upper Luckiamute sub-watershed and 59% in the Vincent sub-watershed. The most impressive increases in 0+trout production were observed in the upper (+841%) and lower (+220%) Luckiamute mainstem reaches. These areas have maintained full surveyor access for all years of this inventory. The most interesting decline for 0+trout was observed in Teal Cr. where abundance levels declined 74% between 2009 (August 13th) and 2010 (September 15th). No data gaps have occurred in the 6 mile Teal Cr. survey during this inventory. Inter-annual comparisons of 0+ age class abundance are largely inappropriate because of the variability in survey timing and fry emergence.

The Middle Little Luckiamute, Pedee-Ritner, and Boulder-Beaver-West Fork sub-watersheds appear to represent the top three priority zones for restoring system function and enhancing both anadromous and resident salmonid populations. A restoration focus on these areas assumes that strengthening and improving existing functional habitats is a desired basin scale strategy for expanding the distribution of salmonids to adjacent habitats.

(Table 1)
Sub-watersheds of the Luckiamute Basin – 2008 Expanded Estimates (Normalized)

Sub-watershed	Area (acres)	coho Salmon	0+	steelhead	cutthroat
Upper Luckiamute River (RM 61-68)	11,700				
Luckiamute River + Boulder, Wolf		0	205	760	3,990
West Fork Luckiamute River + Miller Creek		0	385	215	3,425
Sub-total		**0**	**590**	**975**	**7,415**
Upper Luckiamute River/Vincent Creek (RM 47.3-61)	22,300				
Luckiamute River + other tributaries		0	575	140	1,510
Vincent		6	60	0	245
Sub-total		**6**	**635**	**140**	**1,755**
Upper Luckiamute River/Maxfield Creek (RM 39.7-47.3)	20,000				
Plunkett Creek		0	510	0	535
Price Creek		0	325	0	580
Maxfield Creek		0	260	70	645
Luckiamute River		0	0	0	255
Sub-total		**0**	**1,095**	**70**	**2,015**
Upper Luckiamute River/Pedee Creek (RM 38-39.7)	19,000				
Ritner, Sheythe and Clayton Creeks		0	490	0	865
Pedee Creek		0	495	35	1,345
Luckiamute River		0	0	0	230
Sub-total		**0**	**985**	**35**	**2,440**
Middle Little Luckiamute River (RM 11.5-15.4)	23,500				
Teal, Grant, Boughey Creeks		0	700	0	825
Waymire Creek		50	100	0	100
Little Luckiamute River		6	145	0	100
Sub-total		**56**	**945**	**0**	**1,025**
2008 TOTALS		**62**	**4,250**	**1,220**	**14,650**

- Visual bias included for coho only

(Table 2)
Sub-watersheds of the Luckiamute Basin – 2009 Expanded Estimates (Normalized)

Sub-watershed	Area (acres)	coho Salmon	0+	steelhead	cutthroat
Upper Luckiamute River (RM 61-68)	11,700				
Luckiamute River + Boulder, Wolf		0	745	920	2,810
West Fork Luckiamute River + Miller Creek		0	1,125	140	1,605
Sub-total		**0**	**1,870**	**1,060**	**4,415**
Upper Luckiamute River/Vincent Creek (RM 47.3-61)	22,300				
Luckiamute River + other tributaries		0	1,835	490	2,080
Vincent		0	25	0	135
Sub-total		**0**	**1,860**	**490**	**2,215**
Upper Luckiamute River/Maxfield Creek (RM 39.7-47.3)	20,000				
Plunkett Creek		0	665	0	85
Price Creek		0	445	0	495
Maxfield Creek		0	875	0	895
Luckiamute River + other tributaries		0	0	0	20
Sub-total		**0**	**1,985**	**0**	**1,495**
Upper Luckiamute River/Pedee Creek (RM 38-39.7)	19,000				
Ritner, Sheythe and Clayton Creeks		0	2,420	0	1,170
Pedee Creek		0	1,720	50	1,330
Luckiamute River		0	0	0	0
Sub-total		**0**	**4,140**	**50**	**2,500**
Middle Little Luckiamute River (RM 11.5-15.4)	23,500				
Teal, Grant, Boughey Creeks		0	3,440	110	1,585
Waymire Creek		0	35	0	195
Little Luckiamute River		0	25	0	5
Sub-total		**0**	**3,500**	**110**	**1,785**
2009 TOTALS		**0**	**13,355**	**1,710**	**12,410**

- Visual bias not included

(Table 3)
Sub-watersheds of the Luckiamute Basin – 2010 Expanded Estimates (Normalized)

Sub-watershed	Area (acres)	coho Salmon	0+	steelhead	cutthroat
Upper Luckiamute River (RM 61-68)	11,700				
Luckiamute River + Boulder, Wolf		0	2,630	640	5,120
West Fork Luckiamute River + Miller Creek		0	1,745	55	1,540
Sub-total		**0**	**4,375**	**695**	**6,660**
Upper Luckiamute River/Vincent Creek (RM 47.3-61)	22,300				
Luckiamute River + other tributaries		8,322	2,955	300	2,380
Vincent		456	0	0	115
Sub-total		**8,778**	**2,955**	**300**	**2,495**
Upper Luckiamute River/Maxfield Creek (RM 39.7-47.3)	20,000				
Plunkett Creek		306	0	0	0
Price Creek		264	15	0	105
Maxfield Creek		564	235	0	265
Luckiamute River + other tributaries		300	0	0	30
Sub-total		**1,434**	**250**	**0**	**400**
Upper Luckiamute River/Pedee Creek (RM 38-39.7)	19,000				
Ritner, Sheythe and Clayton Creeks		7,878	80	0	200
Pedee Creek		13,386	1,425	15	1,685
Luckiamute River		300	0	0	0
Sub-total		**21,564**	**1,505**	**15**	**1,885**
Middle Little Luckiamute River (RM 11.5-15.4)	23,500				
Teal, Grant, Boughey Creeks		11,994	880	95	1,145
Waymire Creek		780	15	0	125
Little Luckiamute River		1,284	0	0	60
Sub-total		**14,058**	**895**	**95**	**1,330**
2010 TOTALS		**45,834**	**9,980**	**1,105**	**12,770**

- Visual bias included for coho only
- Estimates for 2010 are normalized to include only the same streams surveyed in 2008 and 2009. Many gaps in survey efforts, however, occurred in Plunkett, Price, Maxfield, Ritner, Sheythe, and Pedee in 2010 due to landowner denials of access. These gaps were not present in 2008 and 2009 (Tables 1 and 2, above) and resulted in an underestimate of abundance for 2010.

Most habitats were not seeded to capacity in the inventoried sub-basins and there remains extensive summer habitat available to salmonids that are currently under-utilized. The average density for a surveyed reach is an excellent measure of trend that can be monitored from year to year. However, it tends to portray only a general description of the current status within a reach. Understanding how each reach is functioning is more accurately interpreted in a review of how the rearing density changes within the reach. The pivot table graphics provided in electronic format with this summary are essential for the proper interpretation of this review.

Information on beaver dam and knotweed locations are documented in the Access database with further description recorded under the comments heading. This information is also summarized below in the Site Specific Observations. Overall, beaver activity appears to be relatively high in the Luckiamute Basin. A total of 92 active dams were encountered in 2008 over 214 stream miles, 44 active dams were encountered in 2009 over 96.6 stream miles, and 69 active dams were noted in 2010 over 90.2 miles. Many streams in the Luckiamute Basin are completely dominated by an extensive legacy of beaver impoundments. The continued collection of this supplemental data could be very revealing as land use patterns and anadromous fish

production change over time. The presence of beaver dams is a powerful ecological attribute capable of re-setting the clock on channel degradation and entrenchment.

Distribution profiles

The distribution of juveniles and their observed rearing densities for each surveyed reach provide a basis for understanding how each reach is functioning in relation to the remainder of the basin or sub-basin. These profiles can help identify spawning locations, identify potential barriers to upstream adult and juvenile migration, identify the end point of anadromous distribution and they may also indicate how juvenile salmonid populations are responding to environmental variables such as increased temperature. You will find a review of these distribution profiles within this document for each of the streams surveyed.

The average rearing density for a stream segment is utilized in this report as a metric for evaluating inter annual variation and long term trend analysis. In this work, stream averages are calculated as the sum of the individual pool averages divided by the number of pools sampled. This approach gives equal value to each pool, independent of pool size.

This analysis effort is interested in getting a sense of what the true rearing potential is for the highest quality individual pool habitats. By attributing equal value to each pool regardless of size, we have been able to identify a realistic rearing target within a stream reach for the metric of full seeding. From this type of analysis we hope to also identify key anchor habitats that exist within a stream segment that exhibit exceptional function. Identifying the localized anchor habitats that exhibit high production potential aides in understanding the unique biological and morphological characteristics that create and maintain exceptional ecosystem functionality.

Because we have chosen to calculate averages without weighting the data for pool size a direct expansion of pool surface areas multiplied by the reach average to calculate a population estimate would be inappropriate.

Adult and Juvenile Barriers

Adult migration barriers are verified by determining that no anadromous production is occurring above a given obstruction (culvert, falls, debris jam, beaver dam, etc.). There are many barriers, both natural and manmade, that impact the migration of salmonids. Some are definitive barriers that are obvious obstructions (such as bedrock falls). Many barriers however, only impede adult salmonid migrations during low flow regimes. Summer juvenile inventories allow us to definitively quantify whether passage was obtained at any point during the season of adult anadromous migration. Barrier classification becomes more subjective within stream reaches exhibiting only cutthroat populations because of the presence of resident and fluvial life history strategies populating stream reaches both above and below definitive barriers.

Juvenile salmonids typically migrate upstream for a variety of reasons (temperature, winter hydraulic refuge, food resources). Hydraulic refuge and food resources are typically fall, winter and spring migrations that would not be detectable during summer distribution inventories. Temperature however, is probably the most significant driver of upstream juvenile salmonid migrations during summer flow regimes. Juvenile barriers are subjective to the eye of the observer. The trend in juvenile density can be a method of detecting either partial or full barriers to upstream migration. Each of the surveyed reaches contains a comments section in the Access database to note the presence of culverts, jams and other physical factors that may influence the ability of salmonid populations to make full use of aquatic corridors.

Temperature Dependant Migrations

Potential temperature dependant migrations can be observed in the database by looking for densities that decrease significantly as the lineal distance increases from the mouth of the stream or tributary. This is more likely to be observed in the case of low abundance years where tributary habitats that are seeded to capacity are the exception. During years of high abundance there is a more significant potential for density dependant upstream migrations that would be indistinguishable from the distribution pattern mentioned above. The recognition of this migration pattern allows us, during years of low escapement, to identify important sources of high water quality within the basin that may be traditionally overlooked because of some other morphological condition that suggests to us that there is no significant potential for rearing salmonids (i.e. lack of spawning gravel). These stream reaches typically exhibit declining densities with increased distance from the mouth and no indication of a spawning peak (a point near the upper distribution of the population with significantly higher rearing densities). These tributaries may be functioning as important summer refugia for salmonid juveniles threatened by increasing temperatures in the mainstems.

This appears to be a critical issue in the predominantly low gradient Luckiamute Basin. Low instream flows and high solar exposure in most streams has resulted in cumulative downstream impacts that create an uninhabitable scenario for juvenile salmonids (a condition that gets progressively worse during summer months). Many miles of warm, stagnant slack-water pools were observed in the lower mainstem habitats of the Luckiamute, Little Luckiamute, and Soap Cr., to name a few. Mainstem headwaters and small tributary habitats adjacent to these reaches provide the only near term source of summer refugia.

Precautions

The average densities generated as an end product for each stream reach are the result of a 20 percent sample. Consequently, they probably vary significantly around the true average density. There are many sources of potential variation, start point, number of units sampled within the reach, surveyor variability, etc. The range of variability for at least one of these variables (start point), was documented in the final review of the 1998 Rapid Bio-Assessment conducted by Bio-Surveys for the Midcoast Watershed Council. To facilitate the proper utilization of the data included in this inventory, the 1998 results are included below. The true average density of a stream reach was retrieved by querying the database from an ODFW survey on East Fk. Lobster in the Alsea Basin where every pool was sampled. Comparisons could then be made between the true average density and a randomly selected 20 percent sub sample (every 5th pool). Only mainstem pools were utilized within the range of coho distribution to match the protocol for the Rapid Bio-Assessment.

(Table 4)

SAMPLE FREQUENCY	AVG. COHO DENSITY	AVG. SH DENSITY	AVG. CUT DENSITY	AVG. 0+ DENSITY
100 %	1.07	.03	.04	.13
50 %	1.10	.04	.03	.14
20 % Start Pool 1	0.87	.04	.03	.13
20 % Start Pool 3	1.01	.03	.03	.13
20 % Start Pool 5	1.13	.05	.04	.12

SITE SPECIFIC OBSERVATIONS

Site specific observations within this document have been organized in an alphabetical format with the exception of the largest stream segment, the Luckiamute mainstem, which is listed first. Small unnamed tributaries to the Luckiamute mainstem are listed last.

These production estimates are based on an expansion of the 20% snorkel sample in pools only and therefore do not constitute an entire production estimate for the basin. These estimates greatly under estimate the standing crop of 0+, steelhead and cutthroat because a large component of their standing crop is summer rearing in riffle / rapid and glide habitats that were not inventoried. In addition, there is also production for 0+ and cutthroat that may extend upstream beyond the end point of some surveys. The information below can be utilized to establish a baseline for trend monitoring for subsequent survey years on the basin-wide scale and by tributary. It also provides a comparison of the relative production potentials between tributaries that can be utilized as a foundation for prioritizing restoration opportunities.

(Table 5)
Luckiamute River 2010 Inventory of high priority stream segments (Expanded Estimates)

Stream	**coho**	% Total	**0+**	% Total	**Sthd**	% Total	**Cut**	% Total
Mainstem	8,904*	19.4	4,535*	44.5	905*	81.9	6,735*	51.7
Boughey/Teal	126		0		0		5	
Boulder	0		225	2.2	30*	2.7	270	2.1
Burgett/Vincent	84		0		0		40	
Clayton/Ritner	540	1.2	0		0		10	
Cougar	18		275	2.7	5	0.5	65	
Grant/Teal	12		0		0		5	
Harris	12		215	2.1	0		290	2.2
Little Luckiamute	1,284*	2.8	0		0		60	
Maxfield	564	1.2	235	2.3	0		265	2.0
Miller/WF Luck.	0		700*	6.9	40*	3.6	565*	4.3
Pedee	13,386*	29.2	1,425*	14.0	15	1.4	1,685*	12.9
Plunket	306		0		0		0	
Price	264		15		0		105	
Ritner	6,510*	14.2	50		0		110	
Rockpit	0		275	2.7	0		275	2.1
Slide	0		135	1.3	0		60	
Sheythe/Ritner	828	1.8	30		0		80	
Teal/Little Luck.	11,856*	25.9	880*	8.6	95*	8.6	1,135*	8.7
Trib. AI/Luck.	12		30		0		0	
Vincent	372		0		0		75	
Waymire/Little Luck.	780	1.7	15		0		125	1.0
WF Luckiamute	0		645*	6.3	15*	1.4	700*	5.4
- Trib. C/WF Luck.	0		320	3.1	0		215	1.7
Wolf	0		100	1.0	0		80	
Total	**45,858**	**100**	**10,105**	**99.2**	**1,105**	**100**	**12,955**	**99.5**

- * Highlighted estimates represent the top 5 producers by species and age class
- Percent contributions are indicated for only those sub-basins that contributed greater than 1% of the total
- Visual bias included for coho only

Mainstem Luckiamute

The Luckiamute mainstem is the largest habitat component within the Luckiamute basin. Due largely to this fact, the highest numbers of juvenile steelhead and cutthroat have been observed there during all surveys. In addition, most of the high quality spawning and rearing habitat in the basin can be observed overlapping the last five miles of anadromous distribution in the mainstem. This zone stretched roughly from the confluence of the WF Luckiamute (RM 61 - just upstream of a 3000 ft. boulder gorge and 4-5 ft. falls) to the confluence of Trib. AD (RM 66) where another long boulder gorge was encountered with a series of 4-6 ft. plunges and sill-logs. River mileages were computed from the stream mouth (confluence with the Willamette) where the 2008 RBA survey began and not from mileages indicated on the USGS stream layer. In 2009 and 2010 the mainstem survey began at RM 38 (Ira Hooker Bridge, just downstream from the confluence of Pedee Cr.), omitting the temperature limited lower mainstem where poor visibility also compromised survey accuracy in previous surveys. In addition, the 2009 and 2010 surveys extended upstream an additional 1.2 miles beyond the last mainstem bridge crossing to RM 69.3.

Coho parr were encountered in the mainstem between RM 38 and RM 58 during the 2010 survey for the first time in 5 years of inventory (2002, 2003, 2008, 2009 and 2010). Upstream distribution was terminated at RM 58 by a 5 ft. bedrock falls which prevented adult coho escapement into the higher quality spawning habitats of the upper mainstem as well as the West Fork, Boulder, Wolf, and Rock Pit. This falls has been passable for adult steelhead during all years of this inventory. An expanded estimate of 8,904 summer parr (including 20% visual bias) was observed in the lower mainstem in 2010. This was the third largest abundance of coho within the Luckiamute after Pedee (13,386 summer parr) and Teal (11,994 summer parr). The Luckiamute mainstem segment represented approximately 19% of the inventory-wide total. The presence of coho parr in the first sample pool of the 2010 survey at the Ira Hooker Bridge suggests that their distribution in the mainstem extended downstream below the survey start point and that some portion of this mainstem segment has not been quantified within the scope of this inventory. Average rearing density for summer parr in the mainstem was extremely low (0.1 coho/sq.m.) and exhibited a peak in abundance at RM 54.2, just below a large log jam formed in association with a series of abandoned railroad bridge abutments (above confluence of Slide Cr.). It is likely that this observed peak in abundance was an indicator of the strong selection of spawning adults for the deep, well sorted spawning gravels accumulated as a result of the log jam that was captured and maintained by the RR Bridge abutments. The current level of high function observed in this area is directly associated with the wood retention and channel roughness provided by the concrete abutments.

Stream flows were higher and colder in the upper mainstem than in any other reach in the basin. Gravel resources were also cleaner and more abundant, and pool / riffle formations (a direct result of underlying gradient) resulted in greater habitat complexity (supplemented by a helicopter-wood restoration treatment between RM 62.5 and RM 64.4). Many steep side tributaries exist throughout this reach which contribute significantly to the abundance of cold water, spawning gravel, and woody debris. Surprisingly, no coho have been observed in this reach during any of the five years of historical inventory. RM 66 marked the end of anadromous distribution during all surveys. The anadromous barriers here do not appear to be permanent. Numerous ephemeral log jam barriers and boulder falls occur between RM 66 - 68.

The abbreviated surveys conducted in 2002 and 2003 included only this upper segment of the Luckiamute mainstem (above the WF Luckiamute confluence) and a few selected tributaries.

The first chart at the end of this discussion compares the findings between years in just this upper segment. The second chart compares findings from the lower mainstem segment for 2008, 2009, and 2010. Consistent and considerable improvements in steelhead (up 52%, then 25%) were noted in the upper reach until 2009, when expanded estimates exhibit little change. In 2010, steelhead abundance declined by 17%, similar to the level documented in 2003. Cutthroat estimates for the same reach for 2010 showed an increase of 222% since 2002, and 90% since 2009. The expanded estimate of 4,770 for 2010 marked the highest abundance yet for the upper Luckiamute mainstem during this five year inventory. A 31% decline in cutthroat abundance was observed between 2008 and 2009. The highest estimate for 0+trout in the mainstem was recorded in 2010 although much of this increase was likely due to the later timing of the survey (Aug. 18-30 compared to the last week in June for 2008 and 2009). Basin-wide trends are difficult to determine for the 2010 inventory since several large data gaps were present in Price, Plunkett, Maxfield, Ritner, and Pedee.

1+ steelhead distribution in the mainstem has remained limited to the 12 stream miles between RM 53.6 - 65.6 during most survey years. The lower end of this distribution occurs near the Slide Cr. confluence (RM 54) and the upper end is terminated by large log and boulder jams (up to 8 ft. high). Density profiles for both juvenile steelhead and cutthroat peaked in similar patterns during 2002, 2003, and 2008 survey years near the upstream end of their distribution between RM 63 and 65. This reach is found above the LWD helicopter treatment segment (RM 61-63). During the 2002 survey, 79% of all 1+ steelhead and 46% of all cutthroat above the confluence of the WF Luckiamute (7 miles total) were observed in the upper 2 stream miles. In the 2003 survey 72% of all 1+ steelhead and 41% of all cutthroat were found there. Considering the same seven miles in the 2008 survey, 71% of all 1+ steelhead and 60% of all cutthroat were found there. The remarkable similarity between these survey years supports a conclusion that this stream segment represents an important anchor habitat for salmonids in the Luckiamute mainstem.

This pattern has been shifting since the 2008 survey with 64% of all 1+ steelhead and 33% of all cutthroat observed in these 2 miles in 2009 and was least pronounced during the 2010 survey when the occupation for RM 63-65 fell to 26% of all 1+ steelhead and 13% of all cutthroat between RM 61 and 68. This may be the result of steelhead and cutthroat expanding their range downstream into the maturing helicopter restoration reach which is beginning to offer exceptional habitat complexity all year around. In 2010 several pools in this restoration reach exhibited levels of extreme complexity (reportedly otter-proof) resulting from the gradual accumulation of transient woody debris. The highest individual pool count for cutthroat in the Luckiamute mainstem in 2010 occurred in this zone near RM 62. The highest individual pool count for 1+ steelhead occurred at the end of their distribution near RM 65.

Estimates from the lower half of the Luckiamute mainstem (RM 38-61) have shown comparatively little change, aside from the presence of coho in 2010. 1+ steelhead abundances appear to be gradually on the rise (down 13% in 2010) while cutthroat abundances exhibit little change (down 5% in 2010). Coho summer parr were observed down to the RM 38 start point. No cutthroat were observed downstream of RM 43, and no 1+ steelhead were observed downstream of RM 53.6. The radical change in 0+trout numbers appears to be mainly due to the later survey timing (July 2008 and 2009, Sept. 3-16 for 2010). Several sightings of large fluvial cutthroat were noted during the late summer survey of 2010 in the lower half of the Luckiamute mainstem.

Invasive knotweed remains firmly established at RM 38 (low density around Ira Hooker Bridge) and between RM 49 – 54 (high density from Hoskins Bridge to the Slide Cr. confluence

at Fisherman's Camp). Only two beaver dams were noted on the mainstem in 2009, both upstream of RM 68. No dams were encountered in 2010.

Year	**coho**	**0+**	**Sthd**	**Cut**
2002	0	135	395	1,480
2003	0	535	600	2,885
2008	0	20	750	3,630
2009	0	245	735	2,505
2010	0	2,305	610	4,770

- Normalized for RM 61 – 68 of Luckiamute Mainstem (West Fork to upper-most Mainstem bridge)
- Visual bias not included

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2008	0	-	215	150	1,515
2009	0	-	610	340	1,720
2010	8,904	0.1	1,955	295	1,640

- Normalized for RM 38 – 61 of Luckiamute Mainstem (Ira Hooker Bridge near Pedee Cr. to West Fork)
- Visual bias included for coho only

Boulder

Moderate steelhead abundance was observed in Boulder Cr. in 2002, 2003, and 2009. None were found in 2008 and a minimal presence was observed in 2010. Cutthroat abundance has displayed a gradual decline between 2002 and 2009 (the lowest level in 5 years of inventory) with a slight rebound in 2010 (+26%). 0+trout abundance showed little change in 2010 and appears to exhibit a positive trend line over the 5 year survey period. The low production levels observed during the last five surveys of Boulder Cr. seem unusual considering the existence of high quality spawning and rearing habitat for salmonids. Water quality (temp) and visibility has been excellent for all survey years.

In 2003, steelhead and cutthroat production increased 52% and 95% respectively from the previous year, in the upper seven miles of the Luckiamute mainstem, compared with 43% and 8%, respectively, in the Boulder sub-basin. Comparing the 2008 and 2003 mainstem Luckiamute surveys indicates that steelhead and cutthroat abundance each increased by 25% but declines of 100% and 22%, respectively, were noted in Boulder. In 2009 both 1+ steelhead and cutthroat abundance declined in the upper mainstem, 2% and 31%, respectively, while an increase from 0 to 140 (expanded) 1+ steelhead was observed in Boulder Cr. along with a 20% decline in cutthroat abundance. The reason for these conflicting trends is not clear. A higher level of agreement between the two reaches was observed in 2010 when 1+ steelhead estimates fell 17% in the upper mainstem (down 79% in Boulder) and cutthroat estimates increased by 90% (up 26% in Boulder).

About 1.5 miles of good spawning and rearing habitat can be observed in Boulder Cr., including the lower 0.2 miles of Tribs. A and B. Abundant gravel reserves with good sorting are present, along with high pool complexities, including numerous man-made log structures. Good stream sinuosity and pool/riffle ratios add to the habitat complexity here. Anadromous production potential in this stream appears high and probably ranks among the top four in the basin, along with the West Fork and Teal/Little Luckiamute, after the Luckiamute mainstem. A large log jam followed by a series of impassable bedrock falls ends anadromous potential at RM

2.2. No knotweed was noted. 2 beaver dams were encountered on Trib. B in 2009, 10 were noted in 2010.

Year	**coho**	**0+**	**Sthd**	**Cut**
2002	0	5	105	320
2003	0	135	150	345
2008	0	115	0	270
2009	0	205	140	215
2010	0	200	30	270

- Visual bias not included

Cougar

Anadromous potential is limited in Cougar Cr. by several bedrock slides and falls. Numerous boulder pours and log jams were also noted. A 5 ft. bedrock falls very near the mouth appears to be the main barrier. An 8 ft. log jam at RM 1.3 followed by a 15 ft. bedrock falls at RM 1.6 represents a more permanent barrier. Water quality was reported to be very high with cold, clear flows documented. This tributary is an important source of high quality flow that mitigates for increasing mainstem temperatures observed in the mainstem Luckiamute at its confluence. Upstream of the Cougar Cr. confluence at RM 59 on the Luckiamute mainstem begins the most highly productive reach in the basin for salmonids.

The 2010 survey on Cougar Cr. extended for 0.7 miles on the mainstem and encountered coho summer parr in the first sample pool (only). This was the only survey in the 5 year inventory to find summer rearing coho in Cougar Cr. This steep stream has exhibited a minor 1+ steelhead presence during all survey years except 2008. Mainstem distribution has varied between 0.2 miles (2003) and 1.3 miles (2009). Cutthroat abundance in Cougar was highest in 2008 and has decreased steadily during the last two surveys, returning to the levels observed in 2002. No knotweed noted. No beaver dams noted.

Year	**coho**	**coho sq.m.**	**0+**	**Sthd**	**Cut**
2002-1.0 miles	-	-	50	30	70
2003-1.0 miles	-	-	290	30	175
2008-1.0 miles	-	-	300	-	255
2009-2.2 miles	-	-	1,065	110	240
2010-0.7 miles	18	0.4	275	5	65

- Visual bias included for coho only

Harris

Harris Cr. was included in this inventory for the first time in 2010. This medium sized tributary enters the Luckiamute mainstem around RM 53.4, downstream of Slide Cr. and upstream of Hull Cr.. Several barriers to juvenile passage and obstacles to adult passage were encountered over the 1.1 mile survey. A 4 ft. bedrock slide was present at the stream mouth immediately followed by a 6 inch culvert perch. Next a 4 ft. beaver dam was encountered,

followed shortly by a 2 ft. irrigation dam. The final obstacle encountered was a 3 ft. bedrock falls. The survey ended upstream of the falls with a steep gradient and a confined channel within a canyon. An expanded estimate of 12 coho summer parr (including 20% visual bias) were encountered in a single, non-random plunge pool beneath the 4 ft. beaver dam. No 1+ steelhead were found. All the obstacles encountered appeared to represent barriers to juvenile migration although none represented a permanent barrier to adult migration. Moderate levels of cutthroat and 0+trout production were observed. This stream appears to be slightly larger than Slide Cr. and Hull Cr.. No stream side knotweed was encountered. 8 beaver dams were observed.

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2010 – 1.1 miles	12	2.7	215	0	290

- Visual bias included for coho only

Little Luckiamute

The 2009 and 2010 Little Luckiamute mainstem surveys began at the confluence of Teal Cr. and ended at the falls in Fall City. Salmonid production in the Little Luckiamute mainstem has remained consistently lower than in the Luckiamute mainstem during each year of this inventory (reason undetermined). The condition of low productivity in the mainstem probably also limits the salmonid rearing capacity of some of the higher quality tributaries such as Teal, Grant and Waymire. In 2008 only one juvenile steelhead (RM 8.7) and one coho summer parr (near the mouth of Waymire) were observed in the Little Luckiamute mainstem, both un-expanded. Most cutthroat and all 0+trout rearing that year occurred upstream of Falls City. Very few anadromous fish of any species were encountered in 2009.

Significantly higher numbers of cutthroat were observed in 2010 along with a small population of coho summer parr. A very low average rearing density of 0.02 coho/sq.m. was maintained all the way from the mouth of Teal Cr. to the falls in Falls City. This population represented 2.8% of the 2010 inventory total estimate for coho. Individual pool counts for coho increased above the mouth of Teal Cr. and peaked (104 parr) about one mile upstream of that confluence. The highest individual pool count for coho in the Little Luckiamute mainstem occurred in the non-randomly selected pool at the base of the falls in Falls City (325 summer parr, expanded). The presence of coho summer parr in the first sample pool of the 2010 survey suggests that their distribution extended downstream from that point and that a portion of the summer rearing population was un-quantified.

Many warm water fish species were observed including shiners, dace, squawfish, and suckers. Several cutthroat exhibited signs of infection. Mixed substrates and large islands were noted. Knotweed presence was heavy near the mouth of Teal Creek. One beaver dam was encountered.

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2008 - 27.4 miles	5	0.01	220	5	960
2009 - 3.8 miles	0	-	25	0	5
2010 - 3.9 miles	1,284	0.02	0	0	60

- Visual bias included for coho only

Maxfield

This stream exhibits good anadromous spawning conditions. An equal distribution of gravel, cobble and exposed bedrock riffle was observed. Good in-stream wood complexity was common. Areas of high solar exposure and thick algae were reported and overall water temperatures were noted as warm. Visibility was poor below RM 0.4. Surveyor access was denied between RM 0.4 and RM 3.2 (2.8 miles) as well as in Trib. A (0.5 mile). Coho were present in 2010 for the first time in three surveyed years. Their distribution extended in low rearing densities from the mouth of Maxfield upstream to RM 3.8 where a 2 ft. mud falls appeared to terminate juvenile migration. A peak rearing density of 0.9 coho/sq.m. was observed at RM 3.3 just upstream of Trib. A (RM 3.2) and the mainstem access denial. This suggests that significant coho production was probably occurring in the downstream segment where access was denied (RM 0.4 – RM 3.2). A wide meander belt and old beaver swamps were encountered further upstream before a shift in gradient and a 3 ft. bedrock falls ended the survey at RM 5. Increasing bedrock exposures and multiple cascades limit production in the upper reaches of the Maxfield Cr. mainstem.

Full spanning log structures were present as a result of an instream restoration project on the Hall property. These structures did not appear to be maintaining significant salmonid rearing densities during summer flow regimes. The cumulative impact of increasing temperature on a downstream gradient from headwaters to mouth, exacerbated by summer water withdrawals has probably resulted in the low salmonid rearing densities on the Hall property.

Maxfield was one of only 5 tributaries in the basin where 1+ steelhead were observed in 2008. No steelhead were observed during the 2009 or 2010 surveys. Cutthroat and 0+trout abundance increased significantly in 2009 (30% and 178% each) but cutthroat densities remained very low with several gaps in distribution. Total expanded estimates for 1+ steelhead and cutthroat from 2010 cannot be directly compared with those from 2008 and 2009 since approximately 3.3 miles of stream were dropped from the 2010 survey because of a loss of access. Production estimates for cutthroat appeared moderate and consistent between all three years for the segments included in 2010.

The potential for higher coho, steelhead, and cutthroat production clearly exists here with improved adult escapement and a focus on restoring ecological function. Water withdrawals are most likely limiting production potential during the summer and restricting the access to and quality of, the aquatic habitats. Increasing stream flow typically leads to cooler water temperatures, deeper pools, and cleaner gravels.

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2008	0	-	315	70	690
2009	0	-	875	0	895
2010	564	0.3	235	0	265

- Visual bias not included

Pedee

High abundances of coho parr were observed in Pedee and SF Pedee in 2010. This was the first year of five that exhibited coho rearing in the Pedee sub-basin. Approximately 29.2% of all coho in the 2010 Luckiamute inventory were encountered in the Pedee mainstem and SF Pedee. The Pedee sub-basin (9 stream miles) supported the largest abundance of coho within the Luckiamute basin during the 2010 inventory (an estimated 13,386 summer parr, expanded including a 20% visual bias). Teal Cr., including Grant Cr., supported the second largest abundance in 6.1 stream miles (11,994 summer parr). The Pedee Cr sub-basin total represents an estimated adult escapement of 107-122 adult coho during the 2009 winter brood. Several portions of the lower Pedee Cr mainstem (below RM 2) were not included in the 2010 survey because of a lack of landowner permission. This issue is problematic when comparing intra-annual trends for the sub-basin. The mainstem estimates provided in the table below for 2010, therefore, under estimate the subbasins production levels for all species. The upper NF Pedee survey and all of the SF Pedee survey remained intact and both are directly comparable to previous years.

Most coho (68%) were observed in the 6.2 miles of the Pedee Cr mainstem in 2010. The average rearing density of 0.5 coho/sqm observed there was interestingly very similar to the average rearing densities observed in Ritner Cr (0.4 coho/sqm), Waymire Cr (0.5 coho/sqm) and Teal Cr (0.6 coho/sqm). These rearing densities are approximately 1/3 of the levels currently considered as seeded to capacity for coastal streams that were evaluated by ODFW to produce the Nickelson / Lawson coho production model. Significant differences in habitat quality may suggest that this coastal model is an inappropriate tool for determining full seeding in Willamette Valley tributaries.

A peak density of 1.9 coho/sq.m. was observed at RM 2.9 of the Pedee mainstem in 2010, just upstream of the confluence of SF Pedee (RM 2.7). The highest average rearing density in a unique stream segment for coho in 2010 was observed in SF Pedee (0.8 coho/sq.m.) over 2.5 stream miles. Two significant peaks were observed in the first inventoried pool (2.2 coho/sq.m.) and at RM 1.4 (2.5 coho/sq.m.) of the SF Pedee mainstem. 89% of all coho found in SF Pedee were between these two peaks. A total expanded estimate of 4,248 summer parr (including visual bias) were observed in SF Pedee, approximately 32% of the Pedee Cr sub-basin total.

No coho were observed in Tribs. A or B of either the Pedee or the SF Pedee mainstems. A minimal coho presence was detected in Trib. D (600 ft. survey) of the Pedee Cr mainstem near the end of coho distribution. coho distribution in Trib. D ended at a 1 ft. diameter culvert perched by 6 ft. with a 3 ft. sill log trapped at the upper end of the culvert. The presence of several bedrock cascades, low summer flows and limited spawning gravels limits the production potential of Trib D. The 4ft. bedrock falls at the mouth of Trib. B followed by many long stretches of exposed bedrock significantly reduces anadromous production potential here as well. Trib.A exhibited the best potential for spawning and summer rearing of all the unnamed tributaries in the sub-basin. There is however only minor summer flows, heavy siltation and poorly sorted gravels. A 6ft. steel pipe culvert was perched by 1 ft. at the mouth of Trib. A, representing a barrier to upstream juvenile migrations from the mainstem.

Steelhead production in the sub-basin has remained minimal during all surveyed years. In 2009, only SF Pedee exhibited 1+ steelhead rearing. Most observations have been in the upper NF Pedee and lower SF Pedee. Cutthroat production has been strong in the Pedee Cr sub-basin when compared to the remainder of the Luckiamute tributaries during most surveyed years. This

sub-basin contained the highest abundance of cutthroat of all the Luckiamute tributaries inventoried in 2010 and the second largest population in both 2008 and 2009 (after West Fork and Teal). In 2010, this represented 13% of all cutthroat observed in the inventory (10% in 2009, 7% in 2008). Cutthroat estimates have increased for two consecutive years in the Pedee Cr mainstem (+41% in 2010) despite the fact that 1.7 miles of surveyed stream were dropped due to a loss of access in 2010. This suggests a significant increase in production for that reach. There has been comparatively little change in cutthroat abundance in the upper NF Pedee. Cutthroat estimates have been considerably higher in SF Pedee during the last three years than in 2002 or 2003. The abundance of 0+ trout declined 72% in the upper NF Pedee and 37% in SF Pedee. Changes in the abundance of the 0+ age class is not a viable indicator of trend.

A large amount of aquatic habitat is present in the Pedee sub-basin. About ten miles of stream was surveyed here in 2008, and most of it was accessible to anadromous salmonids. Habitat conditions were poor, however, throughout the lower three miles of the mainstem (deep channel entrenchment, heavy sedimentation, low summer flows). Habitat conditions began to improve upstream of the South Fork confluence. Good pool / riffle dynamics provided for gravel sorting and a boost in complexity. Anadromous potential in both of the main forks ends in steep boulders, bedrock steps, and large wood jams.

The highest quality habitats were observed in SF Pedee. 2.5 stream miles were accessible to anadromous adults. Productive conditions were noted, including cold water, high quality gravel, well scoured pools, and two passable culverts. The active stream channel was smaller than NF Pedee, but exhibited higher quality habitat conditions. The upslope harvest buffer was intact and some old growth Douglas Firs had been retained in the riparian. A small 2 ft. falls was present at RM 0.4 which represents a barrier to juvenile migrations. SF Pedee is capable of supporting fair to high levels of anadromous spawning and rearing. The first 1.4 miles of SF Pedee was surveyed in both 2002 and 2003. These results are summarized below for comparison.

The above observations and survey data suggest that SF Pedee and the upper 3 miles of NF Pedee exhibit the highest potentials for anadromous salmonid production in the Pedee Cr. sub-basin. These two reaches, along with Teal Cr., the lower WF Luckiamute (including Miller Cr.), Boulder Cr., and the upper Luckiamute mainstem, represent the most important anchor habitats for salmonids in the Luckiamute Basin. No knotweed has been reported in Pedee. A total of 3 beaver dams were encountered in the Pedee Cr mainstem.

Pedee mainstem (6.2 miles)

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2008	-	-	160	30	530
2009	-	-	1,140	0	795
2010	9,132	0.5	760	15	1,120

- Visual bias included for coho only
- 2010 survey missing 1.7 miles (landowner denial)

Normalized for RM 4.6 (Trib. B) – RM 6 of Pedee mainstem (NF Pedee)

Year	coho	coho/sq.m.	0+	Sthd	Cut
2002	-	-	45	20	270
2003	-	-	50	35	220
2008	-	-	60	10	245
2009	-	-	935	-	380
2010	1,795	0.5	265	5	245

- Visual bias included for coho only

Normalized for RM 0 – RM 1.4 of SF Pedee

Year	coho	coho/sq.m.	0+	Sthd	Cut
2002	-	-	55	5	105
2003	-	-	115	-	335
2008	-	-	90	-	550
2009	-	-	470	40	470
2010	3,895	1.0	295	-	425

- Visual bias included for coho only

Plunket

Low numbers of juvenile coho were observed in Plunket in 2010. This was the first time during this 3 year inventory that coho have been documented utilizing Plunket Cr. The expanded estimate here of 306 summer parr (including 20% visual bias) suggests that probably two pairs of coho adults succeeded in spawning within the tributary during the winter of 2009. The above coho estimate is likely to be an underestimate of the total population since surveyor access was denied between RM 1.1-1.9 in 2010. Peak density (0.7 coho/sq.m) was observed at RM 1.9 where the upper half of the survey began. The upper half continued to RM 2.6. Moderate cutthroat and 0+ trout production were observed in Plunket in 2008. Cutthroat estimates decreased by 84% in 2009 and 100% in 2010. Estimates for 0+trout increased slightly in 2009 then collapsed to zero in 2010. A portion of this decline is the result of a decrease in the lineal distance surveyed each year due to a loss of access. Survey distance has decreased by about one mile each year. No steelhead were present during any survey year.

The dry channel conditions encountered at several points during the survey represent temporary barriers to juvenile migrations. A 2 ft. bedrock falls at RM 0.7 and a 4 ft. bedrock falls at RM 1.1 represent more permanent barriers to juvenile migration. The second falls probably restricts adult passage much of the time, although the presence of juvenile coho upstream to RM 2.6 in 2010 indicates that it is passable. Coho distribution ended in large cobbles and steep stream gradients. Medium visibility, low flows, and some pool stagnation was noted. Low wood complexity was reported throughout the survey and bedrock exposures were frequent. A moderate knotweed presence was noted at RM 1.4 in 2009. Two active beaver dams were encountered in 2009, none were observed in 2010. Production potential for anadromous adults appears low in this sub-basin.

Year	coho	coho/sq.m.	0+	Sthd	Cut
2008-3.4 miles	-	-	510	-	535
2009-2.4 miles	-	-	665	-	85
2010-1.8 miles	306	0.3	-	-	-

- Visual bias included for coho only
- Lineal distance not normalized for direct comparison

Price

Price Cr. exhibits potential for anadromous production. Good gravels and cold water were present. Ample shade, many deep pools, and numerous channel braids were also noted. Abundant reserves of old wood were encountered throughout the survey, adding to habitat complexity. The stream passed through a diverse assortment of forest, grassland, and cattle pasture. A similarly diverse mix of sand, mud, cobble, and gravel was present along the stream bottom. Dry channel conditions near the mouth and a culvert plunge of 2 ft. near RM 4.2 limit juvenile migrations. Survey efforts in 2010 ended at the end of coho distribution at RM 2.5.

Low level coho production was observed in Price in 2010. This small population probably resulted from the spawning activities of two pairs of adult coho. Access was denied on Price Cr. between RM 0.4 and RM 1.4. Rearing density for coho peaked slightly (0.3 coho/sq.m.) at RM 0.4 which suggests that higher production levels might have occurred in the stream reach not included in the survey. Cutthroat abundance has declined each year along with survey distance. In 2010, all cutthroat were observed upstream of RM 1.4. No steelhead have been observed in Price Cr in any surveyed year.

There is no obvious reason that steelhead would not succeed here with sufficient adult escapement. Cutthroat production could also be enhanced with attention to water quantity and quality. Water withdrawals are most likely limiting habitat quality and access from the mainstem Luckiamute for temperature dependant upstream migrations during low summer flow regimes. Increasing summer stream flows would be a high priority restoration prescription for this tributary. Two beaver dams were noted in 2010.

Year	coho	coho/sq.m.	0+	Sthd	Cut
2008 - 4.9 miles	-	-	325	-	580
2009 - 4.4 miles	-	-	445	-	495
2010- 1.5 miles	264	0.2	15	-	105

- Visual bias included for coho only
- Lineal distance not normalized for direct comparison

Ritner

5.6 miles of the Ritner mainstem were surveyed in 2008 and 2009, beginning at the stream's mouth and ending at the 15 ft. impassable falls just downstream of Trib. A. Surveys in 2010 began and ended at the same locations, although several landowners denied surveyor access to approximately one mile of stream (over 3 separate data gaps) downstream of RM 3. The two main tributaries in this sub-basin, Clayton and Sheythe, have been summarized separately, below. Approximately 3.5 miles of upper Ritner and Trib. A were also surveyed in 2002 and

2003. These results have been normalized below for the 2.6 mile stream reach between the mouth of Sheythe Cr. and the 15 ft. falls for each of the five surveyed years.

Coho production was observed throughout 9.4 miles of the Ritner sub-basin in 2010. A total expanded estimate of 7,878 summer parr (including 20% visual bias) were present in the sub-basin at the time of survey, 83% in the mainstem (5.6 miles), 7% in Clayton (2.7 miles), and 11% in Sheythe (1 mile). Average rearing densities were low in these three reaches (0.4 coho/sq.m., 0.2 coho/sq.m., and 0.2 coho/sq.m., respectively), but reached a moderate 1.0 coho/sq.m. in Trib. A of Sheythe (366 summer parr, including 20% visual bias). 52% of the total sub-basin productivity was observed in the 2.6 mile upper mainstem reach (0.6 coho/sq.m. average). Back-calculation from the total sub-basin estimate stated above, suggests a minimum adult escapement of between 63-72 coho for the 2009 winter brood. As a whole, the Ritner sub-basin contributed 17.2% to the basin-wide coho estimate, making it the third most productive tributary in the 2010 inventory after Pedee and Teal. A main tributary of Ritner Cr (Kinsey Cr.) has not been surveyed in any of the surveyed years. The upper Ritner mainstem appeared to be by far the most productive reach in the sub-basin for all anadromous species for each of the 5 survey years. 63% of all coho in the Ritner mainstem were observed there in 2010, along with the two highest peaks in rearing density at RM 3.7 (1.2 coho/sq.m.) and RM 4.7 (1.3 coho/sq.m.). Almost all cutthroat and 0+trout in the mainstem in 2008 and 2009 were also found in this reach.

Moderate stream gradients throughout the upper mainstem provide the best spawning and rearing habitat for anadromous species. Clear and cold stream flows have been the norm here. The falls represents a definitive barrier to migration. Stream gradients increase rapidly above the barrier falls where the mainstem canyon narrows and several smaller bedrock falls are present. Cutthroat and 0+ trout were observed above the falls also in 2002, 2003, and 2008.

Downstream of Sheythe and Clayton the mainstem channel is compromised by deep channel entrenchment, high solar exposure, and heavy deposition of sediments. Low stream flows result in slow pool turn over rates and summer water quality obviously declines. Several coho parr were observed with external membrane responses to either parasites or infection. Large schools of dace were observed in this reach along with occasional observations of freshwater mussels. A total of 10 active beaver dams were documented.

Moderate cutthroat production was observed during all previous years of survey with little change in abundance between 2008 and 2009. Both cutthroat and 0+trout estimates declined sharply in 2010 (down 84% and 98%, respectively, in upper Ritner). A similar trend was observed in the lower mainstem in 2010 despite the survey data gaps. Abundance levels for these two age classes appeared to be at their lowest levels for all 5 surveyed years in 2010. Survey timing may have contributed to these variations in the upper mainstem (6/26/08, 8/26/09, 9/9/10), particularly in the case of the extreme spike in 0+trout abundance on 8/26/09. Basin-wide trends were difficult to determine in 2010 since survey access was denied to many stream reaches. Current inventories indicate that steelhead are no longer present. Low level steelhead production was observed in 2002 and 2003.

The main triple culvert at RM 4.4 appeared adequate for fish passage even though two of the pipes displayed an 8 inch perch. This crossing does however compromise the natural migration and delivery of forest resources to lower stream reaches (migratory LWD and gravel). Examination of fish densities revealed spikes in density at this crossing during some years but not others (suggesting that the site sometimes inhibits the upstream migration of juveniles). There was no evidence of this effect in 2010. Moderate to large spikes in cutthroat density were

also observed just below the main falls during some surveys. A moderate spike in coho density was observed at this location in 2010. Invasive knotweed was observed at the mouth of Ritner Cr.

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2008	-	-	290	-	600
2009	-	-	1,540	-	620
2010	6,510	0.4	50	-	110

- 5.6 mile Ritner mainstem only, ending at falls/Trib.A
- Estimates for 2010 are not directly comparable due to survey gaps (landowner denials)
- Visual bias included for coho only

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2002	-	-	70	10	175
2003	-	-	155	35	285
2008	-	-	280	-	535
2009	-	-	1,375	-	430
2010	4,110	0.6	25	-	70

- Normalized for Upper Ritner (Sheythe confluence to falls/Trib. A confluence – 2.6 miles)
- Visual bias included for coho only

Clayton / Trib. to Ritner

Low level coho production in Clayton in 2010 accounted for 7% of the Ritner sub-basin total. This small abundance of summer parr represented a minimum of 3 adult spawning pairs. A relatively low average rearing density of 0.2 coho/sq.m. was maintained in Clayton for a relatively long distance of 2.7 miles. A minor presence was also detected in Trib. A. Moderate cutthroat presence had been observed in Clayton during previous survey years until 2010 when estimates declined dramatically. No 0+ age trout were observed here in 2010. Estimates for these two age classes were very low also in Clayton during the 2008 and 2002 surveys. 1+ steelhead were observed in low numbers in 2002 and 2003 only. Poor visibility in Clayton during all survey years limits confidence in these estimates. Fine gravels were present intermittently throughout the mainstem of Clayton, although siltation rates were high. Production potential for anadromous fish appears low in Clayton and minimal in Trib. A. The survey ended in steeper gradients and larger cobble above a few bedrock steps. The Clayton Cr. culvert was not a barrier to migration.

Clayton Cr. and Sheythe Cr. (1.0 mile) are the two main tributaries to Ritner Cr.. Coho production appeared about 53% higher in Sheythe (including Trib. A) than in Clayton during the 2010 survey, despite the shorter distribution distance. Cutthroat estimates were about 8 times higher. No knotweed was noted in Clayton. Two beaver dams were encountered.

Year	coho	coho/sq.m.	0+	Sthd	Cut
2002-0.8 miles	-	-	25	5	75
2003-0.8 miles	-	-	165	15	145
2008-2.9 miles	-	-	55	-	115
2009-2.1 miles	-	-	160	-	150
2010-2.7 miles	540	0.2	-	-	10

- Visual bias included for coho only
- Lineal distance not normalized for direct comparison

Sheythe / Trib. to Ritner

This stream is the largest and most productive tributary of Ritner Cr. Five years of surveys here have documented generally poor spawning and rearing conditions for anadromous fish. Low numbers of cutthroat and 0+trout only were present until 2010 when moderate coho production occurred. Cutthroat and 0+trout production remained extremely low. An expanded estimate of 462 coho summer parr (including 20% visual bias) were observed in the mainstem (1 mile) with an additional 366 coho summer parr documented in Trib A (only 250 ft.). An expanded estimate of 30 cutthroat were also observed in Trib. A. The total estimate for coho in Sheythe Cr. (828 summer parr) represented a minimum of 4 adult coho pairs spawning and accounted for 11% of the Ritner sub-basin total. The total estimate for cutthroat in Sheythe (80 – expanded) during the 2010 survey accounted for 40% of the Ritner total.

Medium visibility during all surveys reduces our confidence in the snorkel observations in Sheythe Cr. The consistency in visibility classifications between years however, suggests that the comparison for trend between years in the chart below is valid. Rearing densities for coho were low, averaging 0.2 coho/sq.m. and peaking at 0.6 coho/sq.m. near RM 0.7. Spawning conditions appear poor in Sheythe due to high siltation rates. A few marginal sites with fair gravels were noted around RM 1. The confluence with Trib. A occurs near an extensive swamp stretching across the wide floodplain. Several islands have been created there in-between multiple channel braids. This appears to be the most productive and unique zone in Sheythe Cr.. A strong beaver legacy was present there also and 7 active (massive) dams were noted in 2010. No knotweed was noted. The culvert at the mouth was in good condition and passable to adults and summer juveniles.

Year	coho	coho/sq.m.	0+	Sthd	Cut
2002	-	-	-	-	120
2003	-	-	50	-	90
2008	-	-	10	-	5
2009	-	-	175	-	95
2010	462	0.2	20	-	50

- Normalized up to RM 1 (not including Trib. A)
- Visual bias included for coho only

Rock Pit

The 2010 survey extended 1.8 miles upstream from the confluence with the mainstem Luckiamute and encountered two barriers to migration. The first culvert at the mouth of the stream was partially collapsed, full of wood, and perched by 3 ft., while a second culvert at RM 0.8 also exhibited a 3 ft. plunge. A low level 1+ steelhead presence was detected in 2009 only, indicating that the culvert at the mouth was passable for adults at that time. Large wood jams and steep stream gradients limit adult passage and spawning potential upstream of RM 2. The relatively small cutthroat and 0+trout abundances in Rock Pit have increased during each survey year. Production potential appears low. Only one active beaver dam was encountered. Short surveys in Tribs. A and B have exhibited low abundances of 0+trout and cutthroat only. Coho distribution in the Luckiamute mainstem ended about 0.5 mile downstream of the Rock Pit confluence in 2010 at a relatively small 5 ft. bedrock falls. No coho were observed anywhere in the basin upstream of that point.

Year	**coho**	**0+**	**Sthd**	**Cut**
2008	-	-	-	145
2009	-	80	75	180
2010	-	210	-	225

- Mainstem only
- Visual bias not included

Slide

A 6 ft. bedrock slide at the mouth of Slide Cr. and a 12 ft. vertical debris jam at RM 0.5 prohibit upstream juvenile migrations and seriously limit adult passage in this stream. High stream flows and cold water temperatures appear to be the most important contributions from this moderately large sub-basin to the Luckiamute mainstem habitat. No coho or steelhead have been found here during this inventory. No beaver dams or knotweed were reported. No surveys were done in Slide in 2009.

Year	**coho**	**0+**	**Sthd**	**Cut**
2008-0.2 mile	-	40	-	5
2010-0.5 mile	-	135	-	60

- Visual bias not included

Teal / Trib. to Little Luckiamute

The steep canyons at the headwaters of this sub-basin provide one of the best sources of cold summer flows to the Little Luckiamute. The main drinking water reservoir for Falls City is located on a high bench above the upper stream channel. Anadromous access to much of the best habitat in Teal Cr. is blocked by numerous impassable waterfalls. Surveys here in 2009 and 2010 ended at the first of these falls (8 ft.) at RM 6. Significant coho production was observed in Teal in 2010 with evidence of upstream juvenile migrations in the two main tributaries Grant (0.7 miles) and Boughey (200 ft.). This sub-basin accounted for 26% of all coho in the 2010

inventory which ranked as the second largest tributary contribution after Pedee Cr. (29% over 9 stream miles). Almost all coho production (98.8%) occurred in the Teal Cr mainstem. Back-calculation from the above summer parr estimate suggests a minimum adult escapement of 96–109 coho within Teal Cr. for the 2009 winter brood. The low average rearing density of 0.6 coho/sq.m. observed for summer parr in Teal during the 2010 survey indicates that the rearing potential for this habitat is much higher (utilizing metrics for fully seeded habitat derived from ODFW's Nickelson / Lawson Model).

Significantly improved cutthroat production (+295%) was observed in Teal in 2009 with a minor decline of 24% observed in 2010. A similar trend was observed for 1+ steelhead and 0+ trout which increased in abundance dramatically in 2009 and then declined (down 14% and 73%, respectively) in 2010. Differences in survey timing (7/2/08, 8/13/09, 9/15/10) definitively effect these observations. Estimates for all species remained higher in 2010 than when first surveyed in 2008. Cutthroat and 1+ steelhead densities progressively increased as the falls were approached. No cutthroat were observed downstream of RM 1.6. No 1+ steelhead were observed downstream of RM 2.4. This was likely the result of the poor visibility documented by the field crew below RM 2.0. Rearing densities for coho peaked near RM 3.2 (2.5 coho/sq.m.) just upstream of the mouth of Boughey. Coho and 1+ steelhead distribution ended at a 4 ft. log falls at RM 5.3, about 0.7 miles downstream of the first major bedrock falls. Extra large fluvial cutthroat trout were observed in Teal, as well as in the upper Luckiamute mainstem, in 2010.

Teal Cr. was one of the largest fish producers in the 2009 and 2010 Luckiamute Inventories. This stream currently represents one of the top four anchor habitats for anadromous species in the basin, along with Pedee Cr., WF Luckiamute, and the upper Luckiamute mainstem. In 2010, Teal Cr. contributed the second highest estimate for 1+ steelhead (8.6%), after the Luckiamute mainstem, and the fourth highest estimate for cutthroat (9%), after the three stream reaches mentioned above. The potential for increased anadromous production appears large in Teal Cr. and is probably currently limited by low adult escapement.

The lower 3 miles of Teal Cr. was dominated by very low stream gradients and a sinuous entrenched channel. This morphology is directly related to the entrenchment in the Little Luckiamute mainstem that provides hydraulic control to its tributaries. Most pools were long and flat and exhibited extensive exposure to solar impacts. Substrates were dominated by sand with a mix of fine and coarse gravels in the tail-outs of some pools. Red side shiners and dace dominated these warm-water habitats. Numerous log jams were also present, along with 3 beaver dams.

The stream channel changes quickly near RM 4 where Teal Cr. enters a narrow canyon and stream gradients begin to climb. The next two stream miles appear to exhibit the most suitable stream gradients and overall higher quality habitats for anadromous fish in the Teal Cr. sub-basin. Surveys in 2008 extended upstream to RM 7.5 and encountered numerous waterfalls and bedrock slides, including the 8 ft. falls at RM 6 (the end of anadromous passage) and a large 35 – 40 ft. falls at RM 6.3. Cutthroat and 0+trout were observed in good numbers upstream of these falls. The NF Teal exhibited similar characteristics, including a larger 50 ft. falls. Invasive knotweed was noted near the stream's mouth, at RM 1.9, and at RM 3.5.

Minor upstream migrations of coho summer parr were noted in Boughey (126 summer parr, expanded) and Grant (12 summer parr, expanded) during the 2010 surveys. Anadromous production potential in Boughey appears very low due to the lack of spawning gravel, low stream gradient, poor water quality, and a plugged culvert near the mouth. Production potential appears somewhat higher in Grant although a series of small falls at RM 0.4 (4 ft.) and RM 0.6 (5 ft.)

represent significant obstacles to adult migration and definite barriers to juvenile migration. A low abundance and poor sorting of spawning gravels, high siltation rates, and channel entrenchment were observed in Grant. Low numbers of cutthroat were observed in both streams.

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2008	-	-	425	-	380
2009	-	-	3,205	110	1,500
2010	11,856	0.6	880	95	1,135

- Normalized for RM 0 – 6 (up to first 8 ft. falls)
- Not including Boughey or Grant
- Visual bias included for coho only

Vincent

Vincent Cr. is warm and heavily burdened with silt. Very little flow was noticeable and most pools were dominated by stagnant water and large schools of dace. Visibilities were moderate to poor below the forks with Burgett Cr. at RM 2 and then improved for the remainder of the 3.1 mile survey. Water temperatures also decreased upstream of the mouth of Burgett as pool formation and gravel sorting improved. The highest production potential in the Vincent sub-basin is present between RM 2-3 in the mainstem. Moderate wood complexity was present in this reach and the riparian vegetation appeared very healthy, including a continuous mixed forest canopy of Pine, Douglass Fir, and Oak. Burgett and Alexander Cr. were both surveyed in 2008 and exhibited overall poor conditions for anadromous salmonids (lack of spawning gravels, barriers to adult migration, and elevated water temperatures). Burgett Cr. was again surveyed in 2010 due to the presence of coho in Vincent Cr. Coho distribution in Vincent in 2010 ended downstream of the mouth of Alexander and so this small stream was not surveyed. Spawning conditions in Vincent degrade upstream of RM 3 (the confluence of Alexander, roughly) due to increasing substrate size, bedrock exposure, and steeper gradients.

Low level coho production was observed throughout 3.1 miles of Vincent and 0.8 miles of Burgett in 2010. This small abundance suggests a minimum of two adult pairs of coho spawned in the reach for the 2009 winter brood. Summer parr rearing here in 2008 had most likely migrated upstream into Vincent from a spawning event elsewhere. Rearing densities averaged an extremely low 0.1 coho/sq.m. over the 3 mile Vincent distribution as well as the 0.8 mile Burgett distribution. A minor peak in density of 0.4 coho/sqm. was observed at RM 2.7 in Vincent Cr. Poor visibility throughout much of lower Vincent and all of Burgett likely resulted in an under-estimate of overall production for all species. Production estimates for Vincent appear in the table below. Production estimates for Burgett have been omitted from this table since no survey was conducted there in 2009. An expanded estimate of 84 coho summer parr (including 20% visual bias) were observed in Burgett in 2010, as well as 40 cutthroat (also expanded). Anadromous distribution potential ends in Burgett at a 10 ft. cement dam at the Lake of the Winds private campground (RM 0.8).

Cutthroat production has declined consistently in Vincent and no steelhead have been documented in any survey year. In 2010 cutthroat estimates decreased 44% from the previous year and no 0+ age class trout were observed. Low stream gradients and stagnant pools suggest

the potential for poor water quality during summer flow regimes for most of the aquatic corridor in Vincent and Burgett.

In general, this sub-basin exhibits limited anadromous potential and does not exhibit the typical anchor habitat characteristics required for the persistence of large anadromous salmonids. No beaver dams were encountered and no knotweed was observed.

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2008	6	0.01	60	-	245
2009	-	-	25	-	135
2010	372	0.1	-	-	75

- Visual bias included for coho only
- Not including Burgett (not surveyed in 2009)

Waymire / Trib. to Little Luckiamute

A small 3 ft. bedrock falls at the mouth of Waymire represents a barrier for the upstream migration of juveniles but not adults. In 2008, a low abundance of coho was observed in the plunge pool below this falls. The fact that there were no additional coho parr upstream of this falls in Waymire Cr suggests that these juveniles were seeking temperature refugia from the mainstem Little Luckiamute. The only other coho observed in the Little Luckiamute sub-basin (5 – expanded) in 2008 were observed in the Little Luckiamute mainstem just upstream of the mouth of Waymire and just downstream of the 30 ft. falls in Falls City. This combination of coho sightings suggests that a single adult spawning event occurred somewhere between the falls at Fall City and the confluence of Waymire. No coho were observed anywhere in the Luckiamute basin in 2009.

In 2010, coho were again observed in Waymire but their distribution extended to RM 1.4. The average rearing density throughout this distribution was 0.5 coho / sqm. A minimum of 4 adult pairs of spawning coho would have likely been present to produce this level of summer parr abundance. The highest rearing density (4.1 coho/sq.m.) occurred in the first survey pool, downstream of the falls suggesting that again significant numbers of juveniles were attempting to escape the mainstem Little Luckiamute for cooler summer refugia. Rearing density declined gradually from that pool as the survey progressed upstream. Unfortunately a denial of access for the survey occurred at RM 1.4 and extended another 1,000 ft. upstream. No coho parr were observed upstream of that point. Large bedrock slides and boulder steps limit production potential beyond RM 2. A 2.5 ft. concrete step below the culvert at RM 1 (one culvert up from the Falls City Rd.) limits juvenile migration also. Many coho were observed throughout Waymire with substantial infections or lesions on their heads, fins, and tails.

No steelhead have been observed in Waymire Cr in any survey year. Low level cutthroat production has been observed during all three survey years. A 95% increase in abundance in 2009 was followed by a 36% decrease in 2010. Cutthroat densities throughout the mainstem remained very low during the 2010 survey. Estimates for 0+trout have also declined significantly over the survey period.

Moderate production potential was present throughout most of Waymire Cr. Good gravels and a mixed canopy of alder, maple, ash, and blackberry were present. Beaver activity

appeared to be high in 2008 when 9 active dams were encountered. None were observed in 2009. A total of 2 active dams were noted in 2010. Stream gradients and flows were relatively low and most pools were long and flat with limited wood complexity. A large body of knotweed was noted at the first culvert under the Falls City Rd. between RM 0.7 – 0.9.

Year	**coho**	**coho/sq.m.**	**0+**	**Sthd**	**Cut**
2008	40		100	-	100
2009	-	-	35	-	195
2010	780	0.5	15	-	125

- Visual bias not included

Wolf

A clear legacy of beaver activity has been observed in this stream. It is suspected that a dam break flood event has recently scoured large amounts of sediment from the channel (possible collapse of historical beaver dams). Bedrock exposures were common and channel diversity was low. Numerous active dams were noted during the 2002 and 2003 surveys, one dam only in 2008 and 2009, and 6 dams in 2010. Stream flows were very low and visibility was classified as poor. Several pools were completely isolated by sub-surface flows. Several pockets of high quality spawning gravel were observed that would have been appropriate for anadromous spawning.

No coho have been observed here in five years of survey. Coho distribution in 2010 in the Luckiamute mainstem ended about one mile downstream of the confluence of Wolf at a small bedrock falls that did not appear to be a permanent adult barrier. Low numbers of steelhead were observed in 2009 only. Low abundances of cutthroat have been sustained here throughout the surveyed years. Production estimates for 0+trout increased from previous surveys in both 2009 and 2010. Survey distance has remained between 1.0 - 1.5 miles each year, ending in a flat and braided stream channel. Low summer flows and extensive wetlands describe the current condition of the aquatic corridor. The culvert at the mouth of Wolf appeared to be perched by 2 ft. at the time of survey in 2010. Many of the beaver dams encountered in 2010 also exhibited heights of 2-3 ft. The frequently blocked trash rack on the inlet end of the first culvert also restricts passage.

Year	**coho**	**0+**	**Sthd**	**Cut**
2002	-	20	-	105
2003	-	35	-	115
2008	-	70	-	90
2009	-	295	45	90
2010	-	100	-	80

- Visual bias not included

WF Luckiamute

This 3.9 mile stream segment contained the most productive tributary habitat for cutthroat and steelhead during the 2008 Luckiamute Basin inventory. Declines in production for both these species were observed in 2009 when abundance levels for 1+ steelhead declined 18% and those for cutthroat declined 46%. In 2010 1+ steelhead and cutthroat continued this decline with decreases in abundance of 83% and 18% respectively. Luckiamute basin-wide trends for 1+ steelhead mirrored this decline, down 37% and cutthroat trends for the basin exhibited no change. Abundance levels for 1+ steelhead in the West Fork Luckiamute were at their lowest level for the five surveyed years during the summer of 2010. Abundance levels for cutthroat in the West Fork were the lowest since 2003. The West Fork (sub-basin) abundance of cutthroat for 2010 represented 12% of the inventory total, while the 1+ steelhead in the WF represented 5% of the total inventoried. No coho were observed in the West Fork in 2010. Coho distribution in the Luckiamute mainstem ended approximately one mile downstream of the mouth of the West Fork at a 5 ft. bedrock falls.

Strong 0+trout production was observed in the West Fork in 2010 (about 17% of the inventory total). This sub-basin exhibited higher levels of 0+trout production than any other tributary in the 2010 inventory. It is difficult to compare the inter-annual changes for this age class since survey timings have gradually moved later in the year for each survey (6/23/08, 7/14/09, 9/2/10). Emergence of this age class continues throughout the extent of the summer and abundance naturally increases later in the summer. A consistently increasing trend for 0+trout can be seen in the table below.

Considering only the streams surveyed in 2010, stream habitats in the WF Luckiamute appear to be functioning well and continue to represent a strong anchor habitat for salmonids within the larger Luckiamute Basin. This stream is the largest headwater tributary to the Luckiamute mainstem. The geographical position of the WF as a headwater stream reinforces the critical nature of the WF Luckiamutes importance for the survival and maintenance of resident, fluvial, and anadromous salmonid populations in the basin as a whole. Full production potential remains considerably higher.

Distribution profiles for 1+ steelhead and cutthroat most years have displayed peaking densities near the mouth of the stream with abundance levels decreasing upstream. 1+ steelhead distribution in the WF mainstem ended by RM 0.1 in 2010. The Miller sub-basin included 2.1 miles of suitable habitat for anadromous species. Miller Cr. accounted for 40% of all 0+trout in the West Fork, 73% of all 1+ steelhead and 37% of all cutthroat. By comparison the WF mainstem accounted for 37% of all 0+trout, 27% of all 1+ steelhead, and 45% of all cutthroat (over a total of 3.9 miles). The lower three miles of mainstem habitat downstream of the confluence of Trib. C and D is the prime habitat segment for the WF mainstem. The valley and active stream channel narrow considerably upstream of these two tributaries and stream flows diminish. Beaver activity was abundant throughout this zone in 2002 and 2003, but has recently declined (0 dams in 2008, 1 dam in 2009, 3 dams in 2010). No culverts were noted. No knotweed was observed.

The second most important tributary to the WF (after Miller) is Trib. C. An expanded estimate of 545 cutthroat were present in 2008 through 1.1 miles of survey. Only 185 cutthroat (expanded) were observed in 2009 (1.0 miles). In 2010, cutthroat abundance was similar to the previous year at 215 (expanded) in the 1.0 mile survey. No steelhead have been observed here since 2003. A large log jam on top of a bedrock cascade near RM 0.8 appears to be the end of

anadromous passage in Trib. C. A total of 4 fresh beaver dams were encountered in Trib. C in 2010. Low numbers of cutthroat and 0+trout were present in Tribs. B, D, and E as well. Anadromous potential is limited in these habitats by low summer stream flows resulting in small pool surface areas. No culvert problems were identified. A total of 3 beaver dams were encountered in Trib. B.

Year	**coho**	**0+**	**Sthd**	**Cut**
2008	-	315	110	2,255
2009	-	755	90	1,110
2010	-	1,045	15	975

- Includes Tribs. B, C, D, and E
- Visual bias not included

Year	**coho**	**0+**	**Sthd**	**Cut**
2002	-	65	90	560
2003	-	125	70	495
2008	-	150	110	1,570
2009	-	465	90	850
2010	-	645	15	700

- No tributaries included, mainstem WF only
- Visual bias not included

Miller / Trib. to WF Luckiamute

One year (2008) of high cutthroat densities (1,170-expanded) and four years of moderate densities (485-500, expanded) have been observed in Miller Cr. 1+ steelhead densities have remained low during all five survey years. Most cutthroat and all 1+ steelhead were observed rearing in the lower half, from the confluence with the WF Luckiamute to the confluence of Trib. A during all survey years. Cascades dominate the stream channel above the confluence of Trib A and the abundance of pool habitat diminishes quickly. The 2010 survey ended at an ephemeral anadromous barrier, a 5 ft. log jam falls, at RM 1.5. Trib. A offers an additional 0.5 miles of moderately productive habitat. Low abundances of 1+ steelhead were observed in Trib. A in 2003 and 2008. Low abundances of cutthroat and 0+ trout have been observed during all surveys there. Good visibility and excellent water quality was reported throughout the Miller Cr sub-basin.

The abundance of 1+ steelhead here remained among the highest in the inventory for 2010 and accounted for 73% of all 1+ steelhead in the West Fork sub-basin. Teal Cr. was the only tributary in the inventory to exhibit higher levels of steelhead production (95 – expanded). Miller Cr. also exhibited the third largest tributary abundance of cutthroat for 2010 after Teal Cr and the WF mainstem. Miller Cr accounted for 37% of all cutthroat in the WF sub-basin. The continued apparent increases in 0+trout production for Miller are largely the result of later and later survey timings each year (6/23/08, 7/14/09, 9/2/10).

Based on the salmonid production observed during the last five survey years and visual observations of relatively high quality habitat, it is believed that Miller Cr. represents one of the

best anchor habitats for anadromous fish in the basin. Included in these anchor habitats are the WF Luckiamute, Pedee, Teal, Boulder, and the upper Luckiamute mainstem. Production potential in Miller Cr appears significantly higher than observed in any of the five surveyed years. No knotweed was observed. No beaver dams were noted.

Year	**coho**	**0+**	**Sthd**	**Cut**
2002	-	145	40	485
2003	-	50	120	500
2008	-	70	105	1,170
2009	-	370	50	495
2010	-	615	40	490

- Visual bias not included

Unnamed Tributaries

Trib. AI was the only un-named tributary to the Luckiamute mainstem included in the 2010 inventory. This small, steep stream exhibited habitat characteristics very similar to Tribs. AA – AH. These include steep gradients, large cobbles and boulders, poor pool formation, frequent wood jams, and cold clear flows. Production potential for anadromous adults appears to be very low in these streams due to poor spawning conditions and multiple barriers to migration. The most important function of these tributaries is their contribution of cold, clear water to the Luckiamute mainstem which aids greatly in decreasing water temperatures there. Rising water temperature is the main limiting factor to anadromous production potential in the Luckiamute mainstem. For this reason it remains important to maintain forest cover and preserve cool stream flows in the adjacent sub-basins of Tribs. AA-AI. The production potential of these small tributaries is greatest within the extent of the floodplain of the mainstem as the trib traverses a low gradient terrace. This stream was located 0.8 miles downstream (on the Luckiamute mainstem) of the mouth of Cougar Cr. Coho distribution ended at a rusted out culvert perched by 1 ft. over boulders (juvenile barrier).

Watershed Recommendations

- Continue restoration efforts on the upper Luckiamute mainstem, Boulder, West Fork, and Miller. Develop restoration strategies for Pedee, Teal, Price, Ritner, Maxfield, as high priority next steps.
- Decrease water temperatures in the lower Luckiamute, Little Luckiamute, and Soap Cr. mainstem habitats. This is a long term goal that will be accomplished through minimizing water withdrawals, initiating riparian canopy development and excluding cattle from stream channels and riparian vegetation.
- Restore the loss of floodplain linkage caused by deep channel entrenchment, build sinuosity and recover drained riparian wetlands. Promote beaver re-colonization. These strategies will expand aquatic rearing habitat during both summer and winter flow regimes and help to raise the summer water table. The notable drop in stream levels and water tables throughout the

Willamette Valley during the last century appears to be one of the largest factors affecting floodplain habitats and their potential for anadromous fish production.

Distribution and Rearing Density Graphics

An Excel Workbook has been developed from the raw Access data that allows the user to preview distribution, density and abundance graphics by year, stream and species. This pivot table work book allows managers and users to access information for all of the streams surveyed in 2008, 2009, and 2010. Please contact the Luckiamute Watershed Council for an updated version of this tool.

In addition, it is important to note that an extensive amount of supplemental raw data (primarily in the form of surveyor notes and comments) is available in the Access database which can also be obtained through the Luckiamute Watershed Council.