



LUCKIAMUTE WATERSHED RAPID BIO-ASSESSMENT 2008

Estimating Fish Populations in the Watershed

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Luckiamute Watershed Council

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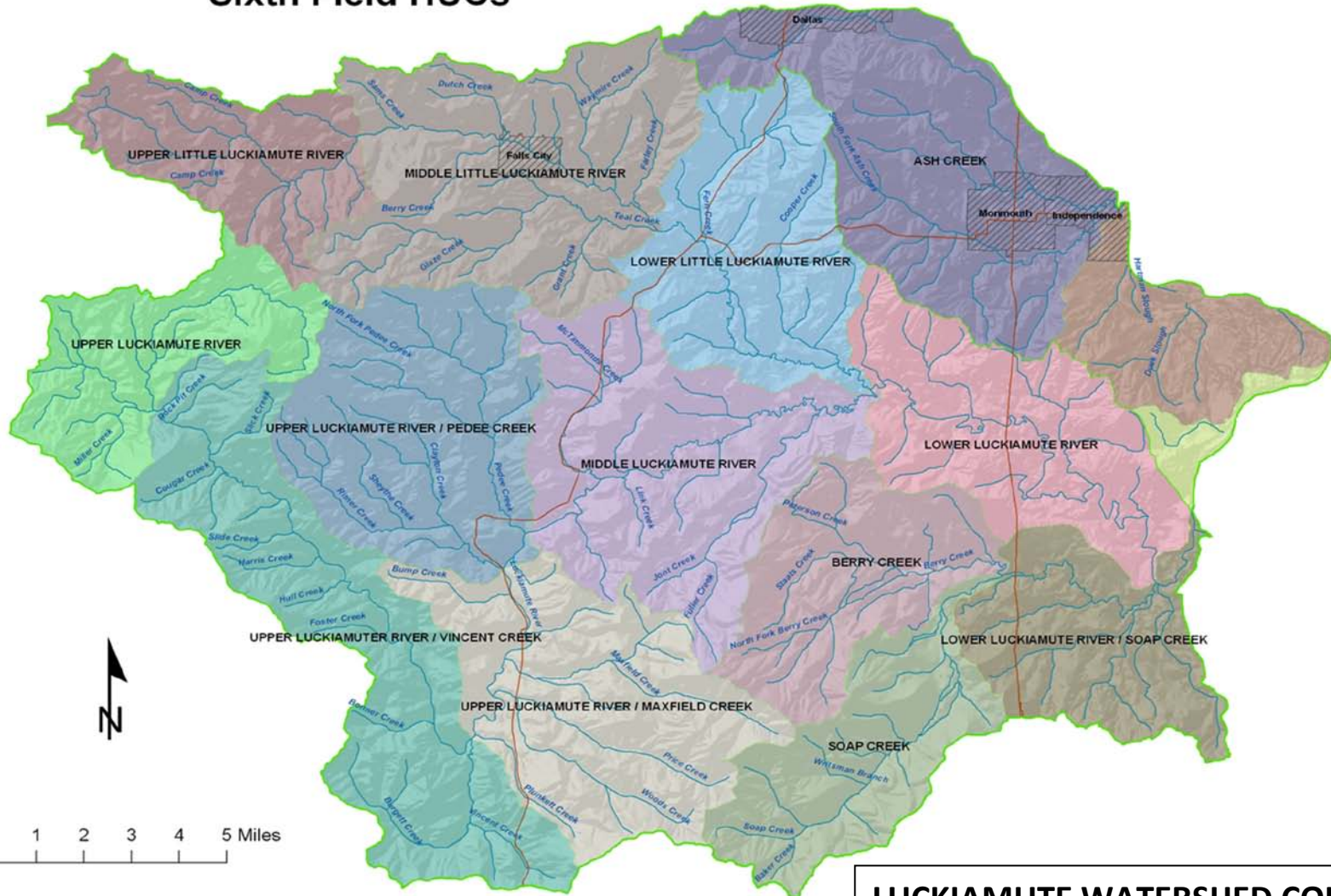
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LUCKIAMUTE WATERSHED RAPID BIO-ASSESSMENT 2008

INTRODUCTION

The 2008 Rapid Bio-Assessment inventory of the Luckiamute Watershed was a basin scale inventory designed to describe the distribution and abundance of salmonid species. The survey encompassed 214 miles of stream corridor from the Luckiamutes confluence with the Willamette River to all of its headwater tributaries. This included all potential anadromous distribution in the Luckiamute and Little Luckiamute mainstems and most of their tributaries. Some small streams were left out of the inventory due to a cap on funding and/or low production potential.

The intent of the project 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 distribution (not to the end of Cutthroat distribution). These surveys will be used to develop a base line understanding of how juvenile salmonids are currently utilizing habitats within the basin during summer flow regimes. Eventually, this baseline inventory will be critical for identifying long term trends in the distribution and abundance of juvenile Coho, Steelhead and Cutthroat in response to restoration and watershed management issues.

Portions of some streams in the basin were also surveyed in 2002 and 2003. 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 Rapid Bio-Assessment survey method (RBA) was designed to encounter a sub-sample (20%) of rearing habitats using a Rapid Assay technique that could cover large distances and succeed in describing the current distribution of Coho and the relative abundance of Cutthroat, Steelhead, and Chinook in all of the surveyed streams and their tributaries. Beaver dam frequency 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 by students from Western Oregon University and LWC staff.

access. The land owner information was recorded (name, contact #, tax lot # and location) and will be available from the LWC as a byproduct of this contract.

Most surveys were initiated by randomly selecting any one of the first five pools encountered. The protocol however was altered for small tributaries (2nd and 3rd 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 dependent 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.

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 map wheeled distances using USGS 1:24,000 series maps. This is related to the level of sinuosity within the floodplain that is not incorporated in mapping. 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 measure 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 the 2008 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 and trend within each 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 only in the raw Access database under the “comments” field and not in the Excel file.

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 subbasins dominated by low elevation headwaters that range primarily between 105 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 has 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 summer pinch period flow regimes.

Steep stream gradients and cool summer flows come to an end as the wide valley floor of both the Luckiamute and Little Luckiamute are encountered. Channel morphologies and the resultant aquatic habitats shift rapidly toward the predominant characteristics of the basin: slack water habitats, low flows, high solar exposure, warm water, heavy siltation and a transition from cold to warm water species. Water withdrawals and a porous 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 is however, not the seasonal limitation for the production and survival of salmonids within the basin.

Expanded estimates for anadromous salmonids were very low during the 2008 inventory. Table #1, below, summarizes these estimates for each of the 10 sub-watersheds within the basin. Table #3, under “Site Specific Observations”, gives totals for each individual stream. Only 63 juvenile Coho and 1,230 1+Steelhead were estimated to be present during the summer of 2008 in the entire Luckiamute basin. This expanded estimate includes a 20% visual bias developed for Coho snorkel sampling. Lack of significant adult coho escapement currently limits their abundance and

distribution. An expanded estimate of 18,580 Cutthroat was observed for the entire basin. Sampling biases have not been developed for 1+Steelhead and Cutthroat but are significantly higher because large numbers of these species rear in riffle/rapid habitats that were not sampled as part of this inventory. 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.

There appeared to be only two successful adult Coho spawning events for the 2007 winter brood in the Luckiamute. Almost all juveniles found during the summer of 2008 were in the Middle Little Luckiamute (Sams-Dutch-Berry-Teal-Boughey-Grant-Waymire) sub-watershed near the mouth of Waymire Creek. Abundance levels were extremely low. The spawning events probably took place either in the Little Luckiamute mainstem or in the very first pool of Waymire. An even lower abundance of juveniles was also observed in Vincent Creek, within the Upper Luckiamute (Vincent-Alexander-Burgett) sub-watershed. There were no outstanding habitat qualities surrounding either of these two spawning sites. Their locations appear to be the result of a relatively random spawning event for at least 4 adults.

1+Steelhead distribution during the 2008 inventory more accurately highlighted the finest salmonid habitat conditions. 80% of the basin-wide population was observed in the uppermost sub-watershed of the Luckiamute mainstem, which included Boulder, Beaver, and the West Fork Luckiamute (including Miller Creek). These reaches exhibited 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 an industrial forest land 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 have also contributed to maintaining and enhancing salmonid production potential. 40% of basin-wide Cutthroat were also observed in this sub-watershed.

These reaches currently represent the most critical habitat for the survival of anadromous salmonids within the Luckiamute watershed. They are characterized by significant summer flows, low water temperatures, and low rates of sedimentation. In addition, good spawning and rearing conditions were observed in Teal and Pedee Creeks. These two subbasins represent secondary anchor habitats within the watershed. A third sub basin exhibiting high quality habitat is the mainstem of the Little Luckiamute River and its tributaries above the natural anadromous barrier in Fall City.

1+Steelhead abundance declined linearly downstream through each sub-watershed. 11% of the basin-wide total was observed in the Vincent-Alexander-Burgett sub-watershed of the Luckiamute mainstem, 6% in the Maxfield-Plunkett-Price-Bump sub-watershed, and 3% in the Pedee-Ritner-Sheythe-Clayton sub-watershed. A more critical comparative analysis of existing habitat parameters in each of these sub watersheds would be necessary to sort out the relationship between steelhead abundance and spatial variation. Cutthroat estimates for each of these three sub-

watersheds were similar, totaling 12%, 11%, and 13%, respectively, of the basin-wide population.

The Middle Little Luckiamute sub-watershed, representing Sams, Dutch, Berry, Teal, Boughey, Grant, and Waymire, also exhibited a significant 13% of the basin-wide Cutthroat population (as well as 90% of all Coho). The Middle Little Luckiamute, Pedee-Ritner, and Boulder-Beaver-West Fork sub-watersheds appear to represent the top three priority zones for restoring, recovering 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.

A single 1+ Steelhead (5–expanded) was observed in the Fern, Cooper sub-watershed of the Little Luckiamute downstream of the anadromous barrier in Falls City. Cutthroat abundance in this unit was very low, representing just 1% of the basin-wide total. Overall salmonid potential here is low due mostly to low stream gradients, heavy sedimentation, and numerous water withdrawals that impair water quality during summer flow regimes.

The remaining 4 sub-watersheds encompassing the lowest reaches of the basin exhibited no 1+Steelhead and less than 5% each of the basin-wide Cutthroat population. No salmonids were observed in the lower Luckiamute-Lower Soap sub-watershed. High water temperatures and heavily silted gravels appeared to limit production in these areas. Irrigation dams in the lower Soap mainstem are probably limiting anadromous migration in that stream. Poor visibility for snorkeling also affected the confidence in fish observations in these lower reaches of the system. Warm water resident fish species, however, including dace, stickleback, squawfish, suckers, and small mouth bass, were visible and highly abundant in these sub-watersheds. Primary production in the form of algae was also highly abundant due to the warm temperatures and nutrient rich waters. Significant fall, winter and spring habitat may be available here for fluvial components of the cutthroat population.

(Table 1)

Sub-watersheds of the Luckiamute Basin and 2008 Expanded Estimates

Sub-watershed	Area (acres)	Coho salmon	0+	Steelhead	Cutthroat
Upper Luckiamute River (Pool 119-194)	11,700				
Luckiamute River + Boulder and Beaver Creeks		0	240	765	3,965
West Fork Luckiamute River + Miller Creek		0	385	215	3,425
Sub-total		0	625	980	7,390
Upper Luckiamute River/Vincent Creek (Pool 73-118)	22,300				
Luckiamute River + other tributaries		0	615	140	1,510
Vincent, Alexander and Burgett Creeks		5	105	0	640
Sub-total		5	720	140	2,150
Upper Luckiamute River/Maxfield Creek (Pool 65-72)	20,000				
Plunkett Creek		0	510	0	535
Price Creek		0	325	0	580
Maxfield Creek + tributaries		0	315	70	690
Bump Creek		0	0	0	0
Luckiamute River + other tributaries		0	0	0	255

Sub-total		0	1,150	70	2,060
Upper Luckiamute River/Pedee Creek (Pool 63-64)	19,000				
Ritner, Sheythe and Clayton Creeks + tributaries		0	670	0	1,035
Pedee Creek + tributaries		0	495	35	1,345
Luckiamute River + other tributaries		0	0	0	0
Sub-total		0	1,165	35	2,380
Middle Luckiamute River (Pool 47-62)	22,000				
Jont Creek		0	0	0	0
McTimmonds Creek		0	45	0	10
Luckiamute River + other tributaries		0	0	0	290
Sub-total		0	45	0	300
Upper Little Luckiamute River (Pool 56-99)	11,200				
Camp Creek		0	0	0	5
Lost Creek		0	0	0	0
Black Rock Creek		0	55	0	100
Little Luckiamute River + other tributaries		0	120	0	780
Sub-total		0	175	0	885
Middle Little Luckiamute River (Pool 27-55)	23,500				
Sam's Creek		0	130	0	320
Dutch Creek + tributaries		0	65	0	485
Berry Creek		0	695	0	365
Teal, Boughey and Grant Creeks + tributaries		0	740	0	1,015
Waymire Creek + tributaries		40	100	0	100
Little Luckiamute River + other tributaries		5	145	0	100
Sub-total		45	1,875	0	2,385
Lower Little Luckiamute River (Pool 1-26)	16,300				
Fern Creek		0	0	0	0
Cooper Creek		0	0	0	0
Little Luckiamute River + other tributaries		0	50	5	110
Sub-total		0	50	5	110
Lower Luckiamute River (Pool 1-46)	16,600				
Luckiamute River + tributaries		0	0	0	0
Soap Creek (Pool 8-110)	12,900				
Soap Creek + tributaries		0	390	0	660
Berry Creek					
Peterson Creek + tributaries		0	0	0	0
South Fork Berry Creek		0	40	0	50
North Fork Berry Creek		0	15	0	65
Berry Creek		0	105	0	145
Sub-total		0	550	0	920
Lower Luckiamute River/Soap Creek (Pool 1-7)	12,400				
Soap Creek + tributaries		0	0	0	0
TOTALS		50	6,355	1,230	18,580

- Visual bias not included

Anadromous access was available in most large tributaries except Soap (irrigation dams), Burgett (dam), the upper Little Luckiamute mainstem (Falls City waterfall), Dutch, Berry/Little Luckiamute, Sams, Black Rock, Camp, Lost, and Tribs. K, P, and Q of the Little Luckiamute (all due to the Falls City waterfall), and the uppermost 2-3 miles of the Luckiamute mainstem (due to boulder plunges and large log jams).

Most habitats were not seeded to capacity in the inventoried sub-basins and there remains extensive summer habitat available to salmonids that is 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 was relatively high in the basin with a total of 92 active dams encountered. Many streams were 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 resetting the clock on channel degradation (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 during the 2008 field season.

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 a 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 genetics 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 population 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 Dependent Migrations

Potential temperature dependent 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 dependent 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) is present in the distribution profile. 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 2)

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

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 underestimate 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 3)

Luckiamute River 2008 Basin Wide Inventory (Expanded Estimates)

Stream	Coho	% Total	0+	% Total	Sthd	% Total	Cut	% Total
Mainstem	-		235	3.7	900*	73.2	5,205*	28.0
Alexander/Vincent	-		20		-		40	
Beaver	-		10		-		30	
Berry/Little Luck.	-		695*	10.9	-		365	2.0
Berry/Soap	-		160	2.5	-		260	1.4
Black Rock/Little Luck.	-		55		-		100	
Boughey/Teal	-		15		-		65	
Boulder	-		105	1.7	-		240	1.3
Bump	-		-		-		-	
Burgett/Vincent	-		25		-		355	1.9

Camp	-		-		-		5	
Clayton/Ritner	-		55		-		115	
Cooper/Little Luck.	-		-		-		-	
Cougar	-		300	4.7	-		255	1.4
Dutch/Little Luck.	-		65	1.0	-		485	2.6
Fern/Little Luck.	-		-		-		-	
Grant/Teal	-		245	3.9	-		315	1.7
Jont	-		-		-		-	
Little Luckiamute	5*	10	220	3.5	5		960*	5.2
Lost/Little Luck.	-		-		-		-	
Maxfield	-		315	5.0	70*	5.7	690	3.7
McTimmonds	-		45		-		10	
Miller/WF Luck.	-		70	1.1	105*	8.5	1,170*	6.3
Pedee	-		495*	7.8	35*	2.8	1,345*	7.2
Plunket	-		510*	8.0	-		535	2.9
Price	-		325	5.1	-		580	3.1
Ritner	-		605*	9.5	-		815	4.4
Rockpit	-		-		-		145	
Sams/Little Luck.	-		130	2.0	-		320	1.7
Sheythe/Ritner	-		10		-		105	
Slide	-		40		-		5	
Soap	-		390	6.1	-		660	3.6
Teal/Little Luck.	-		480*	7.6	-		635	3.4
Vincent	5*	10	60		-		245	1.3
Waymire/Little Luck.	40*	80	100	1.6	-		100	
Wolf	-		70	1.1	-		90	
WF Luckiamute	-		225	3.5	110*	8.9	1,710*	9.2
- Trib. C/WF Luck.	-		90	1.4	-		545	2.9
Total	50	100	6,165	97	1,225	99.6	18,500	99.6

* 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 not included

Mainstem Luckiamute

(Table 4)

Expanded Mainstem Luckiamute Estimates of Juvenile Salmonid Production and Percent Contribution to the Basin

Survey Year	Coho	0+	Sthd	Cut
2008	0	235 (4%)	900 (73%)	5,205 (28%)

- Visual bias not include

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 in the 2008 inventory were found there. This was also due to the fact that most of the high quality spawning and rearing habitat in the basin can be found in the upper-most five miles of mainstem anadromous distribution. This zone stretched roughly from the confluence of the WF Luckiamute (RM 61 - just upstream of a 3000 ft.

boulder gorge and 4 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. Stream flows were higher and colder here compared with the lower mainstem, gravel resources were cleaner and more abundant, and pool / riffle formations (a direct result of underlying gradient) offered greater habitat complexity (supplemented by a helicopter-wood restoration treatment between RM 62.5 and RM 64.4). Surprisingly, no Coho have been observed in this reach during any of the three years of inventory. RM 66 marked the end of anadromous distribution during the 2002, 2003, and 2008 surveys. The anadromous barriers there do not appear to be permanent. A huge 12-20 ft. high debris jam another half-mile upstream was encountered during each of these three surveys which represents a more formidable, although also ephemeral barrier.

The abbreviated surveys conducted in 2002 and 2003 included only this upper segment of the Luckiamute mainstem and a few selected tributaries. The chart at the end of this discussion compares findings from just this upper segment between all three years and shows consistent and considerable improvements in Steelhead (up 52%, then 25%) and Cutthroat (up 95%, then 26%) production. 0+trout production, on the other hand, appears to have drastically declined in 2008. Juvenile Steelhead and Cutthroat counts peaked in similar patterns during all three surveys between RM 63 and 65, just upstream of the confluence of Boulder Cr., a significant cold water tributary. During the eight mile 2002 survey 79% of all 1+Steelhead and 46% of all Cutthroat were found in these two stream miles. In the eight mile 2003 survey 72% of all 1+Steelhead and 41% of all Cutthroat were found there. Considering the same eight miles of the 2008 survey, 71% of all 1+Steelhead and 60% of all Cutthroat were found there. The remarkable similarity between these survey years supports the conclusion that this stream segment represents the most important anchor habitat for salmonids in the Luckiamute mainstem.

This data agrees with the physical observations of high quality stream habitat noted in the surveyor comments. Eight pools were sampled containing restoration log structures, noted in the Access database, which exhibited several of the highest single pool fish counts in the mainstem, including the highest 1+Steelhead count (10, unexpanded) and two of the top five Cutthroat counts (36 and 31, unexpanded). Most of these structures are well incorporated into the stream currently and have created some of the best pool scours and well sorted gravel beds in the mainstem. Along with Boulder Cr., this is definitively the most important anadromous anchor habitat in the whole basin.

Considering the entirety of the 68.1 mile 2008 survey of the Luckiamute mainstem, all 1+Steelhead were observed between RM 48 and 66, with most (76%) found between RM 61 and 65 (peak count RM 64). Most Cutthroat were observed between RM 39 and 49 (14%) and between RM 63 and 65 (36%), with the highest count at RM 63. The lower reach of high Cutthroat counts was located roughly around the confluences of Pedee Cr. (RM 40) and Ritner Cr. (RM 41). 0+trout were noted only in very spotty low counts between RM 48 and 62. Poor visibility throughout the lower 25 miles of the Luckiamute mainstem and only medium visibility up to RM 58 greatly reduced the accuracy of any kind of comprehensive estimate for this habitat segment. While it is likely that some fish were missed by snorkelers in the lower half of the mainstem it is unlikely that occupancy rates there were significant based on the overall

poor physical conditions, elevated stream temperatures and overwhelming dominance of warm water species.

The lower reaches of the Luckiamute mainstem, downstream of the McTimmonds Cr. confluence at RM 37, were characterized by long stagnant pools, some over a mile in length, with high solar exposure and a deeply entrenched channel. Siltation rates were also very high as well as tannin levels from vegetative decomposition. Large old legacy wood buried in the stream channel provided most of the cover available. Huge beds of shallow aquatic grasses were observed full of warm water fish species including dace, stickleback, squawfish, suckers, and small mouth bass (up to the Airlie Road bridge).

The low gradient stream profile throughout the majority of the Luckiamute mainstem prevents the rapid transport of sediments and fines and facilitates the deposition of these mobile substrates. This morphological condition increases the system's sensitivity to accelerated contribution rates from upslope management activities. The resultant impacts include embedded spawning gravels and low egg/ fry survival rates. Increased water temperatures due to the cumulative impact of high solar exposure and low flows further inhibit salmonid production.

This condition gradually improved upstream of McTimmonds Cr. as mainstem stream gradients increased slightly and more gravel and small cobbles were encountered. Intermittent canopy closure and bedrock exposures were noted upstream of the Ritner Cr. confluence (RM 41) and spawning resources became more frequent. Invasive knotweed was noted at RM 55, just downstream of the Slide Cr. confluence at RM 56 (River Mile calculations based on RBA ground distance and not USGS quad). Increases in stream gradient and the positive influences of cold water tributaries such as Boulder Cr. and numerous small, steep, unnamed tributaries leads to improved rearing conditions for salmonids upstream of RM 60. The 2008 survey ended at RM 68.1, upstream of numerous ephemeral log jam barriers and boulder falls. A 7 ft. vertical beaver dam (active) was present at the endpoint with a massive wetland noted upstream full of amphibians and cutthroat.

No culverts were noted on the Luckiamute mainstem and all bridge crossings appeared to be functional and in good condition.

Year	Coho	0+	Sthd	Cut
2002	0	135	395	1,480
2003	0	535	600	2,885
2008	0	20	750	3,630

- Normalized for RM 61 – 68 of Luckiamute Mainstem
 - Visual bias not included

Alexander

This small tributary to Vincent Cr. functions as a source of cold and clear water to the Vincent mainstem. Good canopy shade was noted. Low stream flow and small pool size both limit in-stream anadromous production potential here. No 1+Steelhead were found. The 2008 survey extended 0.6 miles upstream.

Year	Coho	0+	Sthd	Cut
2008	-	20	-	40

- Visual bias not included

Beaver

Poor visibility hindered snorkeling efforts in Beaver Cr. The 2008 survey extended just 0.2 miles upstream and identified a degraded culvert at the first pool with a steep pitch and an 8 inch plunge. This represents a barrier to juvenile migration although the small stream size and overall poor quality of stream habitat contributes to a low production potential for this stream. Fine gravels were rare and poorly sorted, and stream flows were low and stagnant. One active beaver dam was noted. Similar conditions, including bad visibility, were observed during two previous surveys in 2002 (0.5 miles) and 2003 (0.6 miles) when expanded estimates for Cutthroat totaled 40 and 105, respectively.

Year	Coh o	0+	Sth d	Cut
2002-0.5 miles	-	-	5	40
2003-0.6 miles	-	15	-	105
2008-0.2 miles	-	10	-	30

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

Berry / Trib. to Little Luckiamute

Good visibility was noted in this stream. No Steelhead were observed. An 800 ft. long series of chutes, slides, and falls was encountered near the beginning of the survey at RM 0.2 which appeared to be impassable for adult and juvenile fish. Frequent bedrock exposures and large amounts of cobble were also noted. Occasional wood jams have trapped significant loads of fine gravel in places providing good conditions for Cutthroat spawning. High counts for 0+ trout were noted in these locations. A huge 80 ft. falls at RM 1.7 represents a definitive barrier to migration. Stream flows were strong and water temperatures low, which suggests that this stream has an important positive influence on water quality in the Little Luckiamute mainstem. The survey extended 2.7 miles upstream.

Year	Coho	0+	Sthd	Cut
2008	-	695	-	365

- Visual bias not included

Berry /Trib. to Soap

Good visibility was encountered in Berry, NF Berry, and SF Berry. No Steelhead were found. Most of this system is limited by low flows and warm water. Unnamed tributaries were almost all dry during the summer survey of 2008. A huge interactive wetland encompassed the lower mile of the 2.5 mile mainstem survey (145 Cutthroat, expanded, were noted). The 1.1 mile survey in NF Berry exhibited slightly higher flows and colder water (65 Cutthroat, expanded, were noted). The 1 mile survey in SF Berry documented only minor summer flows resulting in limited production potential (50 Cutthroat, expanded, were noted). Much of the lower portion of Berry Creek were not surveyed because of access prohibition.

No salmonids were observed in the Peterson Cr. tributary, although visibility was ranked as poor. There appeared to be no spawning potential in this stream throughout the 1.7 mile survey. Open fields, wetlands, sparsely forested entrenched channels, Christmas tree farms, and shallow muddy pools characterized Peterson. Water quality was described as “very warm and stagnant with just a trickle of flow”. Trib. B of Berry and Staats Cr. exhibited similar conditions, including heavy water withdrawal. No anadromous fish species or spawning potential was identified in these two small streams. Water withdrawals, low stream gradient, and poor gravel sorting are the main limiting factors in this sub-basin.

Year	Coho	0+	Sthd	Cut
2008	-	160	-	260

- Visual bias not included

Black Rock / Trib. to Little Luckiamute

Very little production potential was observed in Black Rock Cr. High solar exposure, warm water, and poor natural fish passage, compounded by two culvert barriers, have limited fish production here. Three major barriers to migration were encountered, first an 8 ft. culvert with a 4 ft. plunge, then a badly rusted 6 ft. culvert with 7 ft. plunge, and lastly a major bedrock slide/falls on Trib. A. Black Rock Cr is located upstream of the anadromous barrier in Falls City on the Little Luckiamute mainstem, this sub-basin currently exhibits no anadromous potential and therefore these two dysfunctional culverts are low priority for replacement. The survey extended 0.67 miles.

Year	Coho	0+	Sthd	Cut
2008	-	55	-	100

- Visual bias not included

Boughey

Low production potential was observed in Boughey Creek, a tributary of Teal Creek. The survey extended for 0.7 miles and no anadromous species were observed. There were low numbers of cutthroat present in multiple year classes. Gravels were

noted as being finer than observed in mainstem Teal. In addition, water temperature appeared favorable.

Year	Coho	0+	Sthd	Cut
2008	-	15	-	65

Boulder

Cutthroat and Steelhead production dropped significantly in 2008 in Boulder Cr., compared to surveys from 2002 and 2003. No 1+Steelhead were observed during this latest survey and Cutthroat abundance was 16% lower than in 2002. These findings were unusual considering the fact that, next to the upper Luckiamute mainstem, the Boulder sub-basin contains some of the best spawning and rearing habitat for salmonids observed in the Luckiamute Basin. Water quality (temp) and visibility has been excellent for all three surveyed years. . The survey extended 1.1 miles. 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. The reason for these conflicting trends is not clear.

About 1.5 miles of good spawning and rearing conditions can be found 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. The only structure pool sampled in 2008, the second dive-pool, supported the highest Cutthroat count of the survey (7 Cutthroat – not expanded). A 4 ft. sill log with a vertical falls ended anadromous passage in 2008 at RM 1.1. This does not represent a permanent barrier to migration. Low level 1+Steelhead rearing was also reported in Trib. A in 2002 and 2003.

Year	Coho	0+	Sthd	Cut
2002	-	5	105	320
2003	-	135	150	345
2008	-	115	-	270

- Visual bias not included

Bump

No fish were observed in the short 0.3 mile survey of Bump Cr. The water was reported to be very tannic and warm. Visibility was poor. The culvert at the mouth was in good condition and passable.

Burgett / Trib. to Vincent

Poor visibility limited surveyor accuracy here during the 2008 survey. Flat murky pools with low flows were observed throughout 3.8 miles of Burgett Cr., the main tributary to Vincent Cr.. A substantial number of Cutthroat were observed and no 1+Steelhead. Low stream gradients were occasionally interrupted by small bedrock falls (4 ft. and 6 ft.) near RM 1.6 and slight climbs in the stream channel further up. The survey ended in low flows and flat gradients in muddy skunk cabbage. Dace and mussels were observed. The large concrete dam at RM 0.5 below the Lake of the Winds appears to be a main barrier to anadromous migration in Burgett Cr. although low stream gradient, poor gravel sorting, and high rates of siltation throughout this stream appear to be the main factors limiting anadromous production. One active beaver dam was noted. . The survey extended 3.84 miles.

Year	Coho	0+	Sthd	Cut
2008	-	25	-	355

- Visual bias not included

Camp / Trib. to Little Luckiamute

This medium-sized tributary exhibits low production potential for Cutthroat only. Anadromous access to this tributary of the Little Luckiamute mainstem is blocked by the Falls City waterfall, about nine miles downstream from the Camp Cr. confluence. Good visibility was reported. The 2008 survey extended 0.6 miles and found only Cutthroat.

Year	Coho	0+	Sthd	Cut
2008	-	-	-	5

- Visual bias not included

Clayton / Trib. to Ritner

Moderate Cutthroat production was observed in Clayton (2.3 miles) and Trib. A (0.6 miles) of Clayton. Expanded estimates of 40 and 75 respectively were observed. Based on the difference in survey distances, it appears that Cutthroat densities were significantly higher in Trib. A of Clayton, although poor visibility in the mainstem of Clayton reduces confidence in the estimate. Water temperatures were lower in the tributary habitat. Fine gravels were present intermittently throughout the mainstem of Clayton, although siltation rates were high. 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. (2.5 miles) are the two main tributaries to Ritner Cr.. Expanded estimates for Cutthroat in Sheythe in 2008 were similar, 105 total, while those in the Ritner mainstem (6 miles) reached 580. The lower mile of Clayton was surveyed in 2002 and 2003. Expanded estimates for Cutthroat during those surveys totaled 75 and 145, respectively. It appears that Cutthroat densities were much higher in

Clayton in 2002 and especially in 2003, considering the much shorter survey distance. Variations in visibility between years limit the confidence in this comparison. Low levels of 1+ Steelhead were also present during those surveys – expanded estimates of 5 in 2002 and 15 in 2003.

Year	Coho	0+	Sthd	Cut
2002-0.8 miles	-	25	5	75
2003-0.8 miles	-	165	15	145
2008-2.9 miles	-	55	-	115

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

Cooper / Trib. to Little Luckiamute

Production potential for salmonids appeared very low in this tributary. This was the first tributary to branch off of the Little Luckiamute, about a mile and a half up from its junction with the mainstem Luckiamute. The 2008 survey followed the flat and windy Cooper Cr. channel for 2.6 miles through heavy marsh grass, low flows, stagnant warm water, and occasional stretches of dry channel. Much of this channel drained through the lower Little Luckiamute floodplain. Water visibility was very poor. Water temperature was estimated at 68 degrees Fahrenheit. No fish were observed. A heavily rusted culvert was encountered at RM 0.3 and a second home-made culvert in good shape at RM 1.1.

Cougar

Anadromous potential is limited in Cougar Cr. by several bedrock slides and falls. Numerous boulder pours and log jams were also noted. A five foot bedrock falls very near the mouth appears to be the main 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 2008 survey on Cougar Cr. extended for 1.1 miles and observed no Steelhead. Surveys conducted in 2002 and 2003 extended through the same mile and found low level 1+ Steelhead presence, 30 juveniles, expanded, each year. In 2002 their distribution extended almost the whole mile, while in 2003 their distribution ended at RM 0.2. 0+trout and Cutthroat estimates both show strong improvements since 2002.

Year	Coho	0+	Sthd	Cut
2002	-	50	30	70
2003	-	290	30	175

2008	-	300	-	255
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Visual bias not included

Dutch / Trib. to Little Luckiamute

This stream joins the Little Luckiamute just upstream of the waterfall at Falls City and therefore exhibits no anadromous potential. In addition, two main barriers to juvenile migration within Dutch Cr. were noted, including the culvert at RM 0.4 with a 3 ft. drop onto a long bedrock slide (no jump pool), and a 20 ft. bedrock slide at RM 0.6 with a partial 4 ft. falls (also no jump pool). Despite these barriers, overall steep stream gradients, and a high abundance of large rock, cobble, and bedrock exposure, Cutthroat production in Dutch appeared relatively high. Good stream flow and cold water were also reported throughout the 2.1 mile survey. Conditions were similar in Trib. A of Dutch (0.4 miles) where another culvert barrier was encountered pouring onto a bedrock slide.

Year	Coho	0+	Sthd	Cut
2008	-	65	-	485

- Visual bias not included

Fern / Trib. to Little Luckiamute

Very similar to Cooper Cr., Fern Cr. exhibited no anadromous potential. The Fern Cr. confluence with the Little Luckiamute is about six miles upstream of the Cooper Cr. confluence and shares most of the same habitat characteristics resulting from the low gradient morphology of the Little Luckiamute and lower Luckiamute floodplains. The 2008 survey extended for 2.7 miles through deeply entrenched channels, shallow muddy pools, low murky flows, occasional dry channel conditions, and heavy cattle impacts. No salmonids were observed. Visibility was very poor. Fresh beaver activity was noted (two dams) along with a high abundance of amphibians, warm water fish species, and aquatic plants. Most tributaries were dry. Water withdrawals and low stream gradients appear to currently limit the habitats suitability for salmonids.

Grant / Trib. to Teal

Moderate Cutthroat production and low Steelhead potential was observed. Production appears mostly limited by a low abundance and poor sorting of spawning gravels, siltation, channel entrenchment, and a series of small falls at RM 0.4 (4 ft.) and RM 0.6 (5 ft.). The stream gradient upstream of this narrow canyon pinch increases compared to the low, flat Teal Cr. floodplain where Grant Cr. begins. There is some potential for anadromous spawning in the upper mile of the mainstem and in the first half-mile of Tribs. A and B, which branch off to the left and right about 1000 ft. apart. The two falls and their shallow bedrock jump pools may limit adult escapement during most winter flow regimes.

The water quality appeared fairly good although some fine particulate turbidity led to medium visibility for much of the survey. Stream flow was high and cool water was reported. Total survey length reached 1.6 miles in Grant, 0.9 miles in Trib. A and 0.6 miles in Trib. B. Trib. A contained roughly as many Cutthroat as the mainstem, 130 (expanded), while Trib. B only supported 60 (expanded). Better visibility was reported in the tributaries. Production potential in all three branches ended at the survey end points where a transition to steeper gradients and larger substrates were observed. Seven beaver dams were encountered, mostly active, with evidence of current occupancy.

Year	Coho	0+	Sthd	Cut
2008	-	245	-	315

- Visual bias not included

Jont

No anadromous potential was observed throughout the 5.6 mile survey in 2008. No salmonids of any species were observed. Conditions similar to Cooper and Fern were reported including overgrown entrenched channels, very warm and muddy water, almost no flow, thick algae, heavy siltation, evidence of sewage leakage, and many log jams. Warm water fish species and frogs were present. Poison oak and blackberries were the dominant riparian vegetation. Fourteen beaver dams were noted.

Little Luckiamute

2008 surveys on the mainstem totaled 27.4 miles, just less than half as long as the Luckiamute mainstem. Salmonid production appeared much lower than in the Luckiamute mainstem, probably due to the natural passage barrier represented by the falls at RM 15.6 near Falls City. This limits anadromous spawning potential to Teal Cr. (also truncated by an impassable waterfall, RM 5.3), Grant Cr., and Waymire Cr., along with some marginal spawning beds in the Little Luckiamute mainstem between RM 6 and Falls City. Only one juvenile Steelhead was observed during the 2008 survey, near RM 8.7. Cutthroat production overall was 82% lower than in the Luckiamute mainstem, in similar visibility conditions. Visibility and accuracy improved upstream of RM 8. Most Cutthroat rearing occurred upstream of Falls City around RM 20 (15%), RM 25 (19%), and RM 27 (32%).

A single juvenile Coho was also reported (in good visibility) near RM 15.5, just downstream from the mainstem falls, near the mouth of Waymire Cr., where another 8 were documented. The Coho seen in Waymire were all in the first pool, right below a small 3 ft. bedrock falls. Some gravel and cobble was observed in this first pool as well as in the Little Luckiamute mainstem nearby. The single adult Coho spawning that must have occurred during the 2007 winter brood most likely took place in one of these two areas. All 0+ trout during the 2008 survey were observed upstream of Falls City, between RM 17 and 19. Many warm water rough fish species were observed including shiners, dace, squawfish, and suckers.

The mainstem survey began in the lower Luckiamute floodplain, following a deeply entrenched and winding channel through heavy aquatic grasses and willow thickets. Heavy siltation was observed and the water was warm and tannic. These conditions improve upstream of RM 6 where a healthy pool/riffle ratio develops and pool scour deepens the active channel. Visibility and stream flow also improve above RM 6. Sporadic spawning conditions were observed for the next 9 miles leading up to the impassable falls. The remaining 12 miles of mainstem habitat above the falls offers moderate spawning and rearing potential for Cutthroat only. In 2008, Cutthroat abundance increased consistently up to the end of the survey. The survey ended in clear cuts on both sides with heavy blow down.

2008 surveys also included short reaches in Tribs. A, K, P, and Q. All were under 0.3 miles. Trib. A exhibited good visibility, warm water, low flows, 10 Cutthroat and 50 0+ trout (expanded). Trib. K showed the most potential (of the upper basin tributaries), though still classified as low priority. Good visibility and spawning gravel were present, along with 20 Cutthroat and 45 0+ trout (expanded). A stream gradient increase upstream of the main concrete culvert limits production potential. No salmonids were found in Tribs. P or Q, though visibility in each was good. Few pools and steep gradients were limiting factors in Trib. P, while a perched culvert above a large cascading waterfall prevented passage in Trib. Q.

Year	Coho	0+	Sthd	Cut
2008	5	220	5	960

- Visual bias not included

Lost / Trib. to Little Luckiamute

Very low production potential was observed here. No salmonids were observed. Good visibility was reported. . The survey extended 0.5 miles.

Maxfield

This stream exhibited good anadromous spawning conditions, moderate Cutthroat abundance, and low level Steelhead production. Maxfield was one of only 5 tributaries in the basin where 1+ Steelhead were found in 2008. A fairly even mix 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 temperature was noted as warm. Visibility was poor below RM 3. Beaver activity was frequent throughout. Sculpin and crayfish were unusually large. Some log structure restoration sites were present in lower Maxfield Cr but did not appear to be maintaining significant salmonid rearing densities during summer flow regimes.

Cutthroat abundance peaked between RM 3.2 and RM 4, while 1+ Steelhead were found mostly in the middle of the survey between RM 2 and 3. A barrier to adult migration was present at RM 4.4 where a culvert plunges 3.5 ft. onto rocks. Two active beaver dams were noted in Maxfield, as well as the presence of invasive knotweed near

the mouth. Short surveys were conducted in Tribs. A (0.6 miles) and B (0.2 miles) as well. Expanded estimates of 45 Cutthroat (Trib. A) and 55 0+ trout (Trib. B) were observed. Low flow, silty cobble, and a large beaver dam were present in Trib. A while Trib. B appeared too small to support Steelhead or Cutthroat beyond the 0+ age class.

The potential for higher 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	0+	Sthd	Cut
2008	-	315	70	690

McTimmonds

Anadromous potential appeared very low throughout the 4 mile survey on McTimmonds. Poor visibility was reported throughout the survey. Flat, swampy pools with heavy cattle impacts created overall poor water quality for salmonid rearing. Low summer flows were most evident upstream of RM 2 where gravel abundance increased slightly. Stream gradient and cobble abundance increased again by the end of the survey where landowners denied access. Most tributaries were dry. Fourteen active beaver dams were encountered along with occasional colonies of freshwater mussels. An intermittent canopy of oak, ash, cottonwood, and alder was present. Three culverts with 2 ft. plunges were encountered at RM 3, 3.4, and 4.

Year	Coho	0+	Sthd	Cut
2008	-	45	-	10

- Visual bias not included

Miller / Trib. to WF Luckiamute

Very high Cutthroat densities and moderate 1+ Steelhead densities were observed in the lower half of the Miller Cr. survey (1.3 miles total). Moderate Cutthroat densities continued to the end of the survey. Good visibility was reported. Eighty-two percent of all Cutthroat and 100% of all 1+ Steelhead were rearing in the lower half, between the mouth of Trib. A/Miller and the mouth of Miller. The highest Cutthroat count was found in the second dive pool, just 400 ft. upstream. The second highest count was found in the first structure pool at RM 0.3. Most of the other structures pools did not exhibit unusually high counts. The survey ended at an ephemeral anadromous barrier, a 5 ft. log jam falls at RM 1.3.

The 1+Steelhead population here was the second largest among the Luckiamute tributaries in 2008 and accounted for 9% of the basin-wide total. Only five tributaries contained Steelhead during this year, the WF Luckiamute, Miller, Maxfield, Pedee, and the Little Luckiamute (in order of abundance). Miller Cr. also contained the third largest Cutthroat population among the Luckiamute tributaries, after the WF Luckiamute and

Pedee Cr. This accounted for 6% of the basin-wide total. Based on these findings 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, Maxfield, Pedee, Boulder, and the upper Luckiamute mainstem.

This stream was also surveyed in 2002 and 2003. Cutthroat abundance in Miller was about twice as high in 2008 as in 2002 and 2003. 1+ Steelhead abundance in 2008 was roughly equal to that in 2003 and about twice as high as in 2002. No fish at all were encountered for the first 0.3 miles of the 2002 survey, which passed mostly through old beaver flats. This lower reach was subsequently treated with LWD structures that have facilitated pool scour and provided complex summer cover.

The 0.6 mile survey in Trib. A encountered Cutthroat and low level 1+ Steelhead production in 2003 and 2008, Cutthroat only in 2002. Good visibility and good flow was reported. Cascades dominate the stream channel above the confluence of Trib A and the abundance of pool habitat diminishes quickly.

Year	Coho	0+	Sthd	Cut
2002	-	145	40	485
2003	-	50	120	500
2008	-	70	105	1,170

- Visual bias not included

Pedee

High abundances of Cutthroat and low level Steelhead production were observed in the Pedee Cr. sub-basin. This stream contained the second largest population of Cutthroat of all the Luckiamute tributaries (behind the WF Luckiamute) and the fourth largest population of 1+Steelhead. Only five tributaries in the Luckiamute Basin contained Steelhead in 2008 – the WF Luckiamute, Miller, Maxfield, Pedee, and the Little Luckiamute (in order of abundance). The expanded estimate of 1,345 Cutthroat observed in this sub-basin accounted for 7% of their basin-wide abundance. The expanded estimate of 35 1+ Steelhead accounted for 3% of the basin-wide total.

A relatively large amount of accessible stream habitat is present in the Pedee sub-basin. About ten miles of stream was surveyed here in 2008, and almost all of it appeared passable for anadromous adults. Conditions appeared relatively poor, however, throughout the lower three miles of the mainstem, leading up to the main junction between the North and South Forks (RM 2.7). Medium visibility due to tannic water was reported through most of this reach along with low flows, heavy sedimentation, and channel entrenchment. The mainstem survey continued up the substantially larger North Fork. Conditions began to improve upstream of the forks. Good pool formation and sufficient gravel sorting became more frequent. Cutthroat abundance peaked around RM 5 and the few 1+ Steelhead observed in the sub-basin were all found in this reach, between RM 3 and 5, and in Trib. B. The mainstem survey ended in steep gradients and large boulder plunges at RM 6.4.

An expanded estimate of 530 Cutthroat and 30 1+ Steelhead were present in the 6.4 mile mainstem at the time of survey. This represented 39% of all Cutthroat in the sub-basin and 86% of all 1+Steelhead. The other 14% of 1+ Steelhead were observed in Trib. B. A short 1.4 mile section of the upper North Fork was surveyed in 2002 and 2003. This reach stretched roughly from RM 4.6 – 6 and included much of the best habitat in the Pedee mainstem. The results are summarized below for comparison. Relatively little change was noted between the three years of survey. Steelhead abundance in 2008 appeared the lowest, but by an insignificant margin.

The highest quality habitats were observed in SF Pedee. The 2008 survey extended 1.9 miles upstream from the forks and encountered cold water, two passable culverts, good gravel, and well scoured pools. The stream channel was smaller than the NF Pedee, but was in overall better condition. Well sorted spawning gravels and an interactive floodplain were noted. The upslope harvest buffer is intact and a few old growth Douglas firs were retained. A small 2 ft. falls was present at RM 0.4 which represents a barrier to juvenile migrations. This stream looks very capable of supporting anadromous spawning and rearing. Cutthroat production appeared very high, although no 1+ Steelhead were observed in 2008.

The first 1.4 miles of SF Pedee were also surveyed in 2002 and 2003. A single juvenile was sighted in 2002, none in 2003. Cutthroat abundance increased 219% between 2003 and 2002, and by another 64% between 2003 and 2008 (considering only the first 1.4 miles of the 2008 survey). 0+ trout abundance also exhibited a positive trend. These results are summarized below for comparison. The entire 1.9 mile survey of the SF Pedee in 2008 encountered an expanded estimate of 610 Cutthroat, 15% more than the 6.4 mile survey of the Pedee mainstem. This represented about 45% of all Cutthroat in the sub-basin at that time. Anadromous potential ends in the SF Pedee around RM 2 due to increasing stream gradients, large boulders, and numerous log jams.

The above observations and survey data suggest that SF Pedee and the upper 3 miles of the NF Pedee exhibit the highest potentials for anadromous salmonid production in the Pedee Cr. sub-basin. These two reaches, along with 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.

Minor spawning and rearing potential was present in Tribs. A, B, C, and D. Low abundances of Cutthroat were present in all of these tributaries and an expanded estimate of 5 1+ Steelhead were observed in Trib. B. All four surveys were under 0.6 miles and encountered steep gradients with limited pool surface area for rearing. Two beaver dams were noted in Trib. A, the first and largest one at RM 0.1. Good gravels were noted upstream. This stream exhibited the lowest stream gradients of all four tributaries. Good flows, few pools, long riffles, and large substrates were reported in Trib. C, where a perched culvert at RM 0.1 presents a juvenile barrier. Similar conditions in Trib. D limit production potential, including a 10 inch perched culvert at the mouth and a large log jam barrier (ephemeral) just upstream.

Year	Coho	0+	Sthd	Cut
2008	-	495	35	1,345

- Pedee sub-basin total (including SF Pedee)
- Visual bias not included

Year	Coho	0+	Sthd	Cut
2002	-	45	20	270
2003	-	50	35	220
2008	-	60	10	245

- Normalized for RM 4.6 – RM 6 of Pedee mainstem (NF Pedee)

- Visual bias not included

Year	Coho	0+	Sthd	Cut
2002	-	55	5	105
2003	-	115	-	335
2008	-	90	-	550

- Normalized for RM 0 – RM 1.4 of SF Pedee

- Visual bias not included

Plunkett

Moderate Cutthroat production was observed in Plunkett. No Steelhead were present. 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. Cutthroat abundance peaked in the first mile of the survey, probably due to these barriers to migration. The second falls probably restricts adult passage much of the time. A relatively even distribution of Cutthroat continued to the end of the survey at RM 3.4. Medium visibility was reported along with a moderate knotweed presence throughout. Three active beaver dams were encountered. Production potential for anadromous adults appears low in this sub-basin.

Year	Coho	0+	Sthd	Cut
2008	-	510	-	535

- Visual bias not included

Price

Price Cr. exhibits moderate potential for anadromous production. The expanded estimate of 580 Cutthroat was relatively high among Luckiamute tributaries, although no 1+ Steelhead were found. 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 in the 4.9 miles of survey. A similarly diverse mix of sand, mud, cobble, and gravel was present along the stream bottom. Dry channel conditions at the mouth and a culvert plunge of 2 ft. at the end of the survey limit juvenile migrations.

Cutthroat counts spiked in the two largest plunge pools of the survey at RM 1.4 and RM 4.9, the endpoint culvert. Steelhead production appears probable here, with

sufficient adult escapement. Cutthroat production could probably also be higher. Water withdrawals are most likely limiting habitat quality and access from the mainstem Luckiamute for temperature dependent upstream migrations during low summer flow regimes. Increasing summer stream flows would be a high priority restoration prescription for this tributary.

Year	Coho	0+	Sthd	Cut
2008	-	325	-	580

- Visual bias not included

Ritner

All six miles of the Ritner mainstem were surveyed in 2008 along with 0.8 miles in Trib. A and 0.4 miles in Trib. A1. The two main tributaries in this sub-basin, Clayton and Sheythe, have been summarized separately. Approximately 3.5 miles of upper Ritner and Trib. A were also surveyed in 2002 and 2003. These results have been summarized in the second table immediately following this discussion. In general, moderate Cutthroat production was observed in the upper 3 miles of the Ritner mainstem and in Trib. A during all three years of survey. Estimates for this species increased by 68% in 2003 and showed little change in 2008. 0+ trout estimates increased consecutively during each of these surveys. Low level Steelhead production was observed in 2002 and 2003 only.

Almost all of the Cutthroat observed during the 2008 survey were found upstream of RM 3 (near the mouth of Sheythe) and downstream of RM 5.6 where a 15 ft. falls was reported. Moderate stream gradients through this reach provide the best looking spawning and rearing habitat for Cutthroat and Steelhead. The falls represents a definitive barrier to migration. Downstream of Sheythe and Clayton the mainstem is dominated by deep channel entrenchment, high solar exposure, and heavily silted gravel, although much of this section was not surveyed due to access prohibition. Large schools of dace were observed in this reach along with a small number of freshwater mussel beds. Stream gradients increase quickly upstream of the falls where the mainstem canyon narrows and several smaller bedrock falls are encountered. Cutthroat and 0+ trout were observed upstream of the falls also.

The main triple culvert at RM 4.4 was in decent shape although two of the pipes displayed an 8 inch plunge which represents a barrier to juvenile migration. The third pipe, however, exhibited no plunge and examination of fish densities revealed no differential above or below this crossing (suggesting the site does not influence the upstream migration of juveniles). A large spike in Cutthroat density was observed just below the main falls. Three beaver dams were noted in the lower half of the Ritner mainstem.

Trib. A branches off to the right (upstream orientation) just upstream of the mainstem falls and provides about one mile of good spawning and rearing habitat for Cutthroat. The stream channel here is steeper than in the Ritner mainstem though several flats with well sorted gravels and deep pools were observed. Several small falls and bedrock exposures eventually terminate anadromous potential in this stream. Trib. A1 branches off to the right of Trib. A about 0.4 miles upstream from the mouth. A 7 ft.

falls was encountered at RM 0.4. Fish passage is further inhibited by a failing culvert at the stream mouth where most of the summer flow was seeping under the culvert. Expanded estimates for 0+ trout in Trib. A and Trib. A1 totaled 145 and 35, respectively. Expanded estimates for Cutthroat totaled 95 and 75, respectively. Sixty-seven percent of the Cutthroat in Trib. A1 were observed in the first pool up from the mouth, just below the dysfunctional culvert, suggesting that upstream temperature dependent migrations from the mainstem were being truncated.

Year	Coho	0+	Sthd	Cut
2008	-	605	-	815

- Includes all of Ritner mainstem and Trib. A
- Visual bias not included

Year	Coho	0+	Sthd	Cut
2002	-	110	10	330
2003	-	215	35	555
2008	-	345	-	540

- Normalized for Upper Ritner (RM 3-5.2) and Trib. A
- Visual bias not included

Rock Pit

The 2008 survey extended 1.6 miles upstream and encountered two barriers to juvenile migration. The first culvert at the mouth of the stream was rusted out and partially collapsed, while a second culvert at RM 0.9 exhibited a 3 ft. plunge. A relatively small Cutthroat population was observed. Production potential appears low. Three fresh beaver dams were encountered.

Year	Coho	0+	Sthd	Cut
2008	-	-	-	145

Sams / Trib. to Little Luckiamute

High quality spawning gravels were encountered in this small stream between RM 0.3 and the survey endpoint at RM 1. This reach begins where Sams Cr. leaves the Little Luckiamute floodplain and enters the forest canopy. Visibility is poor below RM 0.3 although floodplain interaction looks good. An undersized 3 ft. cement culvert at RM 0.1 is currently restricting adult and juvenile access to the best habitat in this stream. Upstream of RM 1 habitat potential is limited by steeper gradients, low flows, and bedrock slides. Two beaver dams were noted.

Year	Coho	0+	Sthd	Cut
2008	-	130	-	320

- Visual bias not included

Sheythe / Trib. to Ritner

Little anadromous potential has been documented in the Sheythe Cr sub-basin during the last three surveys. Low numbers of Cutthroat and 0+ trout were present in 2002, 2003, and 2008. No Steelhead have been identified. Cutthroat abundance in 2008 appears to have dropped by about 75% since the 2002 and 2003 surveys which extended up to RM 2. The 2008 survey continued up to RM 2.5. Medium visibility during all three surveys may have limited fish sightings in the lower mile of Sheythe, though improved water clarity beyond that point was noted each year. The consistency of visibility conditions during each survey suggests that the comparison between years in the chart below is valid.

Spawning conditions appear poor in Sheythe due to high siltation rates. A few marginal sites suitable for Steelhead and Cutthroat spawning were noted around the midpoint of the survey. A strong beaver legacy was present also in this reach, although only one active dam was noted. Cutthroat were observed in a fairly even distribution once visibility improved. The culvert at the mouth was in good shape. No fish were observed in Trib. A.

Year	Coho	0+	Sthd	Cut
2008	-	10	-	105

- Visual bias not included

Year	Coho	0+	Sthd	Cut
2002	-	30	-	300
2003	-	150	-	310
2008	-	10	-	75

- Normalized up to RM 2

- Visual bias not included

Slide

Little to no production potential was noted for this small stream. Visibility was good. The survey in 2008 extended 0.2 miles upstream.

Year	Coho	0+	Sthd	Cut
2008	-	40	-	5

- Visual bias not included

Soap

Mainstem habitat was surveyed for 14.3 miles up the Soap Cr. sub-basin in 2008, along with two short surveys in Tribs. A (0.5 miles) and B (200 ft.). Passage for adult and juvenile fluvial cutthroat and anadromous salmonids appears to be limited by numerous irrigation dams in the lower 5 miles. Huge slack water pools stretched for up to a mile at a time through this reach and the stream channel was deeply entrenched. High water temperatures and heavy siltation rates describe the dominant aquatic

condition and the active channel was heavily encumbered with old trash. Fish observations were low aided by consistent poor visibility.

This zone truncates the linkage for salmonids between lower and upper basin habitats. Numerous large beaver dams were also present in this reach. Fish passage through these structures is typically much easier than through a man-made cement dam due to numerous seeping flows and adjacent flood channels. Overall dam height for beavers is also lower in most cases.

Habitat conditions gradually improve in mainstem Soap by RM 9, as well as snorkel visibilities and confidence in the inventory results Canopy closure becomes intermittent and flow rates increase leading to the cleaning and sorting of spawning gravels. Redside shiners dominated this habitat. The best conditions for Cutthroat and Steelhead were encountered upstream of the large wetland habitat at the Writsman Rd. Bridge. Colder temperatures and stronger flows were noted here between RM 11.2 and the survey endpoint at RM 14.3. A prime stream gradient is maintained through this reach which has created a very healthy pool/riffle ratio and excellent conditions for salmonid spawning. Many steep cold water tributaries to the mainstem were also noted here.

This is clearly the most critical habitat in the Soap Cr sub-basin for salmonid production. The decreasing size of pool habitats here, however, probably limits summer rearing potential. Connecting the smaller, cooler spawning habitats in the upper sub-basin with the lower mainstem Luckiamute should immediately boost salmonid productivity. The survey ended in clear cold flows and steep stream gradients. No Steelhead were observed. Cutthroat distribution appeared relatively even once visibilities improved. Abundance levels for this species were however unusually low throughout. The highest count was observed at RM 13.7. All culverts appeared to be in good condition and passable for adults and juveniles. A total of 9 beaver dams were noted.

Poor visibility was encountered in Trib. A, however there appeared to be some salmonid production potential present. This stream was medium sized, very tannic and silty, but not overly warm. Gravel substrates were noted. The survey ended at RM 0.5 in a large beaver swamp. An expanded estimate of 40 Cutthroat were observed. Trib. B appeared too small for significant salmonid rearing potential and was impassable beyond the first road crossing.

Year	Coho	0+	Sthd	Cut
2008	-	390	-	660

- Includes Tribs. A and B
- 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. Unfortunately, anadromous access to much of the best habitat in Teal Cr. is blocked by numerous impassable waterfalls. The 2008 survey extended 7 miles up the mainstem

and 0.4 miles up the NF Teal. Moderate Cutthroat production was observed in the upper half of the survey. No Steelhead were sighted.

The lower 3 miles of Teal Cr. were dominated by very low stream gradients and a windy entrenched channel. This morphology was directly related to the wide Little Luckiamute floodplain. Most pools were long and flat and very exposed to solar impact. Substrates were dominated by sand with a mix of fine and coarse gravels in the tail-outs of some pools. Redside shiners and dace dominated these warm-water habitats. Numerous log jams were also present, along with a single beaver dam. Invasive knotweed was noted near the stream's mouth.

The stream channel changes quickly near RM 4 where Teal Cr. enters a narrow canyon and stream gradients begin to climb. Numerous waterfalls and bedrock slides were encountered in the next three miles of the survey, including an 8 ft. falls at RM 5.3 (the end of anadromous passage) and a huge 35 – 40 ft. falls at RM 5.6. The large foundation of an old log railroad bridge was encountered just upstream of the largest falls. Cutthroat and 0+ trout were observed in good numbers upstream of this falls. The survey ended in what appeared to be a continuous series of bedrock falls and boulder pours. The NF Teal exhibited similar characteristics, including a larger 50 ft. falls. The lower mainstem tributaries Boughey and Grant are discussed separately above.

Year	Coho	0+	Sthd	Cut
2008	-	480	-	635

- Includes the NF Teal
- Visual bias not included

Vincent

Vincent Cr. is warm and heavily burdened with silt at the start. 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 rest of the 3.8 mile survey. Water temperatures also decreased upstream of the mouth of Burgett. Burgett and Alexander Cr. have been summarized separately above.

A single Coho summer parr was identified in this reach of Vincent, in good visibility, at RM 2.3, between the mouths of Burgett and Alexander. The expanded estimate provided by the 20% sample is 5 summer parr for the entire stream. The most likely scenario for the observation of a single coho parr is that the individual was a holdover from a spawning event that occurred in 2006 instead of 2007. It is not uncommon to observe 1+ age class coho residualizing in freshwater an additional year prior to smolting. Smoltification is partially a function of size and sub yearlings that do not acquire adequate growth in year 1 will stay an additional year in fresh water. If coho parr observed in summer 2008 were the result of a winter 2007 spawning event there would have been more than one observed. Coho are easily identified by experienced surveyors and it is unlikely that this was the result of misidentification.

Upstream of RM 3 spawning conditions degrade due to increasing rock size, bedrock exposure, and steeper gradients. No Coho were observed anywhere else in the upper Luckiamute Basin. The only other Coho summer parr identified during the 2008

inventory were found near the mouth of Waymire Cr. on the Little Luckiamute, just downstream from Falls City.

Cutthroat production is currently low in Vincent and no Steelhead were documented. In general, this sub-basin exhibits low anadromous potential and does not exhibit typical anchor habitat characteristics for large anadromous salmonids.

Year	Coho	0+	Sthd	Cut
2008	5	60	-	245

- Visual bias not included

Waymire / Trib. to Little Luckiamute

Almost all of the Coho summer parr found during the 2008 inventory of the Luckiamute Basin (50 – expanded) were observed in the first pool of Waymire Cr. (40 – expanded), in good visibility. This was a small plunge pool beneath a small 3 ft. bedrock falls, which represented a barrier for juveniles but not adults. A relatively low rearing density of 0.6 Coho/sq.m. was observed in that pool. The fact that there were no more Coho seen upstream in Waymire suggests that these juveniles were seeking temperature refugia in a tributary of the mainstem Little Luckiamute. The only other Coho observed in the Little Luckiamute sub-basin (5 – expanded) 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 Cr. It is likely that all of the observed coho parr were from the same spawning event.

Moderate production potential was present throughout most of the 2.4 mile survey of the Waymire mainstem. Cutthroat counts, however, were low and no Steelhead were observed. Good gravels and a mixed canopy of alder, maple, ash, and blackberry were present. Beaver activity appeared to be high with a total of 9 active dams. Stream gradients and flows were relatively low during the early summer survey and most pools appeared to be long and flat with little wood complexity. Two additional barriers to juvenile migration were noted at RM 1.1 and 1.3, both resulting from a 2 ft. plunge off a cement culvert step. A large body of knotweed was noted at the first culvert. Gradually larger boulders, hard bedrock, and steep rapids began to dominate near the end of the survey. Decent gravels and good forest coverage were noted at the endpoint, where further access was denied. No fish were found in Trib. A. Good visibility was reported. A culvert near RM 0.1 was reported to be packed full of debris and impassable.

Year	Coho	0+	Sthd	Cut
2008	40	100	-	100

- Visual bias not included

Wolf

A clear legacy of beaver activity was 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 though only one fresh dam was found in 2008, perched directly atop the trash rack on the first culvert near the stream's mouth. Stream flows were very low and several pools were completely isolated by sub-surface flows. Several patches of rich spawning gravel were observed, suggesting the potential for anadromous spawning.

No Coho or Steelhead have been found here through three years of survey. Low abundances of Cutthroat have shown little change. Poor water quality, low flows, and extensive wetlands describe the current condition of the aquatic corridor. The frequently blocked trash rack on the upper end of the first culvert also restricts passage. The one mile survey each year ended in a flat and braided stream channel.

Year	Coho	0+	Sthd	Cut
2002	-	20	-	105
2003	-	35	-	115
2008	-	70	-	90

- Visual bias not included

WF Luckiamute

This 3.5 mile stream segment contained the most productive tributary habitat for Cutthroat and Steelhead in the whole 2008 Luckiamute basin inventory. Cutthroat and Steelhead counts were relatively high in the WF Luckiamute during the 2002 and 2003 surveys, with estimates for both species decreasing slightly in 2003. A significant 217% increase in Cutthroat abundance was observed during the 2008 survey along with a more moderate 57% increase in 1+ Steelhead abundance. These two population segments were second in size only to estimates from the highly productive 7 mile reach of the upper Luckiamute mainstem. Young-of-the-year trout estimates in the WF Luckiamute have increased during each survey.

Stream habitat in the WF Luckiamute appears to be functioning well and certainly represents a strong anchor habitat for salmonids in the Luckiamute Basin. This was the second most productive tributary habitat for Steelhead in the 2008 inventory. This stream is the largest headwater tributary to the Luckiamute mainstem. This fact greatly reinforces the critical nature of stream habitat within the WF Luckiamute sub-basin for the survival of salmonids in the basin as a whole. The WF and Miller (7.3 miles combined), accounted for 18% of all Cutthroat and 17% of all 1+ Steelhead in the basin in 2008. This was by far the most productive sub-basin for these two species.

Eighty-six percent of all Cutthroat observed in the WF in 2008 were found below a huge log jam at RM 2.7. The highest counts for this species were found just 600 ft. up from the mouth, and at RM 2.3. All 1+ Steelhead observed in 2008 were downstream of this log jam in a fairly even distribution (suggesting that the barrier currently defines the

upper limit of anadromous distribution). This jam was located just upstream of the large flat near Camp Walker where the stream flow divided into three smaller canyons, the mainstem, Trib. C, and Trib. D. Underground flows surrounding this jam and the large amount of tightly packed debris represent a temporary barrier to adult and juvenile migrations. Stream flow in the mainstem changes from large to medium upstream of this location.

A similar distribution in fish abundance was noticed during the 2002 and 2003 surveys, when anadromous passage still appeared possible. In 2002 the lower 2.7 miles of the WF supported 74% of all Cutthroat and 83% of all 1+ Steelhead found in the mainstem that year. Similarly, in 2003, this reach supported 57% of all Cutthroat and 93% of all 1+ Steelhead. This appears to be the prime zone within the WF mainstem. Beaver activity was abundant throughout this zone in 2002 and 2003, but had declined to almost nothing in 2008. No culverts were noted.

The second most important tributary to the WF, second to Miller, appears to be Trib. C. Cutthroat production here in 2008 was strong and appeared much higher than in 2002 or 2003, although survey distances were much shorter for those years. An expanded estimate of 545 Cutthroat were present in 2008 through 1.1 miles of survey. No Steelhead were observed in 2008, as a result of the log jam barrier, but low numbers were present in 2002 and 2003. Three beaver dams were noted in 2008. A large log jam on top of a bedrock cascade near RM 0.8 appears to be the end of anadromous passage. Low numbers of Cutthroat and 0+ trout were present in Tribs. B, D, and E as well. Surveys in these three small streams were all under 0.4 miles and expanded estimates for Cutthroat were all under 60. Anadromous potential is limited in these habitats by stream flow and pool size. No culvert problems were identified. A 3 ft. falls was noted in Trib. B at RM 0.4.

Year	Coho	0+	Sthd	Cut
2008	-	315	110	2,255

- 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

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

Unnamed Tributaries

Short surveys were also conducted on 5 unnamed tributaries to the Luckiamute mainstem. All exhibited little to no potential for anadromous production and very limited potential for resident cutthroat due to mostly to low flows, steep gradients, poor pool formation, and lack of suitable spawning gravel. These streams are referred to in the database and on the maps as Trib. U, Trib. Y, Trib. AA, Trib. AC, and Trib. AD. Tribs. A through T were labeled on the maps but not surveyed due to small stream size or lack of stream flow.

Trib. U was the furthest downstream of the 5 surveyed tributaries and joined the Luckiamute mainstem at RM 58, just downstream from Cougar Cr.. Only dace were found there. Trib. Y exhibited good flows, cold water, and low expanded estimates of 5 Cutthroat and 20 0+ trout. This stream appears to be most important as cold water refuge for mainstem juveniles. Decent spawning gravel and stream flow was observed in Trib. AA along with an expanded estimate of 35 0+ trout. Trib. AC exhibited good flows, steep stream gradients, and large rock. No fish were present. A strong beaver legacy was observed in Trib. AD, but no recent activity. Expanded estimates of 30 0+ trout, 5 1+ Steelhead, and 15 Cutthroat were present.

Watershed Recommendations

- Continue restoration efforts on the upper Luckiamute mainstem, Boulder, West Fork, and Miller. Develop restoration strategies for Pedee, Price and 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.
- Work on fish passage through lower Soap Cr. irrigation dams. This may be done by removing dams or installing fish ladders.

NOTE: 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 stream and species. This pivot table work book allows managers and users to access information for all of the streams surveyed in 2008. Please contact the Luckiamute Watershed Council for an updated version of this tool: lwc@wou.edu

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.

A GIS layer of current fish distribution in the Luckiamute Basin is also being developed by Western Oregon University.