TILLAMOOK BAY
RAPID BIO-ASSESSMENT 2005

PREPARED FOR:

Tillamook Estuaries Partnership

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INTRODUCTION

A Rapid Bio-Assessment inventory was conducted for the Tillamook Estuaries Partnership during the summer of 2005. This comprehensive inventory included all the watersheds that contribute to Tillamook Bay Complex, the Tillamook, Trask, Wilson, Kilchis, and Miami. 2005 was the first year of a proposed three year project. The intent of the project was to gather information on the status of juvenile salmonid summer distributions and summer rearing densities. The inventory consists of extensive snorkel surveys in each basin that begin at the head of tidal influence and continue to the end of juvenile Coho distribution in each stream and its tributaries. These surveys will be used to develop base line data for each of three successive cohorts and to eventually identify long term trends in the distribution and abundance of juvenile Coho, Steelhead, Cutthroat and Chinook at the 6th field level in response to restoration and watershed management issues. These surveys were conducted using funds granted by OWEB and from the contribution of partners from the Tillamook Estuaries Partnership, Tillamook Bay Watershed Council, BLM, ODF and ODFW.

The escapement of adult Coho in all of the surveyed basins during the 2004 brood year was insufficient to adequately seed the summer habitat currently available on a watershed scale throughout the Tillamook management area. For many of the basins and subbasins, adult escapement is the primary limiting factor for production. The trend in the adult escapement of Oregon Coast Natural (OCN) Coho since 1990 has been positive for most basins.

The 2004 ODFW estimated adult escapement for Tillamook Bay was 2,290. The Rapid Bio-Assessments expanded estimate was 291,264 Coho summer parr (utilizing ODFW's snorkel observation bias of 20%) for the entire Tillamook Bay Watershed. Back-calculating adults from this juvenile estimate (using a range of egg-fry survival rates between 8.8% and 10%) suggests an escapement of between 2,331 and 2,649 adult Coho for the 2004 brood year. This level of agreement in estimated adult escapement between the ODFW adult SRS data and the RBA juvenile estimates increases the confidence in the methodologies for quantifying adult returns on the area wide scale. This agreement in methodology is largely a function of appropriate sampling effort for the size of the target basin. A goal of the three year study is to assess the inter-annual agreement in these trends.

The 2001-2004 adult Coho estimates coast-wide exhibit dramatic increases in abundance and are indicators of recent improvements in ocean conditions. ODFW's long term SRS monitoring of adult Coho escapement suggests that the 15 year trend for the North Coast monitoring area is one of only two statistically significant trends observed in the five coastal monitoring areas. This statistically significant trend was also detected in the more intensive monitoring associated with the Oregon Plan conducted between 1997

and 2001 (E-Map). Both methods suggest that the trend is driven primarily by abundance in the Nehalem River but that a significant positive trend is also quantifiable in the Nestucca.

The Tillamook complex has been classified by Nickelson (Population Assessment: Oregon Coastal Coho, 2001) as exhibiting a coastal Coho population that is none viable and at risk of extinction if the critical threshold (the level at which a population is at relatively high risk of extinction in the near future) of 1,000 adults is not maintained (the Tillamook complex was at or below this threshold most years between 1990 and 1998).

Because adult escapement to the Tillamook complex has been bordering on that critical threshold (except for stellar escapement in 2002 and 2003, approx 15,000) it is important to recognize that low adult abundance may dramatically impact the observed distributions and densities of juvenile salmonids. The resultant distribution data from 2005 still does not describe all of the accessible and suitable spawning and rearing habitats for salmonids because of this under escapement.

The juvenile survey method was designed to look at 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 quantify the rearing densities of Coho and the relative abundance of Cutthroat, Steelhead, and Chinook in all of the surveyed streams and their tributaries.

The 2005 database contains the results of 338.3 stream miles that were surveyed. This included the full extent of Coho distribution in the Tillamook River (62 miles), the Trask River (90.6 miles), the Wilson River (106 miles), the Kilchis River (46.6 miles), and the Miami River (28.6 miles), as well as several small direct tributaries to Tillamook Bay. If a stream is not included in the database it was not surveyed. This will occur only in situations where a mapped tributary was dry or where there was a lack of suitable visibility for the survey methodology.

METHODS

The basins and sub-basins surveyed were selected and prioritized by ODFW, BLM, TEP and ODF technical advisors. Survey crews were concentrated within a 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. Developing these contacts involved extensive research in the county tax assessor's office and then a personal contact to describe the survey and request permission for access. The land owner information was recorded (name, contact #, tax lot # and location) and will be available 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 order) where Coho presence or absence was undetermined. In these tributaries, the first pool above the confluence was selected as unit number one. This alteration in protocol was adopted to identify minor upstream temperature dependant migrations that may not have extended more than a few hundred feet. The identification of this type of migratory pattern in juvenile salmonids is critical for understanding potential limiting factors within the basin (temperature, passage, etc.). Some surveys were initiated at a point above brackish water influence or 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 available through TEP.

The survey continued sampling at a 20% frequency (every fifth pool) until at least two units without Coho were observed. In addition, pools that were perceived by the surveyor as having good rearing potential (beaver ponds, complex pools, tributary junctions) were selected as supplemental sample units to insure that the best habitat was not excluded with the random 20 percent sample. This method suggests that the data existing in the database could tend to overestimate average rearing density if these non-random units were not removed prior to a data query (the selected units are flagged as non-random in the database).

In subbasins with low rearing densities, there were situations where Coho were not detected for more than two sampled units. These situations were left to the surveyor's discretion, whether to continue or terminate the survey. There is a possibility that very minor, isolated populations of juvenile Coho could be overlooked in head water reaches of small 2nd order tributaries. This tributary would have to include a strong beaver population that would impound emergent fry and truncate their normal downstream fry distribution patterns.

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 are typically not highly productive summer rearing locations and they compromise the consistency of measuring, summarizing and reporting lineal stream distances.

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. A minimum of three lineal estimates were also measured with a hip chain for each surveyed stream to develop a calibration factor for each surveyors estimate of distance. 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 be found in the comments column). In addition, the USFS under contract toTEP will be producing a digitized stream layer of Coho distribution for incorporation into the current GIS database.

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. (Coho 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 surveyors 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 delivers 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.

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

The database contains fields designed to facilitate the development of a GIS data layer. These are LLID location numbers that 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 2004 ODFW estimated adult escapement for Tillamook Bay was 2,290. The Rapid Bio-Assessments expanded estimate was 291,264 Coho summer parr (utilizing ODFW's snorkel observation bias of 20%) for the entire Tillamook Bay Watershed. Back-calculating adults from this juvenile estimate (using a range of egg-fry survival rates between 8.8% and 10%) suggests an escapement of between 2,330 and 2,648 adult Coho for the 2004 brood year.

The Wilson Basin exhibited the longest distribution for Coho (106.6 miles) as well as the highest productivity (see table below). 37.4% of all Coho in the Tillamook Bay Watershed were found there. The Wilson Basin also appeared to be, by far, the most productive for Steelhead (24,225 1+juveniles). Low distribution in the Miami (28.6 miles), the smallest basin by acreage, represented the lowest productivity for Coho (6.3% of the total Tillamook Complex Coho). Steelhead production there, however, relative to survey distance, was unusually high (7,350 1+juveniles).

Most of the basins spread out to the south and east of the Tillamook Bay through extensive low gradient tidal channels and the large flat expanse of the Tillamook Bay Floodplain. Winter rearing habitats are high quality and abundant within the estuary. Channel entrenchment, riparian condition and water quality were common factors influencing fish distribution throughout the complex's agricultural lands. Knotweed infestation is also a significant invasive species concern for the lower Tillamook, Trask, Wilson, and Miami Rivers. A data field in the 2005 Access database displays the presence or absence of Knotweed for each surveyed segment of 5 contiguous pools.

Most basins, except for the Tillamook, climb rapidly out of the Tillamook Bay floodplain and are supported by high gradient tributaries of basaltic origin. The Tillamook system is lower gradient and uniquely dominated by sandstone geology. East side tributaries of the Tillamook River (Faucett, Killam, Munson, and Simmons) exhibit the morphology and underlying geology similar to the other major basins of the Tillamook complex. These habitats are typically characterized across the basins by high stream gradients, low pool/riffle ratios, extensive boulder rapids, frequent bedrock exposures, low floodplain interaction, and low wood complexity due to extreme winter flows. Coho distribution ended in many of these streams at bedrock waterfalls or in steep boulder gorges. In stream over winter survival (as opposed to estuarine survival) for Coho pre-smolts in these habitats may be a dominant limiting factor due to the lack of channel-spanning wood/debris jams and the general absence of low interactive floodplains. The Tillamook River, in contrast, and all of its western tributaries, continued south and west out of the Tillamook Bay into low gradient sandstone and clay geomorphologies. Fine gravels were abundant in these reaches along with beaver impoundments, tannic conditions, low summer flows, and heavy siltation.

The most important anchor habitats for Coho in the Watershed, in order of current productivity, were observed in the Little North Fork Wilson, Elkhorn Cr. (NF Trask), the mainstem Wilson, the Devils Lake Fork Wilson, the mainstem Kilchis, the mainstem Miami, the North Fork Trask, the upper Tillamook mainstem, the South Fork Wilson, the North Fork Kilchis, the North Fork North Fork Trask, and Bewley Cr. (Tillamook). These reaches were supporting the largest summer rearing Coho populations in 2005 and, theoretically, the highest 2004 adult escapements. They also represent the best spawning gravels, highest wood complexities, and, in most cases, the lowest land use impacts encountered during the 2005 inventory.

The highest numbers of summer rearing 1+Steelhead were found, in order of magnitude, in the mainstem Wilson, the mainstem Miami, the mainstem Kilchis, the Little North Fork Wilson, the mainstem Trask, the East Fork Trask, and the Devils Lake Fork Wilson. Actual population sizes for Steelhead are much higher than documented because rapid/riffle habitats were not part of the habitat inventoried in the 2005 RBA inventory. Steelhead, Cutthroat and 0+ numbers from this analysis can only be utilized to identify key reaches and monitor inter annual trends.

Several other streams, lacking adequate adult escapement, were found with significant habitat potential for Coho productivity. These included: (1) Faucett and Killam on the Tillamook, (2) Mill (water quality problems), Bark Shanty, Gold, the East Fork, and the South Fork on the Trask, (3) Ben Smith, Jordan, and the North Fork on the Wilson, (4) Vaughn (culvert passage problems) and the Little South Fork on the Kilchis, and (5) Moss, Peterson, and Prouty on the Miami. Patterson Cr., a small tributary to the Tillamook Bay, also exhibited significant anadromous potential despite low 2005 productivity (due mainly to culvert passage problems). Culvert and other passage issues along with restoration recommendations are discussed individually by stream and highlighted at the end of the Site Specific Observations.

(Table 1) **Back-Calculation of Adult Escapement from Juvenile Expanded Estimates**
(based on an 8.8% - 10% egg-to-fry survival rate and 2,500 eggs per female)
(ODFW adult SRS data indicated a total escapement of 2,290 Coho)

Basin	2005 Coho Summer Parr(w/ 20% snorkel bias)	Estimated 2004 Adult escapement
Tillamook	36,522	292 – 332
Trask	89,730	718 – 816
Wilson	108,870	871 – 990
Kilchis	37,326	299 – 339
Miami	18,330	147 – 167
Other Tribs.	486	4 – 5
Total :	291,264	2,331 – 2,649

Most habitats were not seeded to capacity in the inventoried sub basins and there remains extensive summer habitat available to salmonids that are currently under-utilized. For the following review, we are considering 1.5 fish / sq.meter a fully seeded density for Coho. There are concerns from many biologists that this estimate of fully seeded does not represent the production potential that exists in completely functional Coho habitat that is benefiting from the nutrient loading of adult spawning salmonids (eggs, carcasses). There are excellent examples in a wide range of habitats from across the entire coastal ESU of stream reaches that far exceeded the level of 1.5 fish/sq.m. of pool surface area (up to 3.0 fish/sq.m.). The intent of establishing this target of full seeding is to provide a platform for comparing stream reaches to each other and to themselves over time. The graphics available in the Excel Pivot Table that accompanies this document utilize this value to normalize scaling.

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.

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 subbasin. These profiles can help identify spawning locations, identify potential barriers to upstream adult and juvenile migration, identify the end point of Coho 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 major basins and subbasins surveyed during the 2005 field season.

Location of spawning destinations

The approximate locations of spawning pairs was observable in many of the sampled sub basins by the presence of a distinct spike in rearing density that trailed off rapidly just upstream. The physical location of a spawning destination has a range of variance plus or minus 4 pools due to the 20 percent sample methodology. Depending on the average distance between pools, this typically describes a maximum lineal distance that varies between 150 ft. in a small 2nd order tributary to 800 ft. in a fourth order tributary. To utilize the database to identify spawning destinations, an additional precaution is necessary. Surveyed lineal distances are typically longer than calculated distances (map wheel, GIS, etc.) due to the sinuosity of the active channel that is not displayed in the 1:24,000 series USGS maps. To accurately evaluate site specific locations it is important to utilize the digitized map layer that has been justified to known end points and tributary junctions. This layer has been developed by the USFS and is available to the public.

The average densities generated represent a snapshot in time of the current condition that can be compared to known levels of abundance that exist in fully seeded and fully functional Coho habitats. These densities also provide a method for quantifying changes in rearing densities by reach or subbasin over time. Average densities utilized as a metric in this analysis are calculated for pool surface areas only. Lower levels of Coho abundance exist in fast water (riffle/rapid) and glide habitats. Replicate surveys conducted in these same reaches in subsequent years will function as an indicator of response to future restoration and enhancement strategies and potential changes in land use. It does not however, provide any indication of actual smolt production because of the distinct relationship between juvenile Coho survival and the abundance of high quality winter habitat.

Adult and Juvenile Barriers

Adult migration barriers are verified by determining that no juvenile 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 in coastal basins. 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 migration.

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 Dependant Migrations

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

Precautions

The specific location of spawning sites does not infer that the highest quality spawning gravels were targeted by adult salmonids or that there is any relationship

between the location of a redd and the quality of the rearing habitat that exists adjacent to these locations.

The location and distribution of juvenile Coho represented in the database is not related to the quality of the rearing habitat that exists in the aquatic corridor adjacent to these sites.

The average densities that can be 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 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)

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

When calculating the average density of juvenile Coho in a particular stream reach, it is important that only the data be utilized that falls within the distribution of Coho. Many stream reaches contain sample sites that extend well above the actual distribution of juvenile Coho. Including these data points significantly underestimates the average rearing density and provides a poor foundation for monitoring trends in subsequent years. There are also many streams surveyed that have a downstream point of Coho distribution that is well above the start of the survey reach. Two factors for each stream reach surveyed are key elements for trend analysis, the extent of the distribution and the average density within that distribution.

SITE SPECIFIC OBSERVATIONS

Site specific observations within this document have been organized in a format that utilizes GIS definitions to describe basins and subbasins. The area within the Tillamook Watershed management zone includes five major basins. Each of these basins has been summarized separately: (1) the Tillamook, (2) the Trask, (3) the Wilson, (4) the Kilchis, (5) the Miami, and (6) lastly the small order Tillamook Bay tributaries.

These production estimates are based on an expansion of the 20% snorkel sample in pools only and therefore do not constitute an entire production estimate for the basin. These estimates greatly under estimate the standing crop of 0+, Steelhead and Cutthroat because a large component of their standing crop is summer rearing in riffle / rapid and glide habitats that were not inventoried. In addition, there is also production for these three groups that extends upstream beyond the end point of Coho distribution where the surveys were terminated. These figures, however, can be utilized to establish a baseline for trend monitoring for subsequent survey years on the basin wide scale and by tributary. The basin-wide summary tables at the start of each section below function well to establish relative production potentials between tributaries that can be utilized as a foundation for prioritizing restoration opportunities.

Tillamook River Basin

62 miles of stream were surveyed within this basin in June of 2005. This was the third largest basin in the Tillamook Bay Watershed. Total Coho production was low, 30,435 (expanded), compared to the Trask and Wilson Basins, about the same as the Kilchis Basin, and twice as high as the Miami Basin. All habitats were summer rearing well below seeded capacity for Coho. The expanded abundance of 1+ Steelhead for the basin of 1,525 was much lower than any of the other basins in the Tillamook Bay Watershed.

Much of the mainstem (14.8 miles) and western tributaries exhibited low gradient stream habitats with high rates of sedimentation and abundant beaver activity. Geology on this side of the basin was dominated by sandstone and clay and surrounding elevations and resultant gradients were low. The best spawning gravels for Coho in these areas were found in the upper mainstem and in the Bewley Cr. subbasin (10.4 miles). These two subbasins were the largest producers of Coho within the Tillamook River basin. Rearing densities for Coho in these two reaches averaged just 0.3 fish/sq.m. each. Coho distribution typically ended in a series of beaver dams or low gradient wetlands.

The main eastern tributaries to the Tillamook River, including Faucett, Killam, Munson, and Simmons, all originated from higher elevations and basaltic geologies. Stream flows in general were higher and colder and spawning gravel more abundant.

Coho distribution on this side of the basin typically ended in steep boulders or waterfalls. Munson (2.6 miles), Simmons (4 miles), and Faucett (5.1 miles) ranked as the third, fourth, and fifth largest producers of Coho in the basin. The highest average rearing density for Coho in the Basin was observed in Munson Cr. (0.7 fish/sq.m.). Spawning beds here, in Bewley Cr., and in the upper mainstem appear to be the most important target zones for spawning adult Coho in the basin.

Likewise nearly all of the basin's 1+Steelhead production occurred among these four eastern subbasins, mostly in Faucett Cr. Actual 1+Steelhead estimates in Killam (3.8 miles) were likely to be much higher as surveyor access to the first mile of stream was denied by the landowner. Coho seeding appeared accurately low in Killam based on the portions surveyed. The small population of 1+Steelhead found in the mainstem Tillamook were associated almost exclusively with the mouths of these four streams.

(Table 3) Tillamook River 2005 Basin Wide Inventory

Stream	**Coho**	% Total	**0+**	% Total	**Sthd**	% Total	**Cut**	% Total
Mainstem	10,120*	33.3	275*	10.7	100*	6.6	685*	18.2
Beaver	685	2.3	135	5.2	0		200	5.3
Bewley	7,025*	23.1	430*	16.7	15	1.0	810*	21.5
Esther	1,650	5.4	230*	8.9	15	1.0	170	4.5
Fagan	25		0		0		20	
Faucett	2,095*	6.9	485*	18.8	925*	60.7	550*	14.6
Joe	65		70	2.7	0		40	1.1
Killam	410	1.3	180	7.0	115*	7.5	505*	13.4
Mills	1,460	4.8	45	1.7	5		135	3.6
Munson	3,560*	11.7	80	3.1	90*	5.9	175	4.6
Pleasant Valley	155		0		0		10	
Simmons	2,465*	8.1	190*	7.4	260*	17.0	325*	8.6
Sutton	30		0		0		0	
Basin Total	**29,745**	**97.7**	**2,120**	**82**	**1,525**	**100**	**3,625**	**96**

* Highlighted estimates represent the top 5 producers by species and age class

- Percent contributions are indicated for only those subbasins that contributed greater than 1% of the total.

Mainstem Tillamook

(Table 4)
Expanded Mainstem Tillamook Estimates of Juvenile Salmonid Production and Percent Contribution to the 5th field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	10,120	275	100	685
	(33%)	(11%)	(7%)	(18%)

Despite low average rearing densities the Tillamook mainstem was the single most productive component of the entire 5th field for Coho. About one third of all the summer parr in the basin were found there. This was primarily due to the length of distribution observed, 14.8 miles, compared to the remaining components. A low average rearing density of 0.33 fish/sq.m. was observed throughout the mainstem for Coho which rose to 1.5 fish/sq.m. (near rearing capacity) around RM 12.8. A two mile reach of mainstem centered on RM 12.8 appeared to be the main spawning destination for adult Coho. This reach was located upstream of the end of Yellow Fir Road and downstream of the last major logging road culvert (the near end of Coho distribution). This zone displayed healthy riparian conditions including an intact mixed forest canopy, low and interactive floodplain terraces, closely grouped pools, moderate water flow, and well sorted, clean gravels.

Most mainstem habitat downstream of the Yellow Fir Road Bridge was dominated by low gradient, tannic water, a deeply entrenched stream channel, and heavy siltation. Visibility was poor through most of this lower mainstem resulting in lower confidence in the snorkel observations. Habitats in this lower mainstem did not exhibit any spawning potential and water quality limitations to summer production are likely. In addition, there was a 4 mile stretch of mainstem from the confluence of Trib C to a point 3,400 ft above the Yellow Fir Road bridge that exhibited extremely low juvenile Coho abundance.

A strong legacy of beaver activity was noted in many of these small streams. Beaver ponds were abundant on these western Tribs but the abundance of gravel often limited the tributaries potential. The low gradient stream profile throughout the majority of the Tillamook river system prevents the rapid transport of sediments and fines and facilitates the deposition of these mobile substrates. This morphological condition increases the systems sensitivity to accelerated contribution rates from upslope management activities. The resultant impacts include embedded spawning gravels and low egg/ fry survival rates.

Juvenile Steelhead, Cutthroat, and Chinook were also seen in low levels here. All 1+Steelhead in the mainstem were observed between RM 2.4 and RM 4.1. This reach was where Killam Cr., Fawcett Cr., Simmons Cr., and Munson Cr. all met the Tillamook. These streams were the four major high gradient eastern tributaries to the Tillamook

mainstem and the greatest suppliers of cold water, rock, gravel, and Steelhead habitat. Juvenile Chinook (an expanded estimate of 1,045) were observed from the head of tide up to RM 7. Cutthroat were evenly distributed. All mainstem road culverts were in good shape and passable for adults and juveniles. Knotweed was noted in several locations between the head of tide and RM 5.4 (near the mouth of Joe Cr.).

Anderson

1,250 feet of Anderson Cr. were surveyed between the head of tide and Highway 101. No fish were noted. Habitat conditions there were characterized by long trench pools through open pasture with abundant aquatic vegetation. Gravel abundance was low and there were no spawning sites observed that would accommodate large anadromous adults. The stream splits above the survey endpoint into two smaller streams which each cross under Highway 101 and come to an end in the huge flat floodplain surrounding the Tillamook Airstrip. Minor abundances of rock were noted at the highway crossings that may have originated from road fill. Stream flow above the split appeared very low and pool formation was almost non-existent. With such low diversity of substrate, minimal water flow, and a complete lack of riparian canopy, it is doubtful that Anderson Cr. could support any significant adult spawning or juvenile summer rearing.

Beaver

Beaver Cr., Bewley Cr., and Esther Cr. represented the three most productive subbasins on the western side of the Tillamook Basin (Beaver with around 6 miles of Coho habitat, Bewley with 10.4, and Esther with 1.7). Fish production was lowest in Beaver. An expanded estimate of 685 Coho summer parr were observed in the Beaver Cr. subbasin compared to 7,025 in Bewley and 1,650 in Esther. Beaver Cr. meets the Tillamook mainstem below the head of tide and the start point for our survey was about 0.5 miles upstream of this junction. Trib. A leaves Beaver Cr. at this point and heads off to the North. 170 (expanded) Coho were observed in Trib. A in a low average rearing density of 0.35 fish/sq.m. across 1.4 miles of stream habitat. This was the highest average rearing density for Coho seen in the subbasin. The stream channel in Trib. A was small, entrenched, and sandy and Coho distribution was ended by a series of beaver dams and extensive water impoundments.

Coho distribution in the mainstem of Beaver Cr. continued upstream from this point for 2.2 miles at an extremely low average rearing density of 0.1 fish/sq.m. with the highest counts seen about 1.6 miles up (upstream of the Beaver Cr. Road crossing). The expanded estimate for Coho in the mainstem totaled 315 summer parr. The stream channel here wound back and forth across a wide pasture floodplain with minimal riparian canopy and a deep entrenchment averaging six to eight feet. These conditions along with little change in elevation have led to poor pool diversity in general within

mainstem Beaver. Very few pool breaks or tail-outs were observed where anadromous adults could successfully spawn and most occurrences of gravel were poorly sorted and contained high percentages of sand and silt. Many Sticklebacks were noted, indicating elevated aquatic temperatures.

Trib. C meets Beaver Cr. just above the Beaver Cr. Road crossing and also heads north, following the road upstream. 1.3 miles of Coho distribution were observed in Trib. C at an average rearing density of 0.24 fish/sq.m. Expanded estimates totaled 150 summer parr. Distribution ended at 6ft foot clay falls below a massive beaver dam complex which appeared to reach all the way to the headwaters of the stream. Minor juvenile migrations were observed also in Tribs. B and D. Spawning gravel appeared to be the main limiting factor in the subbasin with only minor abundances found in Trib. A, Trib. D, and the upper half of the mainstem. Beaver Cr. geology was largely dominated by sand, mud, and clay, low stream gradients, and extensive wetlands at the upper end of the mainstem and tributaries. No Steelhead were seen and an expanded estimate of 200 Cutthroat were broadly distributed throughout the subbasin. No knotweed was observed.

Bewley

Bewley Cr. was the most productive tributary in the basin for Coho. Expanded estimates for summer parr totaled 7,025 which represented 23% of the basin-wide population. Rearing densities were low in the subbasin, averaging 0.3 fish/sq.m. in the mainstem, 0.4 fish/sq.m. in Tribs. D and E, and 0.8 fish/sq.m. in Trib. G (a short 775 ft. upstream migration). Most of the adult spawning for Coho seems to have occurred in the upper two miles of the mainstem and in Tribs. D and E. Total distribution for Coho in the subbasin reached 10.4 miles. A significant 4.2 miles of this distribution was provided by the many tributary habitats present in upper Bewley. Coho production in the subbasin could be much higher with adequate adult escapement

69% of the Bewley Cr. Coho were found in the mainstem where expanded estimates totaled 4,860 over 6.2 miles of stream. Rearing density rose consistently upstream toward a peak in the last 0.5 mile of distribution. A 4 ft. falls over a sill log terminated distribution in the mainstem. Excellent summer rearing habitat was present in the lower half of Bewley where pools were long and deep and substrates were dominated by sand and old wood. The stream channel here exhibited high sinuosity and deep entrenchment through open pasture lands with intermittent forest coverage. Two small tributaries (A and B) branched off of the lower mainstem exhibiting small upstream migrations. Above the main road bridge the forest canopy became more consistent and pool diversity began to increase. Fine gravels were abundant through the upper reaches and fairly well scoured and sorted. Larger rocky substrates were also present through a stretch of steeper gradients between Tribs. D and E. Stream flows were high and the floodplain exhibited lower terraces and more interaction.

Five tributaries of significant flow branched off of the mainstem in this upper reach. Two exhibited minor upstream migrations of Coho and three, Tribs. C, D, and E, showed signs of adult spawning. The expanded estimate for Coho in Trib. C was a low 45 but 0.4 miles of distribution extended 1,365 ft. past a definitive juvenile barrier – a 3 ft. diameter steel pipe culvert that was perched by 3 ft. This culvert goes under the main gravel logging road about 500 ft. upstream from the junction of Trib. C and the mainstem. It appears that an adult spawning event took place upstream of this culvert and that adult passage, while difficult, must have been possible during high winter flows. This culvert should be high priority for replacement as both spawning and rearing habitat were present in this tributary. Trib. C appeared to be a large resource of fine gravel for mainstem Bewley though stream flow was low compared to Tribs. D and E.

An expanded estimate of 840 Coho were found in Trib D in an average rearing density of 0.4 fish/sq.m. with a distribution reaching 1.4 miles. Beaver dams terminated distribution in this tributary. Trib. E appeared slightly more productive with an expanded estimate of 1,110 Coho (about 16% of the subbasin total), a similar average rearing density, and a distribution of 1.6 miles. Several sill-log structures and debris torrent jams were present in Trib. E, both supporting high Coho counts in the resulting pools. Small spawning peaks can be detected in the rearing density profiles for these two streams. No culvert passage problems were detected in Trib. D or E. The low stream gradient, high pool diversity, and abundance of spawning gravel present in Tribs. D, E, and the upper 2-3 miles of mainstem Bewley characterize these reaches as the most important spawning habitats present in the subbasin. Given the rates of production observed there in the 2005 survey they also appear to be among the most targeted spawning destinations for adult Coho in the whole Tillamook Basin.

Short distributions were terminated in Trib. F by beaver dams and in Trib. G by a large sill log just below a beaver impoundment. Stream flow and future potential in these two tributaries appears low. Expanded estimates for 1+Steelhead in the subbasin were extremely low at 15. 810 (expanded) Cutthroat were also present and widely distributed (72% in the mainstem). Two small culverts on Trib. A appeared to be in bad shape though upstream habitat was minimal and spawning potential low. The first 3 ft. pipe (under a private dirt road) was in good shape but perched by 1 ft., the second was a 2 ft. cement pipe (under main road) that was submerged on the upstream end and poured over 2 ft. of rip-rap on the downstream end. The second terminated Coho distribution. No knotweed was noted.

Esther

Esther Cr. was the furthest downstream of all the Tillamook River tributaries with its mouth just up from the Tillamook Bay on the west side. An extensive tidal slough connected Tomlinson Cr. to Esther Cr. and to the Tillamook mainstem. A large tide-gate opens and closes the 8 ft. entrance culvert to this slough underneath an old road bed. The

main stream channel remained tidally influenced for another 500 ft. upstream before the next 4 ft. culvert under Tomlinson Rd. was reached. Both of these culverts appeared in good shape and passable for adults and juveniles. Trib. A branched to the right just upstream of this crossing. Expanded estimates for Coho totaled 1,650 in the subbasin with distribution reaching 1.7 miles in all. Average rearing densities for Coho were comparably higher here than in other streams in the Basin – 0.84 fish/sq.m. in mainstem Esther and 0.95 fish/sq.m. in Trib. A (probably the result of upstream migration).

The mainstem of Esther provided 1.2 miles of habitat to 89% of the Coho observed in the subbasin. The best spawning reach was found within the first 0.5 miles where rearing density peaked at 1.4 fish/sq.m. This was the transition zone between the lower pasture habitat and the upper mixed forest canopies. The stream channel was deeply entrenched through the pasture habitat but exhibited a high level of sinuosity and several deeply scoured pools. Above this point stream gradient increased along with rock size and several outcroppings of bedrock were observed within the channel. Increases in gradient were greater in Esther Cr. than in other western tributaries to the Tillamook and summer stream flow was lower.

Trib. A to Esther Cr. was low flow with a narrow, entrenched channel. Spawning gravel was present while suitable spawning sites were few. Analysis of Coho density profiles from the 2005 survey suggest that the population here resulted from upstream migration. An expanded estimate of 115 Coho were observed here over 0.25 miles of stream. Summer rearing potential in this tributary was good. Upstream of a short stretch of pasture the stream entered the forest where several deeply scoured pools were observed.

Tomlinson branched off of Esther through its own tidal slough to the north, continued under a small private driveway culvert (where a significant patch of Knotweed was observed easily visible alongside the Cape Meares bayside road), and turned westward into steeper stream gradients. Expanded estimates for Coho totaled just 65 in Tomlinson along 0.3 miles of stream in what appeared to be an upstream migration. Some spawning potential exists here in the mixed gravels just above the tidal slough but stream gradient increases quickly once the stream leaves the main road and heads west.

An expanded estimate of 15 1+Steelhead were observed in mainstem Esther and 170 (expanded) Cutthroat were found throughout the subbasin. No culvert problems were identified.

Fagan

Spawning and rearing habitat appeared to be minimal along Fagan Cr. though 5 juvenile Coho were found 0.3 miles up from the head of tide. It is doubtful that a spawning event occurred in Fagan as much of the surveyed portion appeared swampy and loaded with sand and silt. Trib. A branched to the right 1.1 miles upstream from the head of tide and provided a good source of gravel and summer flow. The active channel was

very narrow and pool size small. No Coho were seen in Trib. A and spawning potential for Coho was minimal. 20 Cutthroat (expanded) were found here and no Steelhead were observed. Approximately 0.6 miles upstream from the head of tide was a 3 ft. diameter culvert that was observed to be collapsing but was still passable for adults and juveniles. No Knotweed was noted.

Faucett

Coho production in the Faucett Cr. subbasin ranked fourth among the Tillamook River tributaries, behind Bewley, Munson, and Simmons. Expanded estimates here totaled 2,095 summer parr and rearing density averaged a low 0.3 fish/sq.m. throughout 4.9 miles of the mainstem and 0.2 miles of Trib. A. An expanded estimate of 925 1+Steelhead within the Faucett Cr. mainstem ranked as the largest population anywhere in the Tillamook River basin. Faucett, Killam, Munson, and Simmons represent the four largest eastern subbasins to the Tillamook River and were all major suppliers of cold water, substrate, and high quality salmonid habitat. Stream gradients rose quickly in all these subbasins and substrates were dominated by hard basaltic rock. Summer flows were high.

Forest canopy associated with the stream channel was intermittent for the first two miles up to a municipal water intake structure where a mixed species canopy became more the norm for the remainder of the survey. The reserve of trees in the upper reaches leading up to the reservoir and the steep canyon walls have maintained low summer stream temperatures and provided a source of stable instream wood complexity. The 3 ft. plunge over the first dam is a juvenile barrier but is passable for adults Steelhead and Coho (adult Chinook did not appear to have passed the facility). 60% of the 1+Steelhead and 67% of the Cutthroat in the subbasin were present below this dam. The distribution pattern suggests that many of these juveniles may have migrated up Faucett Cr. from the mainstem in a temperature dependant migration.

The expanded estimate of Cutthroat in the entire mainstem was 535. An expanded estimate of 530 juvenile Chinook were also found in a distribution that was terminated by the dam. This dam did not appear to be a factor in the distribution of Coho juveniles. A 10 ft. culvert at RM 0.5 is perched by 12 inches and also appears to be a juvenile barrier at summer flow regimes.

Highest rearing densities for Coho were found above the dam near RM 3 where a peak level of 1.1 fish/sq.m. was observed. A second smaller peak of 0.7 fish/sq.m. was observed at RM 1. Spawning and rearing conditions were ideal for Coho and Steelhead in upper Faucett. Channel braids were common around low gravel bars, pool diversity and depth of scour were high, productive riffle habitats were common, riparian vegetation was abundant, and forest coverage was complete. 4.9 miles of Coho distribution ended below the reservoir where stream gradients climbed up to 5% and numerous large

boulder falls were encountered. Coho seeding in Faucett Cr. appeared to be well below its current capacity.

A short 1000 ft. of Coho distribution (60-expanded) was observed in Trib. A in what appeared to be an upstream migration. Spawning potential in this tributary was minimal. The one culvert encountered here was in good shape and passable for adults and juveniles. A large patch of Knotweed was identified on the Tillamook mainstem directly across from the mouth of Faucett Cr.

Joe

Average rearing density (0.03 fish/sq.m.) and expanded estimates (65) for Coho in Joe Cr. were extremely low. Distribution distance however reached 1.3 miles including a short 977 ft. in Trib. A. It was difficult to determine if this minor abundance of Coho was the result of an in-stream spawning event. Based on the low total estimate and the poor quality of spawning sites, an upstream migration is suspected. Low stream gradient, abundant beaver activity, and fine sediments characterize Joe Cr. Future spawning potential is low. No Steelhead, culverts, or occurrences of Knotweed were encountered.

Killam

Stream habitat in Killam Cr. resembled Faucett Cr. while production estimates for Coho were much lower (410 expanded). The low estimate results from access being denied in the first mile of stream. Coho rearing densities were lower through the surveyed portion of Killam than observed in adjacent Faucet Cr averaging only 0.1 fish/sq.m., while distribution distance was similar to Faucett reaching 3.8 miles up from the mouth. Based only on the portions of Killam that were surveyed it would appear that Coho seeding levels were much lower here than in the neighboring eastern subbasins and well below the capacity of the habitat.

Coho were fairly evenly spread throughout the survey without much sign of a spawning peak. However, the size of the population and the 3.8 miles of distribution rule out an upstream temperature dependant migration. Their presence upstream of the dam and fish ladder at RM 2 would also support the conclusion that spawning occurred in upper Killam. Distribution ended in steep boulder habitat upstream of the 50-50 forks with Trib. D.

The 1+Steelhead estimate for Killam of 115 (expanded) also seemed unusually low compared to a similar distance on Faucett. 64% of these were seen in the one mile of stream surveyed below the dam compared to the remaining 1.8 miles of survey above the dam and the 0.6 miles of tributary habitat in Tribs. B, C, and D. 1+Steelhead density above the dam was very low. Most of the 1+Steelhead in neighboring subbasins were also found in the lowest reaches of the stream. This evidence suggests that a significant portion of the Killam Cr. 1+Steelhead population was missed in the first mile of stream

where access was denied. The mainstem Cutthroat population of 370 (expanded) exhibited similar densities above and below the dam.

Permission to survey was also denied in Trib. A. 8 Coho were found in the first pool of Trib. C (25% of the main flow), and none were seen in Tribs. B or D. All culverts appeared in good shape and were passable. Knotweed was noted at the stream mouth.

Mills

Moderate levels of Coho production were observed in Mills Cr. with an expanded estimate of 1,460 summer parr and 1.5 miles of distribution. The average rearing density of 0.43 fish/sq.m. was higher than most streams in the basin and a noticeable spawning peak of 1.1 fish/sq.m. was observed in the first 0.5 miles. Spawning gravel was most abundant between the mouth of Mills and the Highway 101 crossing. Upstream of this point stream gradients increased and larger substrates became more abundant. Only a single 1+Steelhead was seen in the Mills Cr. survey along with 135 (expanded) Cutthroat. Both culverts were in good shape and passable. No Knotweed was observed.

Munson

Coho production in Munson ranked as the second highest among the Tillamook River tributaries although the total expanded estimate here of 3,560 was roughly one-half the total from Bewley Cr. A fairly high average rearing density of 0.7 fish/sq.m. was maintained for 2.4 miles in the mainstem with a spawning peak of 1.3 fish/sq.m. at RM 0.7 and another of 1.1 fish/sq.m. at RM 1.3. The current summer carrying capacity for Coho in Munson is greater than its current level of seeding.

The Stream channel in Munson started off low gradient with intermittent beaver activity then transitioned into steeper habitats more similar to the other eastern Tillamook tributaries Killam, Faucett, and Simmons. Long rocky riffles and hard basaltic substrates led up to the end of fish distribution at the impassable Munson Cr. Falls. An upstream migration of 50 (expanded) Coho was observed up 750 ft. of Trib. A, where a culvert with a 1 ft perch terminated additional upstream migration.

Expanded estimates of 90 1+Steelhead, 160 Cutthroat, and 75 Chinook were seen also in the mainstem of Munson. Culverts all appeared passable. A substantial infestation of Knotweed was also noted along the first 0.3 miles of Munson Cr.

Pleasant Valley

This stream was located in between Munson Cr. and Mills Cr. on the east side of the Tillamook River. A small population of 155 (expanded) Coho was found here. These fish were probably the result of in-stream spawning near the end of distribution, RM 0.9. High quality spawning gravels were noted near the end of the survey, upstream from

numerous larger summer-rearing pools. Coho production potential appears much higher here than present levels. The average rearing density was 0.4 fish/sq.m. No 1+Steelhead were observed. A problem culvert was identified 0.5 miles up from the mouth (the third culvert up). It was "washing out and cocked upward" and noted as impeding adults but considered marginally passable. No Knotweed was located.

Simmons

Simmons Cr. ranked as the third highest Coho producer among the Tillamook River tributaries. One of the main eastern subbasins, Simmons provides at least 4 miles of high quality stream habitat to Coho, Steelhead, and Cutthroat. Abundant gravel flats and wood jams coupled with high stream flow and good forest canopy portray this stream as important anchor refugia for Coho in the Tillamook River 5th field. 2005 surveys found 2,315 (expanded) Coho in the mainstem, up to RM 3.9, and 150 (expanded) in Trib. A, only 500 ft. Rearing density averaged 0.4 fish/sq.m. with spawning peaks located at RM 2.3 (0.9 fish/sq.m.) and RM 3.7 (0.8 fish/sq.m.). Carrying capacity for Coho in Simmons is higher than currently realized. Another noticeable spike in density for Coho and 1+Steelhead was observed in the first pool of the mainstem probably reflecting a rebound of juveniles spawned in Simmons off of mainstem Tillamook temperature profiles.

Habitat in Trib. A was described as flat and swampy and no other tributaries showed signs of Coho potential. 260 (expanded) 1+Steelhead were also documented in Simmons, 42% within the first mile of survey. This ranks as the second largest 1+Steelhead population in the basin behind Faucett Cr. 315 (expanded) Cutthroat were observed mostly near the end of the survey. All culverts were passable and no Knotweed was found.

Sutton

The conditions in Sutton Cr were not acceptable for conducting snorkel inventories to quantify juvenile salmonid distribution or abundance. The stream is very low gradient, traverses large surface areas of wetland and beaver pond habitats and is rich in tannins and decomposing plant matter. These conditions produced only marginal visibility at best for snorkel observations.

A representative 1,800 ft reach was snorkeled at approximately RM 2.0 to establish presence or absence only. An expanded estimate of 30 Coho were observed in this representative reach. This established that Coho were present and that they were the likely result of a spawning event in the subbasin. A complete survey of the Sutton subbasin was not conducted and therefore a comprehensive review of habitat potential is not available. It is likely however, that the abundance of spawning gravel may be the single most critical factor for limiting production in the subbasin.

Unnamed Tributaries

18 unnamed tributaries to the Tillamook were surveyed and given letters from A to Q. Tribs. A through J were mostly low gradient draining swamps and wetlands with large beaver impoundments and generally lacking in potential spawning gravel. Survey efforts generally extended beyond the end of Coho if beaver ponds were encountered or visibility got bad in hopes of finding better conditions, gravel or clear water, upstream. Several exhibited flows that were too low to support either summer rearing or adult spawning. Of these Tribs. C and E had the highest Coho populations (with expanded estimates of 125 and 95, respectively). Distribution lasted for 0.5 miles in Trib. C with no further potential found in an additional one mile of survey above current Coho distribution. Coho distribution continued for 2 miles in Trib. E with no further potential recognized. Heavy siltation is burying the upper two culverts in this stream. Beaver activity here was heavy. Two culverts were observed rusted out and caving in at the beginning of Trib. F where a small upstream migration of Coho was observed. Further potential there is minimal.

Tribs. K through Q were considerably more rocky with more elevation change and little beaver presence. Tribs. M, O, and Q had the largest Coho populations (with expanded estimates of 55, 70, and 90, respectively). All three of these streams exhibited moderate flows, numerous pools, and spawnable gravel. All have future potential for both spawning and rearing with channel size the most limiting factor. It is unlikely that Coho distribution could extend beyond 0.6 miles in any of these tributaries. Culvert passages were all adequate.

Trask River Basin

Coho distribution totaled 90.6 miles in the Trask River Basin during 2005 summer surveys. A total expanded population of 74,775 Coho ranked as the second largest among the Tillamook Bay tributaries behind the Wilson River (90,725 Coho and 106.6 miles). Highest production estimates were observed in the North Fork subbasin where 75% of the Basin's Coho were found. Elkhorn Cr., the mainstem North Fork, and the North Fork of the North Fork appeared to be the main destination for adult spawners. Average rearing densities for Coho in these habitats barely reached 0.6 fish/sq.m. indicating consistent examples of insufficient adult escapement to seed the available habitat. Adult escapement is currently the primary limiting factor. Significant Coho production was also observed in the East Fork and in the 14 mile mainstem Trask.

Most of the Trask basin stream habitat upstream of Mill Cr. and the Tillamook Bay floodplain was high gradient and rocky. High elevations surrounded most of the subbasins and many tributaries were too steep to support Coho spawning. High flow

mainstem habitats were characterized by long boulder rapids and large deep pools with little cover or wood complexity. Steep bedrock walls and low floodplain interaction were typical mainstem observations. Mainstem winter habitats for Coho presmolts are virtually non existent until reaching the Tillamook Bay floodplain and its associated estuarine habitats. Waterfalls and boulder gorges terminated fish distribution in several streams.

These conditions describe excellent Steelhead habitat and the basin-wide expanded estimate for 1+Steelhead in pool habitats only, reached 12,110. This is a significant abundance relative when compared to all of the other Tillamook Bay tributaries, except the Wilson. The Wilson River mainstem estimate for 1+ Steelhead alone (29 miles) was 12,030 (expanded). Most Trask River 1+Steelhead were observed in the mainstem Trask (20%), the East Fork Trask (16%), the South Fork Trask (14%), and Elkhorn Cr. (10%). There appeared to be a clear preference among adult Coho for the North Fork subbasin and among adult Steelhead for the South Fork subbasin. The basin wide inventory and review below is broken down by subbasin – Main, North Fork, and South Fork.

Most culvert problems were observed in the Mill Cr. subbasin. Most of the upper basin road crossings were bridges due to the extreme range in stream flows. The most serious Knotweed infestation (possibly in the entire Tillamook Bay Watershed) was observed along the first 10.9 miles of the Trask mainstem from the head of tide to the Peninsula County Park where an old private dwelling appears to have been the source.

(Table 5) Trask River 2005 Basin Wide Inventory

Stream	**Coho**	% Total	**0+**	% Total	**Sthd**	% Total	**Cut**	% Total
Trask mainstem - To fk	5,335*	7.1	5,085*	12.0	2,370*	19.6	1,790*	15.4
- Gold	95		60		180	1.5	135	1.2
- Green	550		50		0		95	
- Mill	1,160	1.6	50		0		185	1.6
- Sampson	295		150		20		125	1.1
NF Trask mainstem	10,465*	14.0	9,320*	22.0	1,030	8.5	890*	7.6
-Bark Shanty	4,710*	6.3	1,545	3.6	575	4.7	495	4.2
-Clear	2,180	2.9	275		260	2.1	120	1.0
-Hembre	170		95		30		25	
-Trib. D	1,815	2.4	385		60		135	1.2
-MFNF Trask mainstem	3,930	5.3	930	2.2	285	2.4	325	2.8
-Elkhorn	25,235*	33.7	6,460*	15.2	1,160*	9.6	1,595*	13.7
-NFNF Trask mainstem	7,255*	9.7	3,400	8.0	710	5.9	290	2.5
SF Trask mainstem	2,300	3.1	3,210	7.6	1,645*	13.6	1,595*	13.7
-Edwards	3,610	4.8	3,510*	8.3	1,105*	9.1	560	4.8
-EF Trask mainstem	4,445	5.9	5,055*	11.9	1,945*	16.1	1,860*	16.0
-Boundary	360		800	1.9	65		465	4.0
Basin Total	**73,910**	**98.8**	**40,380**	**95.2**	**11,440**	**94.5**	**10,685**	**91.7**

* Highlighted estimates represent the top 5 producers by species and age class

- Percent contributions are indicated for only those subbasins that contributed greater than 1% of the total.

Mainstem Trask

(Table 6)

Expanded Mainstem Trask Estimates of Juvenile Salmonid Production and Percent Contribution to the 5th field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	5,335	5,085	2,370	1,790
	(7%)	(12%)	(20%)	(15%)

The Trask mainstem stretched 13.9 miles from the head of tide near Highway 101 to the junction of the North Fork Trask and the South Fork Trask at the county park campground. The lower reaches exhibited enormous pool surface areas with long cobbly tail-outs and high solar exposure. The stream channel in the upper reaches was often confined by steep canyon walls and sheer bedrock with large boulders and deep pools. High flows and good water quality were supplied by the North and South Fork drainages.

Coho rearing density remained even and extremely low throughout the mainstem, averaging just 0.02 fish/sq.m. Interestingly 67 % of the mainstem abundance was observed in the lower half of the 13.9 mile survey and 50 Coho / pool were still being observed right to the head of tide. The highest pool count for Coho was observed at the mouth of Mill Cr. suggesting a contribution of out migrant fry to the mainstem from Mill Cr was occurring.

The summer distribution of Coho to the head of tide is significant because it is an indicator that these mainstem habitats exhibit some level of summer rearing potential (although lower densities should be expected because environmental stresses such as elevated temperatures have been documented). In addition, it is an indication that fry have likely seeded estuarine habitats and that the potential for this early estuarine life history exists in the Tillamook Bay complex.

Habitat in the mainstem was more suited to the basin's Steelhead and Cutthroat population with an abundance of each present. Some 1+Steelhead counts were over 50 per pool. Rearing densities for both these species increased upstream toward the Forks. 35% of mainstem 1+Steelhead and 38% of mainstem Cutthroat were observed in the last two miles before the Forks. A relatively large abundance of (12,555 expanded) Chinook summer parr were also observed in the mainstem. This represented 72% of the juvenile Chinook observed in the Trask Basin.

A long stretch of Knotweed was observed along most of the mainstem Trask from the head of tide all the way upstream past the Penninsula Park, about 11 stream miles. An older overgrown private residence around RM 11 appeared to be the source. This is a serious problem presently and poses a significant future threat to the expansive riparian gravel bar habitats in the lower Trask and neighboring rivers around the Tillamook Bay floodplain.

Dougherty Slough

This large slough habitat displayed no potential for Coho or Steelhead spawning. The water was dark and slow moving and no fish were observed in the poor visibility and deep stagnant pools here. Snorkel inventory was not even adequate for establishing presence or absence for this location. Substrates consisted mostly of tidal mud and silt and no spawning gravel was found. The channel dies out in the expansive agricultural floodplain before ever reaching the surrounding hillslopes. It is likely that some level of rearing is occurring here for all salmonid species except Steelhead.

Gold

Gold Cr. appears to be a major subbasin of the Trask despite surprisingly low production estimates for Coho. The 5 ft. hatchery dam and fish ladder most likely impede the transfer of wild migrants from the mainstem. The large drainage area here has led to high flows and abundant gravel reserves along several miles of stream with numerous deep pools. Steep stream gradients and long rocky riffles typify Gold Cr. habitat.

Only 95 (expanded) Coho were observed between 1.3 miles of mainstem Gold and 0.6 miles of North Fork Gold, along with 180 (expanded) 1+Steelhead and 135 (expanded) Cutthroat. Higher abundances of Coho could be expected given the relative health and abundance of habitat available in this tributary. Distribution and productivity for Coho would be substantially higher in this subbasin with the provision of adequate adult passage.

Green

Coho spawning appears to have occurred in Green Cr. in the first 0.6 miles of stream below the Trask River Road culvert (in good shape and passable). 550 (expanded) Coho were observed there in an average rearing density of 0.67 fish/sq.m. Highest counts were seen 200 ft. up from the mouth and at RM 0.6 in the culvert plunge pool. Poor water quality and poor pool formation were observed in the low gradient stream channel through this reach. Above this culvert stream gradients climb quickly through a long series of bedrock chutes. A few small rocky pools were found upstream of these chutes without Coho. No good spawning sites were seen above the Trask River Road. No 1+Steelhead were found. The first 1,100 ft. of Green was infested with Knotweed.

Mill

Coho production could be significantly greater in the Mill Cr. subbasin. A low expanded estimate of 1,160 was observed over a broad distribution - 4.3 miles of

spawnable habitat. Another mile of habitat in Trib. B was surveyed which showed little to no spawning potential and poor rearing conditions due to low flows, poor water quality, and heavy silt.

72% of Mill Cr. Coho were observed in the mainstem in 3.1 river miles. Rearing density averaged 0.2 fish/sq.m. 86% of these mainstem Coho were found in the first 1.8 miles above the Trask River. Subbasin spawning potential appeared highest in this reach which ended around the junction of Trib. A. The active channel was the widest here and spawning gravels plentiful. Many deep lateral scour pools were observed with intermittent occurrences of old growth wood being incorporated into the stream above RM 1. Water quality appeared poor due to low flows and extensive residential impacts.

Stream flows divided quickly around RM 2 between Trib. A, Trib. B, and the mainstem. Stream habitat in Trib. A and the upper mainstem was similar and climbed quickly through cobbles and rocks and small pools. Numerous small culverts were encountered. A juvenile barrier was encountered at the first mainstem culvert 0.2 miles upstream of the Brickyard Rd. culvert. The 5 ft. steel pipe was perched by 1 ft. Both culverts in Trib. A appeared to present juvenile barriers. 380 ft. up from the mouth of Trib. A the 4 ft. steel pipe under Brickyard Rd. was perched by 1 ft. An expanded estimate of 380 Coho were found in the 0.9 miles of stream between this culvert and a second 4 ft. steel pipe culvert being crushed badly under a private driveway. This suggests the occurrence of adult spawning in Trib. A. Coho distribution ended at the second culvert indicating a potential barrier to migration. Stream habitats above this point appeared to be in good shape and contained sorted spawning gravels. This culvert represents the most significant barrier to anadromous migration observed in the Mill Cr. subbasin. Rearing density in this tributary for Coho averaged 0.35 fish/sq.m.

Stream gradients were low in Trib. B and several small tributaries divided the flow. What minor spawning potential existed in Trib. B was found within the first 0.6 miles of stream below Trib. B1 in small cobbly pools. A twin 4 ft. cement pipe culvert was encountered just above Trib. B1 with 5 inch wide rebar grating across the top end and a large accumulation of debris. This appeared to be a migration barrier. The remaining stream habitats above this barrier consisted only of beaver marsh. Bad culverts were documented in Tribs. B1 and B2 also but anadromous fish potential in these two low flow tributaries was limited.

Coho production in the mainstem and in Trib. A was well below full capacity and the potential for restoration significant. No 1+Steelhead were found in the Mill Cr. subbasin. 185 (expanded) Cutthroat were present and randomly distributed. No Knotweed was noted.

Rawe

No Coho were found in Rawe. 150 (expanded) 1+Steelhead and 70 (expanded) Cutthroat were observed in a strong upstream temperature dependent migration out of the

Trask mainstem. Total survey distance was 400 ft. High flows and long rapids were noted.

Sampson

Coho spawning may have occurred in this small tributary. A perched culvert with a 1 ft. plunge presented a juvenile barrier about 300 ft. up from the mouth. Coho distribution totaled 0.7 miles with an expanded estimate of 295 summer parr. This evidence suggests that adult spawning took place upstream of the culvert. Coho rearing density averaged 0.7 fish/sq.m. in Sampson with a peak of 1.9 fish/sq.m. observed in the first pool and 1.5 fish/sq.m. in the second pool just below the culvert. This evidence suggests that upstream temperature dependent migration may also be occurring here. In either scenario Sampson Cr. probably represents important temperature refuge for Coho juveniles. Low numbers of 1+Steelhead and Cutthroat were also observed here. No Knotweed was reported.

Trib. A

3 miles of low gradient, low flow habitat was surveyed in this small stream which flows into the Trask mainstem on the south end of Tillamook City. After meandering slowly through long reaches of farm trenching, city housing complexes, and swampy backwaters, Trib. A empties into its own tidal slough and flows out under Highway 101 inside of a narrow roadside ditch. The survey began at a small bridge by the school just upstream from Highway 101. 8 dead Sculpin were found on the bottom of the first pool with no other fish. The stream channel appeared man-made for the first mile or two with lots of trash and extremely poor water quality. Almost no stream flow was observed through this reach of stagnant ponds/pools and dissolved oxygen levels were probably very low. Some rock was seen but no finer gravels or spawning sites were located.

Gradually as the survey progressed eastward, the stream enters a series of flat seeps and swamps on the edge of various housing developments. Much of the channel in this reach was crowded with grass and aquatic plants. Siltation was heavy and the stream bottom was completely dominated by thick mud. Some Stickleback were present here along with a few Cutthroat and 0+trout.

Further upstream the channel entered into agricultural trench pool habitat (about 2 ft. wide) choked with tall grass. There were few pool breaks through this zone and still no gravels. As Trib. A approached the hills east of Tillamook City, several small seeps had branched off in the flat flood plain and the mainstem was reduced to no more than a muddy seep through skunk cabbage. Spawning and rearing potential for anadromous fish is low in Trib. A. No suitable spawning gravels were found and what little rearing habitat exists is currently unsuitable due to multiple water quality issues. It is unlikely that

upstream migrations of juveniles from tidewater Trask would be occurring at summer flow regimes. No culvert problems were identified and no Knotweed was observed.

Trib. B

A small upstream migration of Coho was observed in this little creek just down from Green Cr. on the Trask mainstem. An expanded estimate of 35 Coho were here in narrow trench pool habitats and low flows. No other fish were documented. No spawning sites were observed. This low elevation tributary canyon was dominated by shallow swamps, silt, mud, and high exposure pasture lands. Knotweed was observed at the Trask River Road culvert. The culvert was in good shape. Future spawning and rearing potential in this tributary appears very low.

NF Trask

The North Fork of the Trask River and its associated tributaries contained the most productive reaches for Coho within the Trask basin. Surveys to the end of Coho distribution in the NF Trask subbasin totaled 38 miles also making it the largest provider of stream habitats. Coho production here totaled 55,895 (expanded) summer parr during the summer of 2005, 75% of the total Trask Basin population.

The most productive reaches for Coho within the NF Trask subbasin were found in Elkhorn Cr. (25,235-expanded), the NF Trask mainstem (10,465-expanded), and the NFNF Trask mainstem (7,255-expanded). The highest average rearing densities for Coho basin-wide were found in the Elkhorn tributaries, the Elkhorn mainstem, the NFNF Trask, and lower Bark Shanty Cr.

An expanded estimate of 4,210 1+Steelhead were observed in the NF Trask subbasin, 35% of the Trask basins observed total. Most of the NF Trask 1+Steelhead were observed in Elkhorn (1,160-expanded) and in the mainstem survey (1,030-expanded).

Mainstem NF Trask

(Table 7)

Expanded Mainstem NF Trask Estimates of Juvenile Salmonid Production and Percent Contribution to the 5th Field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	10,465	9,320	1,030	890
	(14%)	(22%)	(9%)	(8%)

Coho production in the NF Trask was approximately double that observed in the Trask mainstem over a similar total distance of 12.4 miles. Coho rearing density was very low, averaging 0.1 fish/sq m, and exhibited a slight increase near the end of the survey

where the NFNF Trask and the MFNF Trask converged (the MFNF Trask providing 2/3 of the flow). Most Coho were found in the shallow margins of the large pools here and consistently displayed a well developed hiding instinct. Avian predation (merganser) through this habitat appeared heavy and wood complexity for the provision of cover was rare. Spawning gravels were abundant and current seeding levels were far below the current potential for carrying capacity. Adult escapement again the main limiting factor. The mainstem NF Trask was the second largest contributor to summer Coho production within the subbasin behind Elkhorn Cr.

The abundance of pool rearing 1+Steelhead in the NF Trask mainstem was approximately half the abundance observed for the Trask mainstem. A similar comparison was observed for Cutthroat. Highest counts for both species were observed within the first 5 miles of the NF Trask. The expanded estimate of 1,160 1+Steelhead in the Elkhorn subbasin (11.3 stream miles) was similar to the NF Trask estimate. Together these two reaches accounted for 52% of all 1+Steelhead observed in the North Fork subbasin. Approximately twice as many Cutthroat were observed in Elkhorn as in the NF Trask mainstem. An expanded estimate of 2,995 Chinook juveniles were also observed in the NF Trask mainstem up to RM 7.5. No culverts exist on the NF Trask mainstem and no Knotweed was located.

Bark Shanty

This stream was one of the largest tributaries to the NF Trask. Coho production in this subbasin of 4,710 summer parr was below its current habitat potential. A steep gorge begins at RM 0.6 with a large debris jam another 0.5 miles upstream. Coho were observed above both of these potential obstacles to RM 3.6. Highest rearing densities, however, were observed in the first 0.5 miles of the survey where an average of 1.0 fish/sq.m. was achieved. The potential for interactive floodplain habitats was greatest in this lower reach and braided channels, abundant spawning gravels and old debris jams were common.

The streams average rearing density for Coho was 0.6 fish/sq.m. A spike in Coho density of 1.7 fish/sq.m. was observed in the first inventoried pool. This was one of the highest average rearing densities for Coho found in the Trask Basin (equal to the NFNF Trask and the Elkhorn mainstem). Coho distribution ended in long boulder rapids just below a 14 ft. falls. All tributaries appeared too steep or low flow for anadromous spawning. 575 (expanded) 1+Steelhead and 495 (expanded) Cutthroat were found here in a relatively even distribution. No culverts or occurrences of Knotweed were encountered.

Clear

An expanded estimate of 2,180 Coho were found in 1.6 miles of boulder / cobble habitat in Clear Cr. Rearing density averaged 0.3 fish/sq.m. and rose to a spawning peak

of 1.1 fish/sq.m. near the end of distribution. The lack of appropriate well sorted spawning gravels may limit Coho production for the tributary. 260 (expanded) 1+Steelhead and 120 (expanded) Cutthroat were observed. No culverts or Knotweed were encountered.

Hembre

A minor abundance of Coho was observed in Hembre Cr. up to a 5 ft. log-jam falls. The expanded estimate for Coho totaled 170. Stream flows were excellent but stream gradient reduces the potential for the development pool habitats appropriate for significant Coho production.

Unnamed tributaries

Small populations of Coho were observed in Tribs. C, D, E, and G. Upstream migration seems to be the source of summer residents in Tribs. C and E, while minor spawning seems to have occurred in D and G.

1,815 (expanded) Coho were observed in Trib. D in an average rearing density of 1.2 fish/sq.m. over 1.2 miles of stream. A spawning peak of 2.9 fish/sq.m. was seen at RM 0.45. A 5 ft. log jam terminated distribution. 60 (expanded) 1+Steelhead and 135 (expanded) Cutthroat were also present. No culverts were encountered. No Knotweed.

The 8 ft. culvert under the main road on Trib. G was perched by 2 ft. and presented a definitive juvenile barrier. Coho were found upstream of this culvert and successful adult spawning was probable. A short 0.2 mile reach contained 75 (expanded) Coho and distribution was terminated at an impassable 8 ft. bedrock falls. Production potential appears to be minimal in this stream due to the limited amount of gravel present below the falls and the small surface areas exhibited by most pools. No Knotweed was observed.

MFNF Trask

The Middle Fork of the North Fork Trask supplied most of the flow and Coho production for the subbasin. 29,165 (expanded) Coho were present between 3 miles in the mainstem and 11.3 miles in Elkhorn, it's only tributary. This represented 52% of the North Fork subbasin total and 39% of the Trask basin total. Spawning beds in the Middle Fork, Elkhorn, and in the North Fork North Fork appeared to be a primary destination for adult Coho returning to the Trask River during a year of low spawner escapement.

Only 3 miles of stream in the MFNF Trask mainstem was passable to adult Coho before a series of 8 ft. and 10 ft. bedrock falls terminated distribution. This narrow pinch in the steep canyon occurred 0.8 miles upstream from the mouth of Elkhorn and well below the reservoir. A long series of braided gravel flats ideal for Coho spawning was

observed just upstream of this pinch. 1+Steelhead were present upstream of the falls. 3,930 (expanded) Coho were present in an average rearing density of 0.4 fish/sq.m. A spawning peak of 0.7 fish/sq.m. was identified near RM 2.3, just upstream from Elkhorn. 285 (expanded) 1+Steelhead and 325 (expanded) Cutthroat were also present, most in the lower pools. No culverts. No Knotweed.

Elkhorn

Elkhorn appeared to supply more of the stream flow at its junction with the MFNF Trask. This was the single largest component of Coho production for the entire Trask Basin. The expanded estimate here of 25,235 Coho represented 45% of the North Fork Trask population and 34% of the total Trask Basin population. The expanded 1+Steelhead estimate of 1,160 over 11.3 stream miles was also the highest abundance for this species observed in any tributary habitat within the Trask Basin. Steelhead production was higher in the Trask mainstem (2,370 over 13.9 miles), the EF Trask mainstem (1,945 over 8.8 miles), and the SF Trask mainstem (1,645 over 8.1 miles). A significant abundance of 1+ and older Cutthroat (1,595) were also present in the Elkhorn subbasin.

Elkhorn branches to the south of the MFNF Trask into lower elevations than the rest to the NF Trask subbasin. This stream provides high quality, low gradient spawning and rearing potential in 6.3 miles of mainstem habitat and 5 miles of tributary habitat. Coho spawning appears to have occurred in three major tributaries (Trib. A, Trib. C, and Cruiser Cr.). Trib. C and Cruiser Cr. contributed 11% and 24%, respectively of the total Elkhorn Coho population. The mainstem contributed 64%. The highest average rearing densities for Coho Basin-wide were observed in Trib. C, Cruiser, the Elkhorn mainstem, the NFNF Trask, and lower Bark Shanty.

16,040 (expanded) Coho were observed in the Elkhorn mainstem in an average rearing density of 0.55 fish/sq.m. Multiple spawning peaks were observed: 1.3 fish/sq.m. at RM 1.4, 1.4 fish/sq.m. at RM 2.7, 1.2 fish/sq.m. at RM 3.7, and 1.2 fish/sq.m. at RM 5.4. Coho distribution ended shortly upstream of the 50/50 forks with Trib. C at an 8 ft. bedrock slide just below a 10 ft. vertical bedrock falls – a definitive adult barrier. Significantly higher levels of Coho production could be realized from mainstem Elkhorn. 91% of all Elkhorn 1+Steelhead observed were rearing in the mainstem, 64% of these were observed in the largest pools within the first 3 miles. Only 47% of all Elkhorn Cutthroat were observed in the mainstem.

Low level spawning activity appears to have occurred in Trib. A (285 Coho, expanded, 0.4 miles), and a minor upstream migration in Trib. B (100 Coho, expanded, 0.3 miles). A 12 ft. bedrock cascade stopped fish in Trib. A while distribution in Trib. B ended in steep boulders.

Significant spawning activity occurred in Trib. C (2,735 Coho, expanded, 1.2 miles), and in Cruiser Cr. (6,075 Coho, expanded, 3.2 miles). These two reaches

displayed the highest average rearing densities for Coho anywhere in the Trask Basin. Coho rearing density averaged 1.3 fish/sq.m. in Trib. C and 1.6 fish/sq.m. in Trib. C1. The main spawning peak occurred in Trib. C near RM 0.4 (2.3 fish/sq.m.). These rearing densities were probably very near the carrying capacity of Trib. C. Coho distribution ended in steep bedrock cascades that were noted as impassable. The culvert in Trib. C1 was noted as being in bad shape though distribution ended at a small falls a short distance upstream of this road crossing. No 1+Steelhead were observed in Trib. C.

The 3.2 miles of ideal Coho habitat in Cruiser Cr. contributed nearly one-quarter of the total Elkhorn Coho population. Coho production in Cruiser was higher than in Bark Shanty or in the MFNF Trask mainstem. Coho rearing density averaged 1.1 fish/sq.m. with multiple spawning peaks of 2.7, 2.2, and 2.4 fish/sq.m. occurring in the two miles of mainstem. This reach accounted for 3,705 (expanded) of the total Coho present in the Cruiser subbasin. Coho distribution ended in Cruiser at an 8 ft. bedrock falls. A collapsed log-stringer bridge at RM 0.6 and the resultant debris jam appears to be a significant obstacle to anadromous migration.

Coho also spawned heavily in Trib. B of Cruiser where a total of 2,325 (expanded) Coho were observed with an average rearing density of 1.5 fish/sq.m. over 1.2 miles of stream. This included two short upstream migrations in Tribs. B1 and B2. A spawning peak of 3.5 fish/sq.m. was detected at RM 0.4 in Trib. B. Stream habitat in Trib. B and in mainstem Cruiser appears to be seeded to capacity with respect to Coho densities. Trib B is the location of the instream restoration project that occurred during the summer of 2005 that placed large wood structures and improved culvert passage.

The Elkhorn mainstem, Trib. C, and Cruiser Cr. appear to be major anchor habitats for Coho in the Trask basin. A large potential for increased Coho production is present in the mainstem and restoration activities focused on over-winter survival should be of high priority for Trib. C and Cruiser. No Knotweed was observed.

NFNF Trask

This was the third most productive stream segment for Coho production in the North Fork Trask subbasin (behind Elkhorn and the mainstem NF Trask) and a major contributor of summer flow. An expanded estimate of 7,255 Coho were observed, representing 13% the North Fork subbasin total and 9.7% of the Trask Basin total. This level of production is significant given that only 2.8 miles of stream were accessible to Coho before a 20 ft. boulder falls terminated distribution. 1+Steelhead were found upstream of this gorge indicating that adult Steelhead passage was occurring and that the falls may not be a definitive barrier for adult Coho every year.

Rearing densities for Coho were relatively high (averaging 0.5 fish/sq.m.) compared to other observations in the Trask basin. This level of seeding is still well below the production potential of the available habitat. Adult escapement and the availability of appropriate spawning gravel probably both limited the 2005 summer

abundance. Long exposures of bedrock and steep boulder rapids were frequent channel characteristics. Pool surface areas were large. A spawning peak of 0.7 fish/sq.m. was observed at RM 1.4 and again at the end of distribution. This reach appears to be another important anchor habitat for Coho in the Trask basin and a main destination for adult spawners.

710 (expanded) 1+Steelhead were documented here, 63% in the first 1.5 miles. 290 (expanded) Cutthroat were observed in an even distribution. No culverts. No Knotweed.

South Fork Trask

Coho distribution in the SF Trask subbasin totaled 26.3 miles (29% of the Trask Basin total). A total expanded estimate of 11,360 Coho were present (15% of the Trask Basin total). This level of production was roughly one-fifth the size of the North Fork subbasin production estimate, equal to the NF Trask mainstem production estimate, and twice as large as the Trask mainstem estimate. The South Fork Coho population was evenly divided between the South Fork mainstem (including its primary tributary, Edwards Cr.) and the East Fork mainstem (including its primary tributary, Boundary Cr.). The largest production components were the East Fork mainstem (39% of SF total) and Edwards Cr. (32% of SF total).

Coho rearing densities throughout the subbasin were unusually low based on the quality of habitat observed and the abundance of high quality summer pool habitat. Over winter survival may be a significant limitation in the SF Trask subbasin. Much of the Coho distribution observed here was in large order mainstem habitats containing long boulder rapids, abundant bedrock and a very low abundance of wood complexity. Few alcove pools or significant backwater habitats were observed for winter refugia. A few rock-weir and log structures were observed in the SF mainstem and in Edwards Cr that were attempting to address this potential limitation. Most tributary habitats were too steep to support Coho spawning or rearing.

Stream habitats in the South Fork subbasin were rearing excellent numbers of older age class Steelhead. 5,045 (expanded) 1+Steelhead were documented, accounting for 42% of the Trask Basin total. This level of production was 20% higher than in the North Fork subbasin and roughly twice as high as in the Trask mainstem. Most were seen in the East Fork mainstem (39%), the South Fork mainstem (33%), and Edwards (22%). Cutthroat estimates (5,130-expanded) in the South Fork subbasin were also high and accounted for 44% of the Trask Basin total. This population was 26% larger than the North Fork subbasin population and almost three times as large as the Trask mainstem population. Most were found in the East Fork mainstem (36%) and in the South Fork mainstem (31%). 1,580 (expanded) Chinook summer parr were also seen, almost all within the first 5.8 miles of the South Fork mainstem.

Mainstem SF Trask

(Table 8)

Expanded Mainstem SF Trask Estimates of Juvenile Production and Contribution to the 5th Field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	2,300	3,210	1,645	1,595
	(3%)	(7.6%)	(14%)	(13.7%)

Coho rearing densities were extremely low throughout 8.1 miles of the SF Trask mainstem, averaging just 0.1 fish/sq.m. A small peak of 0.4 fish/sq.m. was observed around RM 5.8 where spawning conditions appeared to be best. Stream gradients decreased here exhibiting finer gravels and more diverse pool formation. Much of the SF Trask mainstem was dominated by boulder rapids and bedrock and long straight pools with little scour. Coho distribution ended in steeper gradients at a small wood jam that appeared passable for adults. Steelhead and Cutthroat production was relatively high, second only to the East Fork and the mainstem Trask. Distribution for these two species was consistent throughout the survey with the highest counts observed in the first two miles of survey. 1,465 (expanded) Chinook were documented up to RM 5.8.

A few rock-weir and log structure pools were noted (database notes) within the SF Trask mainstem. Most appeared to be functioning well and benefiting channel complexity although consistently low Coho densities indicate little response relative to their locations. The low abundance of high quality winter habitat was also noted as a significant limiting habitat factor for the reach. No culverts or Knotweed were noted.

Edwards

This was the most productive tributary in the South Fork subbasin for Coho (not including the EF Trask mainstem). 3,610 (expanded) Coho were present here throughout 3.7 miles of high quality spawning and rearing habitat. Rearing density averaged 0.3 fish/sq.m. with highest counts observed in the first and last 0.5 miles of the survey. Multiple rock and log structure pools were present in Edwards and Coho densities exhibited moderate improvement in response to these locations. Several wood jams and narrow canyon pinches have trapped a significant resource of spawning gravels in the upper reaches. Production potential for Coho here is significant and currently adult escapement appears to be the primary limiting factor. A particularly large full spanning debris torrent jam terminated Coho passage in Edwards.

Four tributaries were surveyed, all of which were too steep and exhibited little anadromous potential. 1+Steelhead production here was significant with a total expanded estimate of 1,105. This represents 9% of the Trask Basin total and 22% of the SF Trask total. This deme was one of the top five producers for Steelhead basin-wide. Peak

densities for 1+Steelhead in Edwards were observed around RM 0.8. 560 (expanded) Cutthroat were also present in an even distribution. No Culverts. No Knotweed.

Joyce, Summit, South

No Coho were present in these tributaries. Spawning potential appeared minimal in steep gradients and high flows. It is likely that these streams supply significant summer temperature maintenance to the SF Trask mainstem. The protection of upslope riparian canopies on these tributaries in future forest management planning is highly recommended. 1+Steelhead and Cutthroat were present. No problem culverts were identified. No Knotweed.

Unnamed Tributaries

Tribs. A and B supported minor upstream migrations of Coho summer parr. Spawning potential was significant in Trib. A where abundant gravels and several log structures were observed. Anadromous potential in Trib. B appeared minimal. 1+Steelhead were present in Trib. A. No Coho or 1+Steelhead were seen in Tribs. C or D. Moderate spawning potential was noted in Trib. D where new structure logs and fair gravels were present. Mainstem temperature maintenance is the most important functional contribution for these streams. No problem culverts were identified. No Knotweed.

EF Trask

The East Fork of the South Fork Trask was a major producer for all fish species. As the main tributary to the SF Trask, this subbasin was responsible for 47% of the total South Fork Coho population. The EF Trask expanded Coho estimate of 5,375 represented 7.2% of the Trask basin total. This included marginal production estimates from associated tributaries including Bales, Blue Bus, Boundary, Headquarters Camp, Miller, Pigeon, Rock, Scotch, Steampot, and Tribs. A, B, C, and D. This Coho population was about the same size as the Trask mainstem population and was slightly larger than the Bark Shanty population. Coho distribution totaled 13.3 miles. 1+Steelhead estimates in the 8.8 mile EF Trask mainstem (1,945-expanded) were the second highest in the Trask Basin behind the 13.9 mile Trask mainstem (2,370-expanded). The mainstem Cutthroat population of 1,860 (expanded) was the single largest in the Trask Basin.

Mainstem EF Trask

(Table 9)

Expanded Mainstem EF Trask Estimates of Juvenile Production and Contribution to the 5th field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	4,445	5,055	1,945	1,860
	(6%)	(12%)	(16%)	(16%)

83% of the EF Trask Coho population and 87% of the EF Trask 1+Steelhead population were documented rearing in the mainstem. This rearing segment was the largest contributor of the SF Trask Coho production. Rearing densities for Coho in the 8.8 mile mainstem averaged an extremely low 0.09 fish/sq.m. with a spawning peak of 0.6 fish/sq.m. at RM 6.2 and a second of 1.0 fish/sq.m. at RM 7.5.

Long reaches of bedrock and boulder rapids were common along the EF Trask mainstem with several boulder steps breaking up stream gradients. Abundant spawning gravels and wide braided channels were present in intermittent patches. Indications are that current Coho production is well below current potential. A large debris torrent jam terminated Coho distribution. Similar to the SF Trask mainstem, over winter survival may be the most significant limiting factor if adult escapement were adequate to seed the available summer habitat. Most 1+Steelhead and Cutthroat were observed between RM 3.3 and RM 5.4 in the largest pools. The intake dam for the EF Trask rearing pond presents a juvenile barrier at RM 0.6 where a noticeable spike in trout densities was observed. No culverts were encountered on the mainstem EF Trask and no Knotweed.

Bales

Bales Cr. and Boundary Cr. were the only two tributaries of the EF Trask which exhibited signs of Coho spawning. Distribution in Bales extended 1.1 miles and totaled 285 (expanded) Coho. Rearing density averaged 0.24 fish/sq.m. and peaked at 0.5 fish/sq.m. near RM 0.5. Steelhead and Cutthroat were present also. The aquatic habitats were steep and rocky.

Boundary

Coho distribution in Boundary totaled 1.7 miles including 0.4 miles of upstream migration in Headquarters Camp. A low average rearing density of 0.14 fish/sq.m. was observed with a spawning peak of 0.24 fish/sq.m. at RM 0.6. Expanded estimates for Coho here totaled just 360. Habitat conditions in the Boundary Cr. subbasin appeared perfect for Coho. Significantly higher production could be achieved in this stream with higher levels of adult escapement. Stream gradients and flows were moderate and the channel displayed a high level of sinuosity and pool complexity. Floodplains were

generally low and interactive. Fine sandstone gravels were noticeably more abundant in this subbasin than in other parts of the South and East Fork Trask. Wood jams terminated Coho distribution in the Boundary Cr. mainstem. A large wood jam at the beginning of Headquarters Camp Cr. appeared to be a potential barrier to anadromous migration. Stream flow was higher in Headquarters Camp Cr. at its junction with Boundary Cr. Low numbers of Steelhead and moderate numbers of Cutthroat were also present. No culverts. No Knotweed.

Small Tributaries

Blue Bus, Pigeon, and Trib. A all exhibited minor upstream migrations of Coho summer parr of a few hundred feet. Of these, Trib. A appeared the most promising. Expanded estimates reached 225 Coho here and rearing density averaged 1.1 fish/sq.m. Moderate spawning and rearing potential was noted in this tributary. No Coho were present in Miller, Rock, Scotch, Steampot, or Tribs. B, C, or D. Of these, only Rock and Trib. D exhibited spawning and rearing potential for Coho. All these streams were steep and productivity appeared limited mainly by spawning gravel and stream gradient. 1+Steelhead were observed in Blue Bus, Miller, Pigeon, Rock, and Steampot. No culvert problems were observed within the range of Coho distribution. No Knotweed.

Wilson River Basin

The Wilson Basin was the largest drainage in the Tillamook Bay Watershed and the most productive for Coho and Steelhead. 102.5 miles of Coho distribution were surveyed in the Wilson during 2005 and an expanded total of 90,725 summer parr was estimated for the Basin. This population was 21% larger than the Trask basin Coho population (encompassing 90.6 miles). Most Coho were found in the Little North Fork (28%), the Wilson mainstem (19%), the Devils Lake Fork (18%), and the South Fork (11%). The North Fork also appears to be an important anchor habitat for Wilson River Coho but 2005 rearing densities were comparably low. The highest average rearing densities for Coho were observed in Elliot (0.77 fish/sq.m.), Ben Smith (0.62 fish/sq.m.), Idiot (0.6 fish/sq.m.), and the West Fork North Fork (0.5 fish/sq.m.).

24,225 (expanded) 1+Steelhead were estimated to be present in the Wilson Basin during the 2005 survey, about twice as many as in the Trask Basin. The largest contributions came from the Wilson mainstem (50%), the Little North Fork (16%), the Devils Lake Fork (7.6%), and the South Fork (6.2%). Most juvenile Steelhead rear in riffle and rapid habitats, which were not a part of this survey. The fact that these types of habitats dominated in the Wilson Basin suggests that a significant portion of the 1+Steelhead population was not included in the total estimates above.

Most of the stream habitat present in the Wilson Basin was ideally suited for Steelhead. Long rocky riffles and rapids dominated most reaches and fine gravels were rarely separated from boulders and cobbles. High elevations surrounded most subbasins and several surveys ended in tight gorges or bedrock waterfalls. Substrates were predominantly hard rock and boulder with frequent exposures of bedrock.

Extreme winter flows have led to wide open channels and high solar exposures in many streams reaches. Steep side tributaries to these large mainstem reaches which support no fish populations of their own appear to be important sources of cold water for the maintenance of mainstem temperatures. Upslope land use should prioritize the protection of riparian canopies in tributaries such as Bear, Fall, Fox, Hughey, Jones, Kansas, Muesial, Ryan, South Wolf, Stanley, Sylvan, Wolf, and Zig-Zag. High winter flows have also led to a general absence of large wood and channel roughness for the provision of complex cover for juveniles in most mainstem habitats.

All streams in the basin were under seeded with respect to Coho and could support higher adult escapement and juvenile production rates. The basin wide inventory and review below is organized by subbasin – (1)Mainstem and tributaries, (2)Devils Lake Fork, (3)North Fork, and (4)South Fork.

(Table 10) Wilson River 2005 Basin Wide Inventory

Stream	**Coho**	% Total	**0+**	% Total	**Sthd**	% Total	**Cut**	% Total
Mainstem Wilson	17,455*	19.2	35,310*	39.2	12,030*	49.7	1,995*	19.4
-Beaver	140		40		0		75	
-Ben Smith	2,140	2.4	1,150	1.3	45		355	3.4
-Cedar	2,960	3.3	3,400	3.8	385	1.6	765*	7.4
-Elk	2,140	2.4	2,065	2.3	440	1.8	415	4.0
-Fox	440		950	1.1	210		180	1.7
-Hughey	235		15		0		5	
-Jones	360		230		40		55	
-Jordan	3,165	3.5	5,060*	5.6	1,635*	6.7	1,545*	15.0
-Little North Fork	24,025*	26.5	18,395*	20.4	3,710*	15.3	980*	9.5
--Berry	925	1.0	870	1.0	65		400	3.9
--Blowout	365		165		35		45	
--White	115		540		150		165	1.6
-Ryan	20		20		0		5	
-Sylvan	60		260		15		45	
-Trib. B	140		5		0		40	
-Trib. C	225		35		0		50	
-Trib. D	55		195		0		35	
Devils Lake Fork	11,665*	12.9	4,670*	5.2	1,640*	6.8	490	4.8
-Deyoe	410		30		30		20	
-Drift	185		220		0		10	
-Elliot	1,520	1.7	115		65		75	
-Fern Rock	565		70		0		0	
-Idiot	1,065	1.2	365		85		85	
-Trib. A	485		115		15		60	
-Trib. C	245		15		0		10	
North Fork	3,395	3.7	3,780	4.2	965	4.0	665*	6.5
-WF North Fork	3,415*	3.8	3,415	3.8	605	2.5	370	3.6
--Rogers	2,555	2.8	2,255	2.5	410	1.7	310	3.0
South Fork	8,950*	9.9	4,550*	5.0	1,365*	5.6	320	3.1
-Trib. A	480		300		70		30	
-Trib. B	320		160		50		40	
-Trib. C	170		30		15		35	
Basin Total	**90,390**	**99.6**	**88,795**	**98.6**	**24,075**	**99.4**	**9,675**	**93.8**

* Highlighted estimates represent the top 5 producers by species and age class

- Percent contributions are indicated for only those subbasins that contributed greater than 1% of the total.

Mainstem Wilson

(Table 11)

Expanded Mainstem Wilson Estimates of Juvenile Production and Contribution to the 5th field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	17,455	35,310	12,030	1,995
	(19%)	(39%)	(50%)	(19%)

Coho rearing density in the Wilson mainstem averaged a low 0.04 fish/sq.m. and displayed a gradual climb to a peak of 0.2 fish/sq.m. by the end of the 29 mile distribution (ending at the junction of the Devils Lake Fork and the South Fork). Avian predation in the mainstem appeared to be heavy and most Coho were found hiding in the shallow side margins of pools or tightly clustered under any small bit of woody debris. Upstream migrations of Coho due to predator or temperature related pressures were observed in most small side tributaries including Fox, Hughey, Jones, Sylvan, and Tribs. B, C, and D.

Much of the high flow channel here displayed low floodplain interaction and abundant boulder/bedrock glide habitat. Pools were large and deep with very little wood complexity for cover. Stream gradients and substrate size were smaller through the first 6 miles of survey above the head of tide. Above the confluence of the Little North Fk the channel begins to transition in gradient and average substrate size. This reach provides abundant summer and winter rearing habitat for juveniles with low floodplains and extensive gravel bars. Elevated mainstem temperatures during summer flow regimes are apparent with observations of Stickleback to RM 7.8.

Wilson mainstem habitats in general support the production of 1+Steelhead well. Long rapids, excellent pool formation, high stream flow, and rocky substrates were abundant for this species. The Wilson mainstem abundance of Steelhead was the largest observed anywhere in the Tillamook Bay Complex and was equal to that observed for the entire Trask basin. Several pool counts exceeded 100 individuals with the highest pool observation at 181 individuals. 55% of these mainstem 1+Steelhead were rearing between RM 14.6 and RM 21.5. A smaller spike in density was also present at the survey's end near the junction of Elk, Devils Lake, and the South Fork (all major Steelhead producers).

Cutthroat numbers were considerably lower in the mainstem. The entire 29 mile mainstem exhibited only 17% of the mainstems Steelhead abundance. The reason for this contrast is not clear. Cutthroat are more abundant in the lower mainstem as Steelhead abundance is waning. Cutthroat density decreased as the survey progressed upstream. Chinook summer parr were present throughout the entire 29 mile mainstem (15,875-expanded) in a similarly decreasing density profile.

Knotweed infestation was high for the first 9 miles of survey, especially at the mouth of the Little North Fork, and was then intermittently present all the way up to the

North Fork (Lees Camp). Infestation was particularly noted at the mouths of Fall, Muesial, and Jones Cr.

Bear

No Fish were present in Bear during the 2005 survey. A 6 ft. falls at the mouth is a barrier for adults and juveniles. The 4 ft. concrete box culvert under Highway 6 was jammed with gravel and debris and the upstream opening was reduced to just one foot of vertical clearance. This culvert is likely to completely jam up in the next flood event and could cause the road to blow out. Maintenance is recommended.

Beaver

Low level Coho spawning may have occurred in this small lower tributary of the Wilson. Only 140 (expanded) Coho were present but density profiles seem to suggest a spawning peak of 1.5 fish/sq.m. at RM 0.7. Stream-wide rearing density for Coho averaged 0.53 fish/sq.m. and distribution extended 0.9 miles. A two foot concrete dam presents a juvenile barrier at the current end of Coho distribution. It appears passable for adults but may have influenced adult migration in 2004. Gravel resources, forest cover, and sufficient pool scour were all present. Livestock impacts were high at the start of the survey in open pasture trench pool habitat. An excellent restoration opportunity is present in this reach for livestock exclusion fencing and the removal of migration barriers. Low numbers of Cutthroat were also present.

Ben Smith

This subbasin contained high quality spawning habitat for Coho and exhibited significant potential for increased production. Average rearing densities of 0.62 fish/sq.m. in the mainstem relative to the abundance of fine spawning gravels, wood complexity, and low floodplain habitat indicate that 2004/2005 Coho seeding levels were well below carrying capacity. The expanded estimate for Coho was low - 2,140. Distribution extended 1.4 miles in the mainstem, 1 mile in Trib. A, and 0.15 miles in Trib. B. Wide braided floodplains were present at the mouths of Tribs. A and B that were choked with debris.

62% of the total Coho were present in the mainstem where a spawning peak of 1.7 fish/sq.m. was observed at RM 1. Distribution ended in steep boulder rapids. 36% of the total Coho were present in Trib. A in an average rearing density of 1.1 fish/sq.m. A spawning peak of 2.1 fish/sq.m. was found at RM 0.5. The small stream channel here displayed a high level of sinuosity and wood complexity with lots of cover for summer and winter rearing juveniles. Distribution ended in steep boulder falls. Rearing densities for Coho in Trib. A and in the Ben Smith maintstem were among the highest in the Basin.

Stream flow and rearing potential in Trib. B was low. A small upstream migration of Coho was observed (40-expanded). This stream contains a large supply of fine spawning gravels and braided channels across a wide section of the Ben Smith floodplain.

Adult escapement appears to be the main limiting factor in Ben Smith. A steep bouldery entrance off of the mainstem Wilson is a probable obstacle for upstream temperature dependant migrations of juveniles during summer flow regimes. 45 (expanded) 1+Steelhead were observed in the mainstem and 355 (expanded) Cutthroat were present in the subbasin. No Culverts were encountered. No Knotweed.

Cedar

Cedar Cr. provided another significant tributary habitat for Coho spawning and rearing. 5.8 miles of Coho distribution in the subbasin totaled 2,960 (expanded) summer parr and rearing density averaged 0.2 fish/sq.m. in the mainstem. This level of production seems well below spawning potential relative to the number of stream miles present. The extensive rapid habitats observed here may eliminate a substantial portion of the subbasin as potential Coho rearing habitat. Tribs. B and C exhibited low level spawning over a distribution of about one mile each. Rearing densities similar to the mainstem for Coho were observed in both tributaries and expanded estimates totaled 140 in Trib. B and 420 in Trib. C.

81% of the subbasin Coho were found in 3.9 miles of mainstem distribution. A main spawning peak of 0.9 fish/sq.m. was observed at RM 3. Pool frequency was minor in the mainstem due to long straight reaches of riffle and rapid habitats. This type of channel form suggests limited winter habitat exists for the provision of low velocity hiding cover. Adult escapement and lack of spawning gravels currently limit Coho production in Cedar Cr.

385 (expanded) 1+Steelhead and 765 (expanded) Cutthroat were observed equally distributed. No Culverts. No Knotweed.

Elk

4.1 miles of low density Coho distribution was observed here in steep boulders and high flows. Coho production was low, totaling 2,140 (expanded) summer parr. Most good spawning and rearing habitat was found in the first two miles of the survey. Rearing density for Coho averaged 0.24 fish/sq.m. and exhibited a primary spawning peak of 0.9 fish/sq.m. at RM 0.5. Fine spawning gravels were scarce upstream of RM 2. Pools were large in mainstem Elk and forest coverage good. Distribution ended in steep boulder rapids. Coho production potential is high in lower Elk.

The West Fork of Elk exhibited a small upstream migration of Coho summer parr (20 fish, expanded) before several large boulder falls terminated distribution. Adult passage in this tributary appeared limited beyond 0.5 miles. Little spawning or rearing

potential was recognized in Trib. A. 1+Steelhead and Cutthroat production was moderate (440-expanded and 415-expanded, respectively). Most 1+Steelhead were found in the lower 2 miles while Cutthroat density increased upstream. No Culverts. No Knotweed.

Fall

The area of drainage and stream channel size appear large in the Fall Cr. subbasin. No Coho or 1+Steelhead were present during 2005 survey efforts. It appears that the main highway culvert may be deterring adults. The 10 ft. wide cement box culvert here exhibited a steep gradient and had a small plunge pool inside of it. It looked passable at high flow but difficult. There is a lot of cement and road fill around this culvert and the cost of retrofitting this road crossing would be high. Spawning potential appeared moderate but stream gradient probably increased quickly above the short reach surveyed. A small 2.5 ft. bedrock falls is present below the culvert which would be a permanent juvenile barrier. Knotweed was present at the mouth.

Fox

A 3.5 ft. perched culvert (10 ft. diameter) was noted just upstream of the first pool on Fox Cr. Low level Coho spawning occurred between this culvert and the end of distribution at RM 0.9. 440 (expanded) Coho were present in an average rearing density of 0.32 fish/sq.m. with a peak density of 0.9 fish/sq.m. about 600 ft. upstream from the mouth. Stream gradient and substrate size increase substantially above RM 1 limiting any further spawning potential. Coho production potential appears higher than present levels. The perched culvert is the largest factor limiting spawning and upstream temperature dependent migrations of juveniles from the mainstem Wilson. A significant spike in Coho and 1+Steelhead numbers in the first pool (below the culvert) indicate the presence of a temperature dependent migration for these species. 210 (expanded) 1+Steelhead and 180 (expanded) Cutthroat were present. No Knotweed.

Hughey

A strong upstream migration was observed in the first pool of Hughey Cr. just below a 4 ft. culvert which was completely blocked by a beaver dam. Coho rearing density in this pool measured 3.6 fish/sq.m. The 4 ft. by 5 ft. cement box culvert just upstream appeared in good shape and passable for adults and juveniles. Future production potential appears minimal without the removal of this dam or the installation of some sort of beaver-specific debris grate on the upstream end of the pipe.

Jones

Low level Coho spawning was observed in this tributary with a total expanded estimate of 360 summer parr. Rearing density averaged 0.47 fish/sq.m. and distribution extended 1.1 miles. A spawning peak of 0.7 fish/sq.m. was noted about 800 ft. upstream of the mouth. Stream gradients were steep in this stream and spawning gravel was limited. Higher production for Coho could probably be realized here. Significant cold water refuge from the Wilson mainstem is provided by Jones. Low levels of 1+Steelhead and Cutthroat were also present. No culverts. Knotweed was observed at the mouth of Jones.

Jordan

9.5 miles of high quality Coho habitat was surveyed in the Jordan Cr. subbasin. Stream gradients were relatively high, especially in tributaries, and most substrates were composed of boulder and large rock. Pools were large and deep and summer flows were high. Spawning gravel abundance was sufficient to support higher seeding densities than observed in the 2005 survey (0.2 fish/sq.m.-average). A total expanded estimate of 3,165 Coho were observed in the subbasin, 84% in the mainstem and 16% in the South Fork. This was one of the largest tributary subbasins to the Wilson mainstem (not considering the North, South, or Devils Lake Forks) and one of the most productive for Coho and Steelhead.

7.4 miles of Coho distribution was present in the mainstem with highest densities near the end of distribution (0.67 fish/sq.m.). A series of boulder and bedrock step-falls ended Coho distribution (surveyor classified as passable). 2.1 miles of Coho distribution were present in the South Fork at densities similar to the mainstem (515, expanded, total Coho). Spawning occurred around RM 0.6. Stream gradient was steeper in the South Fork and the channel displayed less sinuosity and complexity. Coho ended in long boulder rapids.

1,635 (expanded) 1+Steelhead were present, 93% in the mainstem. This was the third largest component of Steelhead production in the basin behind the Wilson mainstem and the Little North Fork mainstem. Habitat in the Jordan subbasin appeared ideal for Steelhead. 1,545 (expanded) Cutthroat were present, 79% in the mainstem. Most mainstem 1+Steelhead and Cutthroat were found in the first 3 miles of the survey. 350(expanded) Chinook summer parr were present up to mainstem RM 2.

Buck Cr. enters main Jordan in a deep gorge and spills over an impassable 15 ft. falls. Phipps Cr. displayed a minor upstream migration of Coho but is limited by a series of falls (2 ft., 7 ft., and 4 ft.) to less than 500 ft. of utilizable habitat. No culverts. No Knotweed.

Kansas

An 8 ft. step falls at the mouth of Kansas Cr. appears to be a barrier to anadromous migration. This stream displayed high flows at the mouth and steep forested slopes throughout the upper subbasin. Kansas Cr. probably provides significant temperature maintenance to the Wilson mainstem.

Little North Fork

10.9 miles of Coho distribution in this subbasin proved to be the largest component of Coho production within the Wilson Basin (representing 28% of the 2005 basin total). The population of 25,545 (expanded) Coho was 46% larger than the Wilson mainstem population (29 miles), 58% larger than the Devils Lake subbasin population (17.1 miles), and 168% larger than the North Fork (13.6 miles) and South Fork (7.3 miles) subbasin populations. The Little North Fork 1+Steelhead population for 2005 (3,960-expanded) was the second largest in the Basin behind the Wilson mainstem (12,030-expanded), and was roughly twice the size of the North Fork, South Fork, and Devils Lake Fork subbasin populations. This subbasin is the most significant key anchor habitat for Coho within the Wilson River basin.

A large abundance of high quality stream habitat was present in the Little North Fork. The combination of remote location, limited upslope impacts from harvest and the limited development of a road layer result in a premier example of a functional 6th field subbasin. The steepness of the canyon walls generally limit the potential for interactive floodplain habitats but several large debris jams were observed that are currently retaining abundant reserves of high quality spawning gravels. Coniferous riparian canopies were present along most of the stream that provided shade and potential wood recruitment to the mainstem. Stream gradients were moderate in general with boulder cascades and bedrock exposures occurring frequently.

94% of all Little North Fork subbasin Coho were observed in the mainstem (9.3 miles) in an average rearing density of 0.42 fish/sq.m. Multiple spawning peaks were observed between RM 5.1 and RM 9 where an average density of 0.64 fish/sq.m. was maintained. The highest of these peaks reached 2.1 fish/sq.m.. These levels indicate a below-capacity seeding density for the habitat and suggest that significantly higher production rates are possible here. Adult escapement appears to currently limit production. Coho distribution ended above a narrow gorge in a series of 5 ft. and 7 ft. boulder pours below a large wood jam. This jam was passed by adult Steelhead and does not appear to be a definitive barrier for Coho. Good spawning conditions were still present and abundant upstream of RM 9.3.

3,710 (expanded) 1+Steelhead were observed in the mainstem, 65% of them between RM 3.5 and RM 6.9. Cutthroat distribution in the mainstem was fairly even and totaled 980 (expanded). 2,980 (expanded) Chinook summer parr were also present in the

mainstem up to RM 5. Knotweed infestation was heavy on both banks of the Little North Fork from the mouth up to the confluence of Trib A (RM 1.6). No culverts were encountered on the mainstem.

Berry Cr. exhibited the highest production rates for Coho among the Little North Fork tributaries. 925 (expanded) Coho were found here in an average rearing density of 0.45 fish/sq.m. lasting 0.5 miles. Adult Coho spawning appears to have occurred here within the first 1,000 ft. of stream where densities peaked at 0.9 fish/sq.m.. Substrates consisted mostly of large cobbles interspersed with pockets of finer spawning gravels. An enormous 35 ft. high wood jam at RM 0.5 in a tight canyon pinch point represents a definitive adult barrier. 65 (expanded) 1+Steelhead and 400 (expanded) Cutthroat were also present. No culverts. No Knotweed.

Blowout Cr. exhibited expanded estimates of 365 Coho and 35 1+Steelhead over a distribution of 0.24 miles before a large debris jam terminated adult Coho passage. It is likely that Coho are spawning here. Coho rearing density averaged 0.95 fish/sq.m.. No culverts. No Knotweed.

White Cr. exhibited expanded estimates of 115 Coho and 150 1+Steelhead over a distribution of 0.4 miles. A wood jam in conjunction with a series of 4 ft. boulder falls stopped Coho but looked passable. These Coho appear to have been the result of an upstream migration from the mainstem. Flat stream gradients and ample spawning gravels were present upstream of the jam/falls indicating the potential for in-stream spawning of Coho. No culverts. No Knotweed.

Trib. A exhibited a minor upstream migration of 50 (expanded) Coho over 500 ft. before steep stream gradients and bedrock falls terminated distribution. No culverts. Heavy Knotweed infestation was present at the mouth and the Trib appeared to be the source location for the noxious weed.

Trib. B appears to have supported a small spawning event just upstream of a 4 ft. wood jam at the mouth. Just 65 (expanded) Coho were present but the wood jam looked to be a juvenile barrier. Stream gradient and substrate size picked up quickly after 700 ft. of survey limiting any further production potential. No culverts. No Knotweed.

Muesial

No Coho were found in Muesial. Anadromous distribution is limited by a 12 ft. falls approximately 200 ft. up from the mouth. This subbasin is most important for its cold water temperature maintenance of the Wilson mainstem and upslope forest management should prioritize the water quality contribution of this Tributary. No culverts. No Knotweed.

Ryan

A minor upstream migration of 20 (expanded) Coho was observed in Ryan Cr. below a large debris jam barrier 500 ft. up from the mouth. Future anadromous potential appears minimal. Temperature maintenance for the Wilson mainstem is the most important factor for the subbasin. No culverts. No Knotweed.

South Wolf

A single Coho was seen in the first pool of South Wolf. Wood jams and steep bedrock cascades are the main limiting factors here. Temperature maintenance for the Wilson mainstem is significant. No culverts. No Knotweed.

Stanley

No Coho were observed in Stanley Cr. due to the 4.5 ft. perch observed in the cement culvert under the main road (250 ft. up from the mouth). Future potential, assuming the culvert were passable, appeared minimal due to steep stream gradients. Temperature maintenance of the Wilson mainstem is a significant contribution. No Knotweed.

Sylvan

Minor Coho spawning may have occurred in Sylvan. 60 (expanded) Coho were present along with 15 (expanded) 1+Steelhead over 700 ft. of survey. Distribution beyond this point was limited by steep bedrock cascades. Production potential for Coho appears minimal in this subbasin. Temperature maintenance of the Wilson mainstem is the most significant contribution of Sylvan. No culverts. No Knotweed.

Wolf

No Coho were found here. 55 (expanded) 1+Steelhead and 85 (expanded) Cutthroat were present throughout 300 ft. of survey. Steep bedrock substrates limit fish production potential. Temperature maintenance of the Wilson mainstem is the most important contribution for the subbasin. No culverts. No Knotweed.

Zig-Zag

Anadromous distribution in this subbasin is prevented by a 5 ft. bedrock falls just below the 10 ft. cement culvert. This culvert has trapped a 20 ft. high wood and boulder jam on its upstream end. Stream gradient and substrate size appear too large for Coho

spawning. Temperature maintenance to the Wilson mainstem is probably this stream's most significant contribution to salmonid production. No Knotweed.

Unnamed Tributaries

Trib. A showed no anadromous spawning potential. This flat, swampy tributary started below tidal influence, ran through a short section of golf course trench pools, and then dissipated into a wide skunk cabbage and beaver dam complex. No gravels were found and summer flows were minor.

Trib. B contained 140 (expanded) Coho in 0.6 miles of marginal habitat. Rearing density averaged 0.44 fish/sq.m. and peaked at 1.8 fish/sq.m. in the first pool. The location of the peak density suggests the presence of a temperature dependent migration out of the Wilson mainstem and indicates that this tributary may be an important source of temperature refugia for lower basin juveniles. A small 3 ft. culvert at the mouth is badly slumped in the center and in need of repair, though still passable. Stream flow and stream gradient were both very low in Trib. B and most pools were shallow and lacked diversity. Spawning gravels were present but sand and silt were the dominant substrates. Distribution ended where flows divided into several small seeps. No Steelhead were seen. No Knotweed.

Trib. C showed signs of low level Coho spawning. 225 (expanded) Coho were present over 0.7 miles of distribution. No Steelhead were found. Stream gradient and stream flow were again very low in this tributary, which was located just upstream from Trib. B in a similar geologic setting. Most of Trib. C ran through cattle pasture and trench pools. Heavy siltation was observed along with high solar exposure and poor water quality. Some spawning gravels were present. Distribution ended shortly after flows diverged and the main channel passed through the 3 ft. main road culvert. Stream flow above this culvert then went completely dry. Future Coho productivity in Trib. C is limited by lack of spawning gravel, heavy siltation, and elevated water temperatures. Knotweed infestation was heavy at the stream mouth.

Trib. D was located just downstream from Kansas Cr. on the same side of the Wilson River. An expanded estimate of 55 Coho was observed in a distribution which extended beyond a juvenile barrier in the form of a steep bedrock cascade. Total distribution distance was 0.2 miles and the cascade was encountered in the first 500 ft. This evidence suggests the occurrence of a Coho spawning event upstream of the cascade. It would appear that most of the Coho from this spawning had migrated down into the Wilson mainstem by the time of the 2005 survey. Future Coho potential here is limited mainly by the small size of pools and the steepness of the stream gradient. No further barriers were noted. No Steelhead were found. No culverts. No Knotweed.

Trib. E was small and steep and had a 4 ft. falls at the mouth. An 8 ft. square cement culvert with a fish ladder helps adult fish pass this falls but is still impassable for juveniles. No Coho or Steelhead were present. Summer rearing of Wilson mainstem

juveniles was prevented by the falls while some adult spawning potential was noted upstream. The current limitation was inadequate adult escapement. No Knotweed.

Devils Lake Fork

The Devils Lake Fork subbasin displayed the most diverse and unique geology of all the tributaries in the Wilson Basin. The Devils Lake itself is an expansive, flat, swampy drainage on the summit of the Coast Range, probably the remnant of an ancient lake bed. Presently the Devils Lake Fork stream and its many tributaries wind back and forth across this wide floodplain through beaver ponds, slow backwaters, deep depositions of silt and sediment, and open grassy wetlands. Solar exposure through these upper reaches was high during the 2005 survey and the early successional riparian vegetation was lush. This type of low gradient, fine sediment habitat is a rare occurrence in the Wilson River basin. Spawning gravels and even large rock were intermittently encountered within the stream channel.

Near the mouth of the Deyoe Cr. (RM 6.4) the Devils Lake Fork begins to fall through a series of rocky gorges, getting steeper and steeper downstream, and finally enters the main canyon of the Wilson near the mouth of Elk Cr. Stream channel and vegetation characteristics completely shift in this zone from those of a low gradient wetland to those of a typical upper Wilson tributary – steep bedrock walls, long boulder rapids, no floodplain, etc. Some of the best spawning opportunities for Coho were found in this transition zone between RM 3 and RM 6 of the mainstem. The only visible difference in the lower reaches of the Devils Lake Fork is the dark tannic water from the headwater wetlands.

Coho production in the subbasin was relatively high, 16,180-expanded, and roughly equal to the size of the Wilson mainstem population. This accounted for 18% of the basin-wide Coho population. This level of production was about 63% higher than the South Fork subbasin and 70% higher than the North Fork subbasin. Surveys totaled 17.1 miles in the Devils Lake Fork subbasin which included the tributaries of Deyoe (0.8 miles), Drift (0.5 miles), Elliot (1.7 miles), Fern Rock (0.15 miles), Idiot (1 mile), and Tribs. A, B, C, D, E, and F. 72% of the subbasin Coho total was observed rearing in the mainstem. Elliot and Idiot were the two most productive tributaries (9% and 7%, respectively, of total subbasin Coho). This subbasin is a primary anchor habitat for Coho in the Wilson Basin.

1+Steelhead production in the Devils Lake Fork was also high compared to other Wilson River tributaries. 1,845 (expanded) 1+Steelhead were found in the subbasin, 89% in the mainstem. This mainstem population, found almost completely in the steepest first three miles, ranked as the third highest component of Steelhead production in the Basin behind the Wilson mainstem and the Little North Fork mainstem.

Mainstem Devils Lake Fork

(Table 12)

Expanded Mainstem Devils Lake Fk Estimates of Juvenile Production and Contribution to 5th field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	11,665	4,670	1,640	490
	(13%)	(5.2%)	(7%)	(5%)

Definitive Coho distribution in the mainstem extended 8.7 miles from the mouth of the South Fork Wilson to an 8 ft. bedrock cascade just upstream from Brown's Camp. Above this cascade visibility deteriorated rapidly in ancient beaver pond habitats. The cascade appeared passable for adults at high flow but looked difficult. Another 1.6 miles of stream were surveyed until the channel reformed and typical pool/riffle complex of habitats. No Coho were found through this upper reach and visibility was good. Some spawning gravels were found in the last mile of survey along with abundant legacy wood buried within the floodplain. Stream flow was very low, however, and numerous four and five foot beaver dams were encountered above the cascade. Anadromous potential beyond RM 9 appears minimal.

Rearing densities for Coho in the mainstem averaged a low 0.34 fish/sq.m. but peaked at 1.3 fish/sq.m. near RM 5. Excellent spawning gravels and wide channel braids were sporadically encountered between RM 3 and RM 6, usually just above a tight bedrock pinch in the canyon or a small boulder cascade. This was definitively the case at RM 5 where large supplies of gravel were deposited by the mouth of Elliot Cr. and numerous flood channels were present. Excellent spawning conditions were also found just downstream from Browns Camp around RM 7.5 where the mainstem emerged from a large beaver impoundment into a short stretch of well sorted gravels and deeply scoured lateral pools. Some old growth evergreen forest was still intact in this location and channel conditions looked exceptional. A long reach of large angular rock followed to the bedrock cascade and beaver ponds above. Significantly higher production rates for Coho could be sustained in the mainstem. Summer and winter rearing potential here for juveniles is practically unlimited. Adult escapement is presently the main limiting factor. Visibility was poor for much of the Devils Lake Fork survey and it is possible that Coho numbers were higher than reported.

The lower mainstem was a major Steelhead producer. The third largest juvenile population in the whole Basin was found here within a very short distance. 84% of the mainstem 1+Steelhead population was found in the first 3 miles of the survey where stream gradients were highest and white-water rapids were abundant. The only two segments which surpassed the Devils Lake Fork Steelhead production included a much greater distance – the Wilson mainstem (29 miles) and the Little North Fork (9.3 miles).

This reach appeared to be a main anchor habitat for Steelhead in the Wilson Basin. The Cutthroat population in the mainstem was relatively small and also decreased in density as the survey progressed upstream. All culverts were in good shape. No Knotweed.

Deyoe

Low level Coho spawning probably occurred in this small tributary. 410 (expanded) Coho were present along with 30 (expanded) 1+Steelhead. Coho rearing density averaged 0.4 fish/sq.m. with the highest peak reaching 0.77 fish/sq.m. and a distribution totaling 0.8 miles. The channel here was tight (no floodplain) with little sinuosity and clogged with legacy wood. Adult passage is probably difficult and spawning sites are few. No culvert problems. No Knotweed.

Drift

An upstream migration of Devils Lake Fork summer parr was observed in the first 0.5 miles of Drift Cr.. Rearing density averaged 0.28 fish/sq.m. and the expanded estimate totaled 185 Coho. No Steelhead. 10 (expanded) Cutthroat were present. Stream gradient in Drift Cr. was very high and substrates consisted mostly of boulders and bedrock. Spawning and rearing potential for Coho appears minimal in this subbasin. No culverts. No Knotweed.

Elliot

Elliot Cr. was the largest producer of Coho among the Devils Lake Fork tributaries. The average rearing density here for Coho of 0.77 fish/sq.m. was the highest in the subbasin and the expanded estimate of 1,520 summer parr accounted for 9% of the Devils Lake Fork subbasin total. Most spawning appears to have occurred within the first mile of stream where rearing densities rose to 0.9 fish/sq.m.. 1.5 miles of Coho distribution was terminated by the impassable University Falls. A short 0.2 mile upstream migration of Coho juveniles was observed in Trib. A. Rearing densities and habitat quality in Elliot suggest a significant potential for production increases among Coho. 1+Steelhead and Cutthroat were also present in low numbers. No culverts. No Knotweed.

Fern Rock

Coho spawning occurred in this stream in 2004. Only a short 0.15 miles of stream is useable for anadromous fish before a 30 ft. rock falls stops all passage. Stream gradient is low in this short reach and spawning gravels were noted as abundant and of excellent quality. Only three pools were surveyed, Coho rearing density in the first measured 4.0 fish/sq.m., in the second 2.1 fish/sq.m., and No Coho were observed in the third. The

expanded estimate totaled 565 Coho. No Steelhead or Cutthroat were present. A small culvert was perched above the rock falls at a 40 degree angle. No Knotweed.

Idiot

This subbasin exhibited the second highest Coho production rates and rearing densities among the Devils Lake Fork tributaries. 1,065 (expanded) Coho were present in an average rearing density of 0.6 fish/sq.m. over a distribution of one mile. This abundance accounted for 7% of the subbasin Coho total. Multiple spawning peaks were present with the highest at 1.7 fish/sq.m.. Much of the stream channel was composed of large rock and bedrock exposures with patchy occurrences of finer gravels. A 20 Ft. bedrock cascade terminated Coho distribution. Future potential for Coho production appears limited mainly by the abundance of appropriate spawning gravel. 1+Steelhead and Cutthroat were present in low numbers. No culverts. No Knotweed.

Unnamed tributaries

Tribs. A, B, and C all supported small Coho populations. 485 (expanded) Coho were present in Trib. A in an average rearing density of 1.0 fish/sq.m. over 0.5 miles. Adult spawning appears to have occurred here and habitat conditions could support higher Coho densities. Steelhead and Cutthroat were present in low numbers. No culverts. No Knotweed.

An upstream migration of Coho was observed in Trib. B (40 juveniles-expanded) where stream gradients appeared too steep to support adult spawning and all passage was terminated by a 60 ft. falls 350 ft. up from the mouth. Steelhead and Cutthroat were present in low numbers. No culverts. No Knotweed.

Low level Coho spawning probably occurred in Trib. C where an expanded estimate of 245 juveniles were found in an average rearing density of 0.7 fish/sq.m. over 0.4 miles. Stream gradient was low here and minor abundances of spawning gravels were noted. No Steelhead. Cutthroat were present in low numbers. The one culvert encountered was in good shape. No Knotweed.

No Coho were present in Tribs. D, E, or F. Trib. D was limited mainly by low flows and a large beaver impoundment just up from the mouth. No spawning sites were found. Tribs. E and F both branched out of the extensive swamp at the end of the Devils Lake Fork mainstem survey. Trib. E appeared to be the best of the two with moderate flows, small pools, and spawning gravels located about one mile up from its mouth. This one mile, however, was all beaver marsh and lacked any distinct channel. It is doubtful that adult passage is even possible through the upper reaches of the Devils Lake Fork mainstem leading up to the mouth of Trib. E. 0.7 miles of beaver swamp in Trib. F was surveyed without any change in habitat conditions. There was no sign of spawning

gravels or channel formation. There appeared to be no anadromous potential in any of these three streams. No culvert problems were encountered. No Knotweed.

North Fork Wilson

Coho production in the North Fork subbasin reached 9,535 (expanded) and covered 13.6 stream miles. This included the West Fork North Fork (4.2 miles) and its tributary Rogers Cr. (2.3 miles). 10.5% of the total Coho basin-wide were observed here. The subbasin Coho total in the North Fork was nearly identical to the South Fork Wilson subbasin total which covered about half the distance (7.3 miles). Production in the North Fork was split fairly evenly between the three branches: 37% in the mainstem, 36% in the West Fork North Fork, and 28% in Rogers. These Coho populations were among the five highest producers in the Wilson basin. Rearing densities for Coho were low in general and most habitats appeared under seeded.

Healthy mixed species riparian canopies were encountered throughout much of the system as well as ample summer flows and deep pools. Low wood complexity was a common problem for juveniles looking for cover and many were found rearing in the shallow pool tail-outs. Stream gradients were generally high and most stream miles were composed of long straight riffles and boulder rapids. Coho distribution in all three branches passed through numerous tight gorges and all ended at a bedrock falls. Flat, gravelly tail-outs were generally lacking in most pools and the total number of suitable spawning sites may be a significant limitation for Coho in the North Fork subbasin.

1+Steelhead estimates reached 2,015 (expanded) for the subbasin and accounted for 8.3% of the Wilson Basin total. Individual stream estimates represented a moderate to low level of production relative to the distance surveyed and other comparable reaches in the Wilson basin. Habitat conditions here appeared ideally suited for Steelhead. Cutthroat expanded estimates were moderate at 1,460 for the subbasin.

Mainstem North Fork

(Table 13)

Expanded Mainstem North Fork Estimates of Juvenile Production and Contribution to the 5th field

Survey Year	Coho	0+	Sthd	Cut
2005	3,395	3,780	965	665
	(3.7%)	(4.2%)	(4%)	(6.5%)

Rearing densities for Coho in the mainstem averaged a low 0.34 fish/sq.m. but exhibited a significant spawning peak of 2.2 fish/sq.m. at the end of the survey near RM

6. Distribution continued for another 0.4 miles before a debris jam and a double 4 ft. bedrock falls terminated passage. This was the fifth largest Coho producer among the Wilson River tributaries. Substrates consisted mostly of cobbles, boulders, and bedrock with occasional patches of gravels. Floodplain interaction was minimal as the wide rocky channel appeared to support extremely large winter flows. Wood complexity and juvenile cover was minimal.

Moderate 1+Steelhead production was observed in the North Fork mainstem. 72% of the population was observed between RM 3 and RM 5.5. Cutthroat densities were evenly distributed throughout the survey. No culverts. No Knotweed.

Trib. A was the only unnamed tributary where Coho were rearing. 170 (expanded) summer parr were present in a distribution of 0.6 miles. The 10 ft. diameter culvert near the mouth was perched by one foot and represented a juvenile barrier. Attempted upstream migration behavior may be occurring with high densities observed for Coho in the pool below this culvert. It would appear that adult Coho spawning took place upstream of this culvert despite the low total estimate. The stream was steep and cobble dominated with fair pockets of spawning gravel. Coho distribution ended at a small wood jam that looked passable for adults. No Knotweed.

West Fork North Fork

Expanded estimates for Coho were nearly identical in the WFNF as in the North Fork mainstem. Rearing densities for Coho in the WFNF appeared slightly higher and averaged 0.5 fish/sq.m. over a shorter distribution of 4.2 miles. 3,415 (expanded) summer parr were present, accounting for 3.8% of basin-wide production. This was the fourth largest tributary population for Coho in the whole basin. Multiple spawning peaks were located near RM 1.3 (1.3 fish/sq.m.) and RM 2.6 (1.2 fish/sq.m.). Habitat and channel characteristics in the WFNF were similar to the North Fork mainstem with high abundances of boulders and bedrock and a 7 ft. falls ending distribution. Low abundances of spawning gravel could limit production.

1+Steelhead production was moderate at 605 (expanded). Cutthroat estimates totaled 370 (expanded). Most 1+Steelhead and Cutthroat were observed in the first two miles of the survey. No culverts. No Knotweed.

Rogers

Coho production in this tributary was relatively high considering the short 2.3 miles of distribution. 2,555 (expanded) summer parr were present in an average rearing density of 0.5 fish/sq.m. rising to 1.3 fish/sq.m. by RM 1.6. Almost one-third of the total Coho in the subbasin were found here in less than one-fifth of the total stream miles. This was largely the result of flatter gradients (2.8% in the 1st mile) and the resultant higher

pool frequency relative to the North Fork and the WFNF. Spawning gravel was limited but present, and Coho distribution ended at an 8 ft. boulder cascade.

410 (expanded) 1+Steelhead and 310 (expanded) Cutthroat were also present in a relatively even distribution. Small upstream migrations from the mainstem of Rogers of Coho juveniles were observed in Tribs. A and B. Little spawning potential was noted there. No culverts. No Knotweed.

South Fork Wilson

Surveys in the South Fork Wilson started at the mouth of the Devils Lake Fork and stretched 5.1 miles to the end of Coho distribution in a narrow rocky canyon. Spawning gravels eventually disappeared but no definitive barriers to migration were noted. An additional 2.2 miles of Coho distribution was observed in Tribs. A, B, and C. The subbasin Coho total of 9,920 (expanded) was similar in size to the North Fork subbasin (13.6 miles) and accounted for 11% of the basin-wide production. This was the third largest tributary population of Coho in the basin after the Little North Fork and the Devils Lake Fork and exhibited the shortest distribution of all three. 90% of South Fork Coho were rearing in the mainstem.

Habitat conditions were similar to most upper Wilson tributaries including long rapids, frequent bedrock exposures, and patchy spawning gravels. Maximum winter flow rates appeared substantially lower here than in the North Fork or the Devils Lake Fork.

1+Steelhead production was high in the subbasin with an expanded estimate of 1,500 (6.2% of the Wilson basin total). This was the fourth largest tributary population in the basin behind the Little North Fork, the Devils Lake Fork, and Jordan Creek. Most of the largest 1+Steelhead here were residualized hatchery releases with fin clips. 91% of the subbasin population was observed in the mainstem. Cutthroat densities were low in the subbasin with an expanded estimate of just 425.

Mainstem South Fork

(Table 14)

Expanded Mainstem South Fork Estimates of Juvenile Production and Contribution to the 5th field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	8,950	4,550	1,365	320
	(10%)	(5%)	(5.6%)	(3%)

Almost all fish production in the subbasin occurred in the mainstem. Rearing densities for Coho were low, averaging 0.3 fish/sq.m., and distribution totaled 5.1 miles. Two main spawning peaks were located - 1.2 fish/sq.m. at RM 1.8 and 0.5 fish/sq.m. at RM 3.3. 1+Steelhead counts were high but a large percentage of this abundance were fin

clipped and of hatchery origin. 71% of this population was observed below RM 2.5. Cutthroat distribution was fairly even throughout the survey. No culverts. No Knotweed.

Trib. A ran through the South Fork Prison Camp and exhibited 0.9 miles of Coho distribution. Adult spawning occurred in this tributary and the expanded estimate totaled 480 summer parr. Average rearing densities were high, 0.8 fish/sq.m., and a peak density of 1.9 fish/sq.m. was observed at RM 0.2. No barriers to migration were noted. Steelhead and Cutthroat were present in low numbers. No culverts. No Knotweed.

Trib. B also supported Coho spawning with a distribution of 0.7 miles and an expanded estimate of 320 summer parr. Rearing density averaged 0.5 fish/sq.m. and peaked at 0.73 fish/sq.m. near RM 0.4. A badly perched culvert (4 ft. high) was found in Trib. B2 but anadromous potential there was classified as minimal. 1+Steelhead and Cutthroat were present in low numbers. No Knotweed.

Trib. C exhibited spawning potential for Coho and the current distribution extended 0.4 miles with an average rearing density of 0.8 fish/sq.m. 1+Steelhead and Cutthroat were also present in low numbers. No culverts. No Knotweed.

Kilchis River

Expanded estimates for Coho totaled 31,105 in the Kilchis Basin with 46.6 miles of distribution. This was approximately the same level of production observed for the Tillamook River basin (62 miles), less than half the production observed in the Trask Basin (90.6 miles), and about one-third of the production observed in the Wilson Basin (106 miles). Expanded estimates for Coho in the Miami Basin (28.6 miles) totaled just 15,275. Rearing densities for Coho throughout the Kilchis Basin were extremely low and the production potential of the system is currently not functioning at capacity. No habitats were observed seeded to capacity for Coho. The highest average rearing density was observed in Company Cr (0.98 fish/sq.m.).

The main anchor habitats for Coho in the Kilchis Basin during a year of low adult abundance were in the upper Mainstem and in the North Fork. Production in these two reaches accounted for 45% and 25%, respectively, of the basin total. Habitats in the Little South Fork, its tributary Sam Downs, and the North Fork tributary Schroeder all exhibited significant future potential for Coho production although 2005 rearing estimates were depressed. Inadequate adult escapement appeared to be the primary limiting factor in all these stream segments.

The expanded estimate of 8,570 1+Steelhead for the Kilchis Basin ranked as the third highest in the Tillamook Bay complex of streams behind the Wilson (24,225) and the Trask (12,110). This estimate was very close to the Miami estimate of 7,350 (expanded). 65% were observed rearing in the mainstem and another 13% in the Little

South Fork. A large number of these may have originated in the North Fork mainstem where significant 0+trout abundance was observed.

Much of the Kilchis Basin was surrounded by high elevations and thick forest. Numerous side canyons too steep for Coho were observed delivering high flows of cold upslope water to lower mainstem habitats. Forest coverage in these drainages is critical to maintaining the high water quality observed in these large pools on the valley floor. Upslope coniferous wood resources represented significant potential for future recruitment to tributary habitats. Most mainstem habitats appeared to support large winter flows and limited mainstem roughness was observed associated with wood complexity. Stream gradients were high throughout the Basin with boulder rapids and bedrock dominating the substrates in all reaches except the lower mainstem and the tidewater tributaries. Vast networks of tidal channels and sloughs were observed surrounding the mouth of the Kilchis which provide high quality summer and winter rearing for anadromous juveniles. A unique distribution pattern was noted in the Kilchis mainstem where the abundance for all four species of salmonid juveniles remained high into intertidal habitats. No Knotweed was observed in the Basin. The basin-wide review below is broken down into two sections: (1) the Mainstem and tributaries and (2) the North Fork subbasin and tributaries.

(Table 15) Kilchis River 2005 Basin Wide Inventory

Stream	**Coho**	% Total	**0+**	% Total	**Sthd**	% Total	**Cut**	% Total
Mainstem	14,135*	45.4	14,845*	54.0	5,575*	65.1	810*	26.0
-Clear	1,115	3.6	710*	2.6	540*	6.3	185*	5.9
-Coal	350	1.1	110		145	1.7	20	
-Doty	0		10		0		0	
-Hathaway	0		0		0		0	
-Little South Fork	1,625*	5.2	660	2.4	815*	9.5	200*	6.4
--Sam Downs	1,500*	4.8	610	2.2	245	2.9	220*	7.1
-Murphy	295		75		30		55	1.8
-Myrtle	20		0		65		30	1.0
-South Fork	1,575*	5.1	2,245*	8.2	445*	5.2	180	5.8
--Company	970	3.1	245		40		110	3.5
-Vaughn	1,035	3.3	60		15		80	2.6
-Trib. A	200		35		55		60	1.9
-Trib. B	50		75		0		50	1.6
-Trib. E	255		295	1.1	35		100	3.2
North Fork Mainstem	6,115*	19.7	5,685*	20.7	345*	4.0	380*	12.2
-Fossil	85		25		0		20	
-Schroeder	1,315	4.2	805*	2.9	25		165	5.3
--French	150		175		0		0	
-Triangulation	160		25		0		65	2.1
-Trib. A	45		25		10		55	1.8
Basin Total	**30,995**	**99.6**	**26,715**	**97.2**	**8,385**	**97.8**	**2,785**	**89.4**

- * Top five producers for each species and age class for the subbasin
- Percent contributions only given for values of 1% or greater

Mainstem Kilchis River

(Table 16)

Expanded Mainstem Kilchis River Estimates of Juvenile Production and Contribution to the 5th field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	14,135	14,845	5,575	810
	(45%)	(54%)	(65%)	(26%)

Approximately half of all fish species in the basin besides Cutthroat were documented summer rearing in the mainstem. Coho production here was more than twice as high as in the Trask mainstem (13.9 miles) and just 19% lower than in the Wilson mainstem (29 miles). 1+Steelhead production was similarly twice as high in the Kilchis mainstem as in the Trask mainstem but less than half that of the Wilson mainstem.

Surveys in the Kilchis mainstem extended a total of 13 miles from the head of tide (0.5 miles upstream from the Highway 101 bridge) to the confluence of the North and South Forks.

Average rearing density for Coho was extremely low (0.04 fish/sq.m.) with the highest counts observed in the upper reaches between RM 8.7 and RM 11.8. Fine gravels were present there in most pools and riparian canopy coverage was good. A tight pinch in the canyon occurs immediately upstream of RM 12 with large exposures of bedrock and a few small pours. The North and South Forks diverge just above this prominent bedrock intrusion. Brush revetments and rock barb structures in the lowest reach downstream of the Kilchis River Rd. Bridge were noted as highly effective cover and complexity with high rates of occupancy for all juvenile salmonids.

1+Steelhead and Cutthroat densities decreased as the survey progressed upstream (an unusual distribution). The highest 1+Steelhead counts were found downstream of RM 6. A few large 20”-24” Cutthroat were documented in the lower mainstem. Juvenile Chinook were present up to RM 11.4. No culverts were present. No Knotweed was noted.

The mainstem channel showed impacts of extreme winter flows. Both wood complexity and floodplain interaction were minimal. Still, this reach appeared to be the most important production habitat in the basin for both Coho and Steelhead.

Clear

Low level Coho production was present along the first two miles of Clear Creek. The low average rearing density of 0.36 fish/sq.m. exhibited a spawning peak of 1.8 fish/sq.m. at RM 0.8. There was little evidence of any upstream migration of Coho from the lower Kilchis mainstem at the mouth of Clear. The expanded estimate for Coho totaled 1,115 summer parr. A major tributary on the right near the end of the survey exhibited a 5 ft. perched culvert, anadromous potential above this culvert was classified as low. No further barriers to migration were noted and indications are that Clear Cr. could support much higher levels of production.

1+Steelhead production was excellent in Clear with a total of 540 (expanded) present. Most were observed between RM 0.5 and RM 1.5. Cutthroat and Chinook were also present in low numbers. No culverts. No Knotweed.

Coal

Adult Coho spawning occurred in Coal Creek. 350 (expanded) summer parr were present in an average rearing density of 0.36 fish/sq.m. along 1.3 miles of stream. Rearing density peaked at 0.8 fish/sq.m. near RM 0.8. Steelhead and Cutthroat were present in low numbers. A 30 ft. concrete dam terminated distribution. No culverts. No Knotweed.

Doty

0.7 miles in Doty Cr. and 0.65 miles in Trib. A were surveyed in 2005, starting at the head of tide. This tributary traversed marshy floodplain habitats to the North of the Kilchis tidewater through Idaville. Visibility was poor but sufficient to determine presence or absence. No Coho were present, only 0+trout were documented. Anadromous spawning potential was minimal due to low flows, low stream gradients, and a lack of spawning gravel. Some winter rearing of salmonid juveniles may be occurring in the tidewater portions of Doty. Culverts were all passable for adults and juveniles. No Knotweed.

Hathaway

Roughly 1000 ft. of Hathaway Slough was surveyed beginning at the head of tide. No fish were observed. No anadromous potential was recognized in this small waterway which emerges in seeps and spring adjacent to the toe slope of the coast range. Low flows, low stream gradient, elevated summer temperatures and a lack of spawning gravel all limit the systems potential for salmonids. The tidewater portions of the Hathaway Slough are extensive and link together with the mouth of Vaughn Cr. (discussed below). These habitats may be important to the provision of winter habitat for multiple species of juvenile salmonids. No culverts. No Knotweed.

Little South Fork

This subbasin was the second most productive in the Kilchis basin for Coho after the North Fork. Coho production estimates here were 27% higher than in the South Fork (5.4 miles). 5.4 miles of Coho distribution were present in the Little South Fork including 1.2 miles in Sam Downs Creek. Expanded estimates for Coho were evenly split between these two components – 1,625 in the mainstem and 1,500 in Sam Downs. Together, these two reaches accounted for 10% of basin-wide Coho totals. 1+Steelhead production in the subbasin was also significant (1,140-expanded) and represented the second largest producer in the basin (13% of basin total) after the Kilchis mainstem (65% of basin total).

Coho rearing density averaged 0.2 fish/sq.m. through 3.6 miles of mainstem distribution with a peak of 0.56 fish/sq.m. at RM 2.5. The highest count was documented in the first pool which suggests that Coho in this tributary may be preferring summer condition in the Little South Fk over conditions in the mainstem Kilchis. An 8 ft. debris torrent jam terminated Coho distribution. 1+Steelhead were found upstream of this jam and it does not appear to be a definitive barrier for Coho.

No 1+ Steelhead or Cutthroat were observed in the first 1.5 miles of the mainstem survey. Peak counts were observed in the next mile and then densities decreased. No explanation was evident for this very unusual distribution. 815 1+Steelhead were present

in the Little South Fork mainstem making this the largest tributary population in the basin (10% of basin total). A small upstream migration of Coho was documented in Trib. C. All other unnamed tributaries appeared too small and steep to support Coho spawning or rearing.

Sam Downs was the only major tributary to the Little South Fork. Coho production was significant here, accounting for 5% of the basin-wide total in just 1.2 miles of distribution. Rearing densities for Coho were slightly higher (0.36 fish/sq.m.) and distribution ended at a large debris jam which was passed by Steelhead. This jam is not a definitive barrier for Coho. A spawning peak for Coho of 0.47 fish/sq.m. was found at RM 0.7 although the highest individual pool count was again observed in the first pool of the survey. 1+Steelhead and Cutthroat production was moderate with peak counts observed around RM 0.5. Trib. A to Sam Downs showed evidence of adult Coho spawning with 130 (expanded) summer parr present in a high average rearing density of 2.1 fish/sq.m. over 800 ft. of distribution. Trib. B showed signs of a small upstream migration of Coho.

Upslope elevations surrounding the Little South Fork were high and most tributary habitats in the subbasin were too steep to support significant anadromous spawning. The two mainstem reaches exhibited ideal spawning substrates for both Steelhead and Coho. Pools were large and clear and high abundances of all substrate sizes were present. Extensive boulder rapid habitats greatly outnumbered pool habitats and significant numbers of 1+Steelhead rearing in these rapids were not documented in this inventory. The second growth forest canopy along the stream provided contiguous shade.

High summer flows and low temperatures were noted, due to the influence of many steep 1st and 2nd order tributaries. The retention of riparian canopies in these small drainages will be critical for maintaining the current high water quality observed. The Little South Fork appears to be the most important tributary for Steelhead in the Basin and the second most important for Coho after the North Fork (7,875 summer parr). Low average rearing densities and healthy habitat conditions suggest that production potential in the Little South Fork for Coho and Steelhead is below its current capacity. No Culverts. No Knotweed.

Murphy

Moderate Coho spawning occurred in the Murphy Cr. subbasin. 295 (expanded) Coho were present in 2005 along with 30 (expanded) 1+Steelhead and 55(expanded) Cutthroat. Rearing density for Coho averaged 1.0 fish/sq.m. and distribution totaled 1.2 miles. No barriers to migration were noted. Spawning gravel and wood complexity were both present upstream of the influence of the agricultural zone. No culverts. No Knotweed.

South Fork

Steep stream gradients, abundant bedrock, and a huge boulder gorge and falls at RM 1.1 describe the general habitat condition in the lower mile. Coho and Steelhead passed this falls during the 04/05 winter. An excellent stretch of fine spawning gravels and sinuous pools was observed just above this gorge with near-perfect conditions that extended to RM 4 where huge bedrock outcroppings and a 4 ft. falls terminated Coho distribution. Spawning potential appeared minimal upstream of this point due to a lack of fine gravels and high stream gradients.

2,455 (expanded) Coho in the South Fork subbasin represented 8% of the Kilchis basin total. This included 970 (expanded) Coho from an additional 1.4 miles of distribution in Company Cr., the only South Fk tributary with Coho. The mainstem SF Kilchis expanded estimate of 1,575 Coho was similar to the estimates from the Little South Fork mainstem (4.2 miles) and Sam Downs Cr. (1.7 miles). Average rearing density for Coho in the SF Kilchis was very low (0.1 fish/sq.m.) and rose to 0.4 fish/sq.m. above the gorge at RM 1.3. Significantly higher Coho production could be supported here with larger adult escapements. 1+Steelhead production was moderate in the mainstem (445-expanded) with most being observed in the first mile below the gorge. Cutthroat distribution was relatively even throughout the survey.

A significant portion of adult Coho returning to the South Fk Kilchis utilized Company Creek. The mouth of Company is just downstream from the steep boulder gorge in the SF Kilchis. The highest average rearing densities for Coho basin-wide (0.98 fish/sq.m.) were observed here with a peak spawning density of 3.7 fish/sq.m. at RM 0.5. Stream habitats and upslope forest integrity was classified as excellent throughout the Company Cr. survey. No barriers to migration were noted and 1.4 miles of Coho distribution ended in long, steep boulder rapids. Indications are that Coho seeding levels in Company Cr. were near the carrying capacity of the habitat. 1+Steelhead and Cutthroat were present in low numbers.

Other tributaries, including Mutt Cr., were too steep and bouldery to support adult spawning or juvenile rearing but represent important cold water sources for the SF Kilchis mainstem. No culverts. No Knotweed.

Vaughn

This stream exhibited unutilized spawning and rearing potential. Spawning gravels were present in Vaughn in close proximity to the expansive tidal rearing habitats provided by the Vaughn/Hathaway Slough system. The upper reaches above the golf course at Idaville are currently inaccessible because of a series of poorly functioning culverts. Channel simplification that has resulted in entrenchment, a lack of sinuosity, and low pool/riffle ratios also decreases production potential on both the agricultural and golf course properties. Pool depth and complexity are missing structural components of

the aquatic habitats. High solar exposure in the agricultural corridor below the golf course in addition was a significant detriment to summer time water quality.

The highest abundance of Coho was observed just above the tide-gate in the first pool of the survey. Juveniles originating in Vaughn may have been observed stacking up against a salinity wedge near the location of the tide gate (other explanations may exist for this abundance). Thousands of Stickleback were present in this pool also. On an outgoing tide this tide-gate displayed only minimal clearance and may be an intermittent barrier to adult passage. A huge matrix of pasture trenches was present near the start of the survey which provides abundant winter and summer rearing habitat for juveniles. Nutrient storage and food production in this habitat is high as most Coho observed were very large (>100 mm).

Rearing density for Coho averaged 0.6 fish/sq.m. and rose as high as 1.0 fish/sq.m.. 1,035 (expanded) Coho were estimated for the one mile of distribution. This expanded estimate definitively overestimates actual abundance because there were no other habitats above pool 1 that could have maintained the level of abundance observed in pool 1. A more realistic expansion of the 20% snorkel sample for Vaughn Cr would be approximately 395Coho. Coho distribution terminated at the first problem culvert – a 3 ft. culvert perched 2 ft. over rip-rap which was a definitive barrier for upstream juvenile migrants and problematic for adults. This culvert (RM 1) was near the top end of the golf course and was the fourth culvert above the tide-gate (RM 0). The next problem culvert was encountered 0.1 miles further upstream – a larger concrete box with a 2 ft. perch, a definitive juvenile barrier that looked passable for adults. The next problem culvert was encountered another 0.1 miles upstream at the end of the survey – twin 3 ft. concrete pipes that were noted as a juvenile barrier but passable for adults. The first problem culvert perched over boulder rip-rap should be the highest priority for replacement.

These culverts are presently blocking adult access to an additional 0.6 miles of potential habitat (unsurveyed). The stream leaves the open floodplain and begins to gain elevation. Natural sinuosity returns along with gravel sorting and floodplain interaction. 1+Steelhead and Cutthroat were also present in low numbers. No Knotweed was observed.

Small Tributaries

Tribs. A and E both showed evidence of in-stream Coho spawning. A one mile distribution in Trib. A totaled 200 (expanded) Coho with an average rearing density of 0.38 fish/sq.m.. Stream gradients were steep and production potential appeared limited. The culvert was in good shape and no Knotweed was found. Cutthroat and 1+Steelhead were also present in low numbers.

Distribution in Trib. E totaled 0.7 miles and 255 (expanded) Coho. Rearing density averaged 0.2 fish/sq.m.. Stream gradients here were also steep and production

potential also appeared limited. Cutthroat and 1+Steelhead were also present in low numbers. No culverts. No Knotweed.

Mapes, Myrtle, and Trib. B all displayed short upstream migrations of Coho. No culvert problems were identified and no Knotweed was found. These streams were small and steep.

School, Sharp, Tribs. C, D, F, G, H, I, and Washout. No Coho were present in any of these streams. These streams were all too steep for anadromous spawning and several presented impassable bedrock falls or perched culverts. Cold flows in these drainages are critical for temperature maintenance of the Kilchis mainstem. No Knotweed was present in these tributaries.

North Fork Kilchis

The North Fork was the largest and most productive subbasin in the Kilchis for Coho. 15.4 miles of Coho distribution was documented here in 2005 which included the tributaries Fossil, Schroeder, Shaw, Triangulation, Western, and Tribs. A, B, C, D, E, and F. 7,875 (expanded) Coho in the North Fork subbasin accounted for 25% of basin-wide production. This production was second in size only to the 13 mile long Kilchis mainstem population of 14,135 (expanded). 78% of the North Fork Coho population was found within 7.3 miles of mainstem distribution. Schroeder was the most productive tributary for Coho accounting for another 19%. Average rearing densities throughout the subbasin were low for Coho (all less than 0.5 fish/sq.m.) indicating the potential for significantly higher summer carrying capacities.

A low abundance of fine spawning gravels may also be a limitation to Coho production in the North Fork. Stream gradients in all reaches were high with boulders and bedrock dominating the substrates. All tributaries besides Schroeder were too steep to provide any significant anadromous spawning potential. These numerous high flow streams have an important positive influence on mainstem North Fork temperatures and water quality.

High 1+Steelhead estimates were expected based on the aquatic habitat conditions observed in the North Fork. However, only 385 (expanded) 1+Steelhead were observed in the subbasin (345 of them in the mainstem). This was the smallest population of pool-rearing 1+Steelhead in the Kilchis Basin (4.5% of the basin total). 0+trout estimates (5,685-expanded, in the mainstem) were high, however, and second only to the mainstem Kilchis. This indicates that Steelhead spawning may be very significant in the North Fork but that older age class juvenile's end up rearing in the lower mainstem after their first summer. Pool/riffle ratios throughout the North Fork surveys were very low.

Mainstem North Fork

(Table 17)

Expanded Mainstem North Fork Estimates of Juvenile Production and Contribution to the 5th field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	6,115	5,685	345	380
	(20%)	(21%)	(4%)	(12%)

Despite extremely low average rearing densities of 0.2 fish/sq.m. in the mainstem, this was still the largest tributary abundance of Coho in the basin (less than one half of the Kilchis mainstem population). The North Fork mainstem appears to be a main target for adult spawners. Seeding densities were nowhere near the carrying capacity of the habitat available in this reach and the potential for increased production is high. 7.3 miles of Coho distribution was observed here in 2005 ending in steep boulders. There was no adult spawning potential beyond this endpoint.

Coho distribution was inconsistent for the first 5 miles with large fluctuations between pools and several vacant habitats. High winter flows have minimized wood complexity and the resultant juvenile cover from the mainstem and summer rearing was occurring only in the best pools. The best spawning gravels were found in the last two miles of the survey. Peak densities of 0.86 fish/sq.m. and 0.79 fish/sq.m. were observed at RM 5 and RM 6.8, respectively. 1+Steelhead counts were relatively low in the North Fork mainstem compared to the rest of the Kilchis Basin. Most were found below RM 2. Cutthroat counts were similar in size and highest up to RM 3. No culverts. No Knotweed.

Fossil

The distribution data is inconclusive on establishing whether the 85 (expanded) Coho observed originated from an upstream temperature dependant migration or were spawned in gravels within Fossil. The low average rearing density of 0.17 fish/sq.m. exhibited a slight peak of 0.3 fish/sq.m. at RM 0.2. Distribution ended at a large wood jam. Steep stream gradients and multiple wood jams limit future production potential in this stream. A small upstream migration of Coho was noted in Trib. A. No 1+Steelhead were observed. Cutthroats were present in low numbers. No culverts. No Knotweed.

Schroeder

Coho production was significant in Schroeder and its tributary French. An expanded estimate of 1,465 summer parr were present between the two (150 from French) accounting for about 5% of the basin-wide total. Distribution totaled 2.5 miles in Schroeder and 0.5 miles in French. Good spawning conditions were noted in Schroeder with an average rearing density of 0.3 fish/sq.m. and two observed spawning peaks at

RM 0.75 and 2.1. This level of seeding appears well below the current capacity of Schroeder Cr

An average rearing density of 0.5 fish/sq.m. was observed in French with a spawning peak of 0.9 fish/sq.m. identified at RM 0.26. The short distribution in French ended at back-to-back 8 ft. high debris jams which have retained large amounts of alluvium. Significant anadromous potential is available here when these jams decay and are transported out of the system. A large 20 ft. high debris jam near the end of Coho distribution in Schroeder was apparently passable for adults. No further barriers to migration were noted there.

Expanded estimates here were comparable to the Little South Fork, Sam Downs, and the SF Kilchis. Stream and forest conditions in this subbasin appeared to be stable. 1+Steelhead and Cutthroat were also present in the subbasin in low numbers. No culverts. No Knotweed.

Triangulation

Low level Coho spawning may have occurred in Triangulation. Spawning gravels were present in pockets in between long stretches of cobble and rock. Coho distribution extended 0.3 miles to a small pour and an increase in stream gradient. Above the current end of distribution there appears to be no further Coho spawning or rearing potential. No 1+Steelhead were present. Cutthroat were present in low numbers. This stream appears to be most important as a significant source of cold flows for the North Fork mainstem and as potential temperature refugia for North Fork mainstem juveniles. No culverts. No Knotweed.

Small Tributaries

Small upstream migrations of Coho were found in Tribs. A and E that extended less than 1000 ft. and totaled less than 45 (expanded) summer parr. The 4 ft. culvert in Trib. E was in good shape. No Coho were found in Shaw, Western, or Tribs. B, C, D, or F. All these streams were too small and steep for Coho spawning or for significant anadromous use. Their main function currently is the supply of cold flows to the NF mainstem during summer flow regimes. No culvert problems were identified and no Knotweed was sighted.

Miami Basin

Out of the five basins surveyed in the Tillamook Bay Complex, Coho production and distribution in the Miami was the lowest. A total expanded estimate of 15,275 summer parr were rearing in the Miami Basin, almost completely in the mainstem, during the summer of 2005. This was approximately half the level of production observed for the Tillamook and Kilchis basins. Miami basin Coho distribution totaled 28.6 miles, 61% of the lineal distribution observed in the Kilchis basin. The largest tributary populations were documented in Moss and Peterson. The main producers in the basin for Coho were Moss, Peterson, Prouty, and the upper Mainstem.

Low production in Peterson and Prouty and the rest of the Basin was mainly a response to low adult escapement. Evidence of high water temperatures in the highly exposed, low gradient reaches of the lower Mainstem may also play a role in limiting abundance and distribution. Extremely low rearing densities for Coho were observed throughout the basin which suggests that the current capacity for production has not been realized.

Low gradients, large pools, and little cover were the dominant habitat characteristics of the lower 5 miles of the Miami mainstem. Riparian canopy coverage and channel diversity increased in the upper reaches where most stream habitats improved in overall functionality. Many steep, high flow tributaries were present in the upper half of the basin where large rock and boulders dominated the substrates and riffles and rapids dominated the habitat. Many large pools were observed with well sorted gravels in the tail-outs.

The most under utilized reaches (for rearing) were observed in the low gradient sandstone and clay habitats present in Minich, Peterson, Trib. F, and Prouty. Fine gravels, low floodplains, and abundant riparian vegetation exhibit significant future production potential in these streams. Dry channel conditions were observed in Prouty and Moss. Spawning potentials in these two tributaries were among the highest in the basin.

1+Steelhead production was high in the Miami Basin, almost equaling the levels found in the significantly larger Kilchis Basin distribution. Most of the 7,350 (expanded) juveniles found in the Basin were rearing in the lower Mainstem. For clarification, the portion of the 1+Steelhead population rearing in riffle/rapid habitats was not a part of this inventory.

Knotweed infestation was extreme along the lower Miami mainstem and continued up to RM 8.3. The absence of riparian vegetation in the lower mainstem is a significant issue for restoring functionality to the ecosystem.

(Table 18) Miami River 2005 Basin Wide Inventory

Stream	**Coho**	% Total	**0+**	% Total	**Sthd**	% Total	**Cut**	% Total
Mainstem	12,070*	79.0	14,615*	82.6	6,695*	91.1	1,500*	49.9
Hobson	85		80		0		40	1.3
Illingsworth	265	1.7	155		25		100*	3.3
Minich	185	1.2	210*	1.2	0		80	2.7
Moss	825*	5.4	455*	2.6	345*	4.7	145*	4.8
NF Miami	270	1.8	150		55*		85	2.8
Peterson	435*	2.8	275*	1.6	20		190*	6.3
Prouty	280*	1.8	120		0		95	3.2
Struby	20		115		0		40	1.3
Trib. B	40		90		0		60	2.0
Trib. E	320*	2.1	205	1.2	135*	1.8	130*	4.3
Trib. F	260	1.7	120		45*		90	3.0
Trib. G	115		360*	2.0	5		75	2.5
Trib. K	95		80		10		135	4.5
BasinTotal	**15,265**	**99.9**	**17,030**	**96.2**	**7,335**	**99.8**	**2,765**	**92.0**

- * Top five producers for each species and age class
- Percent contributions only given for values of 1% or greater

Mainstem Miami

(Table 19)

Expanded Mainstem Miami Estimates of Juvenile Production and Contribution to the 5th field

Survey Year	**Coho**	**0+**	**Sthd**	**Cut**
2005	12,070	14,615	6,695	1,500
	(79%)	(83%)	(91%)	(50%)

Almost all the fish production in the Miami Basin occurred within 13.6 miles of mainstem habitat. With a distribution distance similar to the Kilchis mainstem, the Miami mainstem produced 85% as many Coho and 20% more 1+Steelhead. Average rearing densities for Coho were low (0.13 fish/sq.m.) which suggests that the habitat could support significantly higher levels of production. Mainstem surveys began at the head of tide, just upstream from the Highway 101 bridge, and Coho distribution ended in long straight boulder rapids upstream of the mouth of the North Fork.

Three small spawning peaks were identified for Coho – 0.4 fish/sq.m. at RM 5.1 and at RM 9.6, and 0.67 fish/sq.m. at RM 11.8. Habitat conditions improved dramatically in the upper half of the mainstem where the stream left the high solar exposures of the lower cattle pastures and entered thick mixed forest canopies and steeper stream gradients. Wide floodplains and high wood complexities were observed in the upper half along with numerous channel braids and deeply scoured lateral pools. Adult escapement

and elevated water temperatures in the lower mainstem appeared to be the main limiting factors for Coho production in the Miami.

The Miami mainstem was rearing more 1+Steelhead in 2005 than any other reach in the Tillamook Bay Complex besides the Wilson mainstem (which was 29 miles long). This included large populations in the North and South Forks of the Trask, the Kilchis mainstem, and the Little North Fork Wilson. Some individual pool counts were as high as 151. 63% of the mainstem population was rearing below RM 5 with gradually decreasing densities further upstream.

Cutthroat estimates for the mainstem were also among the highest in the five basins surveyed in 2005. Food production in the large downstream pools of the mainstem appeared to be greatly benefiting the local trout populations. 3,585 (expanded) Chinook summer parr were present up to RM 9.6 and contributed heavily to supporting the Cutthroat population below RM 5. Low numbers of Chum Salmon summer parr were also detected in the lower mainstem. Knotweed infestation was abundant in the lower Miami mainstem where it dominated the stream-bank from the head-of-tide to the mouth of Moss Cr. (and was especially abundant around the mouth of Peterson Cr.). Knotweed continued to be present intermittently up to RM 8.3 (just above Prouty Cr.). No culverts were found.

Hobson

Low flows and small pools limited production in Hobson. A small upstream migration of 85 (expanded) Coho was observed over a distribution of 0.5 miles ending at a 3 ft. high beaver dam. No 1+Steelhead were present. Three culverts were encountered, all passable for adults and juveniles. Knotweed was present near the mouth of Hobson.

Illingsworth

Low level Coho spawning was detected here along with evidence of upstream migrations of summer parr from the lower Miami mainstem. The lower 0.3 miles of stream between the mouth and the main road culvert (good shape) was dominantly a pasture trench channel with low gradient, heavy siltation, and high solar exposure. Abundances of spawning gravel and rock began to appear at the main culvert along with a light deciduous forest canopy. Pools were well scoured and flows were moderate above the culvert. The first tributary encountered upstream of the culvert on the right exhibited limited anadromous potential.

265 (expanded) Coho were present in an average rearing density of 0.35 fish/sq.m. with the highest densities at the mouth. Distribution totaled 1.1 miles. Spawning conditions looked good in Illingsworth and higher production is possible there with increased adult escapement. 1+Steelhead and Cutthroat were also present in low numbers. Knotweed was present near the mouth of Illingsworth.

Minich

Spawning conditions appeared good for Coho through the lower mile of Minich and to a lesser degree in Trib. B (no Coho present). The Minich, Peterson, and Prouty subbasins shared a unique sandstone and clay geology when compared to the rest of the Miami Basin tributaries. Low stream gradients were observed along with large resources of fine sediment and spawning gravel. Coho distribution ended above a transitional zone in substrates where harder basaltic rock and steeper stream gradients began to dominate. These three subbasins all displayed reaches with ideal conditions for Coho spawning and rearing, despite their greatly depressed 2005 population estimates. Production and distribution potential in Minich was the lowest of the three.

Just 185 (expanded) Coho summer parr were present with little evidence of a spawning peak. The highest count was in the first pool above the Miami mainstem. Channel simplification in much of Minich has resulted in low sinuosity and low pool complexity. Most pools were shallow and provided little cover. Significantly higher Coho production is possible in Minich and rearing conditions could be dramatically improved with the addition of wood complexity. No 1+Steelhead were observed. Cutthroat were present in low numbers. Culverts were all in good shape. No Knotweed was noted.

Moss

This stream was the most productive tributary for Coho and 1+Steelhead in the Miami basin despite low expanded estimates for both species. 825 (expanded) Coho summer parr were observed here in an average rearing density of 0.3 fish/sq.m. and a distribution of 2.8 miles. Counts were spotty at first then became more consistent as a spawning peak of 1.2 fish/sq.m. was approached at RM 1.2. Habitat conditions appeared healthy in Moss and indicate a significantly higher rearing capacity for Coho. A total of 345 (expanded) 1+Steelhead were observed, mostly between RM 1 and RM 2. Chinook summer parr (40-expanded) were also present up to RM 1.

Hard rock substrates were dominant and numerous large tributaries were present without Coho distribution. These steep drainages remain important to the Moss Cr. mainstem by supplying cool flows to the valley floor mainstem. The Moss Cr. mainstem was completely dry for a 2,300 ft stretch that began 1,800 ft above its confluence with the mainstem Miami. The reason for this dry channel was not determined in the course of this survey. However, the dry channel habitats definitively result in large juvenile salmonid mortalities as pool habitats are isolated and predation and temperature eventually terminate all the production that is spring rearing within this stream segment. If the dry channel conditions are the result of water withdrawal activities, then minimum stream flows are not being maintained to the detriment of juvenile salmonid production. No

culverts were noted. Knotweed was present at the mouth of the stream but did not extend up Moss Cr.

NF Miami

Long stretches of straight rocky rapids and large boulder falls dominated this subbasin. Fine spawning gravel was limited and pool/riffle ratios were low. A young, mostly deciduous forest was present along the stream and wood recruitment to the active channel was sparse. Pool complexity and cover for juvenile salmonids was insignificant. Conditions here were very similar to the upper Miami mainstem above the confluence of the North Fork.

Low level Coho spawning occurred in the North Fork where an expanded estimate of 270 summer parr were observed in a distribution of 1.5 miles. Rearing density averaged 0.13 fish/sq.m. with little fluctuation in pool density. This included a short 0.3 mile upstream migration in Trib. B of 90 (expanded) Coho. Steep boulders limited spawning opportunities in Tribs. A and B. Higher Coho production could be supported in the mainstem with increased adult escapement. Steelhead and Cutthroat were present in low numbers. No culverts. No Knotweed.

Peterson

The Peterson subbasin offers excellent spawning opportunities for Coho. A low gradient sandstone and clay geomorphology was observed in this stream similar to conditions in Minich and Prouty. This has resulted in a high level of channel sinuosity, high wood complexities (including several log structures), good pool formation, and a high pool/riffle ratio per stream mile. Abundant reserves of fine sandstone gravels were also present. Fine sediment floodplain development was occurring with low interactive terraces supporting abundant vegetation and providing exceptional winter habitat potential. This was unique habitat within the larger Miami River basin.

Production potential for Coho in Peterson appeared much higher than the low 2005 expanded estimate of 435 summer parr. The observed average rearing density of 0.17 fish/sq.m. supports this conclusion. Significantly higher carrying capacity is present in Peterson. The high levels of sedimentation observed on gravel beds may also ultimately influence egg / fry survival rates.

Little evidence of a spawning peak was located in the Coho distribution profile for Peterson but the size of the 2005 expanded estimate verifies that adult spawning did occur. Minor upstream migrations of summer parr were seen in all of the three tributaries.

Tribs. B and C both exhibited minor spawning potential. Coho distribution extended 1.4 miles in the mainstem and ended shortly after a notable transition in substrates where hard rock and boulders became dominant, pools got smaller, and stream gradients increased. 1+Steelhead and Cutthroat were present in low numbers. The only culvert at the mouth was in good shape. Knotweed infestation was extreme at the mouth of Peterson.

Prouty

With physical habitat conditions similar to Minich and Peterson, including low interactive floodplains and fine spawning gravels, Prouty Cr. exhibits significant under utilized potential. 2005 production levels were extremely low, totaling 280 (expanded) summer parr, 0.15 fish/sq.m., and 1.1 miles of distribution. Evidence of a small spawning peak was located at RM 0.5. Heavy sedimentation was noted as a potential issue for egg /fry survival rates.

Excellent spawning gravels and low stream gradients were noted in the mainstem and in Trib. A (no Coho). Summer flows were low and dry channel conditions were encountered intermittently. A long stretch of dry channel ended Coho distribution in 2005. Stream gradient was just beginning to increase at the end of the survey. No barriers to migration were noted. Rearing capacity for Coho in Prouty is much higher than current levels. No Steelhead were observed. The one culvert encountered was in good shape. No Knotweed was noted.

Struby

A minor upstream migration of 20 (expanded) Coho summer parr was observed in Struby. Distribution ended before the main highway culvert (good shape) at RM 0.25. Low flows at the mouth of Struby entered a farm trench network just north of the head of tide on the Miami mainstem. Anadromous potential here appeared minimal. No Steelhead were observed. Knotweed was present near the mouth of Struby on the Miami mainstem.

Unnamed Tributaries

Trib. A : No Coho. No Steelhead. Anadromous spawning potential was present. Heavy siltation was observed. This stream ran through downtown Garibaldi.

Trib. B : 40 Coho (expanded) summer parr were present in an upstream migration lasting less than 260 ft. and ending below the Highway 101 culvert (good shape). Four culverts were present in Trib. B which ran through downtown Garibaldi. The second culvert up from the mouth (the first a Railroad culvert) was a 3 ft. steel pipe which was partially collapsed but still passable. This culvert needs maintenance. Anadromous

spawning potential was present in Trib. B. The survey ended in a steep narrow channel. Knotweed was present for the first 0.2 miles of the survey.

Trib. D : 5 Coho (expanded) summer parr were present in an upstream migration. This stream could support low level anadromous spawning and rearing. Gravels were poorly sorted and the channel was mainly entrenched. The culvert was in good shape.

Trib. E: 315 Coho (expanded) summer parr were present in 0.5 miles of distribution. Adult spawning occurred here along with a short upstream migration in Trib. E1. Healthy forest conditions and several pockets of spawning gravel were observed in this stream. 1+Steelhead and Cutthroat production was high in Trib. E.

Trib. F: 260 Coho (expanded) summer parr were present and 0.5 miles of distribution. This stream was just upstream on the Miami from Peterson on the same side. Adult spawning looks to have occurred upstream of the main road culvert. Forest and stream conditions were healthy and ideally suited to Coho spawning. High flows and fine sandstone gravels were present along with good pool diversity and wood complexities. Distribution ended in steep boulders. Production potential for Coho through the first 0.5 miles of low stream gradient is high and mainly limited by a problem culvert between the mouth and the main road.

A 5 ft. steel pipe running under a farm track is rusted out badly and bent steeply upward on the upstream end. Debris has accumulated on the upstream lip of the culvert and the situation here could get much worse with the next flood event. A large build-up of silt and fine sediment was also present in this first pool above the culvert and has ruined spawning opportunities there. Passage for juveniles was impossible and for adults looked very difficult. This culvert is high priority for replacement. 1+Steelhead and Cutthroat were also present.

Trib. G: 115 Coho (expanded) summer parr were found in an upstream migration extending 0.5 miles. Moderate spawning potential was present in this stream. Patchy spawning gravel, medium stream gradients, and healthy forest conditions were noted. 1+Steelhead and Cutthroat were present in low numbers. No culverts. No Knotweed.

Trib. J: No Coho. This stream had spawning potential for Coho but was lacking adult escapement. Spawning gravels and medium stream gradients were present along with several log structures. Steep gradients and increasing rock size limit production potential above RM 0.5. 1+Steelhead and Cutthroat were present in low numbers. No culverts. No Knotweed.

Trib. K: 95 Coho (expanded) summer parr were present in an upstream migration, including 10 (expanded) summer parr in Trib. K1. Distribution lasted for 0.5 miles in the

mainstem and 0.25 miles in Trib. K1. Spawning potential was present in this tributary although stream gradients were high and large rock and boulders were abundant. 1+Steelhead and Cutthroat were present in low numbers. No culverts. No Knotweed.

Tribs. H, I, L, M, N, O: No Coho were present in any of these streams. Spawning and rearing potential for anadromous fish was minimal due to low flows, steep stream gradients, and large substrate size. Stream flow contribution and temperature maintenance for the Miami mainstem appeared to be the most important contribution for these tributaries. Preservation of upslope riparian integrity in these drainages should be maintained for the protection of water quality.

Tillamook Bay Tributaries

These nine small streams emptied directly into the Tillamook Bay with little to no affiliation with any of the five major basins. Minimal spawning potential was found in any of these streams except Patterson. Low flows and steep stream gradients were the main limiting factors. Extensive tidal marsh habitats were observed in some and the winter rearing of juvenile salmonids appeared to be the most important function of these streams.

Dick

A minor upstream migration of 15 (expanded) Coho summer parr was present in Dick. High quality spawning gravel was present here and the stream exhibits unutilized production potential. The stream channel appeared to have been recently torrented and pool development remained limited. The stream could benefit from structure placement to enhance pool development. Anadromous potential ended at a 12 ft. bedrock falls about 0.45 miles up from the mouth. 1+Steelhead and Cutthroat were present in low numbers. The culvert was in good shape. No Knotweed was noted.

Flower Pot

No Coho were present in Flower Pot. Extensive tidal and beaver marsh habitats dominated this stream and represented an enormous rearing opportunity for juvenile salmonids in the Tillamook Bay. Vegetation was lush and complex cover from predators was highly abundant. No spawning gravels were found. This appeared to be an excellent habitat for all estuary species. Cutthroat and 0+trout were present. No Knotweed.

Larson

No Coho. Cutthroat trout only were present. Additional tidal marsh rearing habitat was present in lower Larson which appeared to be the most significant contribution to salmonid rearing. Spawning gravels were present but heavily silted over. Limited anadromous spawning potential was present. No Knotweed.

McCoy Cove

A small upstream migration of 20 (expanded) Coho summer parr was found in McCoy Cove. No 1+Steelhead were present. Spawning potential appeared minimal. Low flows and steep stream gradients were limiting factors. The culvert was in good shape. No Knotweed.

Memaloose

No Coho. No Steelhead. Minimal anadromous spawning potential was present due to low flows and steep stream gradients. The culvert was in good shape. No Knotweed.

Patterson

360 (expanded) Coho summer parr were present (210 from the main tributary Jacoby Cr.). Adult spawning appears to have occurred in both Patterson which runs directly through downtown Bay City, and in Jacoby. Average rearing densities were extremely low in each (0.13 fish/sq.m.). Distribution totaled 0.8 miles in both reaches.

Seven culverts were encountered on Patterson. Three of them were barriers to juvenile migration and two of them presented obstacles to adult migration as well. The first (Highway 101) and second culverts (6 ft. steel pipe) were in good shape.

The third culvert, (RM 0.37), was a 10 ft. cement culvert with a 1.5 ft. perch which presented the first juvenile barrier. A spike in Coho density was present immediately downstream, indicating a propensity for upstream migration. The fourth culvert (RM 0.5) was 3 ft. in diameter and perched by 2 ft. at a 10 degree pitch. This culvert was a definitive juvenile barrier and looked difficult for adults. The fifth culvert (a 4 ft. pipe) was in good shape. The sixth culvert (RM 0.63) was a 4 ft. pipe perched by 3 ft. over the highest pool of a four-step fish ladder. This presented another juvenile barrier as well as another difficult obstacle for adults.

The seventh culvert, another 500 ft. upstream, was a 4 ft. pipe completely submerged but still passable. Coho were still present in low numbers upstream of the final culvert in 2005 which indicates adult passage occurred. All three of these juvenile

barrier culverts need attention and/or replacement with highest priorities going to the two which presented adult passage problems as well. No culverts were present in Jacoby.

Low stream gradients and fair spawning gravels were found in both Patterson and Jacoby although siltation was heavy in both reaches. The best spawning gravels in Patterson were found downstream of the fish ladder. High levels of natural wood complexity were reported in upper Jacoby. Higher potentials for Coho production exist in this subbasin. No 1+Steelhead were found. No Knotweed.

Smith

No Coho. No Steelhead. Minimal anadromous potential was documented in Smith due to steep stream gradients and large poorly sorted substrates. Pools were few and small. The stream entrance over large jetty rock was complex except during the highest of tidal conditions. Cutthroat were present in low numbers. The culvert was in good shape. No Knotweed.

Trib. A

No Coho. Only 0+Trout present. Low flows and steep stream gradients were observed. No anadromous spawning potential. The culvert was in good shape. No Knotweed.

Trib. B

A small upstream migration of 55 (expanded) Coho summer parr was present along with 15 (expanded) 1+Steelhead and 15 (expanded) Cutthroat. Anadromous spawning potential is limited by low flows and steep stream gradients. The culvert was in good shape and no Knotweed was found.

Watershed Recommendations

There are several conclusions based on the preceding analysis that lead us to the point of developing some general recommendations.

- The mainstem reaches of the five major Tillamook Bay Rivers were rearing the largest populations of all anadromous species in the Watershed. They therefore represent the highest priority for restoration and enhancement because of their observed production potential for all salmonids. This suggests that the maintenance, enhancement and preservation of water quality in the mainstem Tillamook, Trask, Wilson, Kilchis, and Miami may be the single most important long term issue for

maintaining a functional ecosystem that continues to be capable of salmonid production. It is the cumulative impacts of upslope management strategies that will impact the productivity of these large mainstem habitats in the next few decades. The protection of riparian canopies for both type F and N streams in the upper elevations of each basin is critical to maintaining low mainstem water temperatures during summer low flow regimes. Mainstem conditions currently exhibit temperature limitations that result in truncating the distribution of some salmonid species. With mainstem water quality identified as the single most critical future issue for salmonid production, it seems appropriate to suggest that a well developed monitoring strategy is essential for quantifying the inter / intra annual trends in water quality parameters.

- Address the multiple passage issues described in detail by stream in the body of this document. The highest priority culverts for replacement were observed in Vaughn, Trib. F (Miami), Patterson (in Bay City), and Mill (Trask). Cement dams (with fish ladders) in Faucett (Tillamook), Killam (Tillamook), Gold (Trask), and EF Trask are barriers to juvenile migrations and may be restricting adult passage as well. Cement dams in Coal (Kilchis) and Beaver Cr (Wilson) also terminate salmonid distribution. A review of the significance of these dams and an investment in passage improvements may be appropriate. Old tide gates in Esther (Tillamook) and Vaughn could be restricting adult passage during certain stream flow and tidal conditions. The installation of fish friendly tidegate in these locations, preferably one that opens horizontally rather than vertically, could greatly benefit adult escapement in these tributary streams. The provision of additional access to spawning habitat may represent some of the more indisputable restoration opportunities in the Tillamook complex.

- Knotweed infestation along the lower Tillamook, Trask, Wilson, Little North Fork Wilson, and Miami Rivers was extreme and demands attention. Diverse inner riparian vegetation communities and the function of floodplain habitats in these locations are rapidly being altered and simplified. A separate column was added to the 2005 Access database which displays the presence or absence of Knotweed for each pool surveyed. A lineal profile of Knot weed distribution can be graphed for each stream surveyed.

- Initiate DNA sampling of wild Coho (carcasses) in each of the five major basins and in Netarts Bay streams to explore and document the potential of unique population units (demes) in each of the major basins in the Tillamook Watershed Complex of streams. The future of Coho management within the Coastal ESU may depend highly on how a population is described. If the Tillamook Watershed Complex exhibits unique genetic characteristics, their management may require a different approach than is currently pursued by management agencies.

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 basins and subbasins in the Tillamook watershed Complex. Subsequent inventories planned for 2006 and 2007 will be augmented to this Workbook which will allow trend analysis in each subbasin for the most important variables (rearing density, distribution distance, and total expanded estimate). Please contact the Tillamook Estuaries Partnership for an updated version of this tool.

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

A GIS layer of current fish distribution for the Tillamook Watershed Complex of streams will also be available through the Tillamook Estuaries Partnership by approximately July, 2006.