APPENDIX E.
ANADROMOUS FISH BARRIER ASSESSMENT

This chapter was drafted in 2004 and has not been revised for 2010.

APPENDIX E. ANADROMOUS FISH BARRIER ASSESSMENT

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E.1. Introduction

For each of six anadromous salmonid species in the LCFRB planning area, we mapped historically accessible stream segments, currently blocked stream segments, and the type and location of passage barriers. This assessment was conducted in GIS using the WDFW Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) fish distribution and barrier datasets (see ://wdfw.wa.gov/hab/sshiap/index.htm).

E.1.1. Methods

The SSHIAP fish distribution and barrier datasets were used as the basis for this assessment. In several cases, the layers were edited where there better information existed on distributions or barriers. To identify historically accessible stream segments, we used those segments coded in the fish distribution layer as either documented, documented trap and haul, documented-historic, presumed, or potential. For the Lewis River above Merwin Dam, there was no distribution of any type identified. For this case, historical distribution was assumed to be the extent of reaches used for runs of the EDT model. This distribution likely underestimates the true distribution, especially for coho.

A conservative approach was taken to identify stream segments currently blocked by artificial barriers. For our analysis, in order for a segment to be identified as blocked, it had to be designated as 'potential' distribution in the fish distribution dataset and had to have a blocking barrier in the barrier dataset. Thus, a two-step method was used to identify blocked segments. First, the segment had to be identified as potential habitat in the fish distribution layer. Potential habitat is defined as that which currently does not support fish for one of three reasons (O'Connor 2002):

1. artificial obstructions
2. poor quality habitat, or
3. extirpation of local fish populations

Second, blocked segments were identified only for areas upstream of artificial barriers documented in the barrier dataset. Barriers created by natural features such as falls, stream gradient, and beaver dams were not considered in this assessment. Barriers designated complete blockage, partial blockage, and unknown blockage in the barrier dataset were all assumed to block passage if located on a potential distribution segment for the species of interest. We did not remove segments where the barrier was designated as a partial blockage or an unknown blockage because some barriers may present different levels of blockage depending on the species; a level of information that was not available in the barrier database.

Although there were many barriers in the barrier dataset that were not located on potential distribution segments, we chose not to infer blocked segments from this information due to the inconsistency with which species-specific blockage information was included in the barrier dataset. Instead, our conservative approach requires conformity between the two datasets in order for a stream segment to be considered blocked.

For each of the 21 LCFRB planning basins, we calculated the amount of blocked habitat, the amount of historically accessible habitat, the amount of currently accessible habitat, the number and type of barriers, and the amount of blocked habitat by each barrier type. For this last calculation, we used only primary barriers; those at the downstream end of the blocked segment. It should be noted that in many cases removing the primary barrier will only restore access to a portion of the blocked segment due to

upstream barriers. In most cases, upstream barriers are culverts. Miles of currently accessible stream segments were obtained by subtracting currently blocked miles from historically accessible miles, thus, currently accessible miles do not reflect miles of historically un-accessible stream segments that have been made accessible through human intervention (i.e. fish ladders around falls).

E.1.2. Results

For each species, region-wide maps were developed that depict historically available habitat, currently blocked habitat, and the location and type of barriers (see figures below). Pie charts summarize the amount of historically accessible habitat that is currently blocked by particular types of barriers. The accessible portion of the pie represents the amount of historically accessible habitat that is currently accessible. The information is summarized in a table by species and by each of the 21 LCFRB planning basins.

E.1.3. Discussion

The data presented is limited by the accuracy of the SSHIAP datasets, which have been compiled from a variety of sources and have not been field checked in all cases. Time and resources did not allow for field verification of the information presented in the datasets.

Although we used the most recent datasets that were available, barrier removal projects are on-going throughout the region, and therefore the GIS datasets do not always represent the most recent information. In a few instances, we amended the datasets where more recent information was available.

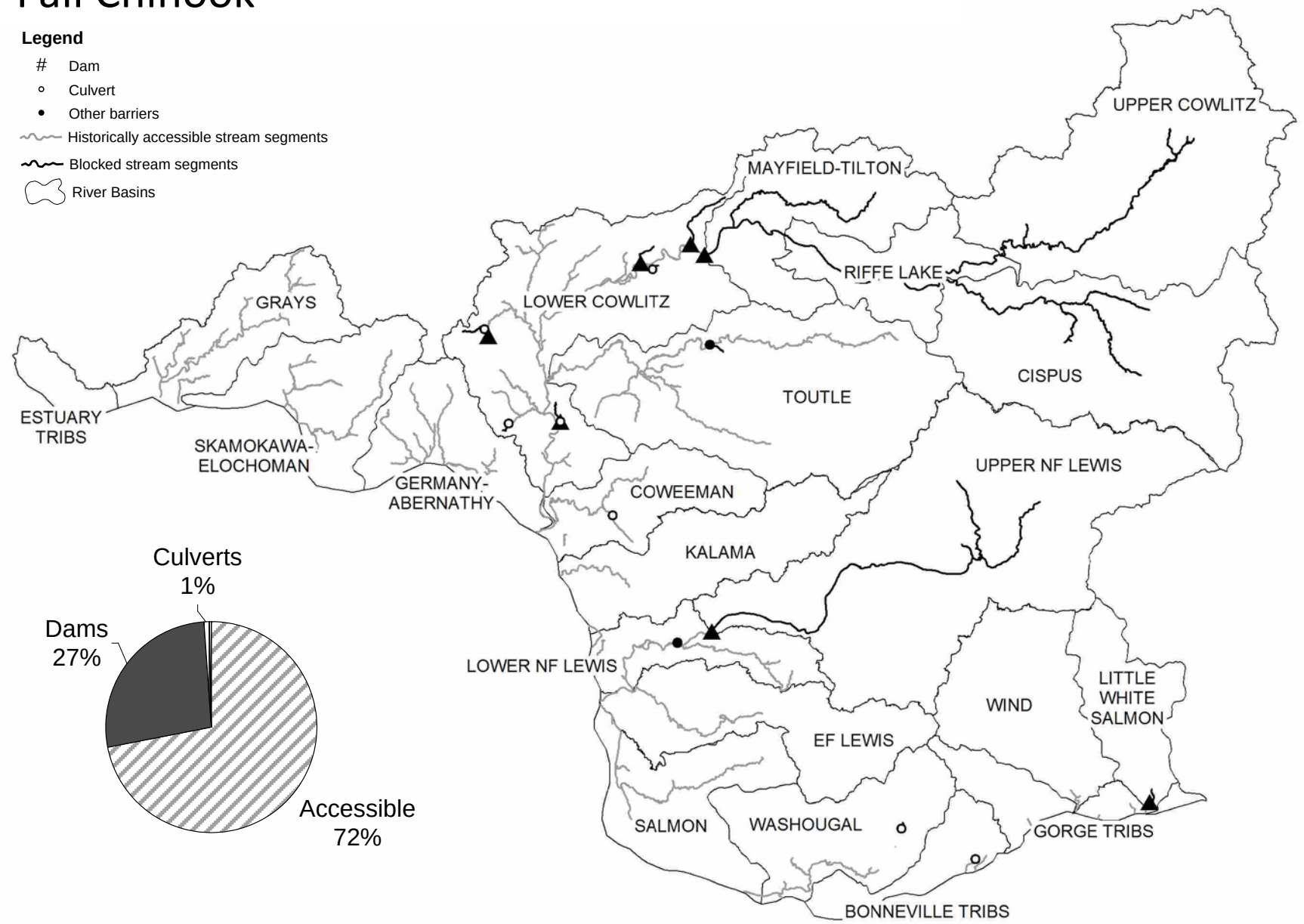
This assessment likely underestimates the degree of blocked habitat due to the conservative approach taken. There still remain many streams that have not been surveyed for passage barriers. Many of the unsurveyed barriers, however, likely present little in the way of detriment to production at the population scale, as they are primarily located on smaller stream systems with a low amount of potential fish capacity.

This barrier assessment is intended as an overview of the relative degree of blocked habitat by species and by basin. This assessment is useful as a first screen of how much of an impact passage barriers might have on a particular population. Development of specific strategies to restore access should be made with reference to site specific information including Limiting Factors Analyses and the knowledge of local resource managers.

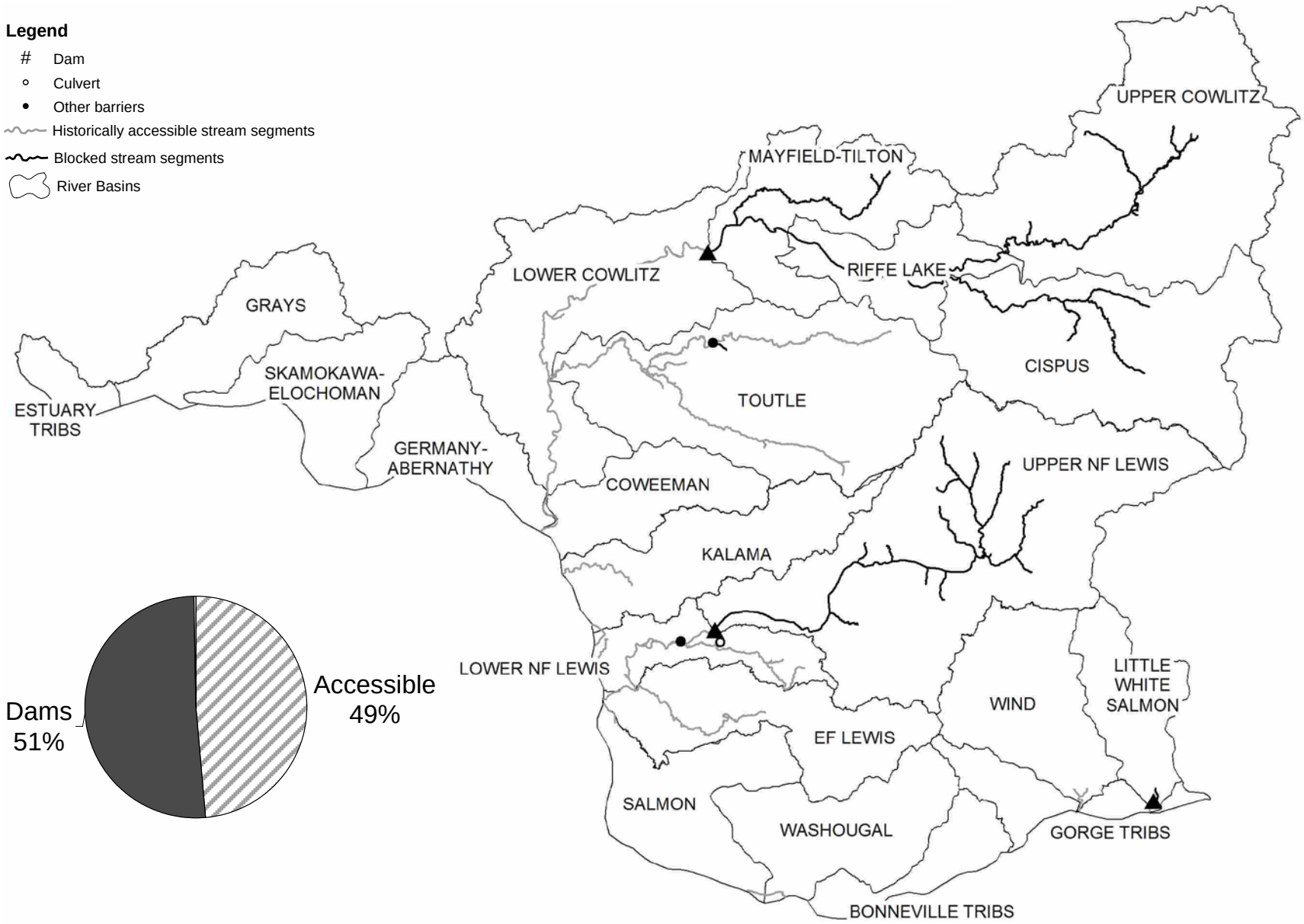
E.1.4. References

O'Connor, D. 2002. Fish Distribution and Use Data Category Definitions. Informational sheet by WDFW, September 12, 2002. Olympia, WA.

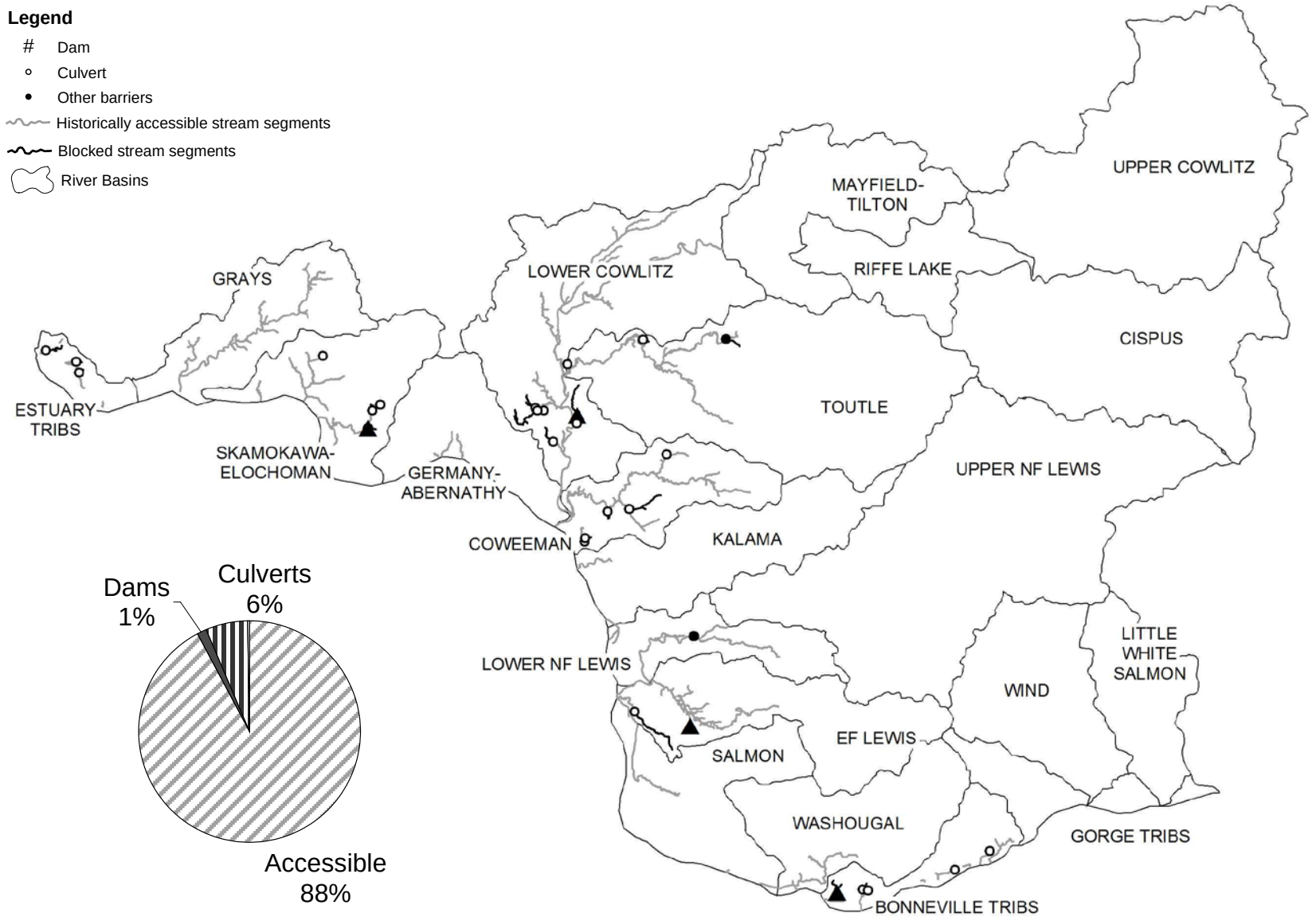
Fall Chinook



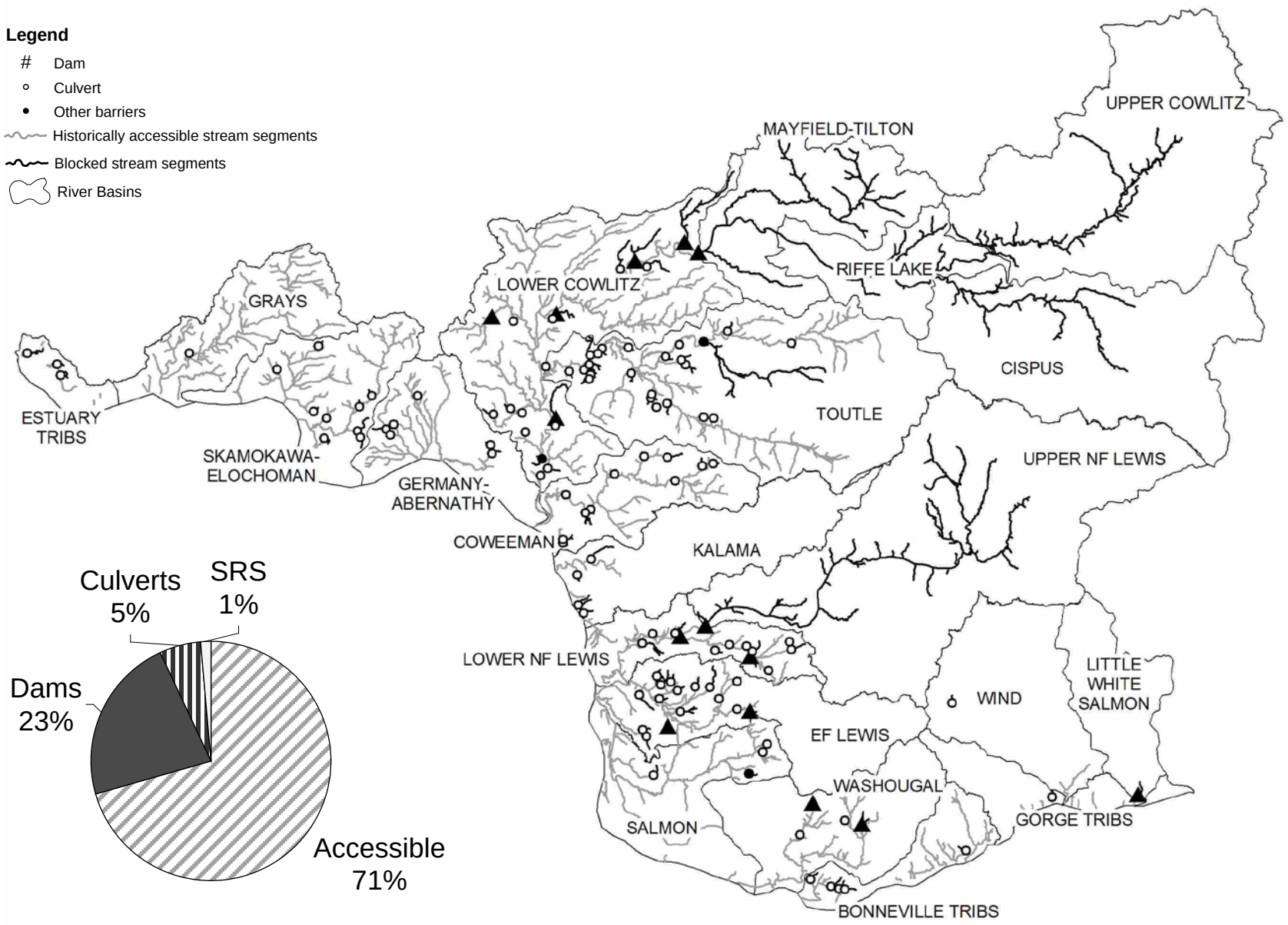
Spring Chinook



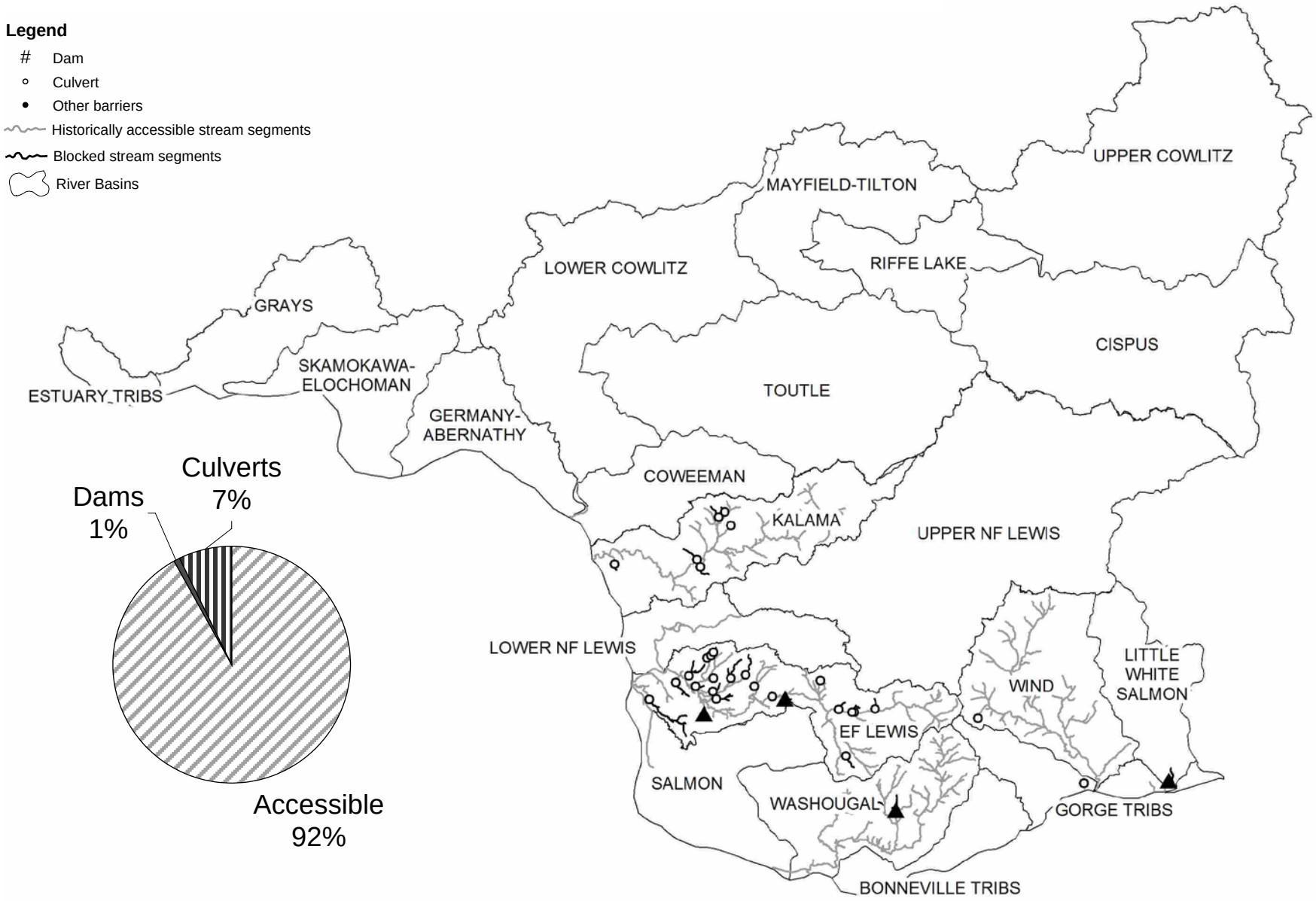
Chum


Legend
Dam
Culvert
Other barriers
Historically accessible stream segments
Blocked stream segments
River Basins
GRAYS
ESTUARY TRIBS
SKAMOKAWA-ELOCHOMAN
GERMANY-ABERNATHY
LOWER COWLITZ
MAYFIELD-TILTON
UPPER COWLITZ
RIFFE LAKE
CISPUS
TOUTLE
UPPER NF LEWIS
COWEEMAN
KALAMA
LOWER NF LEWIS
LITTLE WHITE SALMON
WIND
EF LEWIS
SALMON
WASHOUGAL
GORGE TRIBS
BONNEVILLE TRIBS
Dams 1%
Culverts 6%
Accessible 88%

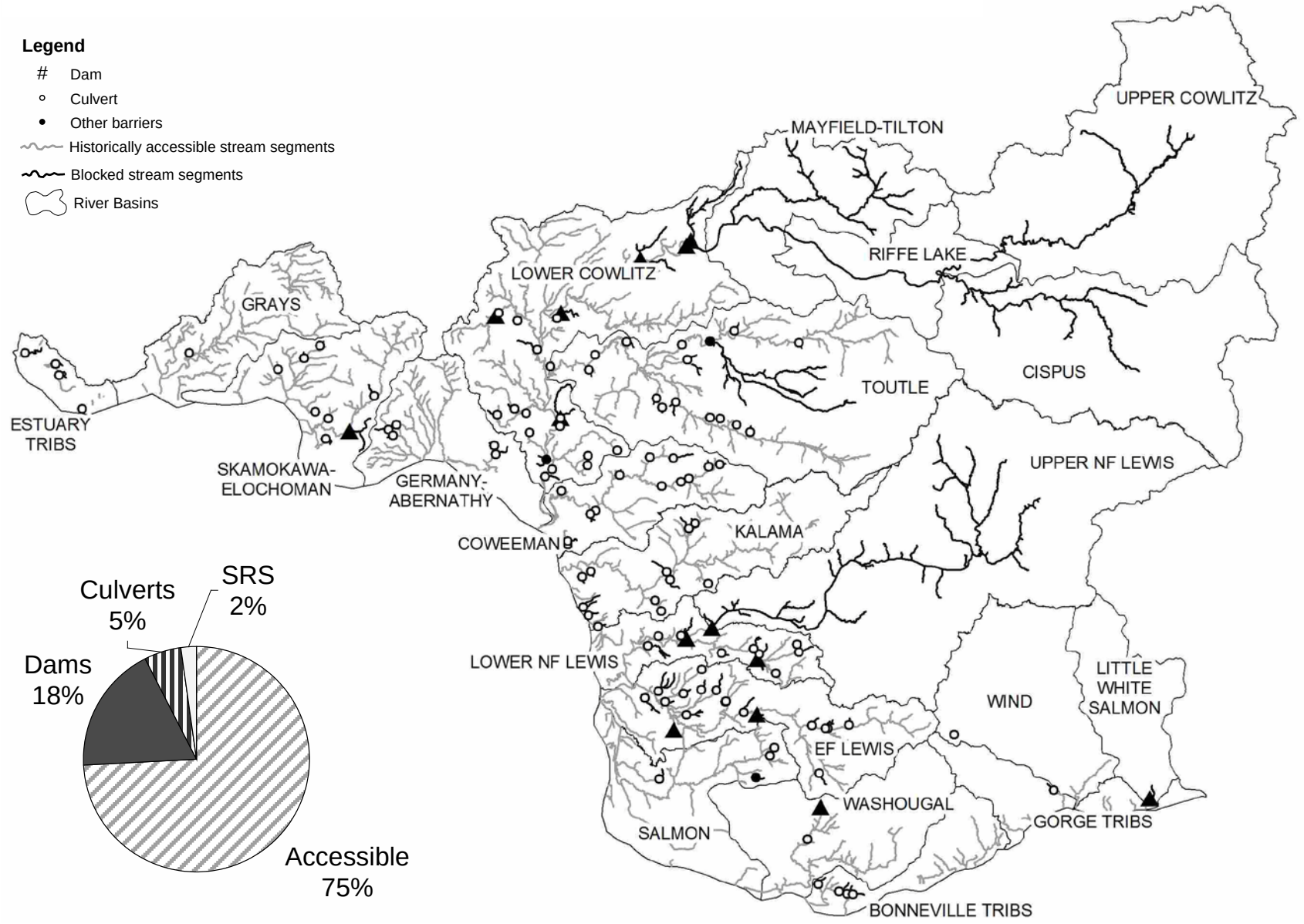
Coho


Legend
Dam
Culvert
Other barriers
Historically accessible stream segments
Blocked stream segments
River Basins
UPPER COWLITZ
MAYFIELD-TILTON
RIFFE LAKE
LOWER COWLITZ
GRAYS
CISPUS
TOUTLE
ESTUARY TRIBS
SKAMOKAWA-ELOCHOMAN
GERMANY-ABERNATHY
UPPER NF LEWIS
COWEEMAN
KALAMA
LOWER NF LEWIS
LITTLE WHITE SALMON
WIND
EF LEWIS
WASHOUGAL
SALMON
GORGE TRIBS
BONNEVILLE TRIBS
Culverts 5%
SRS 1%
Dams 23%
Accessible 71%

Summer Steelhead



Winter Steelhead



Tabular Summary of Barrier Data

Species Code[1]	Basin	Historical miles	Blocked miles	Accessible miles[2]	Percent miles blocked	Primary[3] Block Type (Count)					Primary[3] Block Type (miles blocked)					Primary[3] Block Type (percent of count)				Primary[3] Block Type (percent miles blocked)			
						Dam	Culvert	SRS[4]	Other[5]	Total	Dam	Culvert	SRS[4]	Other[5]	Total	Dam	Culvert	SRS[4]	Other[5]	Dam	Culvert	SRS[4]	Other[5]
CHFA	BONNEVILLE TRIBS	4.7	0.3	4.4	5%		1		0	1		0.3		0.0	0.3		100%		0		100%		0%
	COWEEMAN	42.3	0.4	41.9	1%		1		0	1		0.4		0.0	0.4		100%		0%		100%		0%
	EF LEWIS	27.0		27.0	0%				0					0.0									
	GERMANY-ABERNATHY	49.5		49.5	0%				0					0.0									
	GORGE TRIBS	2.8		2.8	0%				0					0.0									
	GRAYS	69.7		69.7	0%				0					0.0									
	KALAMA	12.3		12.3	0%				0					0.0									
	LITTLE WHITE SALMON	3.2	1.9	1.3	59%	1			0	1	1.9			0.0	1.9	100%			0%	100%			0%
	LOWER COWLITZ	163.5	19.0	144.6	12%	5	4		0	9	11.2	7.7		0.0	19.0	56%	44%		0%	59%	41%		0%
	LOWER NF LEWIS	47.7	0.2	47.5	0%				2	2				0.2	0.2				100%				100%
	SALMON	42.3		42.3	0%				0					0.0									
	SKAMOKAWA-ELOCHOMAN	44.9		44.9	0%				0					0.0									
	TOUTLE	111.8	1.6	110.2	1%			1	0	1			1.6	0.0	1.6			100%	0%			100%	0%
	UPPER COWLITZ (total)	159.7	159.6	0.0	100%	1			0	1	159.6			0.0	159.6	100%			0%	100%			0%
	CISPUS	48.7	48.7	0.0	100%	1			0	1	48.7			0.0	48.7	100%			0%	100%			0%
	MAYFIELD-TILTON	35.9	35.9	0.0	100%	1			0	1	35.9			0.0	35.9	100%			0%	100%			0%
	RIFFE LAKE	29.3	29.3	0.0	100%	1			0	1	29.3			0.0	29.3	100%			0%	100%			0%
	UPPER COWLITZ	45.8	45.8	0.0	100%	1			0	1	45.8			0.0	45.8	100%			0%	100%			0%
	UPPER NF LEWIS	59.2	59.1	0.1	100%				0		59.1			0.0	59.1					100%			0%
	WASHOUGAL	24.4	0.7	23.7	3%		1		0	1		0.7		0.0	0.7		100%				100%		0%
	WIND	3.3		3.3	0%				0					0.0									
CHFA Total		868.4	242.8	625.6	28%	7	7	1	2	17	231.8	9.1	1.6	0.2	242.8	41%	41%	6%	12%	95%	4%	1%	0%
									0					0.0									
CHSP	COWEEMAN	2.1		2.1	0%				0					0.0									
	EF LEWIS	25.9		25.9	0%				0					0.0									
	GERMANY-ABERNATHY	0.3		0.3	0%				0					0.0									
	GORGE TRIBS	0.4		0.4	0%				0					0.0									
	KALAMA	12.3		12.3	0%				0					0.0									
	LITTLE WHITE SALMON	3.2	1.9	1.3	59%	1			0	1	1.9			0.0	1.9	100%			0%	100%			0%
	LOWER COWLITZ	64.0	0.0	64.0	0%	1			0	1	0.0			0.0	0.0	100%			0%	100%			0%
	LOWER NF LEWIS	49.8	0.6	49.1	1%		1		2	3		0.4		0.2	0.6		33%		67%		69%		31%
	SALMON	3.6		3.6	0%				0					0.0									
	TOUTLE	104.6	1.6	103.0	2%			1	0	1			1.6	0.0	1.6			100%				100%	0%
	UPPER COWLITZ (total)	176.3	176.3	0.0	100%				0		176.3			0.0	176.3					100%			0%
	CISPUS	47.3	47.3	0.0	100%				0		47.3			0.0	47.3					100%			0%
	MAYFIELD-TILTON	40.6	40.6	0.0	100%				0		40.6			0.0	40.6					100%			0%
	RIFFE LAKE	29.3	29.3	0.0	100%				0		29.3			0.0	29.3					100%			0%
	UPPER COWLITZ	59.2	59.2	0.0	100%				0		59.2			0.0	59.2					100%			0%
	UPPER NF LEWIS	104.5	104.4	0.1	100%	1			0	1	104.4			0.0	104.4	100%				100%			0%
	WASHOUGAL	2.5		2.5	0%				0					0.0									
	WIND	4.2		4.2	0%				0					0.0									
CHSP Total		553.5	284.8	268.7	51%	3	1	1	2	7	282.6	0.4	1.6	0.2	284.8	43%	14%	14%	29%	99%	0%	1%	0%

Species Code[1]	Basin	Historical miles	Blocked miles	Accessible miles[2]	Percent miles blocked	Primary[3] Block Type (Count)					Primary[3] Block Type (miles blocked)					Primary[3] Block Type (percent of count)				Primary[3] Block Type (percent miles blocked)			
						Dam	Culvert	SRS[4]	Other[5]	Total	Dam	Culvert	SRS[4]	Other[5]	Total	Dam	Culvert	SRS[4]	Other[5]	Dam	Culvert	SRS[4]	Other[5]
CHUM	BONNEVILLE TRIBS	24.1	4.2	19.9	17%	1	4		0	5	2.4	1.8		0.0	4.2	20%	80%			56%	44%		
	COWEEMAN	65.3	6.1	59.2	9%		6		0	6		6.1		0.0	6.1		100%				100%		
	EF LEWIS	57.1	7.3	49.8	13%	1	1		0	2	0.5	6.7		0.0	7.3	50%	50%			7%	93%		
	ESTUARY TRIBS	13.0	3.9	9.0	30%		5		0	5		3.9		0.0	3.9		100%				100%		
	GERMANY-ABERNATHY	7.2		7.2	0%				0					0.0									
	GRAYS	54.0		54.0	0%				0					0.0									
	KALAMA	6.5		6.5	0%				0					0.0									
	LOWER COWLITZ	146.2	15.9	130.3	11%	1	5		0	6	4.0	11.8		0.0	15.9	17%	83%		0%	26%	74%		0%
	LOWER NF LEWIS	36.0	0.3	35.7	0%				1	1				0.3	0.3				100%		100%		100%
	SALMON	18.5		18.5	0%				0					0.0									
	SKAMOKAWA-ELOCHOMAN	43.7	2.5	41.2	6%	1	10		1	12	0.9	1.6		0.0	2.5	8%	83%		8%	37%	63%		0%
	TOUTLE	65.3	2.9	62.4	4%		2	1	0	3		1.3	1.6	0.0	2.9		67%	33%	0%		43%	57%	0%
	UPPER NF LEWIS	0.1		0.1	0%				0					0.0									
	WASHOUGAL	17.4		17.4	0%				0					0.0									
CHUM Total		554.4	43.1	511.3	12%	4	33	1	2	40	7.9	33.3	1.6	0.3	43.1	9%	81%	2%	5%	11%	86%	2%	0%
									0					0.0									
COHO	BONNEVILLE TRIBS	59.6	6.1	53.5	10%		5		0	5		6.1		0.0	6.1		100%		0%		100%		0%
	COWEEMAN	99.1	9.6	89.5	10%		12		0	12		9.6		0.0	9.6		100%		0%		100%		0%
	EF LEWIS	109.4	19.7	89.6	18%	2	17		0	19	1.8	17.9		0.0	19.7	11%	89%		0%	9%	91%		0%
	ESTUARY TRIBS	14.6	5.2	9.5	35%		5		0	5		5.2		0.0	5.2		100%		0%		100%		0%
	GERMANY-ABERNATHY	96.1	4.0	92.2	4%		6		0	6		4.0		0.0	4.0		100%		0%		100%		0%
	GORGE TRIBS	9.0	0.8	8.1	9%		1		0	1		0.8		0.0	0.8		100%		0%		100%		0%
	GRAYS	153.8	0.5	153.4	0%		1		0	1		0.5		0.0	0.5		100%		0%		100%		0%
	KALAMA	27.0	7.9	19.2	29%		4		0	4		7.9		0.0	7.9		100%		0%		100%		0%
	LITTLE WHITE SALMON	3.2	1.9	1.3	59%	1			0	1	1.9			0.0	1.9	100%			0%	100%			0%
	LOWER COWLITZ	407.1	46.6	360.5	11%	6	12		1	19	23.2	21.3		2.2	46.6	32%	63%		5%	50%	46%		5%
	LOWER NF LEWIS	97.6	13.4	84.2	14%	2	12		0	14	3.4	10.0		0.0	13.4	14%	86%		0%	25%	75%		0%
	SALMON	120.8	2.6	118.2	2%		3		1	4		1.6		1.0	2.6		75%		25%		63%		37%
	SKAMOKAWA-ELOCHOMAN	129.0	8.2	120.8	6%		9		0	9		8.2		0.0	8.2		100%		0%		100%		0%
	TOUTLE	297.4	53.7	243.7	18%		27	1	0	28		23.0	30.6	0.0	53.7		96%	4%	0%		43%	57%	0%
	UPPER COWLITZ (total)	307.6	307.8	-0.1	100%				0		307.8			0.0	307.8					100%			0%
	CISPUS	66.7	66.7	0.0	100%				0		66.7			0.0	66.7					100%			0%
	MAYFIELD-TILTON	94.3	94.3	0.0	100%				0		94.3			0.0	94.3					100%			0%
	RIFFE LAKE	56.1	56.3	-0.2	100%				0		56.3			0.0	56.3					100%			0%
	UPPER COWLITZ	90.6	90.6	0.0	100%				0		90.6			0.0	90.6					100%			0%
	UPPER NF LEWIS	146.4	146.3	0.1	100%	1			0	1	146.3			0.0	146.3	100%			0%	100%			0%
	WASHOUGAL	76.3	3.5	72.8	5%	2	2		0	4	2.7	0.8		0.0	3.5	50%	50%		0%	78%	22%		0%
	WIND	7.0	0.9	6.1	13%		1		0	1		0.9		0.0	0.9		100%		0%		100%		0%
COHO Total		2,161.2	638.5	1,522.6	30%	14	117	1	2	134	487.1	117.6	30.6	3.2	638.5	10%	87%	1%	1%	76%	18%	5%	0%

Species Code[1]	Basin	Historical miles	Blocked miles	Accessible miles[2]	Percent miles blocked	Primary[3] Block Type (Count)					Primary[3] Block Type (miles blocked)					Primary[3] Block Type (percent of count)				Primary[3] Block Type (percent miles blocked)			
						Dam	Culvert	SRS[4]	Other[5]	Total	Dam	Culvert	SRS[4]	Other[5]	Total	Dam	Culvert	SRS[4]	Other[5]	Dam	Culvert	SRS[4]	Other[5]
STSU	COWEEMAN	2.1		2.1	0%				0					0.0									
	EF LEWIS	192.3	35.4	156.8	18%	2	21		0	23	1.6	33.8		0.0	35.4	9%	91%			4%	96%		
	GERMANY-ABERNATHY	0.4		0.4	0%				0					0.0									
	GORGE TRIBS	2.6	0.3	2.3	12%		1		0	1		0.3		0.0	0.3		100%				100%		
	KALAMA	108.2	6.8	101.4	6%		6		0	6		6.8		0.0	6.8		100%				100%		
	LITTLE WHITE SALMON	3.3	1.9	1.4	58%	1			0	1	1.9			0.0	1.9	100%				100%			
	LOWER COWLITZ	0.0		0.0	0%				0					0.0									
	LOWER NF LEWIS	19.3		19.3	0%				0					0.0									
	SALMON	10.7		10.7	0%				0					0.0									
	SKAMOKAWA-ELOCHOMAN	0.0		0.0	0%				0					0.0									
	TOUTLE	0.0		0.0	0%				0					0.0									
	UPPER NF LEWIS	0.2		0.2	0%				0					0.0									
	WASHOUGAL	128.5	2.8	125.7	2%	1	1		0	2	2.4	0.4		0.0	2.8	50%	50%		0%	86%	14%		0%
	WIND	113.8	0.1	113.8	0%		1		0	1		0.1		0.0	0.1		100%		0%		100%		0%
STSU Total		581.3	47.3	534.0	8%	4	30		0	34	5.9	41.4	0.0	0.0	47.3	12%	88%		0%	12%	88%		0%
									0					0.0									
STWI	BONNEVILLE TRIBS	47.6	5.1	42.5	11%		4		0	4		5.1		0.0	5.1		100%		0%		100%		0%
	COWEEMAN	92.3	9.0	83.2	10%		15		0	15		9.0		0.0	9.0		100%		0%		100%		0%
	EF LEWIS	177.7	25.4	152.4	14%	2	17		0	19	1.3	24.1		0.0	25.4	11%	89%		0%	5%	95%		0%
	ESTUARY TRIBS	15.3	5.5	9.8	36%		6		0	6		5.5		0.0	5.5		100%		0%		100%		0%
	GERMANY-ABERNATHY	109.5	4.6	104.8	4%		5		0	5		4.6		0.0	4.6		100%		0%		100%		0%
	GORGE TRIBS	15.0	1.0	14.0	7%		1		0	1		1.0		0.0	1.0		100%		0%		100%		0%
	GRAYS	157.2	0.5	156.6	0%		1		0	1		0.5		0.0	0.5		100%		0%		100%		0%
	KALAMA	135.0	13.6	121.4	10%		15		0	15		13.6		0.0	13.6		100%		0%		100%		0%
	LITTLE WHITE SALMON	3.3	1.9	1.4	57%	1			0	1	1.9			0.0	1.9	100%			0%	100%			0%
	LOWER COWLITZ	377.3	51.9	325.4	14%	6	18		1	25	30.1	19.4		2.4	51.9	24%	72%		4%	58%	37%		5%
	LOWER NF LEWIS	106.6	16.0	90.6	15%	2	10		0	12	4.3	11.7		0.0	16.0	17%	83%		0%	27%	73%		0%
	SALMON	124.3	2.6	121.7	2%		3		1	4		1.7		0.9	2.6		75%		25%		64%		36%
	SKAMOKAWA-ELOCHOMAN	134.5	10.5	123.9	8%	1	7		0	8	5.8	4.8		0.0	10.5	13%	88%		0%	55%	45%		0%
	TOUTLE	293.8	63.5	230.3	22%		17	1	0	18		12.5	51.0	0.0	63.5		94%	6%	0%		20%	80%	0%
	UPPER COWLITZ (total)	228.0	228.0	0.0	100%				0		228.0			0.0	228.0					100%			0%
	CISPUS	63.6	63.6	0.0	100%				0		63.6			0.0	63.6					100%			0%
	MAYFIELD-TILTON	75.8	75.9	0.0	100%				0		75.9			0.0	75.9					100%			0%
	RIFFE LAKE	29.4	29.4	0.0	100%				0		29.4			0.0	29.4					100%			0%
	UPPER COWLITZ	59.2	59.2	0.0	100%				0		59.2			0.0	59.2					100%			0%
	UPPER NF LEWIS	137.1	137.0	0.1	100%	1			0	1	137.0			0.0	137.0	100%			0%	100%			0%
	WASHOUGAL	63.0	0.7	62.3	1%	1	1		0	2	0.4	0.4		0.0	0.7	50%	50%		0%	51%	49%		0%
	WIND	8.5	0.1	8.4	1%		1		0	1		0.1		0.0	0.1		100%		0%		100%		0%
STWI Total		2,225.9	577.0	1,649.0	26%	14	121	1	2	138	408.7	113.9	51.0	3.3	577.0	10%	88%	1%	1%	71%	20%	9%	1%

[1]Species Codes: CHFA=fall Chinook; CHSP=spring Chinook; STSU=summer steelhead; STWI=winter steelhead

[2]Represents the portion of historically accessible habitat that is currently accessible. Non-native habitat made available to species through human modifications (i.e.laddering falls) are not included in this value.

[3]Primary block is the most downstream barrier of the blocked segment. Restoration of only the primary block may not always restore passage to the entire blocked segment due to other barriers upstream of the primary barrier.

[4]SRS = Sediment Retention Structure on the NF Toutle River. Fish are blocked by a fish trap located downstream of the structure itself.

[5]Other includes other types of barriers not included individually. The primary other barriers are pump stations and fish ladders.