APPENDIX E – Estimating Current Population Status.

We compared historical and current population abundance, productivity, spatial structure and diversity to determine whether values of each of these parameters had declined substantially, indicating that there is the potential to improve population status. Obviously, historical conditions are unavailable in virtually every case. We therefore estimated the intrinsic potential of the landscape to support salmon and steelhead, and used the results of this analysis as our hypothesis of the distribution of salmon and steelhead historically (Appendix D). This comparison does not consider whether current conditions or some point in between current and historical conditions could be considered viable, but rather only whether it is possible to increase the values of each of these parameters, assuming that historical values were a maximum potential.

Current distributions. We used GIS layers available on Streamnet and refined with layers provided by Idaho Fish and Game, Oregon Department of Fish and Wildlife and Washington Department of Fish and Wildlife to describe current spawning and rearing distribution for each species. Digital spatial themes were compiled from existing sources, including Streamnet, the Oregon Department of Fish and Wildlife (ODFW), the Washington Department of Fish and Wildlife (WDFW), and the Idaho Department of Fish and Game (IDFG). Using this state agency data, we created use defined themes describing spawning, rearing, and migration corridors for summer and winter steelhead, and summer, spring, and fall chinook. Spatial layer scales were inherited from the sponsoring agencies, and were left unaltered in our data development efforts. Once the various lifecycle and specie specific themes were separated for each state, we reduced and standardized the attribute tables so that GIS layer merging techniques could be applied. The appended outputs were re-projected into a common coordinate system and combined to form continuous feature layers within the study area. These spatial themes illustrate a presence/absence view, in regards to the various lifecycles, of the population structure within the sub-basins.

In a small number of cases, we have discovered errors in these data layers. For consistency, however, we are using these layers as they were provided (i.e. we have made no changes), and are noting those errors.

We took the following approach to comparing historical and current population status for each viability-related parameter:

Abundance/Capacity. We evaluated two characteristics of abundance and capacity. First, for those populations for which a total population estimate was available, we calculated the geometric mean number of spawners for the last five years of the time series. An abundant literature suggests that a population size less than 500 is subject to a variety of demographic and genetic impacts severely limiting viability. Therefore, we judged that any population with less than 500 spawners (geometric mean over five years) had potential for improvement with respect to abundance. We used the data set compiled by the Biological Review Team in its recent status review of Northwest ESUs (http://www.nwfsc.noaa.gov/trt/brtrpt.htm)

For all populations, we also calculated a capacity metric, based on our intrinsic potential analysis (see Appendix D). Specifically, we summed the total number of meters currently occupied, weighted by its intrinsic potential. Stream segments rated high were weighted 1.0; segments rated "moderate" were weighted 0.5; and segments rated "low" were weighted 0.25. This weighted sum was compared with the weighted sum of all stream segments historically accessible and usable. If the value of this relative metric currently was 75% or less of the value historically, we considered the population to have potential for improvement with respect to capacity.

A population was considered to have potential to improve if either of these conditions was met.

Productivity. To evaluate current productivity, we used four metrics used by the Biological Review Teams (BRT) during the 2002/2003 status reviews: short-term trend, long-term trend, long-term population growth rate, assuming hatchery fish do not contribute to subsequent generations and long-term population growth rate assuming that hatchery fish do contribute to subsequent generations (see McClure et al. 2003 for an explanation of these population growth rates). Because it is essentially impossible to gauge a population's historical productivity, we judged that a population had potential to improve with respect to productivity if any one of these metrics was less than one (i.e. the trend or growth rate was declining). For many populations, data were not available to calculate productivity metrics. In these cases, we noted the lack of data; for categorization purposes, we applied the average of each productivity metric across populations within the relevant ESU. The mean population growth rate of a group of populations is a robust indicator of the central tendency of that group (Holmes and Fagan 2002).

Spatial Structure. We used three metrics to gauge whether there was potential for a population's spatial structure to be improved.

Percent potential habitat currently occupied. We calculated the percent of the potentially suitable habitat (that is currently occupied; any value less than 66% was deemed as impaired (having potential for improvement). This was an absolute comparison between the absolute stream km currently occupied and the absolute number of stream km identified as usable in our intrinsic potential analysis. This metric is intended to identify those situations where substantial portions of the historic distribution are not occupied.

Distributional differences. Second, we calculated the distribution of distances between spawning areas and determined whether there was a significant difference between the historical and current distribution. Any significant difference was deemed to be impaired. We classified each 6^{th}-field HUC within the population as occupied or un-occupied based on the current distribution (any presence was scored as occupied). For historic distribution, we classified each 6^{th}-field HUC as occupied or unoccupied by the presence of any stream segment ranked "high" or

"moderate" in our intrinsic potential analysis. We then generated a matrix of distances from each occupied 6th-field HUC to every other occupied 6th field HUC. We then tested whether the distribution of distances within these matrices were different using a Kolmogorov-Smirnoff test. Any significant difference was considered impaired. This metric is intended to identify differences in clustering patterns of spawning areas within a population.

Range. Finally, we examined the range of distances between spawning areas; any substantial reduction in this range was judged to provide potential for improvement. We based this analysis on the matrices generated above. If the range (minimum distance between two occupied HUCs to maximum distance between two occupied HUCs) was reduced by 2 or more, the population was considered to have potential to improve. This metric was intended to identify those situations where the current distribution had become restricted in comparison to historical distributions.

A population was deemed to have potential for improvement if any one of these conditions was met.

Diversity. Because relevant life history, genetic and morphological diversity has not been characterized for most populations, we relied on habitat differences, characterized by ecoregion as a proxy for the potential for a population to express relevant diversity. We devised a diversity metric that considered both the number of ecoregions and the distribution across those ecoregions. If the historical value was greater than the current value of this metric, we considered there to be room for the population to improve with respect to diversity.

To generate a diversity score, we examined the distribution of spawnable stream km across the EPA level-3 ecoregions using GIS mapping techniques. For a current diversity score, we generated the percentage of currently used stream kilometers in each ecoregion. For a potential historic diversity score we generated the percentage of stream kilometers categorized as "high" or "moderate" for spawning in our intrinsic potential analysis in each ecoregion.

We then calculated a diversity score for each population by adding together "points" based on the distribution of stream km across the ecoregions. Any ecoregion with less than 1% of a population's stream km received 0 points; an ecoregion that contained from 1-10% or 90-100% of the population's stream km received 1 point and an ecoregion that encompassed from 11-89% of the population's stream km received 2 points. Thus, a population with streams distributed more or less equally across 3 ecoregions received more points than a population distributed across 3 ecoregions, but with one or two ecoregions containing a very small proportion of the total stream km.

We recognize that EPA ecoregions may have limitations in their descriptive powers for aquatic community diversity. However,

Table E-1. Abundance metrics for Interior Columbia populations

ESU	Pop. Code	Population Name	Abundance			Capacity			Impaired (geomean <500 or capacity <75%)
			Geo mean, last 5 years	Last Year of Time Series	Count Type	Historic Weighted Stream km	Current Weighted Stream km	% Stream kms Used	
Snake River Spring / Summer Chinook									
	SNASO	Asotin River	*	*	*	31.39	5.20	16.57	X
	SNTUC	Tucannon River	71.99	2001	TLC	106.78	31.14	29.16	X
	GRWEN	Wenaha River	81.561[1]	1996	TLC	61.99	36.19	58.38	X
	GRLOS	Wallowa/Lostine Rivers	NA	NA	RC	141.75	62.86	44.35	X
	GRLOO	Lookingglass Creek (Historic)	NA	NA	RC	17.88	11.67	65.27	X
	GRMIN	Minam River	171.93	2001	TLC	61.66	31.00	50.28	X
	GRCAT	Catherine Creek	22.13	1996	TLC	94.86	20.44	21.55	X
	GRUMA	Upper Grande Ronde River	19.69	1996	TLC	148.42	36.16	24.36	X
	IRMAI	Imnaha River	NA	NA	EXP. RC	90.06	39.22	43.55	X
	IRBSH	Big Sheep Creek	NA	NA	RC	47.08	9.96	21.16	X
	SRLSR	Little Salmon River	NA	NA	RPM	77.48	38.16	49.25	X
	SFMAI	South Fork Salmon River	371.75[1]	2001	TLC	126.09	79.68	63.19	X
	SFSEC	Secesh River	NA	NA	RPM/RC	60.70	1.5	2.47	X
	SFEFS	E Fk S Fk Salmon River	NA	NA	RPM	56.29	47.98	85.24	
	SRCHA	Chamberlain Creek	NA	NA	RPM	71.51	38.6	53.98	X
	MFBIG	Big Creek	52.509[1]	2001	TLC	112.76	61.95	54.94	X
	MFLMA	Lower Middle Fork Salmon River	*	*	*	31.81	.75	2.36	X
	MFCAM	Camas Creek	NA	NA	RC	44.91	39.9	88.84	
	MFLOO	Loon Creek	NA	NA	RC	44.81	21.02	46.91	X
	MFUMA	Upper Middle Fork Salmon River	*	*	*	101.02	63.77	63.13	X
	MFSUL	Sulphur Creek	23.26	2001	TLC	15.77	14.26	90.42	X
	MFBEA	Bear Valley Creek	266.42	2001	TLC	71.95	71.95	100.00	X
	MFMAR	Marsh Creek	53.01	2001	TLC	43.16	42.96	99.54	X
	SRPAN	Panther Creek (Historic)	*	*	*	61.75	11.32	18.33	X
	SRNFS	N Fk Salmon River	NA	NA	RC	40.37	24.15	59.82	X
	SRLEM	Lemhi River	NA	NA	RC	153.62	67.84	44.16	X
	SRLMA	Upper Salmon Lower Mainstem	*	*	*	131.54	36.8	27.98	X
	SRPAH	Pahsimeroi River	161.42[2]	2001	TLC	126.27	0.00	0.00	X
	SREFS	E Fk Salmon River	NA	NA	RPM	64.88	55.42	85.42	
	SRYFS	Yankee Fork	NA	NA	RPM/RC	30.79	30.79	100.00	
	SRVAL	Valley Creek	NA	NA	RPM/RC	43.30	33.24	76.77	
	SRUMA	Upper Salmon River	NA	NA	RPM/RC	94.51	75.39	79.77	
Upper Columbia Chinook									
	UCWEN	Wenatchee River	273.78	2001	TLC	243.73	112.52	46.17	X
	UCENT	Entiat River	64.83	2001	TLC	56.99	19.26	33.8	X
	UCMET	Methow River	282.21	2001	TLC	203.31	109.75	53.98	X
Snake River Fall Chinook									
	SNMAI	Snake mainstem and lower tributaries	871.12	2001	TLC	*	132.80	*	

Table E-1 Abundance metrics for Interior Columbia populations, cont.

ESU	Pop. Code	Population Name	Abundance			Capacity			Impaired (geomean <500 or capacity <75%)
			Geo mean, last 5 years	Last Year of Time Series	Count Type	Historic Weighted Stream km	Current Weighted Stream km	% Stream kms Used	
Middle Columbia Steelhead									
	MCWSA-s	While Salmon River (Historic)	*	*	*	237.51	1.95	0.82	X
	MCKLI-s	Klickitat River	NA	NA	RC	806.28	81.33	10.09	X
	MCFIF-s	Fifteen Mile Creek (winters)	NA	NA	RPM	363.28	135.26	37.21	X
	DREST-s	Deschutes River, Eastside	4767.92[3]	2002	DC (Sherars)	363.54	297.14	56.87	X
	DRWST-s	Deschutes River, Westside	NA	NA	RPM/RC	522.51	109.65	24.31	X
	MCROC-s	Rock Creek	*	*	*	451.04	39.66	35.54	X
	JDLMT-s	John Day River lower mainstem tribs	NA	NA	RPM	111.6	944.29	62.45	X
	JDNFJ-s	North Fork John Day River	NA	NA	RPM	1511.96	740.92	76.03	
	JDMFJ-s	Middle Fork John Day River	NA	NA	RPM	974.51	321.72	77.47	
	JDSFJ-s	South Fork John Day River	NA	NA	RPM	415.26	123.83	46.04	X
	JDUMA-s	John Day upper mainstem	2042.40	2002	TLC	268.96	392.44	78.21	
	MCUMA-s	Umatilla River	1686.79	2002	TLC	501.75	270.07	24.98	X
	WWMAI-s	Walla Walla River	355.36	2000	TLC	1081.15	149.55	23.68	X
	WWTOU-s	Touchet River	289.79	2001	TLC	631.45	118.38	27.44	X
	YRTOS-s	Toppenish and Satus Creeks	*	*	*	431.4	159.21	27.44	X
	YRNAC-s	Naches River	*	*	*	580.27	195.70	25.91	X
	YRUMA-s	Yakima River upper mainstem	1746.70	2001	TLC	755.43	101.81	8.33	X
Snake River Steelhead									
	SNTUC-s	Tucannon River	94.62	2001	TLC	302.00	58.68	19.43	X
	SNASO-s	Asotin Creek	NA	NA	EXP. RC	531.43	117.34	22.08	X
	CRLMA-s	Clearwater lower mainstem	*	*	*	974.38	415.14	42.61	X
	CRNFC-s	North Fork Clearwater (historic)	*	*	*	1313.11	0.00	0.00	X
	CRLOL-s	Lolo Creek	*	*	*	154.43	68.64	44.45	X
	CRLOC-s	Lochsa River	*	*	*	599.58	315.84	52.68	X
	CRSEL-s	Selway Reiver	*	*	*	795.72	444.96	55.92	X
	CRSFC-s	South Fork Clearwater River	*	*	*	501.53	325.41	64.88	X
	GRLMT-s	Grande Rone lower mainstem tribs	*	*	*	598.03	318.94	53.33	X
	GRJOS-s	Joseph Creek	1542.34[1]	2002	TLC	299.12	225.97	75.54	
	GRWAL-s	Wallowa River	NA	NA	RPM	433.86	250.08	57.64	X
	GRUMA-s	Grande Ronde Upper Mainstem	NA	NA	RPM/RC	1054.77	600.99	56.98	X
	SRLSR-s	Little Salmon and Rapid Rivers	*	*	*	423.82	177.55	41.89	X
	SRCHA-s	Chamberlain Creek	*	*	*	391.12	238.69	61.03	X
	SFSEC-s	Secesh River	*	*	*	154.39	69.76	45.18	X
	SFMAI-s	South Fork Salmon River	*	*	*	393.79	265.24	67.36	X
	SRPAN-s	Panther Creek	*	*	*	378.96	90.68	23.93	X
	MFBIG-s	Big, Camas, and Loon Creeks	*	*	*	688.69	447.64	65.00	X
	MFUMA-s	Middle Fork Salmon River Upper Mainstem	*	*	*	619.84	441.93	71.3	X
	SRNFS-s	North Fork Salmon River	*	*	*	172.87	112.59	65.13	X
	SRLEM-s	Lemhi River	*	*	*	566.88	106.53	18.79	X
	SRPAH-s	Pahsimeroi River	*	*	*	372.63	36.04	9.67	X
	SREFS-s	East Fork Salmon River	*	*	*	420.96	110.33	26.21	X
	SRUMA-s	Salmon River upper mainstem	*	*	*	544.45	284.08	52.18	X
	SNHCT-s	snake River Hells Canyon Tributaries	*	*	*	107.67	40.36	37.48	X
	IRMAI-s	Imnaha River	42.3[1]	2002	TLC	554.00	389.68	70.34	X

Table E-1 Abundance metrics for Interior Columbia populations, cont.

ESU	Pop. Code	Population Name	Abundance			Capacity			Impaired (geomean <500 or capacity <75%)
			Geo mean, last 5 years	Last Year of Time Series	Count Type	Historic Weighted Stream km	Current Weighted Stream km	% Stream kms Used	
Upper Columbia Steelhead									
	UCWEN-s	Wenatchee River	893.67[4]	2001	TLC	558.04	94.71	16.97	X
	UCENT-s	Entiat River	893.67[4]	2001	TLC	141.16	32.82	23.25	X
	UCMET-s	Methow River	358.37	2001	TLC	640.66	122.17	19.07	X
	UCOKA-s	Okanogan River	*	*	*	421.54	12.30	2.92	X
Columbia River Chum[5]									
		Youngs Bay	*	*		287	269	93.73	
		Grays River (Hymer)	331	2000		230	229	99.57	X
		Grays River (Rawding)	704	1998		230	229	99.57	
		Big Creek	*	*		407	369	90.66	
		Elochoman River	*	*		242	242	100.00	
		Clatskanie River	*	*		165	160	96.97	
		Mill, Abernathy, Germany	*	*		306	266	86.93	
		Scappoose Creek	*	*		1,048	888	84.73	
		Cowlitz River	*	*		120	114	95.00	
		Kalama River	*	*		579	382	65.98	X
		Lewis River	*	*		362	319	88.12	
		Salmon Creek	*	*		471	416	88.32	
		Clackamas River	*	*		194	148	76.29	
		Sandy River	*	*		240	125	52.08	X
		Washougal river	*	*		82	81	98.78	
		Lower Gorge Tributaries	425	2000		77	55	71.43	X
Snake River Sockeye									
	SRRED[6]	Redfish Lake[6]							X

* No data available

NA--Not Applicable

[1] Data available for only part of the population.

[2] Hatchery data are unavailable; % wild is assumed to be 100 for the purpose of calculating geo mean.

[3] Abundance for DREST-s was calculated from data for the entire Deschutes basin.

[4] Wenatchee and Entiat Rivers are combined.

[5] Data for Chum are from BRT Report.

[6] Sockeye are maintainted in captive propagation and therefore have room to improve in all areas.

Table E-2. Productivity metrics for Interior Columbia populations

ESU	Pop. Code	Population Name	Productivity/Freshwater Survival				Range (years used)		Impaired (Trend or Lambda < 1)
			Long Term Trend	Short Term Trend	Long Term Lambda		Long Term Trend & Lambda	Short Term Trend	
					without hatchery	with hatchery			
Snake River Spring / Summer Chinook									
	SNASO	Asotin River	(0.939)	(1.046)	(0.961)	(0.889)			x
	SNTUC	Tucannon River	0.89	0.86	0.951	0.883	1979-2001	1990-2001	X
	GRWEN	Wenaha River	0.928	1.232	0.977	0.909	1963-2001	1990-2002	X
	GRLOS	Wallowa/Lostine Rivers	0.937	1.162	0.97	0.649	1964-2001	1990-2003	X
	GRLOO	Lookingglass Creek (Historic)	0.885	0.884	0.903	0.757	1957-2000	1990-2000	X
	GRMIN	Minam River	0.953	1.152	0.977	0.94	1964-2001	1990-2001	X
	GRCAT	Catherine Creek	0.966	#	0.98	0.926	1953-1996	#	X
	GRUMA	Upper Grande Ronde River	0.915	0.959	0.937	0.366	1960-2001	1990-2001	X
	IRMAI	Imnaha River	0.916	1.065	0.916	0.873	1957-2001	1990-2001	X
	IRBSH	Big Sheep Creek	0.888	1.014	0.863	0.819	1957-2001	1990-2001	X
	SRLSR[1]	Little Salmon River[1]	0.975	0.933	0.966	*	1972-2001	*	X
	SFMAI	South Fork Salmon River	0.965	1.01	0.967	0.961	1957-2001	1990-2001	X
	SFSEC	Secesh River	0.975	#	0.959	0.957	1957-1997	#	X
	SFEFS	E Fk S Fk Salmon River	(0.939)	(1.046)	(0.961)	(0.889)			x
	SRCHA[1]	Chamberlain Creek[1]	1.001	#	0.992	*	1952-1997	#	X
	MFBIG[1]	Big Creek[1]	0.926	1.035	0.948	0.969	1957-2001	1990-2001	X
	MFLMA	Lower Middle Fork Salmon River	(0.939)	(1.046)	(0.961)	(0.889)			x
	MFCAM	Camas Creek	0.959	1.114	0.992	0.992	1974-2001	1990-2001	X
	MFLOO	Loon Creek	0.928	1.122	0.97	0.97	1957-2001	1990-2001	X

	MFUMA	Upper Middle Fork Salmon River	(0.939)	(1.046)	(0.961)	(0.889)			x
	MFSUL	Sulphur Creek	0.921	0.858	0.961	0.961	1957-2001	1990-2001	X
	MFBEA	Bear Valley Creek	0.932	1.062	0.959	0.959	1960-2001	1990-2001	X
	MFMAR	Marsh Creek	0.922	0.96	0.971	0.971	1957-2001	1990-2001	X
	SRPAN	Panther Creek (Historic)	(0.939)	(1.046)	(0.961)	(0.889)			x
	SRNFS[1]	N Fk Salmon River[1]	0.907	1.156	0.936	*	1960-2000	1990-2000	X
	SRLEM	Lemhi River	0.917	1.128	0.956	0.956	1957-2001	1990-2001	X
	SRLMA	Upper Salmon Lower Mainstem	(0.939)	(1.046)	(0.961)	(0.889)			x
	SRPAH[1]	Pahsimeroi River[1]	1.154	1.128	1.211	*	1980-2001	1990-2001	
	SREFS	E Fk Salmon River	0.94	1.009	0.946	0.946	1957-2001	1990-2001	X
	SRYFS[1]	Yankee Fork[1]	0.9	1.012	0.937	0.942	1960-2001	1990-2001	X
	SRVAL[1]	Valley Creek[1]	0.901	1.149	0.952	0.955	1957-2001	1990-2001	X
	SRUMA[1]	Upper Salmon River [1]	0.925	#	0.893	*	1957-1997	#	X
Upper Columbia Chinook									
	UCWEN	Wenatchee River	0.931	0.926	0.965	0.947	1960-2001	1990-2001	X
	UCENT	Entiat River	0.943	0.938	0.971	0.95	1960-2001	1990-2001	X
	UCMET	Methow River	0.946	0.903	0.968	0.945	1960-2001	1990-2001	X
Snake River Fall Chinook									
	SNMAI	Snake mainstem and lower tributaries	1.013	1.188	1.024	0.899	1975-2001	1990-2001	X
Middle Columbia Steelhead									
	MCWSA-s	While Salmon River (Historic)	(1.008)	(1.049)	(1.024)	(0.974)			x
	MCKLI-s[1]	Klickitat River[1]	1.139	1.139	1.15	*	1990-2002	1990-2002	
	MCFIF-s	Fifteen Mile Creek (winters)	1.021	1.082	1.014	1.014	1985-2001	1990-2001	

Productivity metrics for Int. Col. populations, cont.

ESU	Pop. Code	Population Name	Productivity/Freshwater Survival				Range (years used)		Impaired (Trend or Lambda < 1)
			Long Term Trend	Short Term Trend	Long Term Lambda		Long Term Trend	Short Term Trend	
					without hatchery	with hatchery			
	DREST-s[2]	Deschutes River, Eastside[2]	0.975	1.089	1.022	0.84	1978-2002	1990-2002	X
	DRWST-s[1]	Deschutes River, Westside[1]	1.011	1.078	1.032	*	1982-2002	1990-2002	
	MCROC-s	Rock Creek	(1.008)	(1.049)	(1.024)	(0.974)			x
	JDLMT-s	John Day River lower mainstem tribs	0.988	0.975	0.978	0.978	1965-2002	1990-2002	X
	JDNFJ-s	North Fork John Day River	0.99	1.103	1.009	1.01	1977-2002	1990-2002	X
	JDMFJ-s	Middle Fork John Day River	0.975	0.973	0.966	0.966	1974-2001	1990-2001	X
	JDSFJ-s	South Fork John Day River	0.961	0.992	0.967	0.967	1974-2002	1990-2002	X
	JDUMA-s	John Day upper mainstem	0.975	0.98	0.975	0.973	1974-2002	1990-2002	X
	MCUMA-s	Umatilla River	0.989	1.084	1.01	0.953	1966-2002	1990-2002	X
	WWMAI-s	Walla Walla River	(1.008)	(1.049)	(1.024)	(0.974)			X
	WWTOU-s	Touchet River	0.973	0.983	1.012	0.908	1987-2001	1990-2001	X
	YRTOS-s	Toppenish and Satus Creeks	(1.008)	(1.049)	(1.024)	(0.974)			x
	YRNAC-s	Naches River	(1.008)	(1.049)	(1.024)	(0.974)			x
	YRUMA-s	Yakima River upper mainstem	1.1	1.105	1.148	1.129	1980-2001	1990-2001	
Snake River Steelhead									
	SNTUC-s	Tucannon River	0.877	0.908	0.799	0.61	1987-2001	1990-2001	X
	SNASO-s[1]	Asotin Creek[1]	0.95	1.04	0.95	*	1986-2001	1990-2001	X
	CRLMA-s	Clearwater lower mainstem	(0.976)	(1.018)	(0.957)	(0.887)			x
	CRNFC-s	North Fork Clearwater (historic)	(0.976)	(1.018)	(0.957)	(0.887)			x

	CRLOL-s	Lolo Creek	(0.976)	(1.018)	(0.957)	(0.887)			x
	CRLOC-s	Lochsa River	(0.976)	(1.018)	(0.957)	(0.887)			x
	CRSEL-s	Selway Reiver	(0.976)	(1.018)	(0.957)	(0.887)			x
	CRSFC-s	South Fork Clearwater River	(0.976)	(1.018)	(0.957)	(0.887)			x
	GRLMT-s	Grande Rone lower mainstem tribs	(0.976)	(1.018)	(0.957)	(0.887)			x
	GRJOS-s	Joseph Creek	(0.976)	(1.018)	(0.957)	(0.887)			x
	GRWAL-s[1]	Wallowa River[1]	1.024	1.151	1.009	*	1965-2001	1990-2001	
	GRUMA-s[1]	Grande Ronde Upper Mainstem[1]	0.992	0.996	0.976	0.954	1967-2000	1990-2000	X
	SRLSR-s	Little Salmon and Rapid Rivers	(0.976)	(1.018)	(0.957)	(0.887)			x
	SRCHA-s	Chamberlain Creek	(0.976)	(1.018)	(0.957)	(0.887)			x
	SFSEC-s	Secesh River	(0.976)	(1.018)	(0.957)	(0.887)			x
	SFMAI-s	South Fork Salmon River	(0.976)	(1.018)	(0.957)	(0.887)			x
	SRPAN-s	Panther Creek	(0.976)	(1.018)	(0.957)	(0.887)			x
	MFBIG-s	Big, Camas, and Loon Creeks	(0.976)	(1.018)	(0.957)	(0.887)			x
	MFUMA-s	Middle Fork Salmon River Upper Mainstem	(0.976)	(1.018)	(0.957)	(0.887)			x
	SRNFS-s	North Fork Salmon River	(0.976)	(1.018)	(0.957)	(0.887)			x
	SRLEM-s	Lemhi River	(0.976)	(1.018)	(0.957)	(0.887)			x
	SRPAH-s	Pahsimeroi River	(0.976)	(1.018)	(0.957)	(0.887)			x
	SREFS-s	East Fork Salmon River	(0.976)	(1.018)	(0.957)	(0.887)			x
	SRUMA-s	Salmon River upper mainstem	(0.976)	(1.018)	(0.957)	(0.887)			x
	SNHCT-s	Snake River Hells Canyon Tributaries	(0.976)	(1.018)	(0.957)	(0.887)			x
	IRMAI-s	Imnaha River	0.942	0.965	0.938	0.915	1985-2000	1990-2000	X

Productivity metrics for Interior Columbia populations, cont.									
			Productivity/Freshwater Survival				Range (years used)		
					Long Term Lambda				
ESU	Pop. Code	Population Name	Long Term Trend	Short Term Trend	without hatchery	with hatchery	Long Term Trend	Short Term Trend	Impaired (Trend or Lambda < 1)
Upper Columbia Steelhead									
	UCWEN-s and UCENT-s	Wenatchee River + Entiat River	1.033	1.066	1.067	0.733	1976-2001	1990-2001	X
	UCMET-s	Methow River	1.059	1.048	1.086	0.589	1976-2001	1990-2001	X
	UCOKA-s	Okanogan River	(1.046)	(1.057)	(1.077)	(0.661)			x
Columbia River Chum									
		Youngs Bay	(1.009)	(0.954)	(0.994)	*			x
		Grays River (Hymer)	0.99	0.904	0.954	*	1951-2000	1990-2000	X
		Grays River (Rawding)	1.058	#	1.043	*	1967-1998	#	
		Big Creek	(1.009)	(0.954)	(0.994)	*			x
		Elochoman River	(1.009)	(0.954)	(0.994)	*			x
		Clatskanie River	(1.009)	(0.954)	(0.994)	*			x
		Mill, Abernathy, Germany	(1.009)	(0.954)	(0.994)	*			x
		Scappoose Creek	(1.009)	(0.954)	(0.994)	*			x
		Cowlitz River	(1.009)	(0.954)	(0.994)	*			x
		Kalama River	(1.009)	(0.954)	(0.994)	*			x
		Lewis River	(1.009)	(0.954)	(0.994)	*			x
		Salmon Creek	(1.009)	(0.954)	(0.994)	*			x
		Clackamas River	(1.009)	(0.954)	(0.994)	*			x
		Sandy River	(1.009)	(0.954)	(0.994)	*			x
		Washougal river	(1.009)	(0.954)	(0.994)	*			x
		Lower Gorge Tributaries	0.979	1.003	0.984	*	1950-2000	1990-2000	X
Snake River Sockeye									
	SRRED[3]	Redfish Lake[3]							X
* No data available									
# Insufficient data									

[1] Where hatchery data are unavailable, % wild is assumed to be 100 for the purpose of calculating trend and lambda-without-hatchery.

[2]Productivity for DREST-s was calculated from data for the entire Deschutes basin.

[3] Sockeye are maintainted in captive propagation and therefore have room to improve in all areas.

( ) Values in parentheses are derived from an average taken from across respective ESUs (corresponds to a lowercase “x” in impaired column).

Table E-3. Spatial Structure metrics for Interior Columbia chinook populations

ESU	Pop. Code	Population Name	% "Historical" Area Currently Used[1]	K-S Statistical Significance (p=<0.1)	Current Highest Range	Potential Highest Range	Range Difference	Impaired (Range Difference >= 1)
Snake River Spring/Summer Chinook								
	SNASO	Asotin River	20.69 %	N	1	4	3	X
	SNTUC	Tucannon River	31.51%	Y	3	10	7	X
	GRWEN	Wenaha River	56.48 %	N	4	5	1	X
	GRLOS	Wallowa/Lostine Rivers	42.86%	Y	5	10	5	X
	GRLOO	Lookingglass Creek (historic)	69.30%	N	1	2	1	X
	GRMIN	Minam River	55.89%	N	2	5	3	X
	GRCAT	Catherine Creek	26.57%	N	9	10	1	X
	GRUMA	Upper Grande Ronde River	23.87%	Y	5	7	2	X
	IRMAI	Imnaha River	32.70%	Y	4	11	7	X
	IRBSH	Big Sheep Creek	23.49%	Y	2	8	6	X
	SRLSR	Little Salmon River	100.00%	N	8	9	1	X
	SFMAI	South Fork Salmon River	99.27%	N	25	24	-1	
	SFSEC	Secesh River	100.00%	N	5	5	0	
	SFEFS	E Fk S Fk Salmon River	100.00%	Y	6	8	2	X
	SRCHA	Chamberlain Creek	93.24%	N	11	11	0	
	MFBIG	Big Creek	89.23%	Y	12	14	2	X
	MFLMA	Lower Middle Fork Salmon River	5.19%	N	2	9	3	X
	MFCAM	Camas Creek	100.00%	Y	6	9	3	X
	MFLOO	Loon Creek	100.00%	N	5	6	1	X
	MFUMA	Upper Middle Fork Salmon River	100.00%	Y	8	12	4	X
	MFSUL	Sulphur Creek	100.00%	N	1	1	0	
	MFBEA	Bear Valley Creek	100.00%	N	3	5	2	X
	MFMAR	Marsh Creek	100.00%	N	3	5	2	X
	SRPAN	Panther Creek (historic)	29.19%	Y	2	8	6	X
	SRNFS	N Fk Salmon River	67.47%	N	5	6	1	X
	SRLEM	Lemhi River	47.07%	Y	9	16	7	X
	SRLMA	Upper Salmon Lower Mainstem	100.00%	Y	11	19	8	X
	SRPAH	Pahsimeroi River	20.25%	Y	2	9	4	X
	SREFS	E Fk Salmon River	100.00%	Y	5	9	4	X
	SRYFS	Yankee Fork	100.00%	Y	3	7	4	X
	SRVAL	Valley Creek	100.00%	N	2	4	2	X
	SRUMA	Upper Salmon River	100.00%	N	6	7	1	X
Upper Columbia Chinook								
	UCWEN	Wenatchee River	41.62%	Y	6	11	5	X
	UCENT	Entiat River	32.75%	N	3	6	3	X
	UCMET	Methow River	53.41%	Y	7	12	5	X

Spatial Structure metrics for Interior Columbia chinook populations, cont.

ESU	Pop. Code	Population Name	% "Historical" Area Currently Used[1]	K-S Statistical Significance (p=<0.1)	Current Highest Range	Potential Highest Range	Range Difference	Impaired (Range Difference >= 1)
Middle Columbia Steelhead								
	MCWSA-s	While Salmon River (Historic)	2.3%	N	2	8	6	X
	MCKLI-s	Klickitat River	13.4%	Y	11	16	5	X
	MCFIF-s	Fifteen Mile Creek (winters)	47.6%	N	8	10	2	X
	DREST-s	Deschutes River, Eastside	65.7%	Y	14	18	4	X
	DRWST-s	Deschutes River, Westside	28.9%	Y	8	13	5	X
	MCROC-s	Rock Creek	37.3%	N	4	4	0	
	JDLMT-s	John Day River lower mainstem tribs	63.0%	Y	29	42	13	X
	JDNFJ-s	North Fork John Day River	85.7%	Y	17	21	4	X
	JDMFJ-s	Middle Fork John Day River	89.6%	Y	15	19	0	X
	JDSFJ-s	South Fork John Day River	63.7%	Y	6	11	5	X
	JDUMA-s	John Day upper mainstem	88.9%	Y	13	16	3	X
	MCUMA-s	Umatilla River	26.2%	Y	12	16	5	X
	WWMAI-s	Walla Walla River	22.7%	Y	9	13	4	X
	WWTOU-s	Touchet River	25.6%	Y	9	12	3	X
	YRTOS-s	Toppenish ans Satus Creeks	28.4%	Y	13	13	0	X
	YRNAC-s	Naches River	34.5%	Y	9	13	4	X
	YRUMA-s	Yakima River upper mainstem	12.8%	Y	6	21	15	X
Snake River Steelhead								
	SNTUC-s	Tucannon River	23.9%	Y	10	10	0	X
	SNASO-s	Asotin Creek	21.6%	Y	14	17	3	X
	CRLMA-s	Clearwater lower mainstem	43.5%	Y	13	19	6	X
	CRNFC-s	North Fork Clearwater (historic)	0.0%		14	24	10	X
	CRLOL-s	Lolo Creek	47.8%	Y	2	6	4	X
	CRLOC-s	Lochsa River	58.1%	Y	11	13	2	X
	CRSEL-s	Selway River	64.2%	Y	15	16	1	X
	CRSFC-s	South Fork Clearwater River	72.7%	Y	7	10	3	X
	GRLMT-s	Grande Ronde lower mainstem tribs	51.3%	Y	11	15	4	X
	GRJOS-s	Joseph Creek	84.4%	N	9	8	1	
	GRWAL-s	Wallowa River	58.2%	Y	11	15	4	X
	GRUMA-s	Grande Ronde Upper Mainstem	59.4%	N	14	14	0	X
	SRLSR-s	Little Salmon and Rapid Rivers	51.0%	N	31	16	15	X
	SRCHA-s	Chamberlain Creek	89.8%	Y	4	23	19	X
	SFSEC-s	Secesh River	50.1%	N	5	5	0	X
	SFMAI-s	South Fork Salmon River	92.2%	Y	13	15	2	
	SRPAN-s	Panther Creek	29.0%	Y	14	15	1	X
	MFBIG-s	Big, Camas, and Loon Creeks	73.1%	Y	12	21	9	
	MFUMA-s	Middle Fork Salmon River Upper Mainstem	77.8%	y	14	16	2	X
	SRNFS-s	North Fork Salmon River	68.4%	N	6	8	2	X
	SRLEM-s	Lemhi River	22.0%	Y	15	18	3	X
	SRPAH-s	Pahsimeroi River	13.3%	Y	12	16	4	X
	SREFS-s	East Fork Salmon River	28.9%	y	12	14	2	X
	SRUMA-s	Salmon River upper mainstem	57.7%	y	12	17	5	X
	SNHCT-s	Snake River Hells Canyon Tributaries	50.3%	N	11	11	0	X
	IRMAI-s	Imnaha River	73.5%	N	12	12	0	

Spatial Structure metrics for Interior Columbia chinook populations, cont.

ESU	Pop. Code	Population Name	% "Historical" Area Currently Used[1]	K-S Statistical Significance (p=<0.1)	Current Highest Range	Potential Highest Range	Range Difference	Impaired (Range Difference >= 1)
Upper Columbia Steelhead								
	UCWEN-s	Wenatchee River	25.8%	Y	8	14	6	X
	UCENT-s	Entiat River	27.2%	N	3	5	2	X
	UCMET-s	Methow River	26.9%	Y	8	13	2	X
	UCOKA-s	Okanogan River	2.3%	Y	2	11	9	X
Columbia River Chum								
		Youngs Bay	7.5%	N	2	4	2	X
		Grays & Chinook Rivers	40.1%	N	3	3	0	X
		Big Creek	28.2%	N	1	2	1	X
		Elochoman River	82.7%	N	3	3	0	
		Clatskanie River	19.2%	N	1	6	5	X
		Mill Creek	41.9%	N	0	3	3	X
		Scappoose Creek	3.4%	N	0	4	4	X
		Cowlitz River	42.2%	N	6	6	0	X
		Kalama River	49.3%	N	2	2	0	X
		Lewis River	40.9%	N	3	4	1	X
		Salmon Creek	20.4%	N	1	1	0	X
		Clackamas River	3.0%	N	0	6	6	X
		Sandy River	13.2%	N	1	5	4	X
		Washougal river	17.6%	N	1	3	2	X
		Lower Gorge Tribs	34.7%	N	3	4	1	X
		Upper Gorge Tribs	52.5%	N	4	5	1	X
Snake River Sockeye								
	SRRED[2]	Redfish Lake[2]						X

[1]Impaired area is < 66% historic.

[3] Sockeye are maintainted in captive propagation and therefore have room to improve in all areas.

Table E-4. Diversity Metrics for Interior Columbia chinook populations

ESU	Pop. Code	Population Name	Diversity Score based on Level 4 Ecoregions			Impaired (Difference >=1)
			Historic	Current	Difference	
Snake River Spring/Summer Chinook						
	SNASO	Asotin River	2	4	-2	
	SNTUC	Tucannon River	5	6	-1	
	GRWEN	Wenaha River	2	1	1	X
	GRLOS	Wallowa/Lostine Rivers	8	6	2	X
	GRLOO	Lookingglass Creek (Historic)	4	4	0	
	GRMIN	Minam River	5	5	0	
	GRCAT	Catherine Creek	6	6	0	
	GRUMA	Upper Grande Ronde River	4	2	2	X
	IRMAI	Imnaha River	6	6	0	
	IRBSH	Big Sheep Creek	5	6	-1	
	SRLSR	Little Salmon River	7	9	0	
	SFMAI	South Fork Salmon River	6	5	1	X
	SFSEC	Secesh River	2	4	0	
	SFEFS	E Fk S Fk Salmon River	4	4	0	
	SRCHA	Chamberlain Creek	5	5	0	
	MFBIG	Big Creek	5	5	0	
	MFLMA	Lower Middle Fork Salmon River	4	4	0	
	MFCAM	Camas Creek	4	4	0	
	MFLOO	Loon Creek	2	2	0	
	MFUMA	Upper Middle Fork Salmon River	1	1	0	
	MFSUL	Sulphur Creek	1	1	0	
	MFBEA	Bear Valley Creek	1	1	0	
	MFMAR	Marsh Creek	4	4	0	
	SRPAN	Panther Creek (Historic)	4	1	3	X
	SRNFS	N Fk Salmon River	8	6	2	X
	SRLEM	Lemhi River	5	5	0	
	SRLMA	Upper Salmon Lower Mainstem	9	9	0	
	SRPAH	Pahsimeroi River	5	1	4	X
	SREFS	E Fk Salmon River	4	4	0	
	SRYFS	Yankee Fork	1	1	0	
	SRVAL	Valley Creek	4	4	0	
	SRUMA	Upper Salmon River	4	6	0	
Upper Columbia Chinook						
	UCWEN	Wenatchee River	7	5	2	X
	UCENT	Entiat River	6	2	4	X
	UCMET	Methow River	5	6	-1	

Diversity Metrics for Interior Columbia chinook populations, cont.

ESU	Pop. Code	Population Name	Diversity Score based on Level 4 Ecoregions			Impaired (Difference >=1)
			Historic	Current	Difference	
Middle Columbia Steelhead						
	MCWSA-s	While Salmon River (Historic)	6	4	2	X
	MCKLI-s	Klickitat River	9	5	4	X
	MCFIF-s	Fifteen Mile Creek (winters)	9	8	1	X
	DREST-s	Deschutes River, Eastside	8	8	0	
	DRWST-s	Deschutes River, Westside	8	9	-1	
	MCROC-s	Rock Creek	8	7	1	X
	JDLMT-s	John Day River lower mainstem tribs	10	9	1	X
	JDNFJ-s	North Fork John Day River	10	10	0	
	JDMFJ-s	Middle Fork John Day River	7	7	0	
	JDSFJ-s	South Fork John Day River	9	9	0	
	JDUMA-s	John Day upper mainstem	8	8	0	
	MCUMA-s	Umatilla River	9	8	1	X
	WWMAI-s	Walla Walla River	13	10	3	X
	WWTOU-s	Touchet River	9	6	3	X
	YRTOS-s	Toppenish ans Satus Creeks	7	5	2	X
	YRNAC-s	Naches River	9	9	0	
	YRUMA-s	Yakima River upper mainstem	12	8	4	X
Snake River Steelhead						
	SNTUC-s	Tucannon River	7	8	-1	
	SNASO-s	Asotin Creek	8	5	3	X
	CRLMA-s	Clearwater lower mainstem	13	12	1	X
	CRNFC-s	North Fork Clearwater (historic)	6	0	6	X
	CRLOL-s	Lolo Creek	4	6	-2	
	CRLOC-s	Lochsa River	7	7	0	
	CRSEL-s	Selway Reiver	7	7	0	
	CRSFC-s	South Fork Clearwater River	1	1	0	
	GRLMT-s	Grande Rone lower mainstem tribs	7	5	2	X
	GRJOS-s	Joseph Creek	6	6	0	
	GRWAL-s	Wallowa River	9	9	0	
	GRUMA-s	Grande Ronde Upper Mainstem	9	9	0	
	SRLSR-s	Little Salmon and Rapid Rivers	8	10	-2	
	SRCHA-s	Chamberlain Creek	5	6	-1	
	SFSEC-s	Secesh River	2	4	-2	
	SFMAI-s	South Fork Salmon River	4	4	0	
	SRPAN-s	Panther Creek	6	6	0	
	MFBIG-s	Big, Camas, and Loon Creeks	4	4	0	
	MFUMA-s	Middle Fork Salmon River Upper Mainstem	2	4	-2	
	SRNFS-s	North Fork Salmon River	9	8	1	X
	SRLEM-s	Lemhi River	7	7	0	
	SRPAH-s	Pahsimeroi River	9	4	5	X
	SREFS-s	East Fork Salmon River	8	5	3	X
	SRUMA-s	Salmon River upper mainstem	6	5	1	X
	SNHCT-s	snake River Hells Canyon Tributaries	2	1	1	X
	IRMAI-s	Imnaha River	9	6	3	X

Diversity Metrics for Interior Columbia chinook populations, cont.

ESU	Pop. Code	Population Name	Diversity Score based on Level 4 Ecoregions			Impaired (Difference >=1)
			Historic	Current	Difference	
Upper Columbia Steelhead						
	UCWEN-s	Wenatchee River	8	5	3	X
	UCENT-s	Entiat River	6	2	4	X
	UCMET-s	Methow River	7	5	2	X
	UCOKA-s	Okanogan River	8	1	7	X
Columbia River Chum						
		Youngs Bay	1	5	4	X
		Grays & Chinook Rivers	8	7	-1	
		Big Creek	1	4	3	X
		Elochoman River	5	5	0	
		Clatskanie River	6	5	-1	
		Mill Creek	5	6	1	X
		Scappoose River	5	6	1	X
		Cowlitz River	7	8	1	X
		Kalama River	4	5	1	X
		Lewis River	5	6	1	X
		Salmon Creek	1	6	5	X
		Clackamas River	1	5	4	X
		Sandy River	6	7	1	X
		Washougal River	4	5	1	X
		Lower Gorge Tribs	6	5	-1	
		Upper Gorge Tribs	6	6	0	
Snake River Sockeye						
	SRRED[1]	Redfish Lake[1]				X

[1] Sockeye are maintainted in captive propagation and therefore have room to improve in all areas.

DRAFT