Wenaha River Spring Chinook Population

The Wenaha River Chinook population (Figure 1) is part of the Snake River Spring/Summer Chinook ESU which has five major population groupings (MPGs), including: Lower Snake River, Grande Ronde / Imnaha, South Fork Salmon River, Middle Fork Salmon River, and the Upper Salmon River group. The ESU contains spring, spring-summer, and summer run Chinook. The Wenaha River population is a spring run and is one of seven extant populations in the Grande Ronde / Imnaha River MPG.

The ICTRT classified the Wenaha population as an "intermediate size" population (Table 1) based on historical habitat potential (ICTRT 2005). A Chinook population classified as intermediate has a mean minimum abundance threshold criteria of 750 naturally produced spawners with a sufficient intrinsic productivity (greater than 1.6 recruits per spawner at the threshold abundance level) to achieve a 5% or less risk of extinction over a 100-year timeframe.

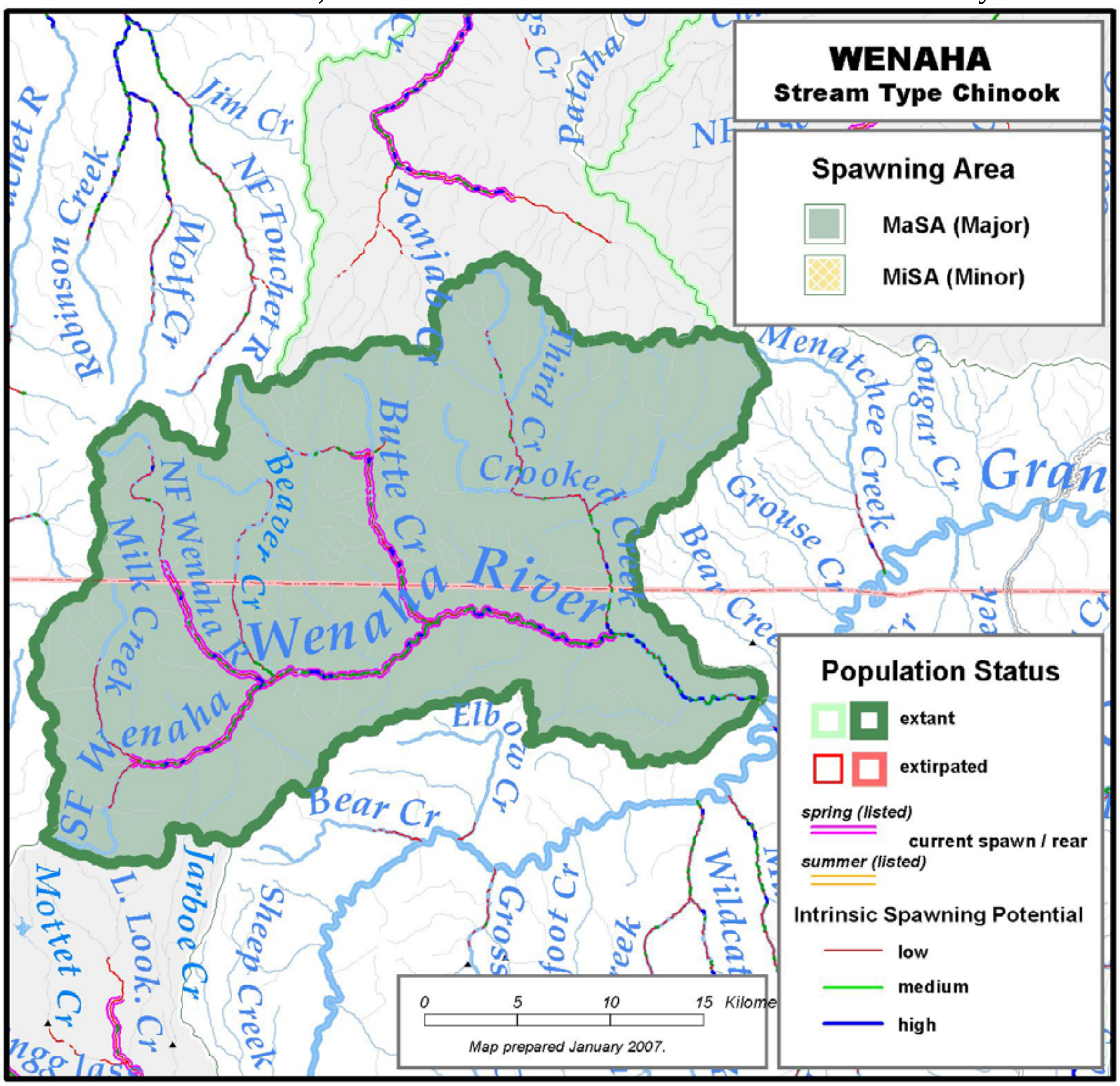

Figure 1. Wenaha River Chinook major and minor spawning areas.

Table 1. Wenaha River Chinook Basin Statistics

Drainage Area (km2)	766
Stream lengths km* (total)	404
Stream lengths km* (below natural barriers)	339
Branched stream area weighted by intrinsic potential (km2)	0.197
Branched stream area km2 (weighted and temp. limited)	0.197
Total stream area weighted by intrinsic potential (km2)	0.359
Total stream area weighted by intrinsic potential (km2) temp limited	0.359
Size / Complexity category	Intermediate / "A" (simple linear)
Number of MaSAs	1
Number of MiSAs	0

*All stream segments greater than or equal to 3.8m bankfull width were included
**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C.

Current Abundance and Productivity

Current (1964 to 2005) abundance (number of adult spawning in natural production areas) has ranged from 47 in 1979 to 2,545 in 1970 (Figure 2). Estimates of abundance of adult spring Chinook spawners are based on expanded redd counts observed during spawning ground surveys conducted annually in mainstem and tributary spawning reaches of the Wenaha River.

Spawning ground surveys have been conducted once annually in index survey reaches from 1949-1986 with the exception of the 1951 and 1957 to 1962 spawning years (Tranquilly et al. 2004). From 1987-1990 one-time surveys were conducted in index areas and also throughout the entire additional area used for spawning. For the period 1991-1995 one-time entire area surveys at the index time were conducted and supplemental surveys were conducted following the index surveys in selected reaches to assess temporal relationships. Since 1996 two complete area surveys have been conducted each year (N.F. not surveyed in all years). For this analysis, observations of redds and the locations of surveys are those reported in Tranquilli et al. (2004), updated with annual summaries of spawning ground survey results (personal communications, P. Keniry and F. Monzyk, ODFW NE Fisheries Research Program, La Grande, OR), and cross referenced to Beamesderfer et al. (1997).

To account for spawning activity in unsurveyed reaches, we estimate each season's total redds by expanding index redd counts to unsurveyed areas with an average redds per unsurveyed reach expansion factor (redds in index reaches represent approximately 38% of total area redds; N = 19, C.V. = 0.29.). To account for spawning activity occurring later than that observed during single pass surveys, we divide total area redd abundance by the average ratio of first pass redds to the cumulative count observed in both the first and second surveys (first-pass observations average approximately 89% of all redds observed; N = 15, C.V. = 0.05.). For the period 1996-2005 nearly all spawning areas were surveyed multiple times resulting in a redds census, therefore only minor spawning areas in the North Fork Wenaha River and Butte Creek required spatial or temporal expansions. To convert redds to spawning fish, we assume each redd represents 3.2 fish (including ocean age 1-yr jacks) based on the relationship between the number of fish spawning and redds observed upstream of the weir for the Imnaha population over a long period of time.

To estimate the abundance of natural-origin adult progeny on the spawning grounds each season, we subtract hatchery-origin fish from total spawner abundance. The proportion of adult hatchery origin fish on the spawning grounds is estimated from carcass recoveries and observations of finclips and results of discriminant scale pattern analysis in past years (pre-1995). Hatchery-origin jacks are believed to be underrepresented in the spawning ground carcass samples, and we estimate the jack hatchery fraction based on age structure of hatchery rack returns at Lookingglass Fish Hatchery (1987 – 2001) and fish trapped at Lostine River weir (2002 – 2005).

To estimate abundance of progeny for each brood year, we apportion natural-origin adult spawners into brood years using observed age-at-return. Generally, age composition of adults on the spawning grounds is determined from analysis of scales collected from carcasses on the spawning grounds. For years when fewer than 20 or more readable scale samples were available from the Wenaha River, we aggregated scale samples with samples from the other populations in the Grande Ronde Basin. Since 2001, we applied observed length frequencies of unmarked carcasses in the Wenaha River to length-at-age relationships developed with samples from 1987 – 2000. In 1981 and 1982, when no age samples were available, we used the average proportion at age by return year observed for the Wenaha River from all other years.

Recent year natural spawners include returns originating from naturally spawning parents, and hatchery strays primarily produced from Lookingglass Fish Hatchery. Prior to 1995 strays were of Carson and Rapid River stock origin. In the recent years strays originated from local broodstock sources from other Grande Ronde basin populations. Natural-origin spawners have comprised an average of 85% of total spawners since 1964, and the recent 10-year average is 95% (Table 2).

Abundance in recent years has been variable, the most recent 10-year geomean number of natural-origin spawners was 376 (Table 2). During the period 1981-2000, returns per spawner for Chinook in Wenaha River ranged from 0.08 (1987) to 3.56 (1999). The most recent 20 year (1981-2000) SAR adjusted and delimited (at 75% of the abundance threshold) geometric mean of returns per spawner was 0.74 (Table 2).

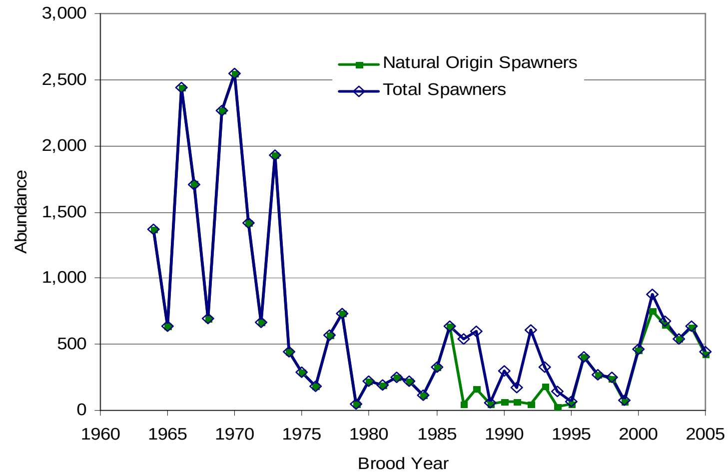

Figure 2. Wenaha River abundance trends 1964-2005.

Table 2. Wenaha River abundance and productivity measures

10-year geomean natural abundance	376
20-year return/spawner productivity	0.66
20-year return/spawner productivity, SAR adj. and delimited*	0.74
20-year Bev-Holt fit productivity, SAR adjusted	1.58
20-year Lambda productivity estimate	1.1
Average proportion natural origin spawners (recent 10 years)	0.95
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the size category threshold for this population. This approach attempts to remove density dependence effects that may influence the productivity estimate.

Comparison to the Viability Curve

- Abundance: 10-year geomean natural origin spawners
- Productivity: 20-year geomean R/S (adjusted for marine survival and delimited at 563 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Wenaha River population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3).

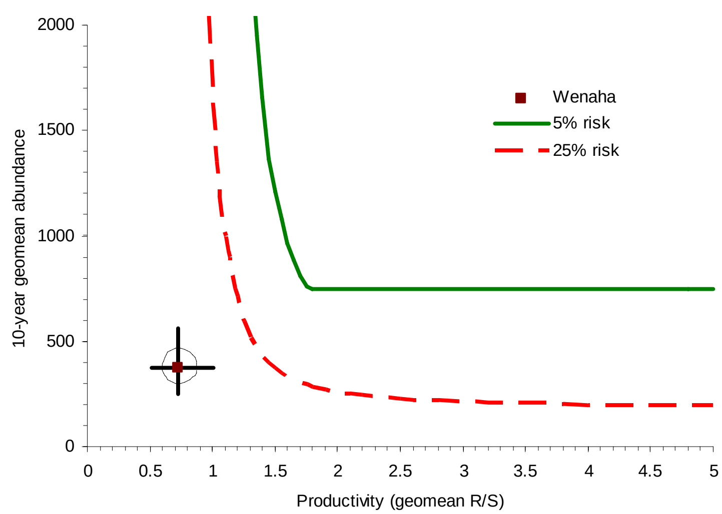

Figure 3. Wenaha River Chinook abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Estimate includes a 1 SE ellipse, 1.81 X SE abundance line, and 1.74 X SE productivity line.

Spatial Structure and Diversity

The ICTRT has identified one major spawning area (MaSA) and no minor spawning areas (MiSA) within the Wenaha River Chinook population (Figure 4). There are no modeled temperature limitations within this MaSA. Current spawning distribution is similar to historic with major production areas in the South Fork and the mainstem Wenaha River from the confluence of the North and South Forks downstream to Crooked Creek. A minor amount of spawning occurs in the North Fork Wenaha River and in Butte Creek. Spawners in recent years are primarily natural-origin fish. No hatchery releases have occurred in the Wenaha drainage. Strays of Rapid River and Carson stock origin, which resulted from Lookingglass Fish Hatchery production, comprised a significant proportion of spawners prior to 1996. Use of Carson and Rapid River stock has been discontinued and local broodstocks have been developed for supplementation programs in the Lostine River, upper Grande Ronde River, and Catherine Creek. Recent years hatchery strays in the Wenaha River are from these local broodstock supplementation programs.

Factors and Metrics

<u>A.1.a. Number and spatial arrangement of spawning areas</u>.
The Wenaha River spring Chinook population has one MaSA and no MiSAs. Although there are three tributaries that support production outside of the mainstem, none have sufficient habitat quantity to meet MaSA criteria. The area of weighted habitat is greater than the minimum quantity needed for three MaSAs; however, the continuous connected spawning distribution results in only one MaSA. Based on complete area spawning ground surveys conducted since 1987, all MaSAs are currently occupied. Because the Wenaha population is an "A" type with a linear distribution, it rates at **moderate risk** for this metric.

A.l.b. Spatial extent or range of population.
The current spawner distribution mirrors the historical distribution with the one MaSA occupied (Figure 4). The current spatial extent and range criteria for the Wenaha River population is rated at **low risk**.

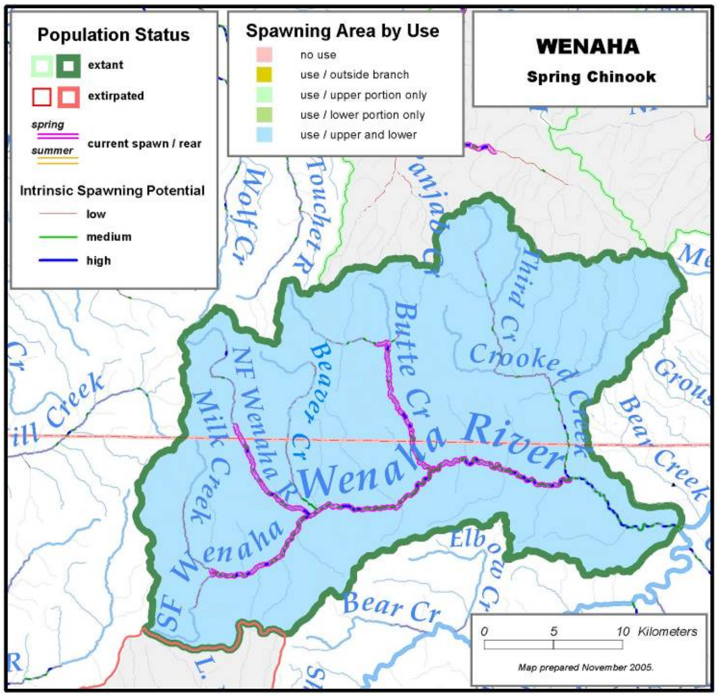

Figure 4. Wenaha River Chinook distribution.

A.1.c. Increase or decrease in gaps or continuities between spawning areas.
There have been no increases in gaps between spawning areas or any loss of occupancy in any MaSAs. Connectivity between spawning areas is unchanged from historical conditions. The Wenaha population rates at **low risk** for gaps.

B.1.a. Major life history strategies.
Limited information exists to evaluate changes in life history pathways for the Wenaha River Chinook salmon. Therefore, we use habitat information and subbasin plan EDT analyses to infer changes in life history strategies. A majority of Wenaha basin resides in wilderness area and habitat for adult holding, spawning, and juvenile rearing is in relative pristine condition. Habitat conditions throughout the life cycle provide conditions for expression of a variety of life history strategies. We have no evidence of loss of major life history pathways, thus the rating is **very low risk** for this metric.

B.1.b. Phenotypic variation.
Data are not available to assess the degree to which phenotypic traits have been altered or lost. We used habitat changes to infer potential changes in phenotypic traits. We have rated the Wenaha population at **low risk** because the seaward migration timing through the mainstem Snake and Columbia rivers has likely been altered due to flow and temperature changes and no other traits have been significantly influenced.

B.1.c. Genetic variation.
The Wenaha population has been rated at **moderate risk** for the genetic variation metric. It is significantly different from other populations within the MPG, but clearly falling within the

Grande Ronde group. The population shows similarity in some years with out-of-ESU hatchery fish which are known to have comprised a significant fraction of spawners in some years, but not as similar as the Catherine Creek samples.

B.2.a. Spawner composition.

(1) *Out-of-ESU strays*. From the early 1980's through the mid 1990's, Carson and Rapid River stock hatchery fish were used in the Grande Ronde Basin. The use of these stocks has been discontinued . For our assessment we characterized both Carson and Rapid River hatchery stocks as out-of-ESU origin. For the period 1991-2005 out-of-ESU hatchery strays comprised an estimated 23.1% of the natural spawners in the Wenaha River population. This level results in a **high risk** rating.

(2) *Out-of-MPG strays from within the ESU*. The mean out-of-MPG hatchery fraction from 1991-2005 was 0.1%, thus the rating for this metric is **low risk**.

(3) *Out of population within MPG strays*. Strays from local Grande Ronde broodstock sources were first observed in 2000 when adults from the supplementation programs began to return. The mean out of population within MPG hatchery fraction for the period 2000-2005 was 3.4%. These strays originated from local origin broodstock supplementation programs in other Grande Ronde Basin populations. Because the influence has been only one generation the population is rated at **low risk**.

(4) *Within-population hatchery spawners.* There are no hatchery programs operated within the Wenaha population, therefore this metric is rated as **very low risk**.

The overall rating for spawner composition is **high risk** due to the out-of-ESU stray fraction.

B.3.a. Distribution of population across habitat types.

The intrinsic distribution of the Wenaha population encompassed two level 4 ecoregions with Canyons and Dissected Highlands comprising 87.2% of the distribution. The remaining 12.8% resides in Canyons and Dissected Uplands. Although intrinsic potential analyses indicates potential for historic spawning in the lower 6 miles of the Wenaha River (Figure 5) where the Canyons and Dissected Uplands ecoregions resides (Table 3), there is no documented historic use in this reach. Current distribution is believed to be identical to historic so no substantial change has occurred. We have rated the population at **low risk** because there is one ecoregion and no change from historic distribution.

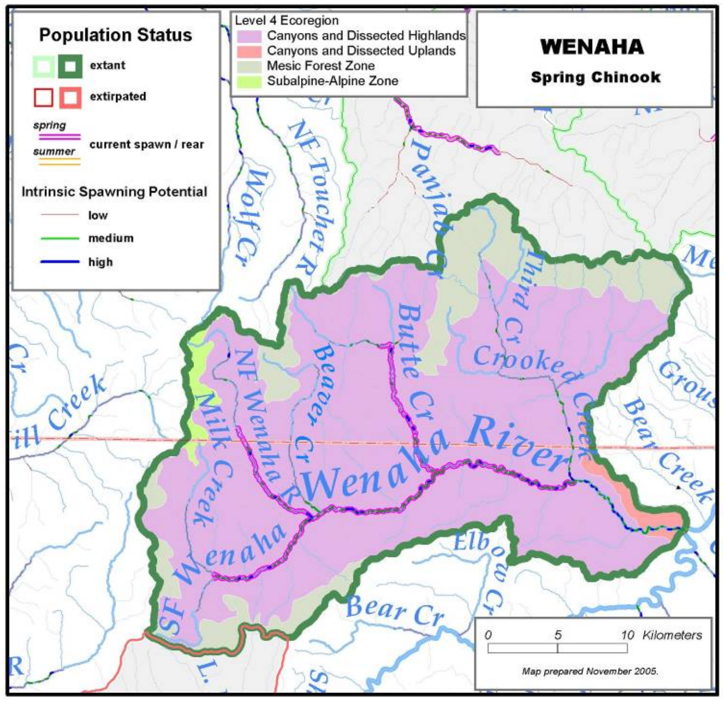

Figure 5. Wenaha River Chinook population distribution across

Table 3. Wenaha River Spring Chinook—proportion of spawning areas across various ecoregions.

Ecoregion	% of historical branch spawning area in this ecoregion (non-temperature limited)	% of historical branch spawning area in this ecoregion (temperature limited)	% of currently occupied spawning area in this ecoregion (non-temperature limited)
Canyons and Dissected Highlands	87.2	87.2	100.0
Canyons and Dissected Uplands	12.8	12.8	0.0

B.4.a. Selective change in natural processes or selective impacts.

Hydropower system: The hydropower system and associated reservoirs likely pose some selective mortality on both adult upstream migrants and downstream migrating smolts. We do not have quantitative data to assess if the mortality is selective on 25% or more of affected individuals. We hypothesize that the mortality is not 25% or greater consistently for any component, however, we have rated this metric as **low risk** because multiple life stages are affected.

Harvest: Current harvest regulations are very restrictive and allow for only a small proportion (5-10%) of Snake River spring/summer Chinook to be harvested annually. The methods of harvest are generally non-selective for adult sized fish. We have rated this metric as **low risk**.

Hatcheries: No hatcheries are operated in the Wenaha population. The rating is **very low risk**.

Habitat: There does not appear to be any within-basin habitat changes which would pose any significant selective mortality on adult or juvenile life stages. The rating is **very low risk**.

The overall rating for selective changes is **low risk**.

Spatial Structure and Diversity Summary

The combined integrated Spatial Structure/Diversity rating is moderate risk for the Wenaha River population (Table 4). The rating for Goal A "allowing natural rates and levels of spatially mediated processes" was low risk. The current spawning distribution mimics the intrinsic distribution. The population is distributed throughout the Wenaha River Mainstem, South Fork Wenaha River and in small numbers in the North Fork and Butte Creek. Good continuity exists in the distribution without any gaps.

The rating for Goal B "maintaining natural levels of variation" was moderate risk. This overall rating was primarily driven by the risk rating for genetic variation, spawner composition, and hydrosystem selective mortality. The genetic variation rating of moderate was a result of similarity with out-of-ESU hatchery fish that were used in the LSRCP program from the late 1970's until the mid 1990's. Strays from the hatchery program during this time period comprised a high proportion of spawners in the Wenaha River thus resulting in a high risk rating (Table 5). We expect the risk ratings for both genetic variation and spawner composition to improve since out-of-ESU hatchery fish are no longer released in the Grande Ronde Basin and the hatchery fraction has been much lower in recent years.

Table 4. Spatial structure and diversity scoring table.

<table>
<tr><th rowspan="2">Metric</th><th colspan="5">Risk Assessment Scores</th></tr>
<tr><th>Metric</th><th>Factor</th><th>Mechanism</th><th>Goal</th><th>Population</th></tr>
<tr><td>A.1.a</td><td>M (0)</td><td>M (0)</td><td rowspan="3">Mean = (0.67)
Low Risk</td><td rowspan="3">Low Risk (0.67)</td><td rowspan="13">Moderate Risk</td></tr>
<tr><td>A.1.b</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>A.1.c</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.1.a</td><td>VL (2)</td><td>VL (20</td><td rowspan="3">Moderate (0)</td><td rowspan="10">Mean = (.25)
Moderate Risk</td></tr>
<tr><td>B.1.b</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.1.c</td><td>M (0)</td><td>M (0)</td></tr>
<tr><td>B.2.a(1)</td><td>H (-1)</td><td rowspan="4">High Risk
(-1)</td><td rowspan="4">High Risk (-1)</td></tr>
<tr><td>B.2.a(2)</td><td>L (1)</td></tr>
<tr><td>B.2.a(3)</td><td>L (1)</td></tr>
<tr><td>B.2.a(4)</td><td>VL (2)</td></tr>
<tr><td>B.3.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
<tr><td>B.4.a</td><td>L (1)</td><td>L (1)</td><td>L (1)</td></tr>
</table>

Overall Viability Rating:

The overall viability rating for the Wenaha River spring Chinook population does not meet viability criteria and is considered high risk (Figure 6). The 10-year geomean of natural origin abundance is 376 which is only 50.1% of the minimum abundance threshold of 750. The point estimate for productivity (0.74, Table 6) is in the high risk zone well below the 25% risk level. The spatial structure/diversity rating is moderate risk due to a moderate risk rating for genetic variation and a high risk rating for spawner composition. The ratings for both these SS/D criteria are significantly influenced by the stray out-of-ESU hatchery fish that were used in the Grande Ronde Basin from the late 1970s until the mid 1990s.

Abundance/ Productivity Risk	Spatial Structure/Diversity Risk →	**Very Low**	**Low**	**Moderate**	**High**
	Very Low (<1%)	HV	HV	V	M
	Low (1-5%)	V	V	V	M
	Moderate (6 – 25%)	M	M	M	
	High (>25%)			**Wenaha**	

Figure 6. Viable Salmonid Population parameter risk ratings for the Wenaha River Spring Chinook population. This population does not currently meet viability criteria. *Viability Key: HV – Highly Viable; V – Viable; M – Maintained; Shaded cells-- not meeting viability criteria (darkest cells are at greatest risk)*

Wenaha River Spring Chinook – Data Summary

Data type: Redd count expansions
SAR: Averaged Williams/CSS series

Table 5. Wenaha River Chinook run data (used for curve fits and R/S analysis). Data used in the productivity calculation (years where the parent escapement was less than 563) are bolded.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1981	**188**	**1.00**	**188**	**480**	**2.55**	**0.63**	**302**	**1.60**
1982	**254**	**1.00**	**254**	**418**	**1.64**	**0.51**	**214**	**0.84**
1983	**220**	**1.00**	**220**	**181**	**0.82**	**0.58**	**104**	**0.47**
1984	**115**	**1.00**	**115**	**41**	**0.36**	**1.65**	**68**	**0.59**
1985	**331**	**1.00**	**331**	**50**	**0.15**	**1.57**	**78**	**0.24**
1986	639	1.00	639	85	0.13	1.41	120	0.19
1987	**537**	**0.09**	**48**	**46**	**0.08**	**1.83**	**83**	**0.15**
1988	597	0.28	167	183	0.31	0.75	137	0.23
1989	**61**	**0.75**	**46**	**53**	**0.86**	**1.79**	**94**	**1.54**
1990	**298**	**0.22**	**67**	**11**	**0.04**	**4.65**	**53**	**0.18**
1991	**170**	**0.33**	**67**	**57**	**0.34**	**3.01**	**173**	**1.02**
1992	606	0.09	52	470	0.78	1.65	777	1.28
1993	**330**	**0.54**	**180**	**296**	**0.90**	**1.61**	**476**	**1.45**
1994	**143**	**0.20**	**29**	**153**	**1.07**	**1.04**	**160**	**1.12**
1995	**68**	**0.67**	**48**	**52**	**0.77**	**0.60**	**31**	**0.46**
1996	**409**	**0.98**	**401**	**594**	**1.45**	**0.54**	**323**	**0.79**
1997	**275**	**0.97**	**265**	**725**	**2.64**	**0.30**	**215**	**0.78**
1998	**250**	**0.98**	**246**	**864**	**3.46**	**0.30**	**257**	**1.03**
1999	**80**	**0.85**	**68**	**284**	**3.56**	**0.65**	**184**	**2.30**
2000	**462**	**0.97**	**450**	**633**	**1.37**	**1.00**	**633**	**1.37**
2001	881	0.85	750					
2002	674	0.96	651					
2003	539	1.00	539					
2004	634	0.98	624					
2005	448	0.94	422					

Table 6. Geomean abundance and productivity measures. Abundance and productivity values used in the current status assessment are boxed.

	R/S measures				Lambda measures		Abundance
	Not adjusted		SAR adjusted		Not adjusted		Nat. origin
delimited	median	75% threshold	median	75% threshold	1989-2000	1981-2000	geomean
Point Est.	1.14	0.75	0.98	0.74	1.05	1.10	376
Std. Err.	0.27	0.31	0.17	0.19	0.08	0.08	0.22
count	10	17	10	17	12	20	10

Table 7. Poptools stock-recruitment curve fit parameter estimates.

	Not adjusted for SAR							Adjusted for SAR						
SR Model	a	SE	b	SE	adj. var	auto	AICc	a	SE	b	SE	adj. var	auto	AICc
Rand-Walk	0.66	0.18	n/a	n/a	0.93	0.62	69.7	0.67	0.12	n/a	n/a	0.56	0.39	53.2
Const. Rec	161	43	n/a	n/a	n/a	n/a	68.5	162	29	n/a	n/a	n/a	n/a	52.9
Bev-Holt	1.85	1.67	275	167	0.84	0.60	69.8	1.58	0.88	312	145	0.43	0.42	51.2
Hock-Stk	0.96	0.41	211	112	0.86	0.57	69.2	1.05	0.17	188	0	0.45	0.36	51.2
Ricker	1.46	0.73	0.00261	0.00142	0.90	0.55	69.4	1.26	0.40	0.00210	0.00089	0.45	0.37	51.1

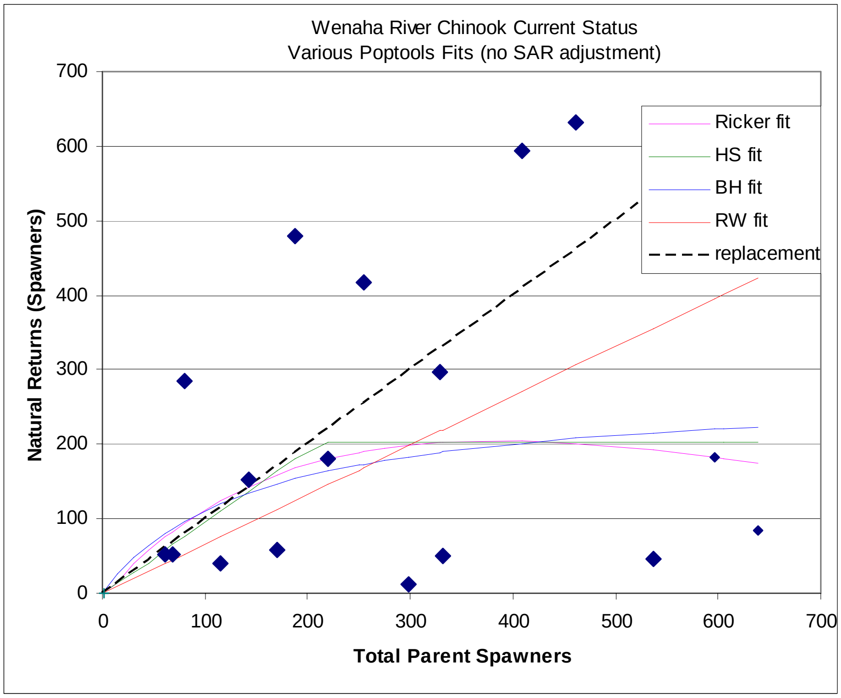

Figure 7. Stock recruitment curves for the Wenaha River Chinook population. Data not adjusted for marine survival. Points used in the current productivity calculation are bolded.

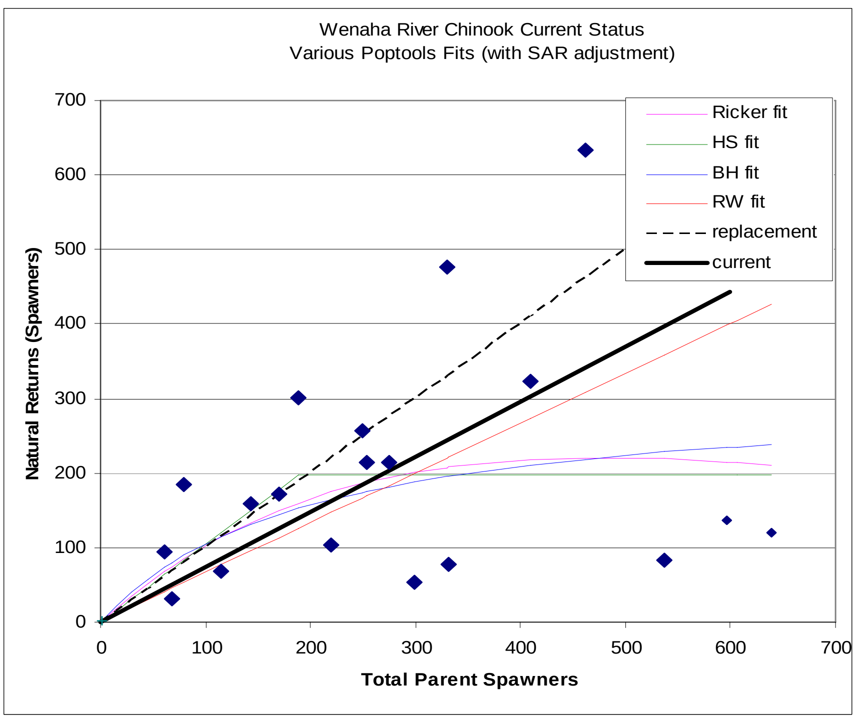

Figure 8. Stock-recruitment curves for the Wenaha River chinook population. Data adjusted for marine survival. Points used in the current productivity calculation are bolded.

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