Minam River Spring Chinook Population

The Minam 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 Minam River population is a spring run and is one of seven extant populations in the Grande Ronde / Imnaha MPG.

The ICTRT classified the Minam River population as an "intermediate" 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 750 abundance) to achieve a 5% or less risk of extinction over a 100-year timeframe.

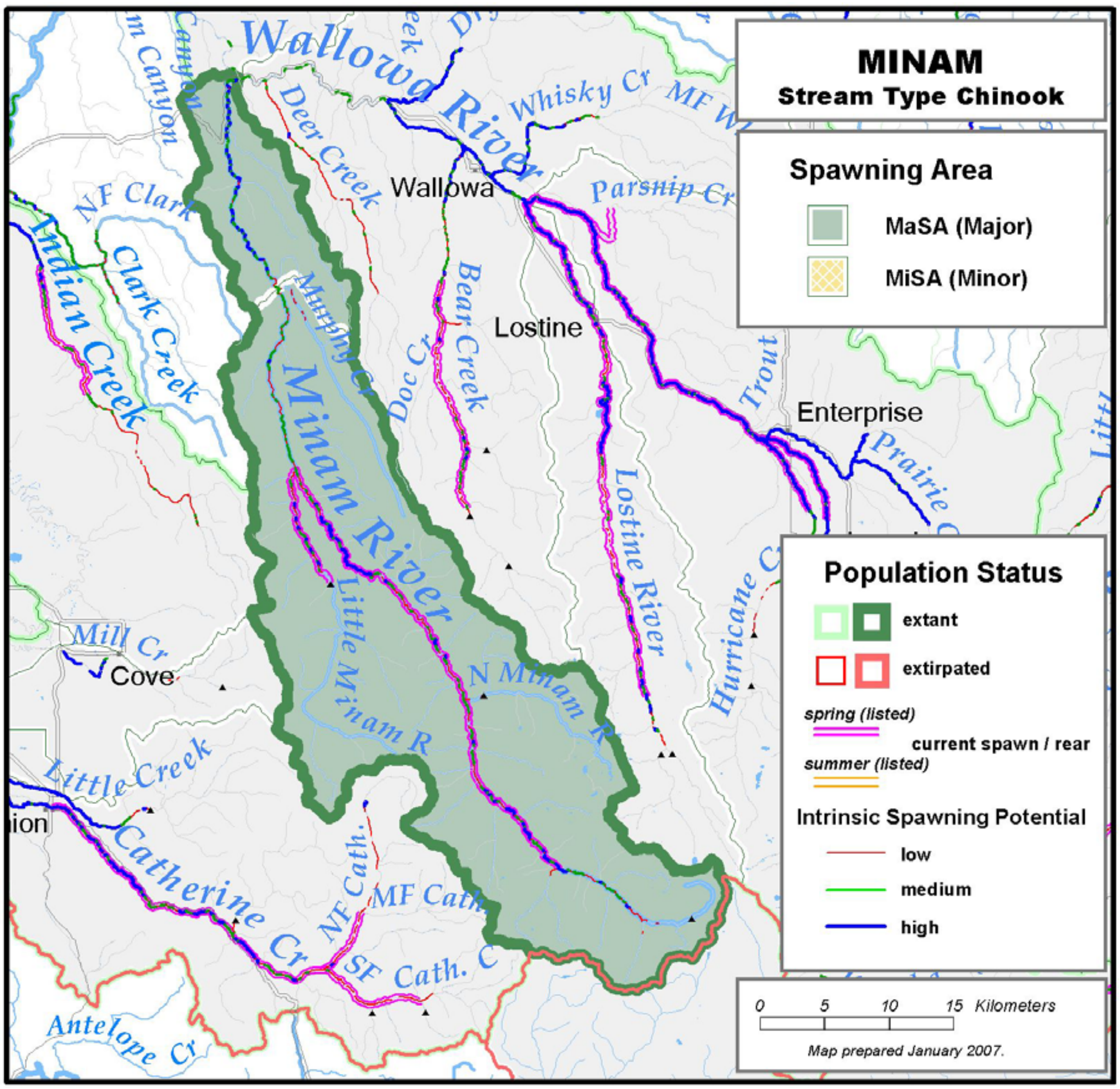

Figure 1. Minam River Spring Chinook Salmon population boundary and major (MaSA) and minor (MiSA) spawning areas.

Table 1. Minam River Chinook Spring Chinook Salmon population basin statistics and intrinsic potential analysis summary.

Drainage Area (km2)	618
Stream lengths km[a] (total)	304
Stream lengths km[a] (below natural barriers)	166
Branched stream area weighted by intrinsic potential (km2)	0.311
Branched stream area km2 (weighted and temp. limited)[b]	0.311
Total stream area weighted by intrinsic potential (km2)	0.418
Total stream area weighted by intrinsic potential (km2) temp limited[b]	0.418
Size / Complexity category	Intermediate / “A” (simple linear)
Number of Major Spawning Areas	2
Number of Minor Spawning Areas	0

[a]All stream segments greater than or equal to 3.8m bankfull width were included
[b]Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22^{o}C.

Current Abundance and Productivity

Current (1978 to 2005) abundance (number of adult spawners in natural production areas) has ranged from 54 (1994) to 1,446 (1978; 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 Minam River.

Spawning ground surveys have been conducted once annually in index survey reaches since 1954. The index survey was extended upstream in 1964 to include most or all of known mainstem spawning habitat. Index surveys were conducted most years from 1954 through 1975 in the Little Minam River. This survey was discontinued from 1975-1992, when it was again surveyed once annually including additional spawning habitat in the Little Minam River. Multiple pass surveys (three times annually) were conducted in portions or all of the lower mainstem beginning in 1987 and in both lower and upper mainstem spawning reaches in 1996. (Tranquilli et al. 2004). 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).

We estimate each season’s total number of redds by first summing the number of redds observed during the first pass survey in the lower and upper mainstem of the Minam River and in the Little Minam River. For years when the Little Minam River was not surveyed, we assume the number of redds in the Little Minam River are the proportion of total redds in the Minam watershed that had been observed in the Little Minam River (on average this represents 0.26, 1992 – 2005). To account for spawning that occurs after the index survey in those years and reaches where multiple surveys were not conducted, we: 1) sum the area and time census survey observations in the Minam River mainstem (1996 – 2005); 2) sum the area first-pass observations and adjust them upwards with a temporal expansion factor derived from subsample observations during second and third pass surveys (1987 – 1995 in the lower Minam mainstem and 1996 – 2005 in the upper Minam mainstem); 3) sum the area first-pass observations and adjust them upwards with a temporal expansion factor derived from the average of subsample observations during second and third pass surveys (0.57, 1978 – 1985 in the lower Minam mainstem; 0.77, 1978 – 1995 in the upper Minam mainstem); and 4) assume that temporal expansion factors to apply to the Little Minam River single-pass survey observations are similar to the upper Minam River, based on similar spawning habitat conditions due to elevation, temperature, and gradient.

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 time series.

To estimate the abundance of 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 with addition of discriminant scale analysis for the pre-1995 time period. Hatchery-origin jacks are believed to be underrepresented in the spawning ground carcass samples, and we estimate the jack hatchery fraction based on hatchery rack returns at Lookingglass Fish Hatchery (1987 – 2001) and fish trapped at Lostine Weir (2002 – 2005).

To estimate abundance of progeny by brood year, we apportion natural-origin adult spawners into brood year cohorts 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 Minam 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 Minam River to a length-at-age relationship developed with samples from 1987 – 2000. In 1979 through 1982, when no age samples were available, we used the average proportion at age by return year observed for the Minam River.

Recent year natural spawners include returns originating from naturally spawning parents, and hatchery strays primarily produced from Lookingglass Fish Hatchery releases in the Grande Ronde Basin. Prior to 1995 strays were strictly of Carson and Rapid River hatchery stock origin. In recent years strays originated from local broodstock sources from other Grande Ronde population hatchery supplementation programs. Natural-origin spawners have comprised an average of 92% of total spawners since 1952, while the most recent 10-year average is 96% (Table 2).

Abundance in recent years has generally remained in the 200-600 spawner range, and the recent 10-year geomean number of natural-origin spawners was 337 (Table 2). During the period 1981-2000, returns per spawner for Chinook in Minam River ranged from 0.02 (1990) to 7.70 (1981). The most recent 20 year (1981-2000) SAR adjusted and delimited (at 75% of the 750 threshold) geometric mean of returns per spawner was 1.02 (Table 2).

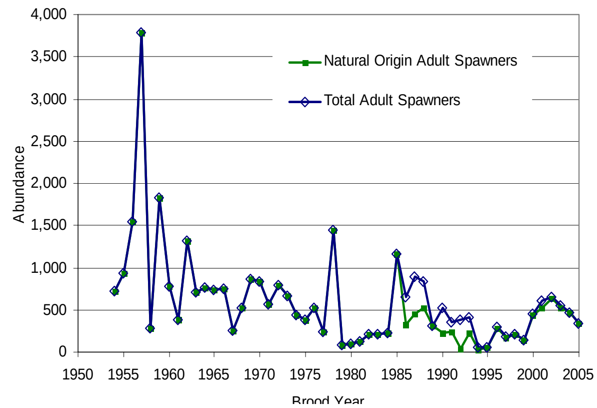

Figure 2. Minam River Spring Chinook Salmon population spawner abundance estimates (1954-2005).

Table 2. Minam River Spring Chinook Salmon population abundance and productivity estimates.

10-year geomean natural abundance	337
20-year return/spawner productivity	0.80
20-year return/spawner productivity, SAR adj. and delimited[a]	1.02
20-year Bev-Holt fit productivity, SAR adjusted	3.26
20-year Lambda productivity estimate	1.05
Average proportion natural origin spawners (recent 10 years)	0.96
Reproductive success adj. for hatchery origin spawners	n/a

[a]Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the size 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 Minam River Chinook population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3).

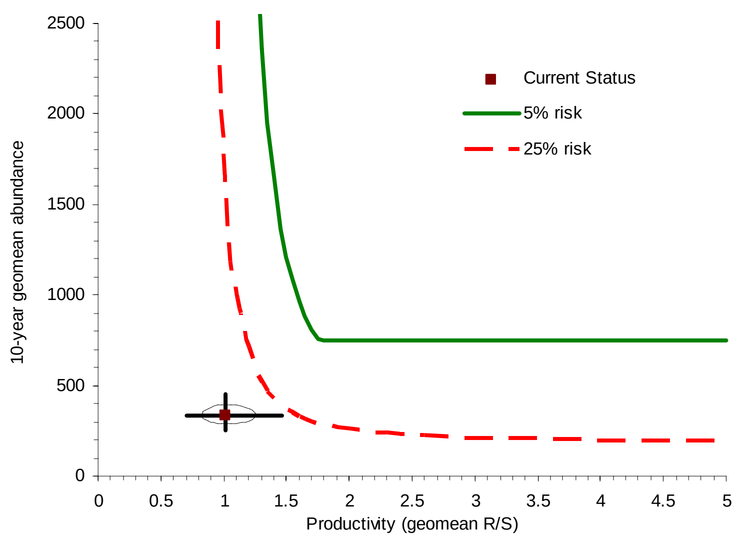

Figure 3. Minam River Spring Chinook Salmon current estimate of abundance and productivity compared to the viability curve for this ESU. The point estimate includes a 1 SE ellipse and 95% CI (1.81 X SE abundance line, and 1.73 X SE productivity line).

Spatial Structure and Diversity

The ICTRT has identified two major spawning areas (MaSAs) and no minor spawning areas (MiSAs) within the Minam River Spring Chinook population (Figure 4). There are no modeled temperature limitations for this population. Current spawning distribution is believed to be identical to historic. Current spawning occurs primarily in the mainstem Minam River from the headwaters downstream to the confluence with the Little Minam River and in the Little Minam River. Recent surveys have indicated some use in the lower Minam. Spawners in recent years (1995-2005) were primarily natural-origin fish. No hatchery releases have occurred in the Minam. Strays of Carson and Rapid River stock origin comprised a significant proportion of spawners from 1986-1994. Use of these outside basin stocks was discontinued and local broodstocks from the Lostine, Catherine Creek and Upper Grande Ronde River populations are now used for supplementation under the LSRCP program. Recent years strays were from these local broodstock supplementation programs.

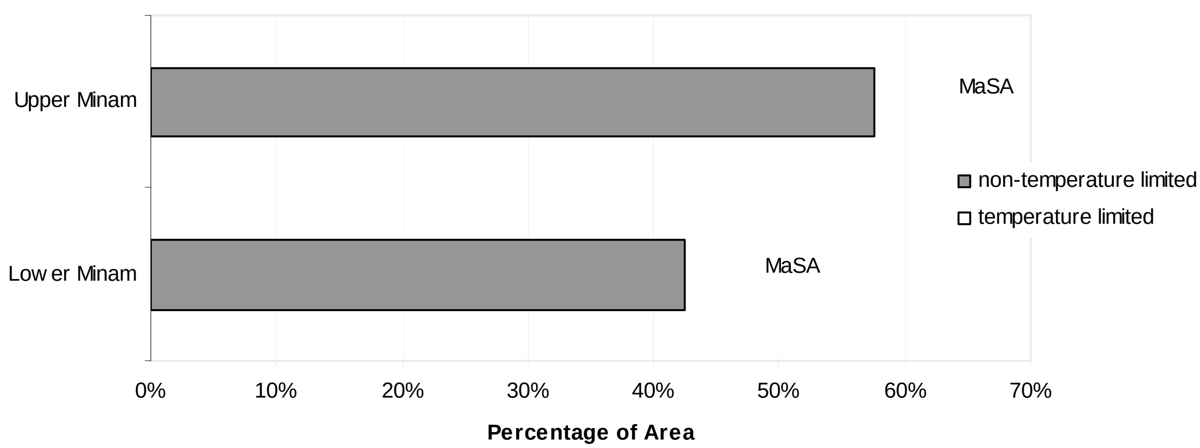

Figure 4. Minam River Spring Chinook Salmon population distribution of intrinsic potential habitat across major and minor spawning areas.

Factors and Metrics

<u>A.1.a. Number and spatial arrangement of spawning areas.</u>

The Minam River spring Chinook population has two MaSAs and no MiSAs. Although the Little Minam River supports production outside of the mainstem, it does not have sufficient habitat quantity to meet MaSA criteria. The area of weighted habitat in the two MaSAs is greater than the minimum quantity needed for three MaSAs; however, the continuous connected spawning distribution results in only two MaSAs. Based on spawning ground surveys conducted for well over three generations, the upper MaSA is currently occupied. Spawning surveys conducted in the early 1950’s documented spawning in the lower Minam MaSA. In 2005, ODFW surveyed six miles in the lower Minam and documented use. The current distribution map needs to be updated to reflect current use. It should be noted that due to the confined nature and predominant boulder/cobble substrate in most of the lower Minam, there is limited spawning gravel. Because the Minam population is an "A" type with a linear distribution, it rates as **moderate risk** for this metric.

<u>A.l.b. Spatial extent or range of population.</u>

The current spawner distribution is similar to the historical distribution. Current distribution on the map should be extended to the confluence with the Wallowa River (Figure 5). The current spatial extent and range criteria for the Minam population is rated at **low risk**.

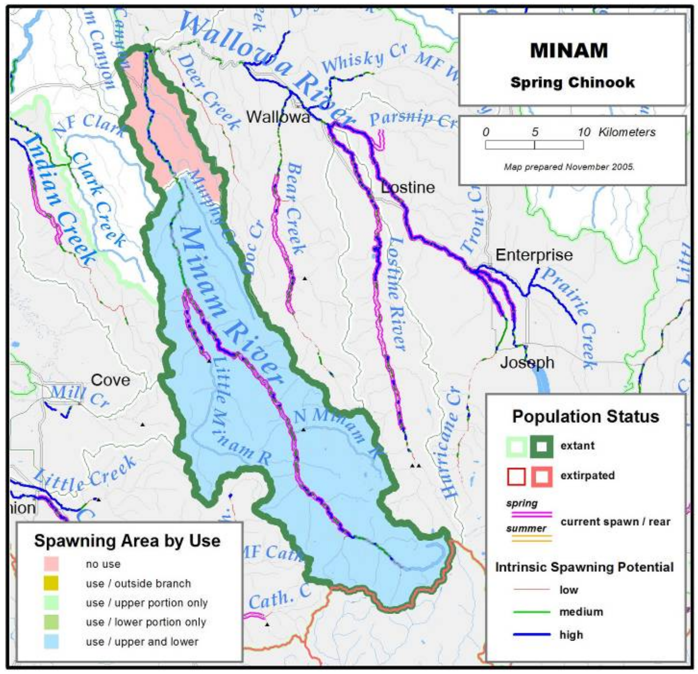

Figure 5. Minam River Spring Chinook Salmon population current spawning distribution and spawning area occupancy designations..

<u>A.1.c. Increase or decrease in gaps or continuities between spawning areas.</u>

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 Minam population rates at **low risk** for gaps.

<u>B.1.a. Major life history strategies.</u>

Limited information exists to evaluate changes in life history patterns for the Minam River Chinook salmon. Therefore, we use habitat information and subbasin plan EDT analyses to infer changes in life history strategies. A majority of Minam 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 in the Grande Ronde Basin provide conditions for expression of a variety of life history strategies. Recently collected juvenile life history information indicates that the typical spring Chinook fall redistribution pathway is utilized by this population. 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. Changes in mainstem Snake River and Columbia River hydrograph and temperatures have altered migration patterns, survival rates, and changed relationships of migration timing and survival. We do not know the extent of impact but do not believe any traits have been lost. We have rated the Minam 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.

B.1.c. Genetic variation.

The Minam 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/Imnaha 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. The samples show moderate interannual variation.

B.2.a. Spawner composition.

(1) *Out-of-ESU spawners*. From the early 1980s through the mid-1990s, 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 15.9% of the natural spawners in the Minam River population. This level results in a **high risk** rating.

(2) *Out-of-MPG spawners from within the ESU*. The mean percent out-of-MPG hatchery fraction from 1991-2005 was 0 thus the rating for this metric is **very low risk**.

(3) *Out of population within MPG spawners*. Strays from local Grande Ronde broodstock sources were first observed in 2000 when adults from the supplementation programs began to return. The mean percent out of population within MPG hatchery fraction for the period 2000-2005 was 0.4. 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 Minam 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 spawner fraction.

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

The intrinsic distribution of the Minam population encompassed two level 4 ecoregions that accounted for more than 10% of the distribution (Figure 6, Table 3). The lower reaches of the Minam have limited gravel for spawning. Current distribution should include the lower Minam MaSA and current distribution is believed to be similar to historic, thus no change has occurred. We have rated the population at **low risk** because there are two ecoregions and no substantial change from historic distribution.

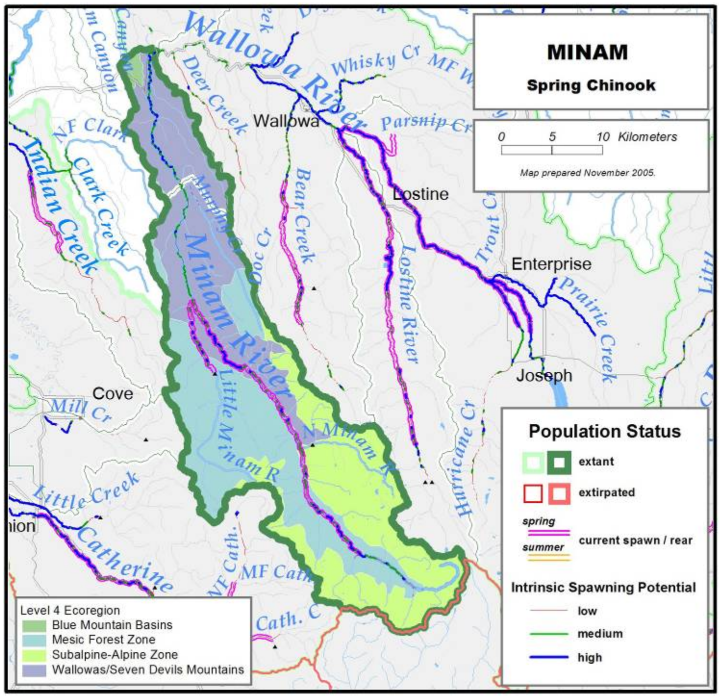

Figure 6. Minam River Spring Chinook Salmon population spawning distribution across EPA level 4 ecoregions.

Table 3. Minam River Spring Chinook Salmon population proportion of current spawning areas across EPA level 4 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)
Mesic Forest Zone	24.0	24.0	41.6
Subalpine-Alpine Zone	2.7	2.7	5.6
Wallowas/Seven Devils Mountains	73.3	73.3	52.8

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 upstream migrating adults 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 affected population component, thus we have rated this metric as **low risk**.

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 Minam 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 Minam 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 is similar to the intrinsic distribution. The population is distributed throughout the Minam River mainstem and in the Little Minam River. 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 ratings for genetic variation and spawner composition. 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 Minam 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. Minam River Spring Chinook Salmon population spatial structure and diversity risk rating summary.

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	M (0)	M (0)	Mean = (0.67) Low Risk	Low Risk (0.67)	**Moderate Risk**
A.1.b	L (1)	L (1)			
A.1.c	L (1)	L (1)			
B.1.a	VL (2)	VL (20	Moderate (0)	Mean = (.25) Moderate Risk	
B.1.b	L (1)	L (1)			
B.1.c	M (0)	M (0)			
B.2.a(1)	H (-1)	High Risk (-1)	High Risk (-1)		
B.2.a(2)	VL (2)				
B.2.a(3)	L (1)				
B.2.a(4)	VL (2)				
B.3.a	L (1)	L (1)	L (1)		
B.4.a	L (1)	L (1)	L (1)		

Overall Viability Rating:

The overall viability rating for the Minam River spring Chinook population does not meet viability criteria and is considered high risk (Figure 7). The 10-year geomean of natural origin abundance is 337 which is only 44.9% of the minimum abundance threshold of 750. The point estimate for productivity (1.02, Table 6) is in the high risk zone 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 1970's until the mid 1990's.

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

Figure 7. Minam River Spring Chinook Salmon population risk ratings integrated across the four viable salmonid population (VSP) metrics. *Viability Key: HV – Highly Viable; V – Viable; M – Candidate for Maintained; Shaded cells-- not meeting viability criteria (darkest cells are at greatest risk).*

Minam River Spring Chinook – Data Summary

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

Table 5. Minam River Spring Chinook population abundance and productivity data used for curve fits and R/S analysis. Bolded values were used in estimating the current productivity (Table 6).

Brood Year	Adult Spn.	%Wild	Nat. Adults	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1981	**130**	**1**	**130**	**998**	**7.70**	**0.63**	**627**	**4.84**
1982	**212**	**1**	**212**	**271**	**1.28**	**0.51**	**138**	**0.65**
1983	**216**	**1**	**216**	**718**	**3.32**	**0.58**	**413**	**1.91**
1984	**233**	**1**	**233**	**269**	**1.16**	**1.65**	**445**	**1.91**
1985	1,163	1	1,163	289	0.25	1.57	454	0.39
1986	649	0.50	322	291	0.45	1.41	411	0.63
1987	892	0.50	450	129	0.14	1.83	235	0.26
1988	842	0.63	525	178	0.21	0.75	132	0.16
1989	**308**	**1**	**308**	**100**	**0.33**	**1.79**	**179**	**0.58**
1990	**525**	**0.44**	**231**	**12**	**0.02**	**4.65**	**54**	**0.10**
1991	**352**	**0.62**	**238**	**62**	**0.18**	**3.01**	**188**	**0.53**
1992	**389**	**0.10**	**37**	**300**	**0.77**	**1.65**	**495**	**1.27**
1993	**411**	**0.56**	**232**	**327**	**0.79**	**1.61**	**525**	**1.28**
1994	**54**	**0.56**	**30**	**102**	**1.90**	**1.04**	**106**	**1.98**
1995	**62**	**1**	**62**	**85**	**1.37**	**0.60**	**51**	**0.82**
1996	**299**	**0.95**	**285**	**571**	**1.91**	**0.54**	**310**	**1.04**
1997	**184**	**0.96**	**177**	**565**	**3.07**	**0.30**	**167**	**0.91**
1998	**209**	**1**	**209**	**813**	**3.88**	**0.30**	**241**	**1.15**
1999	**149**	**0.95**	**142**	**313**	**2.11**	**0.65**	**203**	**1.37**
2000	**448**	**0.99**	**443**	**405**	**0.90**	**1.00**	**405**	**0.90**
2001	608	0.87	526					
2002	650	0.98	638					
2003	550	0.94	526					
2004	468	0.99	462					
2005	346	1	346					

Table 6. Minam River Spring Chinook Salmon population geometric mean abundance and productivity estimates (values used for current productivity and abundance are shown in boxes).

	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.	2.33	1.08	1.40	1.02	1.02	1.05	337
Std. Err.	0.19	0.35	0.18	0.21	0.16	0.16	0.16
count	10	16	10	16	12	20	10

Table 7. Minam River Spring Chinook Salmon population stock-recruitment curve fit parameter estimates. Biologically unrealistic or highly uncertain values are highlighted in grey.

	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	0.80	0.24	n/a	n/a	1.11	0.63	73.7	0.81	0.16	n/a	n/a	0.69	0.34	56.4
Const. Rec	232	53	n/a	n/a	n/a	n/a	62.2	234	37	n/a	n/a	n/a	n/a	47.6
Bev-Holt	18.67	83.60	247	87	0.78	0.49	64.9	3.26	2.04	338	96	0.40	0.18	46.8
Hock-Stk	1.94	0.42	130	0	0.69	0.52	63.2	1.96	0.27	130	0	0.37	0.17	44.8
Ricker	2.66	1.01	0.00311	0.00079	0.78	0.50	65.0	1.77	0.43	0.00204	0.00051	0.40	0.26	47.3

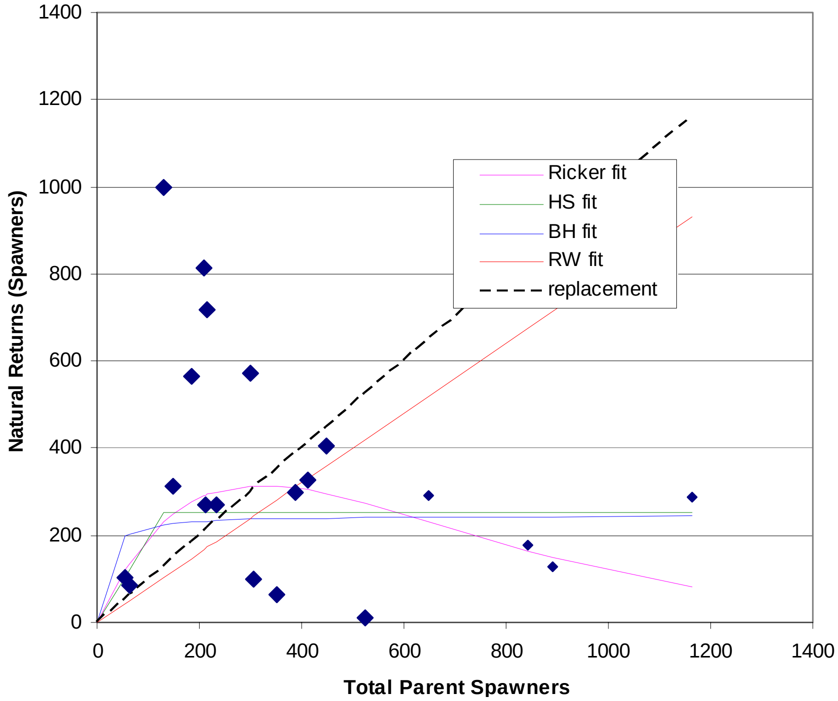

Figure 8. Minam River Spring Chinook Salmon population stock recruitment curves. Bold points were used in estimating the current productivity. Data were not adjusted for marine survival.

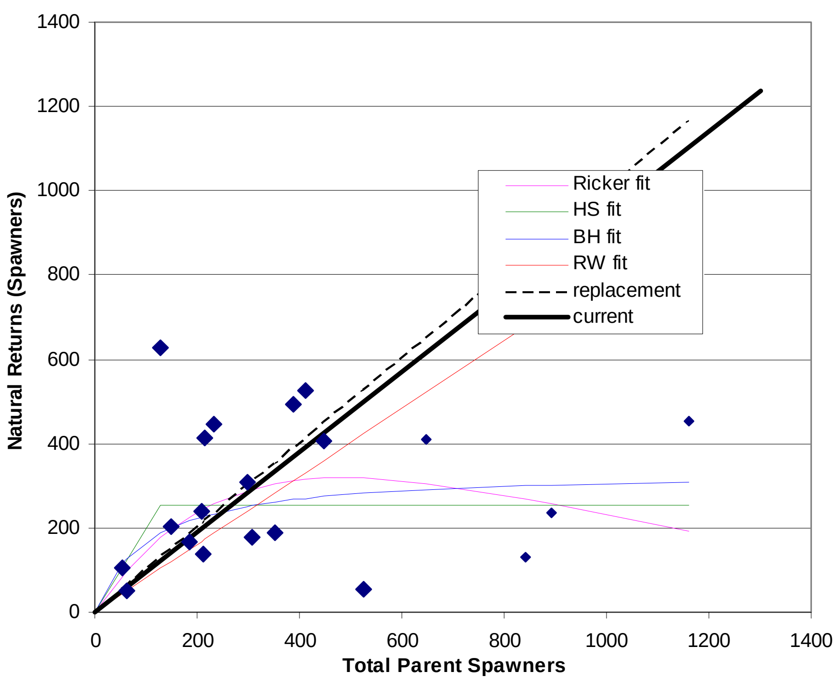

Figure 9. Minam River Spring Chinook Salmon population stock recruitment curves. Bold points were used in estimating the current productivity. Data not adjusted for marine survival.