Big Creek Spring/Summer Chinook Salmon Population

The Big Creek Spring/Summer 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 both spring and summer run chinook. The Big Creek population is a spring/summer run and is one of nine extant populations in the Middle Fork Salmon River MPG.

The ICTRT classified the Big Creek population as a "large" population (Table 1) based on historical habitat potential (ICTRT 2005). A chinook population classified as large has a mean minimum abundance threshold criteria of 1000 naturally produced spawners with a sufficient intrinsic productivity to achieve a 5% or less risk of extinction over a 100-year timeframe.

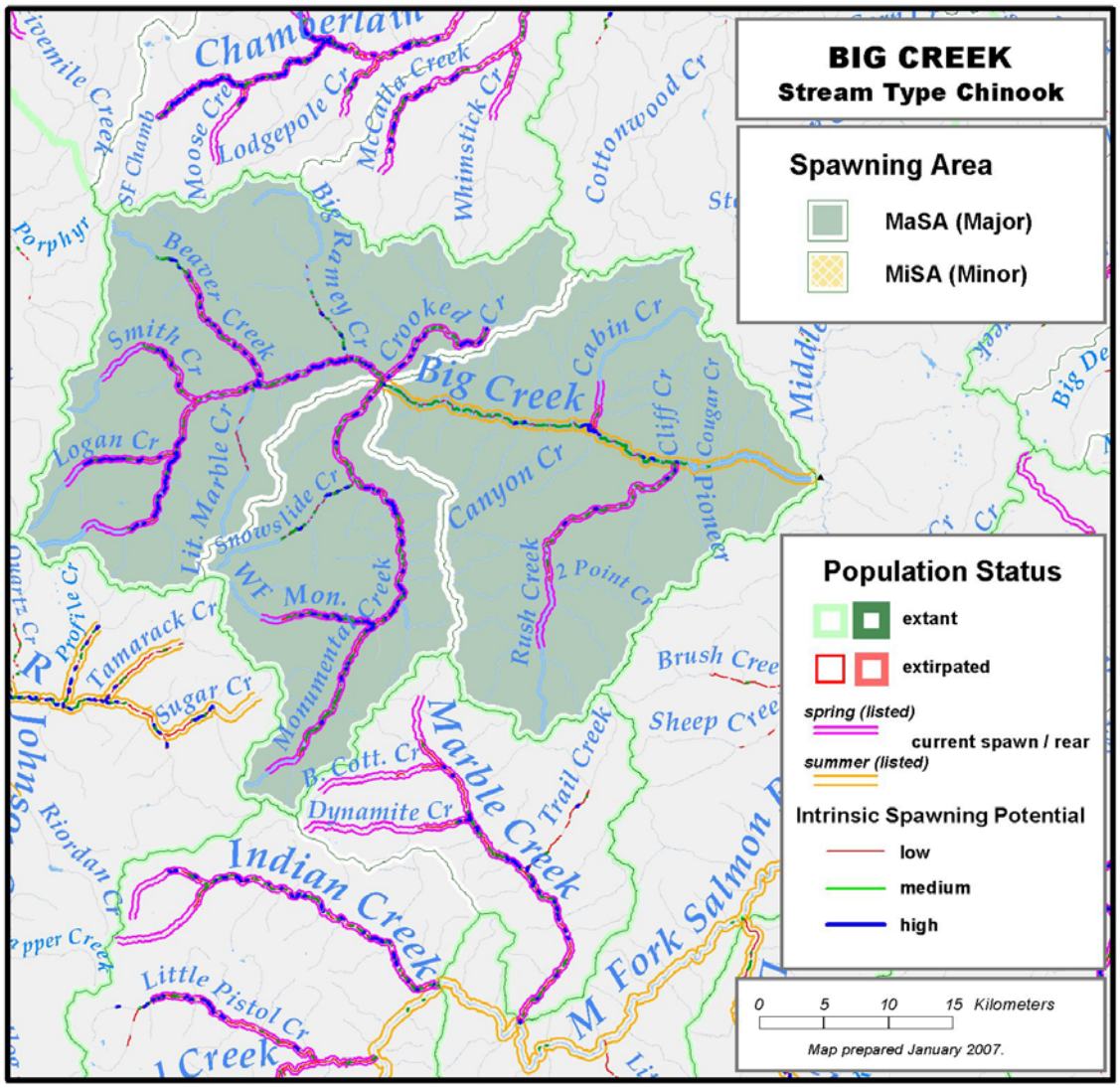

Figure 1. Big Creek Spring/Summer Chinook salmon population boundary and major (MaSA) and minor (MiSA) spawning areas.

Table 1. Big Creek Spring/Summer Chinook salmon population basin statistics and intrinsic potential analysis summary.

Drainage Area (km2)	1,543
Stream lengths km (total)[a]	567
Stream lengths km (below natural barriers)[a]	466
Branched stream area weighted by intrinsic potential (km2)	0.390
Branched stream area km2 (weighted and temp. limited)[b]	0.390
Total stream area weighted by intrinsic potential (km2)	0.577
Total stream area weighted by intrinsic potential (km2) temp limited[b]	0.577
Size / Complexity category	Large / "B" (Dendritic structure)
Number of Major Spawning Areas	3
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°C.

Current Abundance and Productivity

Current (1957 to 2004) abundance (number of adult spawning in natural production areas) has ranged from 5 in 1996 to 1,858 in 1961 (Figure 2). Abundance estimates are based on expanded redd counts.

Recent year natural spawners include returns originating from naturally spawning parents, no known strays. Spawners originating from naturally spawning parents have comprised nearly 100% since 1957 (Table 2).

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 94 (Table 2). During the period 1980-1999, returns per spawner for chinook in Big Creek ranged from 0.10 (1981) to 14.6 (1980). The most recent 20 year (1978-1997) SAR adjusted and delimited (at 75% of the size category threshold) geometric mean of returns per spawner was 1.25 (Table 2).

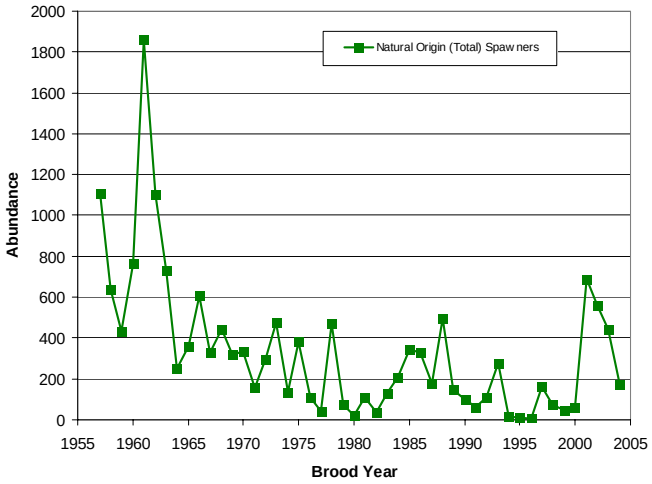

Figure 2. Big Creek Spring/Summer Chinook salmon population spawner abundance estimates (1957-2004).

Table 2. Big Creek Spring/Summer Chinook salmon population abundance and productivity estimates.

10-year geomean natural abundance	94
20-year return/spawner productivity	1.23
20-year return/spawner productivity, SAR adj. and delimited[a] at 75% of the threshold	1.25
20-year Bev-Holt fit productivity, SAR adjusted	n/a
20-year Lambda productivity estimate	n/a
Average proportion natural origin spawners (recent 10 years)	1.0
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 category threshold. This approach attempts to remove density dependence effects that may influence the productivity estimate.

Comparison to the Viability Curve

- Abundance: 10-yr geomean natural origin spawners
- Productivity: 20-yr geomean R/S (adjusted for marine survival and delimited at 750 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Big Creek population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3).

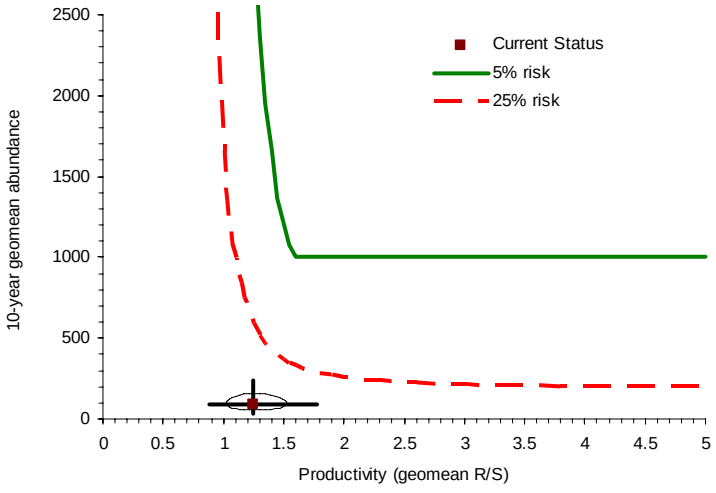

Figure 3. Big Creek Spring /Summer Chinook salmon current estimate of abundance and productivity compared to the viability curve for this ESU. Point estimate includes a 1 SE ellipse and 95% CI (1.81 X SE abundance line, and 1.73 X SE productivity line).

Spatial Structure and Diversity

The ICTRT has identified three major spawning areas (MaSAs) and no minor spawning areas (MiSAs) within the Big Creek Spring/Summer Chinook population. Spawning is distributed throughout the population, but typically is concentrated in the upper Big Creek MaSA, a spring Chinook salmon production area.

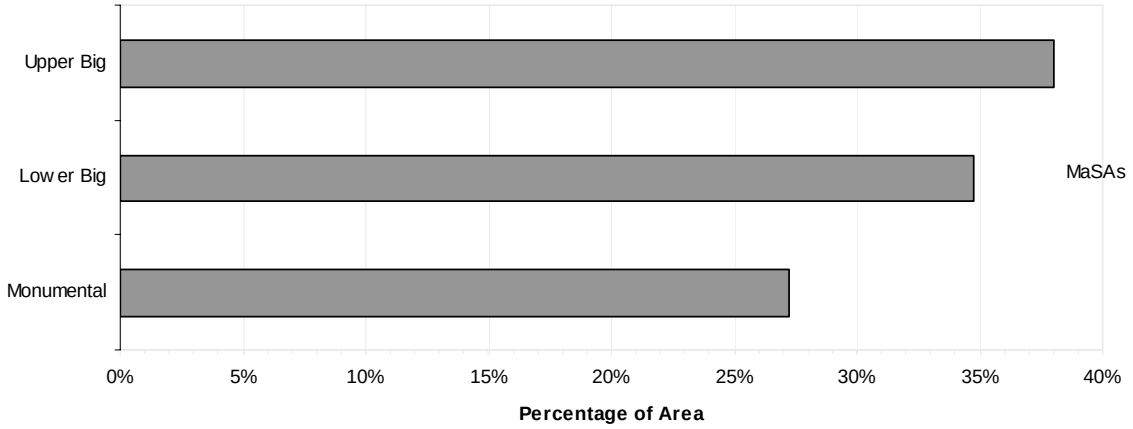

Figure 4. Big Creek Spring/Summer Chinook salmon population distribution of intrinsic potential habitat across major and minor spawning areas.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.

The Middle Fork Salmon Big Creek population of spring/summer Chinook has three MaSAs (Lower Big Creek, Upper Big Creek and Monumental) in a non-linear configuration. The total branched stream area weighted by intrinsic potential is 390,378 m2. Historically the majority of spawners used the Upper Big MaSA. The spatial arrangement of spawning areas results in a *Low Risk* rating for this metric.

A.l.b. Spatial extent or range of population.

The IDFG has conducted annual spawner index counts since 1957 in Big Creek from Jacobs Ladder Creek downstream to the mouth of Big Creek. The time series of counts covers nearly all years for the index area from Jacobs Ladder Creek to Logan Creek. Index counts were not conducted in many years downstream of Logan Creek. Monumental Creek was never included in the index counts. Since 1995 researchers from the USFS-Rocky Mountain Research Station have been surveying all potential spawning habitat in the basin. This metric is rated *Very Low Risk* because current spawning distribution mirrors historical and the historical range has not been reduced. All MaSAs are occupied at both the lower and upper ends based on recent spawner surveys.

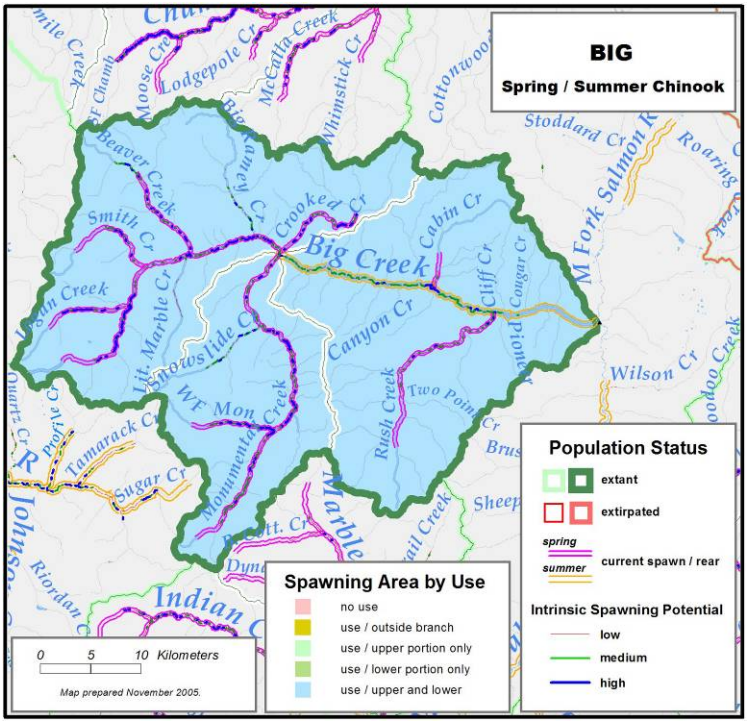

Figure 5. Big Creek Spring/Summer Chinook salmon population current spawning distribution and spawning area occupancy designations.

A.1.c. Increase or decrease in gaps or continuities between spawning areas.

There has been no change in gaps when comparing current and historical spawning distribution. The population is rated at *Very Low* risk because all historical MaSAs are occupied, gap distance and continuity have not changed, and there has been no increase in distance between this population and other populations in the MPG or ESU.

B.1.a. Major life history strategies.

There are limited data to allow any comparisons between historic and current life history strategies. The IDFG classifies adult spawners using the upper portions of the basin as spring run, and spawners in the lower reaches as summer run timing. The known major juvenile life history strategy is a spring yearling migrant. No natural or anthropogenic impacts that could have

resulted in loss of a life history strategy are known to have occurred. It appears all historic juvenile and adult life history strategies are present, but because data is limited the metric is rated *Low Risk*.

B.1.b. Phenotypic variation.

There is no data to indicate that any phenotypic traits have been significantly changed or lost. No alterations of within-basin habitat conditions that could have resulted in loss of a phenotypic trait are known to have occurred. No major selective pressures exist which would cause significant changes in or loss of traits. Changes in the mainstem migration corridor (lower Snake and Columbia rivers) likely have altered timing of juvenile downstream passage and adult upstream passage. Because smolt entry into the estuary is substantially delayed relative to historic conditions, this metric is rated at *Low Risk.*

B.1.c. Genetic variation.

Genetic ratings were based on IC-TRT analysis of allozyme data presented in Waples et al. 1993. In addition, the IC-TRT analyzed WDFW and R. Waples, unpublished allozyme data, and P. Moran, unpublished microsatellite data. Some within population spatial differentiation is apparent, but only one year of sampling was available. This metric was rated *Moderate Risk.*

B.2.a. Spawner composition.

Spawner composition is determined from spawning ground carcass recoveries. Any marked fish that are recovered are examined for the presence of a coded-wire or PIT tag. The entire Middle Fork Salmon River MPG is managed by the IDFG as a wild production area with no hatchery intervention. While carcass surveys have been conducted annually in many of the core spawning areas in the MPG, extremely few hatchery strays have been documented. Assessment of this metric is restricted to the observation of only hatchery strays.

(1) *Out-of-ESU strays*. No out-of-ESU strays have been detected spawning in the population and this metric is rated *Very Low* risk.

(2) *Out-of-MPG strays from within the ESU*. Potential out-of-MPG fish that could stray into this population would originate from hatcheries in the downstream South Fork Salmon River MPG or upstream Upper Salmon River MPG. An exhaustive review of all spawner carcass data has not been completed however, it is possible that one or two hatchery strays were observed in the population across all survey years. The occurrence of that small number of strays is not suspected of increasing risk to the population and this metric is rated *Very Low* risk.

(3) *Out of population within MPG strays*. There is no within-MPG hatchery program, and this metric is rated *Very Low Risk*.

(4) *Within-population hatchery spawners.* There is no within population hatchery program, and this metric is rated *Very Low* risk.

The overall risk rating for metric B.2.a “spawner composition” is *Very Low Risk* since the population and entire MPG are managed for wild production and essentially no hatchery strays have been observed spawning in the population.

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

The Big Creek population intrinsic potential distribution historically was distributed across two EPA level IV ecoregions, with the Southern Forested Mountains being predominant. The current distribution is nearly identical to the historic intrinsic distribution (Table 3 and Fig. 6). There are no substantial changes in ecoregion occupancy and this metric was rated *Low Risk* for the population.

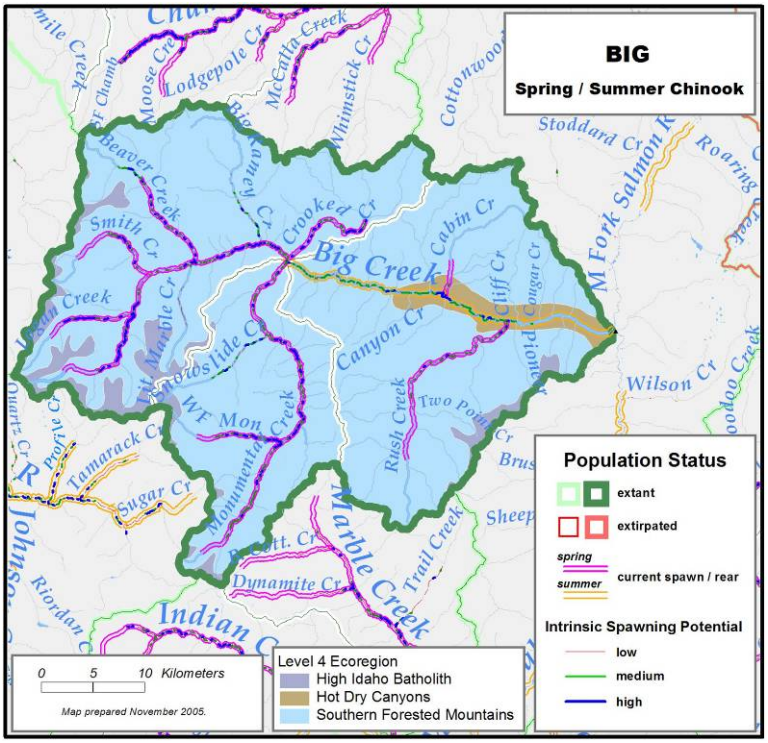

Figure 6. Big Creek Spring/Summer Chinook salmon population spawning distribution across EPA level 4 ecoregions.

Table 3. Big Creek Spring/Summer 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)
Hot Dry Canyons	25.7	25.7	21.5
Southern Forested Mountains	74.3	74.3	78.5

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

Hydropower system: The hydrosystem and associated reservoirs impose some selective mortality on smolt outmigrants and adult migrants, the selective mortality is not likely to remove more than 25% of the affected individuals. The likely impacts are rated as *Low Risk* for this action.

Harvest: Recent harvest rates for spring/summer Chinook salmon are generally less than 10% annually. There are no freshwater fisheries directly targeting wild spring/summer Chinook salmon; indirect mortalities are expected to occur in some fisheries selective for hatchery fish. It is not likely that the incidental mortality is selective for a particular group of fish or if it is, it

would not select 25% or more of that particular group, therefore this action was rated as *Very Low* risk.

Hatcheries: The proportion of hatchery strays has always been estimated as 0%. This selective impact was rated *Very Low Risk*.

Habitat: Habitat changes resulting from natural events or anthropogenic impacts may impose some selective mortality, but the extent is unknown. Habitat in the basin has been impacted by mining activities and naturally occurring forest fires. It is likely that any selective mortality imposed as a result of habitat alterations in the basin would impact a non-negligible portion of the population. This selective impact was rated *Very Low Risk*.

Spatial Structure and Diversity Summary

Overall spatial structure and diversity has been rated *Moderate Risk* for the Big Creek population (Table 4). The *Moderate* risk rating assigned to this population is driven by the genetic variation score (metric B.1.c.) which in turn is influenced by a very limited number of samples. It is very possible the actual risk for the genetic variation metric is Low or Very Low, and the population's overall spatial structure/diversity risk is Low.

Table 4. Big Creek Spring/Summer Chinook salmon population spatial structure and diversity risk rating summary.

<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>L (1)</td><td>L (1)</td><td rowspan="3">Very Low risk
(Mean=1.67)</td><td rowspan="3">Very Low</td><td rowspan="15">Moderate Risk</td></tr>
<tr><td>A.1.b</td><td>VL (2)</td><td>VL (2)</td></tr>
<tr><td>A.1.c</td><td>VL (2)</td><td>VL (2)</td></tr>
<tr><td>B.1.a</td><td>L (1)</td><td>L (1)</td><td rowspan="3">Moderate Risk</td><td rowspan="9">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>VL (2)</td><td rowspan="4">VL (2)</td><td rowspan="4">Very Low Risk</td></tr>
<tr><td>B.2.a(2)</td><td>VL (2)</td></tr>
<tr><td>B.2.a(3)</td><td>VL (2)</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>Low Risk</td></tr>
<tr><td>B.4.a</td><td>L (1)</td><td>L (1)</td><td>Low risk</td></tr>
</table>

Overall Viability Rating

The Big Creek Spring/Summer Chinook salmon population does not currently meet viability criteria because Abundance/Productivity risk is high (Table 5). The 20-year delimited recruit per

spawner point estimate (1.25) is less than the 1.45 required at the minimum threshold abundance. The 10-year geometric mean abundance is only 9% of the minimum threshold abundance. Improvement in abundance/productivity status (reduction of risk level) will need to occur before the population can be considered viable. Also, the population currently does not meet the criteria for a "maintained" population, but could potentially achieve this rating pending resolution of data on genetic variation.

		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%)			**Big Creek**	

Figure 7. Big Creek Spring/Summer 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 – does not meet viability criteria (darkest cells are at greatest risk).*

Big Creek Spring/Summer Chinook – Data Summary

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

Table 5. Big Creek Spring/Summer Chinook salmon 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	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	SAR Adj. Factor	Adj. Rtns	Adj. R/S
1980	**20**	**1**	**20**	**288**	**14.62**	**0.58**	**168**	**8.52**
1981	**108**	**1**	**108**	**413**	**3.81**	**0.63**	**260**	**2.40**
1982	**35**	**1**	**35**	**177**	**5.13**	**0.51**	**90**	**2.62**
1983	**133**	**1**	**133**	**433**	**3.25**	**0.58**	**249**	**1.87**
1984	**207**	**1**	**207**	**237**	**1.14**	**1.65**	**392**	**1.89**
1985	**345**	**1**	**345**	**106**	**0.31**	**1.57**	**166**	**0.48**
1986	**330**	**1**	**330**	**93**	**0.28**	**1.41**	**131**	**0.40**
1987	**177**	**1**	**177**	**51**	**0.29**	**1.83**	**93**	**0.53**
1988	**498**	**1**	**498**	**297**	**0.60**	**0.75**	**222**	**0.44**
1989	**148**	**1**	**148**	**57**	**0.39**	**1.79**	**103**	**0.69**
1990	**99**	**1**	**99**	**16**	**0.17**	**4.65**	**77**	**0.78**
1991	**64**	**1**	**64**	**6**	**0.10**	**3.01**	**19**	**0.30**
1992	**108**	**1**	**108**	**79**	**0.73**	**1.65**	**131**	**1.21**
1993	**276**	**1**	**276**	**151**	**0.55**	**1.61**	**242**	**0.88**
1994	**15**	**1**	**15**	**38**	**2.55**	**1.04**	**39**	**2.66**
1995	**10**	**1**	**10**	**22**	**2.20**	**0.60**	**13**	**1.32**
1996	5	1	5					
1997	**163**	**1**	**163**	**954**	**5.86**	**0.30**	**282**	**1.73**
1998	**74**	**1**	**74**	**499**	**6.75**	**0.30**	**148**	**2.00**
1999	**49**	**1**	**49**	**297**	**6.03**	**0.65**	**193**	**3.91**
2000	64	1	64					
2001	690	1	690					
2002	557	1	557					
2003	444	1	444					
2004	173	1	173					

Table 6. Big Creek Spring/Summer 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	1988-1999	1980-1999	geomean
Point Est.	2.03	1.23	1.86	1.25	1.07	1.09	94
Std. Err.	0.64	0.34	0.36	0.20	0.39	0.31	0.52
count	8	19	8	19	11	19	10

Table 7. Big creek Spring/Summer 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	1.23	0.40	n/a	n/a	0.75	0.79	72.1	1.25	0.25	n/a	n/a	0.47	0.60	52.8
Const. Rec	119	35	n/a	n/a	n/a	n/a	67.9	120	24	n/a	n/a	n/a	n/a	53.6
Bev-Holt	6.09	6.32	170	78	0.99	0.58	69.1	3.31	1.37	240	80	0.38	0.35	45.9
Hock-Stk	4.35	3.12	31	24	1.08	0.51	68.8	2.11	0.56	83	28	0.42	0.38	48.0
Ricker	2.68	1.20	0.00515	0.00227	1.04	0.59	70.4	2.32	0.56	0.00411	0.00122	0.40	0.36	46.8

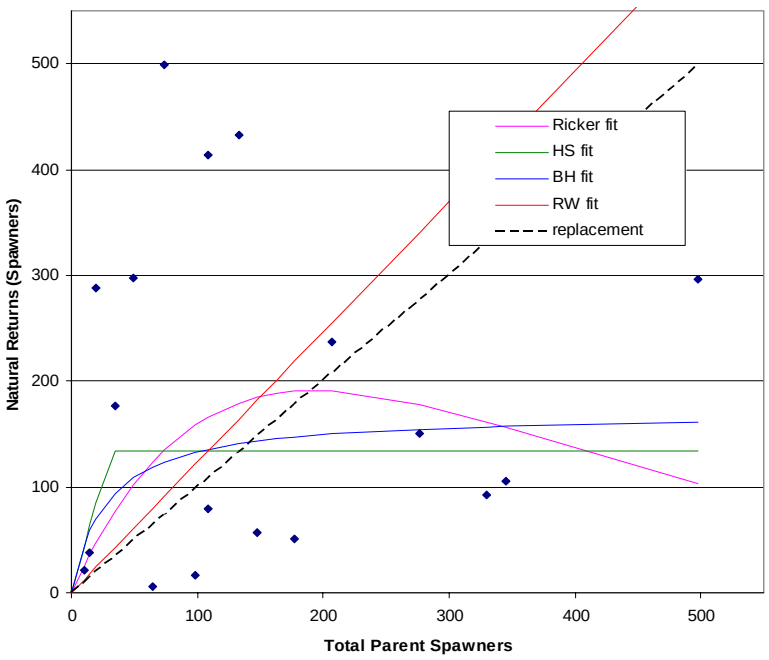

Figure 8. Big Creek Spring/Summer Chinook salmon population stock recruitment curves. All available R/S pairs were used in estimating the current productivity for this population. Data were not adjusted for marine survival.

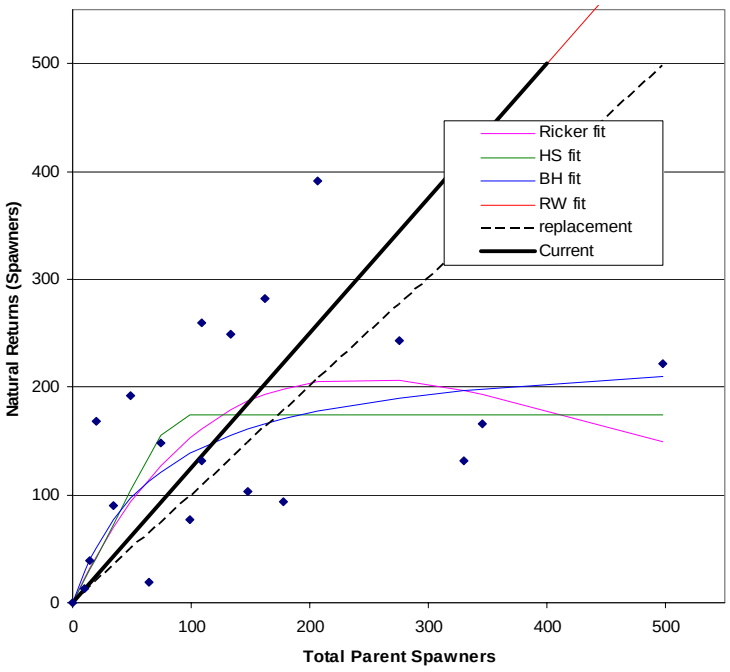

Figure 9. Big Creek Spring/Summer Chinook salmon population stock recruitment curves. All available R/S pairs were used in estimating the current productivity for this population. Data were adjusted for marine survival.