East Fork Salmon River Chinook Population

The East Fork Salmon River chinook population (Figure 1) is part of the Snake River Spring/Summer Chinook ESU which has five major population groupings (MPGs): 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 East Fork Salmon population is a spring/summer run and is one of eight extant populations in the Upper Salmon River MPG.

The ICTRT classified the East Fork Salmon 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.

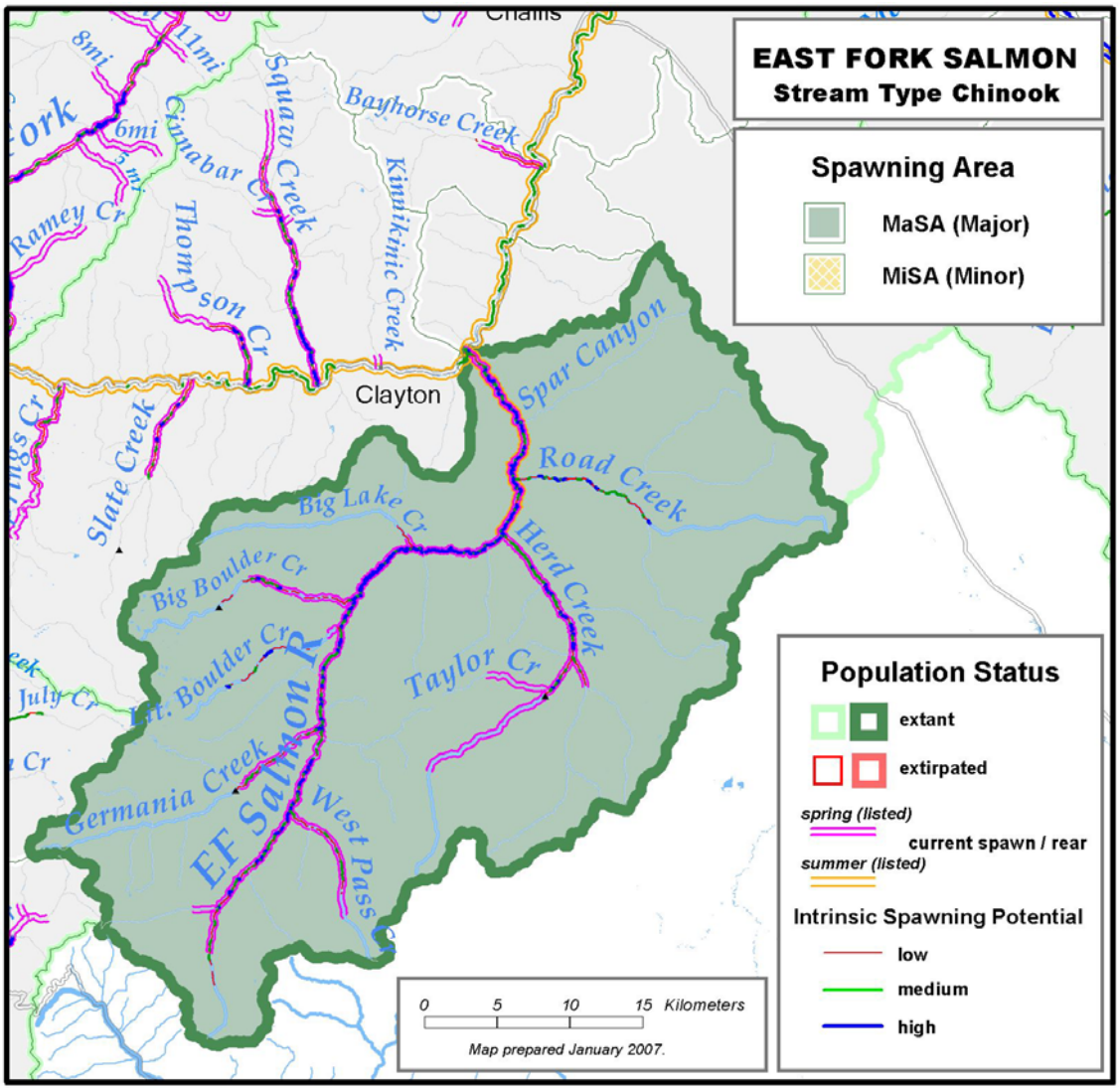

Figure 1. East Fork Salmon River chinook major and minor spawning areas.

Table 1. East Fork Salmon River chinook basin statistics

Drainage Area (km2)	1,426
Stream lengths km* (total)	371
Stream lengths km* (below natural barriers)	289
Branched stream area weighted by intrinsic potential (km2)	0.491
Branched stream area km2 (weighted and temp. limited)	0.491
Total stream area weighted by intrinsic potential (km2)	0.564
Total stream area weighted by intrinsic potential (km2) temp limited	0.564
Size / Complexity category	Large / "C" (trellis pattern)
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 (1960 to 2005) abundance (number of adults spawning in natural production areas) has ranged from 11 in 1995 to 3374 in 1961 (Figure 2). Annual abundance estimates for the East Fork Salmon River were based on a combination of weir counts and expanded redd counts. Insert expansion methodology here

Recent year natural spawners include returns originating from naturally spawning parents. A hatchery program was operated in the East Fork Salmon River that released hatchery reared juveniles from brood years 1984 to 1993. Adults from those releases returned from 1986 through 1998. Estimated annual returns of hatchery origin fish for those years ranged from 9 to 134 fish. Spawners originating from naturally spawning parents have comprised an average of 93% since 1960, while the most recent 10-year average of naturally spawning parents is 92% (Table 2). The IDFG initiated a captive rearing program for the East Fork Salmon River population in 1995 by collecting brood year 1994 parr and rearing them to sexual maturity in captivity. A captive population was sourced from the natural population each year through 2003. A small number of sexually mature adults from the captive-cultured groups have been released into the population to spawn naturally each year since 1998.

Abundance in recent years has been moderately variable, the most recent 10-year geomean number of natural origin spawners was 169 (Table 2). During the period 1981-2000, returns per spawner for chinook in the East Fork Salmon River ranged from 0.10 in 1991 to 12.16 in 1996. The most recent 20 year (1981-2000) SAR adjusted and delimited (at 75% of the size threshold) geometric mean of returns per spawner was 1.18 (Table 2).

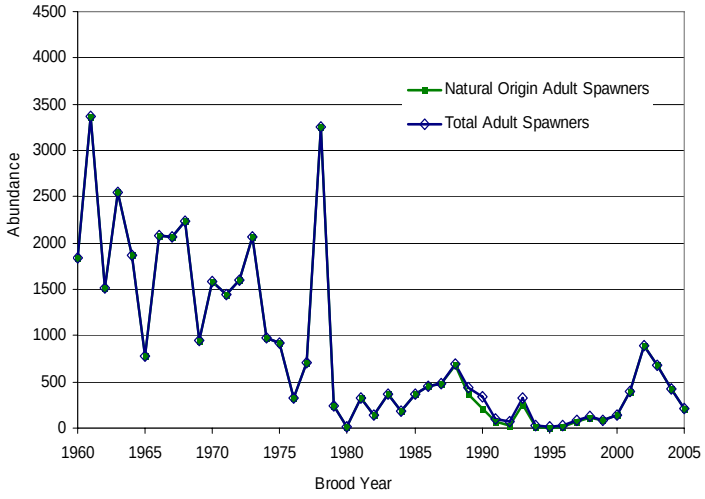

Figure 2. East Fork Salmon abundance trends 1960-2005.

Table 2. East Fork Salmon abundance and productivity measures

10-year geomean natural abundance	169
20-year return/spawner productivity	1.17
20-year return/spawner productivity, SAR adj. and delimited*	1.18
20-year Bev-Holt fit productivity, SAR adjusted	8.39
20-year Lambda productivity estimate	1.04
Average proportion natural origin spawners (recent 10 years)	0.92
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. However, there were no parent escapements above 75% of the threshold for this population.

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 East Fork Salmon River chinook population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3).

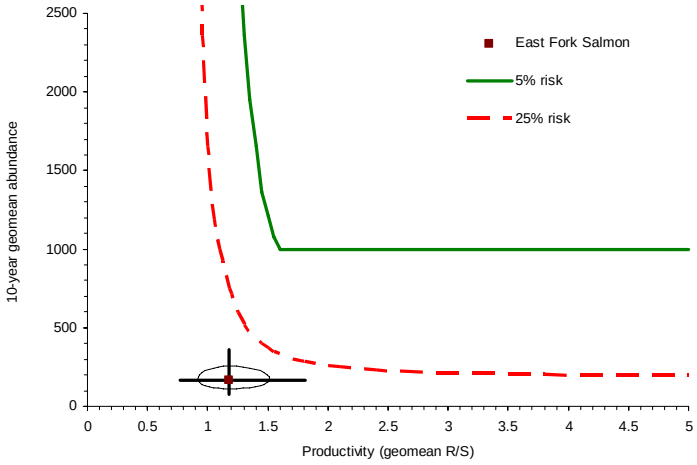

Figure 3. East Fork Salmn River chinook abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at 75% threshold. Estimate includes a 1 SE ellipse, 1.81 X SE abundance line, and 1.72 X SE productivity line.

Spatial Structure and Diversity

The ICTRT has identified one major spawning area (MaSA) and no minor spawning areas (MiSA) within the East Fork Salmon River chinook population. There are no modeled temperature limitations within this MaSA. Spawning is widely distributed across the population from the mouth of the East Fork Salmon River upstream to the headwaters (near Bowery Guard Station) and in the major tributary Herd Creek.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.
There is only one MaSA in the population. The total branched stream area weighted by intrinsic potential is 491,001 m^2, an area equivalent to 4.9 MaSAs. Even though only one MaSA was identified in the population this metric was rated *Moderate Risk* because of the very large total amount of habitat present and the branching provided by tributary streams.

A.l.b. Spatial extent or range of population.
The IDFG has conducted annual spawner index counts since 1957 in the East Fork Salmon River from the mouth upstream to Bowery Guard Station. This metric is rated *Very Low Risk* because current spawning distribution mirrors historical and the historical range has not been reduced. The MaSA is occupied at both the lower and upper ends based on recent spawner surveys.

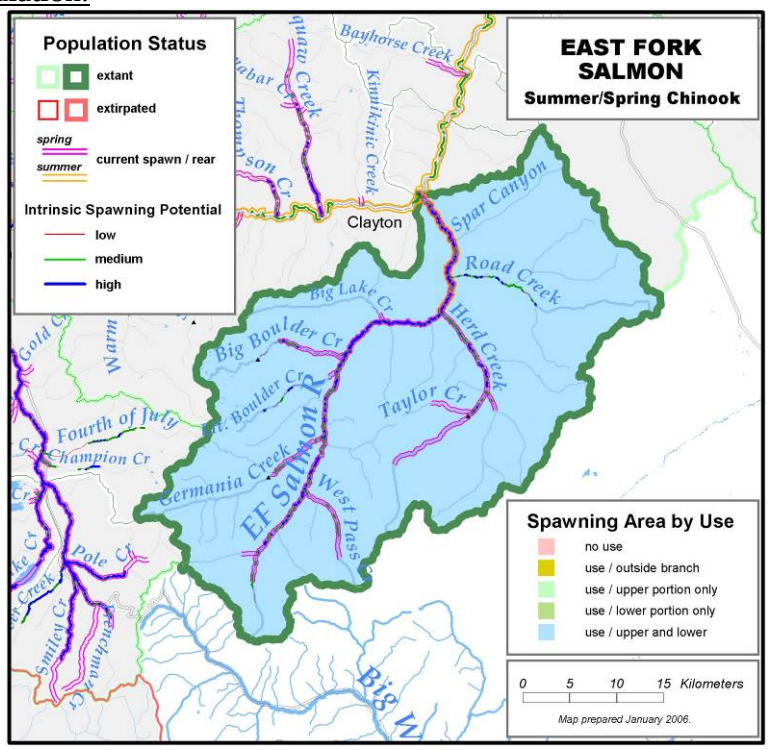

Figure 4. East Fork Salmon River chinook distribution.

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 *Low* risk because the historical MaSA is 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. This metric cannot achieve a Very Low risk rating because there are not three or more historic MaSAs.

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 upstream of approximately Big Boulder Creek as spring run and downstream as summer run. The known major juvenile life history strategy is a spring yearling migrant. Anthropogenic impacts in the watershed that could have resulted in loss of a life history strategy include extensive channel alteration and relocation although there is no evidence those impacts were selective against any major life history strategy. Adult spawners still occupy the upper and lower reaches of the stream. 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. There have been alterations of within-basin habitat conditions that could have resulted in loss of a phenotypic trait but there is no evidence that loss or change 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. Among population variation showed Herd Creek was not significantly different from four Sawtooth samples and the East Fork Salmon River was not significantly different from seven hatchery samples. There is potential homogenization of Upper Salmon River basin populations. Also, there was high within population variation, likely due to a bottleneck as a result of low escapements. This metric was rated *High Risk.* The rating is highly influenced by the combination of hatchery similarity and apparent bottleneck. Additional genetic samples and analyses may indicate a reduced risk rating is more appropriate.

B.2.a. Spawner composition.
Spawner composition typically 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. Spawner carcass data is not collected within this population. Risk ratings are inferred from data collected in proximate populations. From 1981 through 2004 3,955 marked fish were recovered in the upstream Upper Salmon River population (at Sawtooth Fish Hatchery) and a CWT was extracted and read from 3,932 of those fish. From 1980 through 2004 551 marked fish were recovered in the downstream Pahsimeroi River population (at Pahsimeroi Fish Hatchery) and a CWT was extracted and read from all fish.

(1) *Out-of-ESU strays*. In the upstream Upper Salmon River Mainstem population, four out-of-ESU strays were recovered at the Sawtooth Hatchery across the 23 years of data reviewed. Two were fall Chinook that had been reared in the Hagerman Valley, one was a stray from the Tucannon River and one was a stray from the Umatilla River. Those four fish most likely were spawned in the hatchery, thus did not spawn naturally. In the Pahsimeroi population, one out-of-

ESU fish was trapped in 1984; its origin was the Rogue River in Oregon. No expansions were done to account for unmarked returns from the respective mark groups. This sub-metric is rated *Very Low* risk since the total number of out-of-ESU strays observed was very low.

(2) *Out-of-MPG strays from within the ESU.* Five out-of-MPG strays were recovered at the Sawtooth Hatchery across the 23 years of data reviewed. Two of the strays were Rapid River origin and two were South Fork Salmon River origin. Four out-of-MPG strays were recovered at the Pahsimeroi Fish Hatchery over 24 years of data surveyed. All were Rapid River stock; two (one each in 1988 and 1999) were reared and released at Rapid River and two (one each in 1976 and 1977) were reared in a facility on Hayden Creek (tributary to the Lemhi River). No expansions were done to account for unmarked returns from the respective mark groups. This sub-metric is rated *Low* risk.

(3) *Out of population within MPG strays*. Out-of-population hatchery-origin strays that could enter the population in recent years would originate from the upstream Upper Salmon River Mainstem population (Sawtooth Hatchery) or the Pahsimeroi Hatchery program operated in the Pahsimeroi River population. Proportion of strays spawning naturally is suspected to be less than 10% per year, and this sub-metric is rated *Low Risk*.

(4) *Within-population hatchery spawners.* A within population hatchery program was operational from 1984 through 1993 (brood years). During that period the largest smolt release was 514,600 and the median annual release was 103,500 smolts. A weir was operated on the East Fork Salmon River from 1984 through 1993. During that period three different brood years of hatchery fish were recruiting back to the weir (at ages 3, 4 and 5) only from 1989 through 1993, and the estimated proportion of hatchery fish in the total return to the weir ranged from 89% to 92%. The proportion of hatchery fish in the group released above the weir for natural spawning was 83% in one year, 89% in one year and 90% in three years. Information on the composition of spawners downstream of the weir is not collected. The estimated proportion of hatchery spawners in the total population from 1988 through 1998 (when hatchery fish were returning) ranged from approximately 2% to 70% and exceeded 20% in eight of the years in the last three brood cycles. Even though the natural spawning population contained a high proportion of hatchery origin fish in the last three brood cycles, this sub-metric is rated *Moderate* risk because there have been no hatchery spawners since 1998.

The overall risk rating for metric B.2.a “spawner composition” is *Low Risk* assuming that hatchery fish will not be spawning naturally in future years.

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

The East Fork Salmon River population intrinsic potential distribution historically was distributed across two EPA level IV ecoregions, with Dry Gneissic-Schistose-Volcanic Hills being predominant. The current distribution is similar 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.

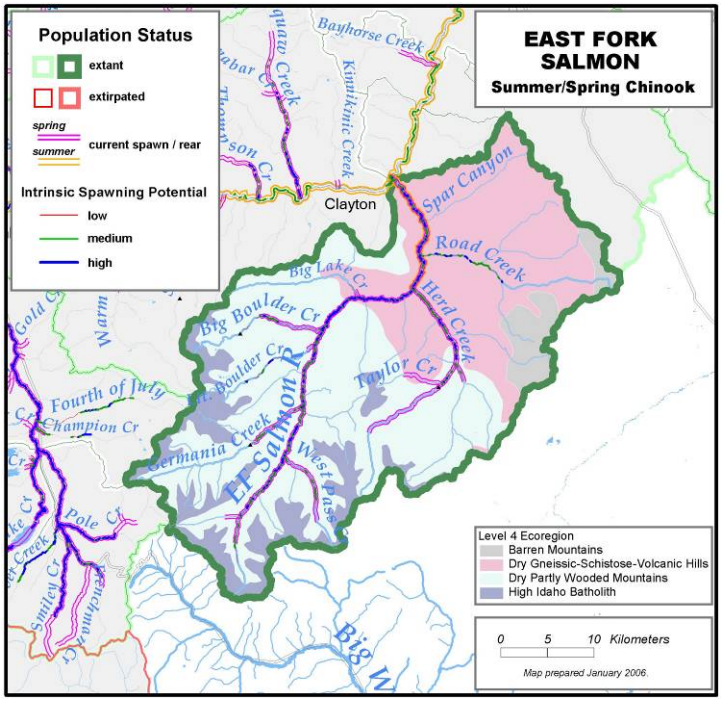

Figure 5. East Fork Salmon River chinook population distribution across various ecoregions.

Table 3. East Fork Salmon River 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)
Dry Gneissic-Schistose-Volcanic Hills	61.1	61.1	55.5
Dry Partly Wooded Mountains	38.9	38.9	44.5

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: Although the length of time a hatchery program was functional in the population was short, the apparent effect of hatchery fish on the population was significant, since the population is not significantly different from several (out-of-population) hatchery programs. This selective impact was rated *High Risk*.

Habitat: Habitat changes resulting from land use activities in the basin may impose some selective mortality, but the extent is unknown. It is likely that in this population any mortality impacts resulting from habitat changes would have affected the entire population because of the spatial extent of habitat alterations. This selective impact was rated *Low Risk*.

Spatial Structure and Diversity Summary

Overall spatial structure and diversity has been rated *High Risk* for the East Fork Salmon River population (Table 4). The lowest spatial structure/diversity risk level the population could achieve would be Low risk because of the historic (natural) number and spatial arrangement of spawning areas and total amount of intrinsic potential habitat. The current *High* risk rating is driven by genetic diversity and the legacy effects of hatchery fish. The risk could be reduced in future years if only natural origin fish are spawning, total escapement increases and local adaptation is occurring.

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">Low Risk
(Mean=1.0)</td><td rowspan="3">Low Risk</td><td rowspan="15">High 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>L (1)</td><td>L (1)</td></tr>
<tr><td>B.1.a</td><td>L (1)</td><td>L (1)</td><td rowspan="3">High Risk</td><td rowspan="9">High 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>H (-1)</td><td>H (-1)</td></tr>
<tr><td>B.2.a(1)</td><td>VL (2)</td><td rowspan="4">Low Risk</td><td rowspan="4">Low Risk</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>M (0)</td></tr>
<tr><td>B.3.a</td><td>L (1)</td><td>Low Risk</td><td>Low Risk</td></tr>
<tr><td>B.4.a</td><td>H (-1)</td><td>High Risk</td><td>High Risk</td></tr>
</table>

Overall Viability Rating

The East Fork Salmon River spring/summer Chinook salmon population does not currently meet viability criteria because both Abundance/Productivity risk and Spatial Structure/diversity risk are high (Table 5). The 20-year delimited recruit per spawner point estimate (1.18) is significantly less than the 1.45 required at the minimum abundance threshold. The 10-year geometric mean abundance is only 17% of the minimum threshold abundance. Improvement in abundance/productivity status and spatial structure/diversity status (reduction of risk level for both categories) will need to occur before the population can be considered viable. Also, the population currently does not meet the criteria for a "maintained" population.

		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%)				**East Fork Salmon**

Figure 6. Viable Salmonid Population parameter risk ratings for the Lemhi River Spring/Summer Chinook salmon 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)*

East Fork Salmon River Chinook – Data Summary

Data type: Combined expanded redd and weir counts
SAR: Averaged Williams/CSS series

Table 5. East Fork Salmon River Chinook run data (used for curve fits and R/S analysis). All available return/spawner data were used since the parent escapement never exceeded 75% of the size threshold.

Brood Year	Spawners	%Wild	Natural Run	Nat. Rtns	R/S	Rel. SAR	Adj. Rtns	Adj. R/S
1981	**323**	**1.00**	**323**	**390**	**1.21**	**0.63**	**245**	**0.76**
1982	**136**	**1.00**	**136**	**460**	**3.38**	**0.51**	**235**	**1.73**
1983	**367**	**1.00**	**367**	**579**	**1.58**	**0.58**	**333**	**0.91**
1984	**178**	**1.00**	**178**	**493**	**2.77**	**1.65**	**814**	**4.57**
1985	**367**	**1.00**	**367**	**325**	**0.88**	**1.57**	**509**	**1.39**
1986	**457**	**1.00**	**457**	**157**	**0.34**	**1.41**	**221**	**0.48**
1987	**484**	**1.00**	**484**	**68**	**0.14**	**1.82**	**123**	**0.25**
1988	**690**	**0.98**	**676**	**154**	**0.22**	**0.74**	**114**	**0.17**
1989	**440**	**0.82**	**362**	**110**	**0.25**	**1.78**	**197**	**0.45**
1990	**334**	**0.64**	**214**	**42**	**0.13**	**4.64**	**195**	**0.58**
1991	**105**	**0.63**	**66**	**10**	**0.10**	**3.00**	**30**	**0.29**
1992	**70**	**0.49**	**34**	**39**	**0.56**	**1.63**	**64**	**0.91**
1993	**319**	**0.82**	**261**	**87**	**0.27**	**1.61**	**139**	**0.44**
1994	**30**	**0.64**	**19**	**92**	**3.07**	**1.04**	**96**	**3.20**
1995	**11**	**0.64**	**7**	**116**	**10.58**	**0.59**	**69**	**6.27**
1996	**22**	**0.45**	**10**	**267**	**12.16**	**0.54**	**145**	**6.59**
1997	**83**	**0.82**	**68**	**620**	**7.47**	**0.30**	**183**	**2.20**
1998	**127**	**0.93**	**118**	**724**	**5.70**	**0.30**	**215**	**1.69**
1999	**79**	**1.00**	**79**	**574**	**7.27**	**0.65**	**372**	**4.71**
2000	**143**	**1.00**	**143**	**347**	**2.43**	**1.00**	**346**	**2.42**
2001	402	1.00	402					
2002	891	1.00	891					
2003	679	1.00	679					
2004	424	1.00	424					
2005	213	1.00	213					

Table 6. Geomean abundance and productivity measures. Boxed values were used in evaluating the current status of this population.

	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.	2.97	1.17	2.20	1.18	1.07	1.04	169
Std. Err.	0.48	0.36	0.30	0.25	0.53	0.42	0.42
count	10	20	10	20	12	20	10

Table 7. Poptools stock-recruitment curve fit parameter estimates. Values potentially indicating a non-fit are highlighted in gray.

	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	1.17	0.41	n/a	n/a	0.84	0.81	79.1	1.18	0.28	n/a	n/a	0.72	0.62	64.7
Const. Rec	179	45	n/a	n/a	n/a	n/a	65.8	180	30	n/a	n/a	n/a	n/a	49.5
Bev-Holt	39.68	98.40	189	54	0.42	0.81	68.4	8.39	5.94	233	54	0.30	0.59	48.8
Hock-Stk	10.58	11.47	17	19	0.43	0.80	68.4	5.10	2.07	39	17	0.32	0.58	50.0
Ricker	4.59	1.90	0.00574	0.00138	0.66	0.70	69.3	3.51	0.87	0.00459	0.00082	0.32	0.54	48.6

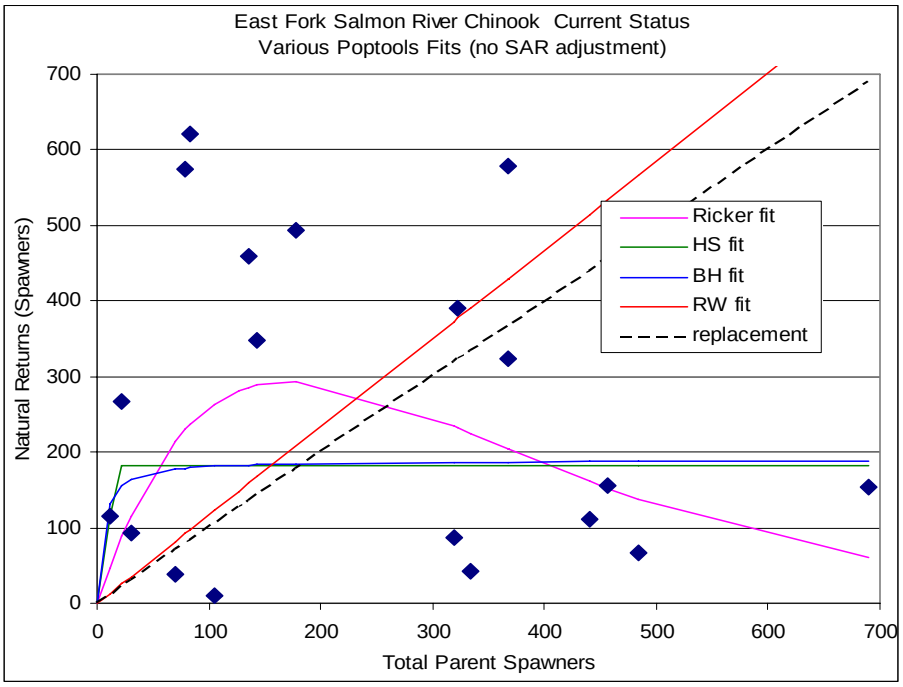

Figure 7. Stock recruitment curves for the East Fork Salmon River chinook population. Data not adjusted for marine survival.

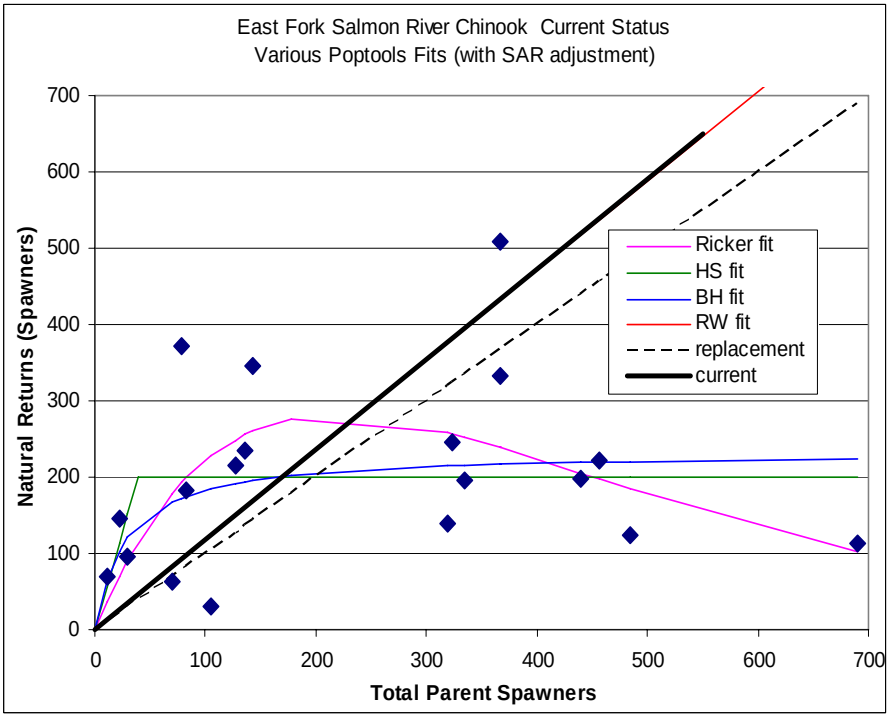

Figure 8. Stock-recruitment curves for the East Fork Salmon River chinook population. Data adjusted for marine survival.