**South Fork Salmon River Summer Chinook Salmon**
**Population Viability Assessment**

The South Fork Salmon 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 South Fork Salmon River population is a summer run and is one of four extant populations in the South Fork Salmon MPG.

The ICTRT classified the South Fork Salmon River 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 of 1000 naturally produced spawners with sufficient intrinsic productivity to achieve a 5% or less risk of extinction over a 100-year timeframe.

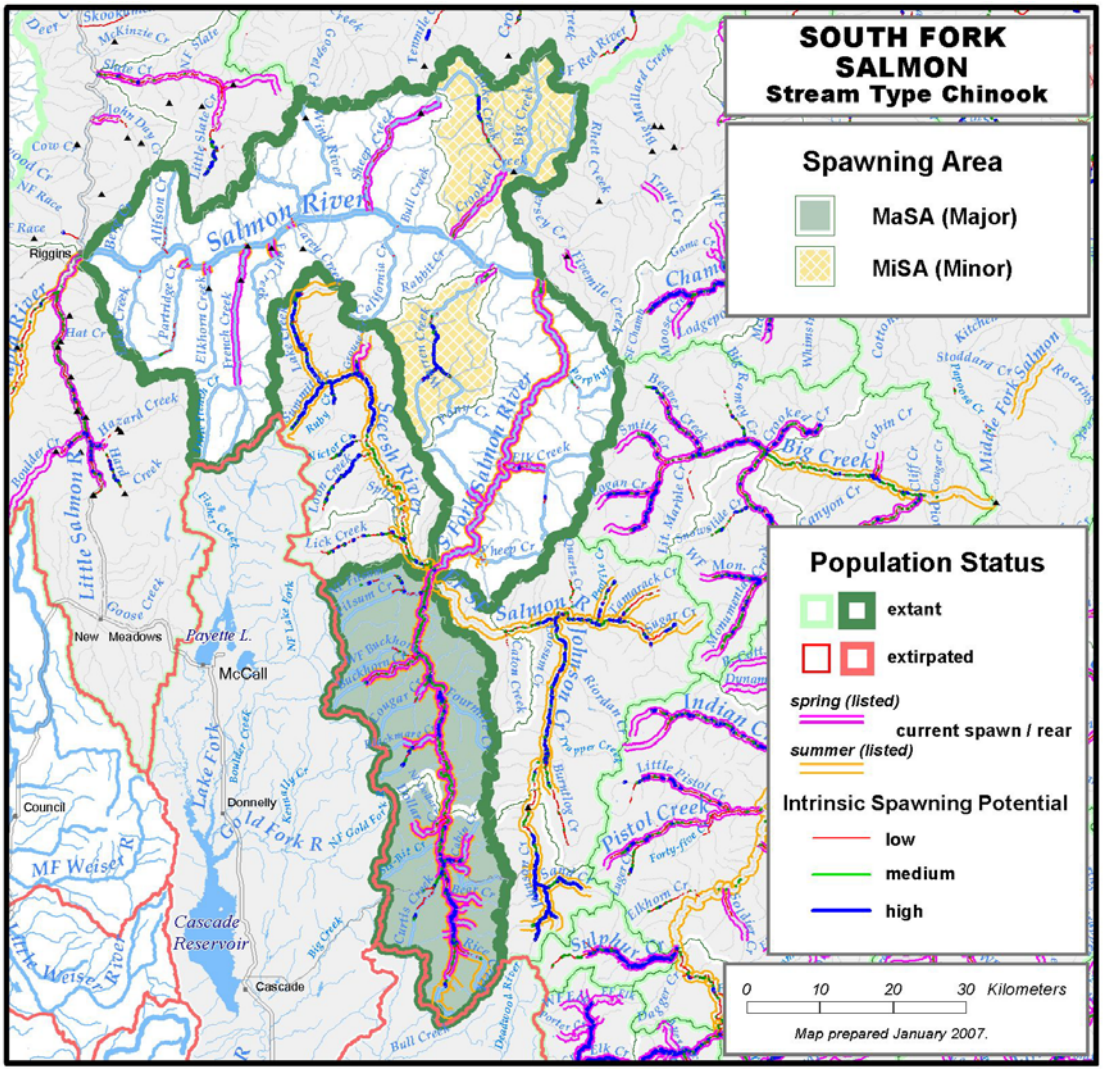


**Figure 1. South Fork Salmon River chinook major and minor spawning areas.**

**Table 1. South Fork Salmon River chinook basin statistics**

| | |
|---|---|
| Drainage Area (km2) | 3,678 |
| Stream lengths km* (total) | 1411 |
| Stream lengths km* (below natural barriers) | 780 |
| Branched stream area weighted by intrinsic potential (km2) | 0.418 |
| Branched stream area km2 (weighted and temp. limited) | 0.418 |
| Total stream area weighted by intrinsic potential (km2) | 0.729 |
| Total stream area weighted by intrinsic potential (km2) temp limited | 0.729 |
| Size / Complexity category | Large / "C" (trellis pattern) |
| Number of MaSAs | 2 |
| Number of MiSAs | 2 |

*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$^{o}$C.

### *Current Abundance and Productivity*

Current (1957 to 2001) natural abundance (number of adult spawning in natural production areas) has ranged from 224 (1995) to 5,290 in 1960 (Figure 2). Annual abundance estimates for the South Fork Salmon River were based on expanded redd counts. IDFG has consistently surveyed four index reaches within the South Fork Salmon River drainage for summer chinook spawning (IDFG # NS 26,27,28,29). The index areas contained virtually the entire historical spawning habitat identified for this population based on the habitat potential analyses. We applied the South Fork average fish per redd (2.31) to the sum of the expanded redd counts (South Fork mainstem and Lake Creek) to generate estimated spawners.

Recent year natural spawners include returns originating from naturally spawning parents, and some hatchery fish originating from a local stock mitigation hatchery program operated in the basin. Also, a Chinook salmon supplementation research program was releasing natural origin and supplementation program adults upstream of the weir located near Cabin Creek. Spawners originating from naturally spawning parents have comprised an average of 98% since 1953, while the most recent 10-year average is 92% (Table 2).

Abundance in recent years has been variable, the most recent 10-year geomean number of natural spawners was 556 (Table 2). During the period 1979-1998, returns per spawner for chinook in the South Fork Salmon River ranged from 0.15 (1991) to 3.42 (1983). The most recent 20 year (1979-1998) SAR adjusted and delimited (at 75% of the size threshold) geometric mean of returns per spawner was 1.18 (Table 2).

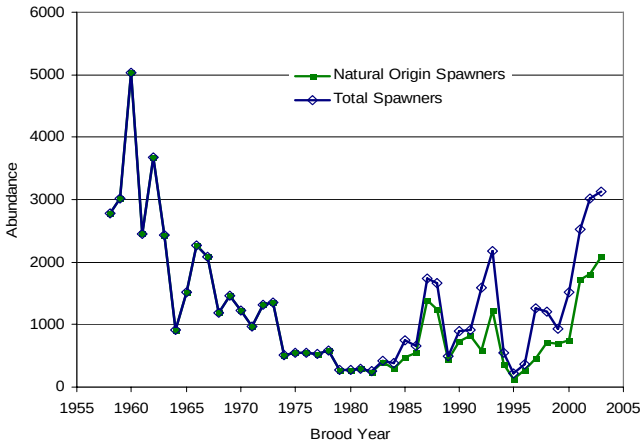


**Figure 2. South Fork Salmon River abundance trends 1958-2003.**

**Table 2. South Fork Salmon River abundance and productivity measures**

| | |
|---|---|
| 10-year geomean natural abundance | 553 |
| 20-year return/spawner productivity | 0.78 |
| 20-year return/spawner productivity, SAR adj. and delimited* | 1.18 |
| 20-year Bev-Holt fit productivity, SAR adjusted | 1.69 |
| 20-year Lambda productivity estimate | 1.11 |
| Average proportion natural origin spawners (recent 10 years) | 0.61 |
| 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-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 South Fork Salmon River population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3).

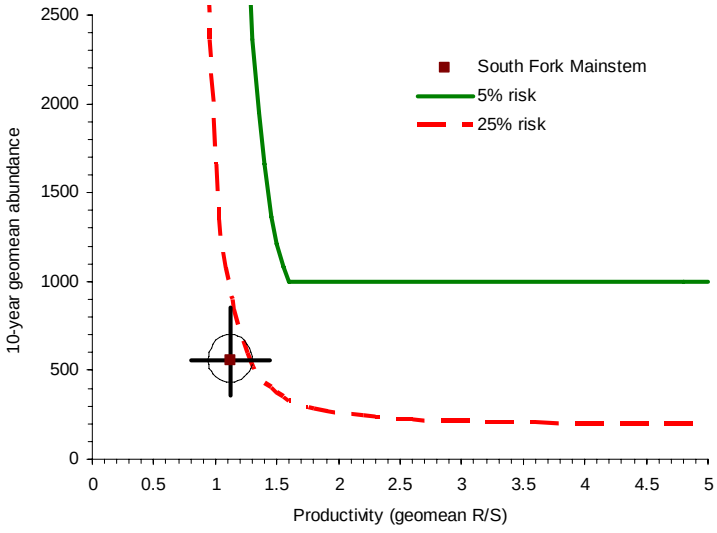


**Figure 3. South Fork Salmon River chinook abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at the median. Estimate includes a 1 SE ellipse, 1.81 X SE abundance line, and 1.78 X SE productivity line.**

### *Spatial Structure and Diversity*

The ICTRT has identified two major spawning areas (MaSAs) and two minor spawning areas (MiSAs) within the South Fork Salmon River Spring/Summer Chinook population. Nearly all spawning occurs in the mainstem South Fork Salmon River upstream of the East Fork South Fork Salmon River. There are two areas of concentrated spawning, Poverty Flat and Stolle Meadows.

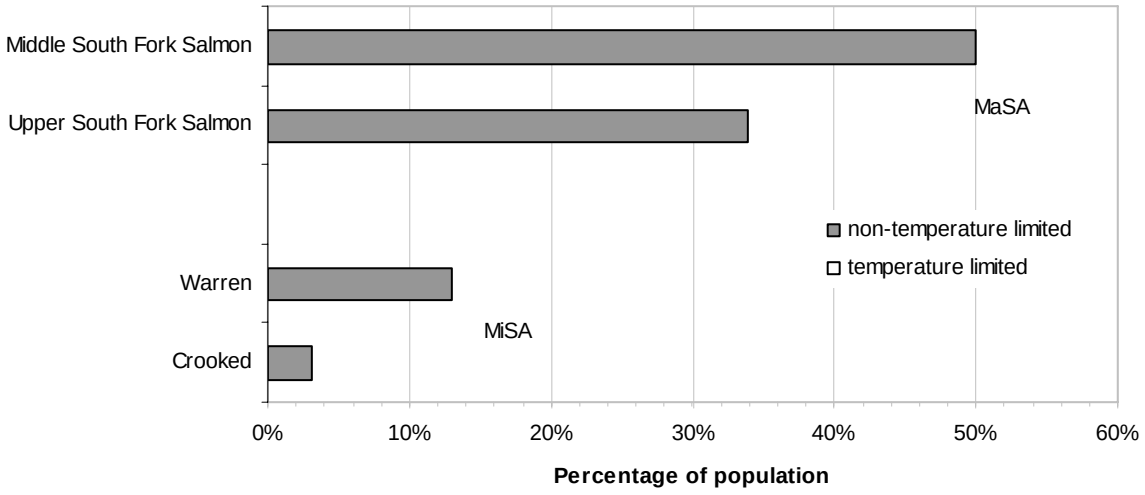


**Figure 4. Proportion of major and minor spawning areas that make up the South Fork Salmon River population. There are no modeled temperature limitations for the MiSA/MaSAs in this population.**

Factors and Metrics

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

The South Fork Salmon Mainstem population of summer Chinook has two MaSAs (Middle and Upper South Fork) and two MiSAs (Crooked and Warren). The MaSAs are occupied at both the lower and upper ends. The MiSAs are not occupied. This metric is rated *Low Risk* because actual spawning is in a non-linear configuration in two MSAs. Some of the spawning is separated by confluences, however most is in the mainstem South Fork of both MaSAs.

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

The IDFG has conducted annual spawner index counts since 1957 on the mainstem South Fork Salmon River from the East Fork South Fork Salmon River upstream to Rice Creek. The index area counts cover almost the entire mainstem intrinsic habitat in both MaSAs. This metric is rated *Very Low Risk* because current spawning distribution mirrors historical. Both MaSAs are occupied at both the lower and upper ends.

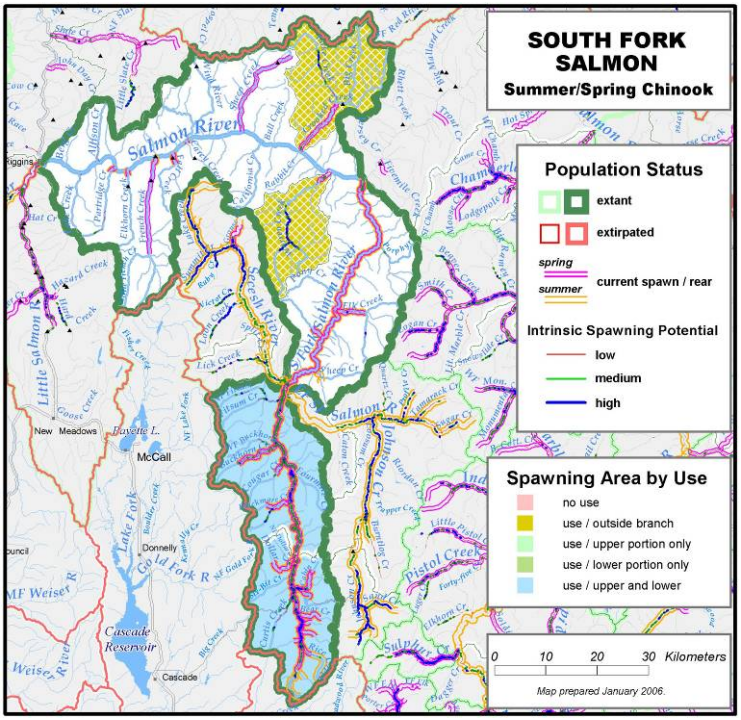


**Figure 5. South Fork Salmon River Summer Chinook distribution.**

A.1.c. Increase or decrease in gaps or continuities between spawning areas.
There has been little or no change in gaps when comparing current and historical spawning distribution. The population is rated at *Low* R*isk* because all historical MaSAs are occupied, gap distance and continuity have changed none or little, gaps between MaSAs separated by 10 km or less 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 major adult life history strategy is 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 in the basin. The effects of sedimentation in the system are not expected to be selective against any major life history strategy. It appears all historic juvenile and adult life history strategies are present however, the metric is rated *Low Risk.* There is some evidence that late season spawners also were present in the population (USFS personnel). Payette National Forest staff (Burns and Nelson) state that there has been a loss of late season spawners in the mainstem South Fork Salmon River from its mouth upstream to the East Fork South Fork Salmon River. It is not known if the late fall (October) spawners were fall Chinook salmon (a different ESU) or a late returning group of summer run fish.

B.1.b. Phenotypic variation.

Except for the limited information on late fall spawners discussed above, there is no data to indicate that any phenotypic traits have been significantly changed or lost. The major habitat alteration in the system is increased sedimentation, but it is not likely that this could have resulted in loss of a phenotypic trait. No major selective pressures are known to exist which would cause significant changes in or loss of traits. Because of the evidence that there has been a change in the mean adult run timing, this metric is rated as *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. There is low inter-annual variation; all within population samples are indistinguishable from each other. If the data suggest that lack of inter-annual variation is hatchery driven (as opposed to the result of being a large, stable population), this rating should be high risk. This population clusters with other South Fork Salmon River populations. This metric was rated *Moderate Risk.*

B.2.a. Spawner composition.

Spawner composition is mainly determined from recovery of tags from fish trapped at the weir on the South Fork Salmon River. Marked fish also are recovered during spawning ground surveys and during sport fishery sampling. Any marked fish that are recovered are examined for the presence of a coded-wire or PIT tag. From 1985 through 2004 7,270 marked fish were recovered from the population and a CWT was extracted and read from 7,243 of those fish.

(1) *Out-of-ESU strays*. Two out-of-ESU strays were recovered across the 7,243 tags that were read. Those two fish were recovered in 1987 and originated from Eagle Creek National Fish Hatchery (Clackamas River, Oregon). Both fish most likely were spawned in the hatchery, thus did not spawn naturally. No expansions were done to account for unmarked returns from the respective mark groups. This sub-metric is rated *Very Low* risk since no strays have been observed in recent years and the total number observed was very low.

(2) *Out-of-MPG strays from within the ESU*. Eleven out-of-MPG strays were recovered from within the population across the 20 years of data reviewed. One of the strays was a Rapid River stock fish that was reared and released at Lookingglass Fish Hatchery (Grande Ronde/Imnaha Rivers MPG). Six of the strays were from the Lostine River endemic brood stock program

(Grande Ronde/Imnaha Rivers MPG); five of the Lostine River strays were recovered in 2003 and one in 2004. The remaining four strays were Sawtooth Fish Hatchery origin (Upper Salmon River MPG). No expansions were done to account for unmarked returns from the respective mark groups. The distribution of out-of-MPG strays by year was: 1992 – 2, 1995 – 1, 2001 – 1, 2003 – 6 and 2004 – 1. This sub-metric is rated *Low* risk.

(3) *Out of population within MPG strays*. Seventeen out-of-population strays were recovered from within the MPG across the 20 years of data reviewed. Three of the strays were Johnson Creek (supplementation program) origin and fourteen were Rapid River Fish Hatchery origin. No expansions were done to account for unmarked returns from the respective mark groups. The distribution of out-of-population strays by year was: 1988 – 1, 1993 – 1, 1996 – 3, 1997 – 2, 1999 – 1, 2001 - 7 and 2003 – 2. This sub-metric is rated *Low* risk.

(4) *Within-population hatchery spawners.* Hatchery-origin spawners that have been observed in the population in recent years originated from the within-population South Fork Salmon River mitigation hatchery program (McCall Hatchery). Proportion of hatchery spawners observed has ranged from 9% to 64% per year from 1988 through 2003 (most recent series of years analyzed). The most recent 10 year average (1994-2003) for the proportion of total population spawners that were hatchery fish is 38% and over the last three brood cycles hatchery fish comprised slightly more than 30% of the natural spawners. The mitigation hatchery program is characterized as best management practices based on the following:

- mating protocols provide for a high number of family groups annually,
- there is no culling or grading of parr or smolts,
- hatchery smolts are released only in the vicinity of the hatchery weir, and
- there is no genetic differentiation between natural and hatchery fish.

Given that best management practices are used and the average hatchery fraction has been greater than 30% over three generations, this sub-metric is rated *High Risk*.

The overall risk rating for metric B.2.a “spawner composition” is *High Risk* because of the high proportion of hatchery origin fish spawning naturally.

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

The South Fork Salmon River population intrinsic potential distribution historically was distributed across three EPA level IV ecoregions, with the Southern Forested Mountains and Hot Dry Canyons being predominant and equally represented. All historically occupied ecoregions are currently occupied (Table 3 and Fig. 6). There are no substantial changes in ecoregion occupancy, and this metric was rated *Low Risk* for the population.

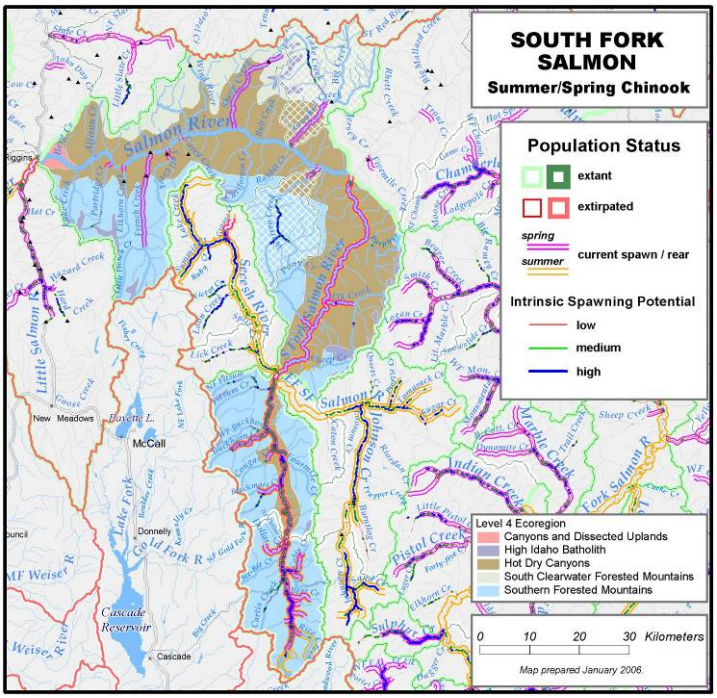


**Figure 6. South Fork Salmon River chinook population distribution across various ecoregions.**

**Table 3. South Fork Salmon River Spring/Summer 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) |
|---|---|---|---|
| Hot Dry Canyons | 48.4 | 48.4 | 65.9 |
| South Clearwater Forested Mountains | 3.1 | 3.1 | 0.6 |
| Southern Forested Mountains | 48.5 | 48.5 | 33.5 |

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 impact rates for spring/summer Chinook salmon are generally less than 10% annually. There are no freshwater fisheries directly targeting naturally produced spring/summer Chinook salmon; indirect mortalities are expected to occur in some fisheries selective for hatchery fish. In recent years there have been sport fisheries in the mainstem Salmon River and a section of the South Fork Salmon River to target marked hatchery summer Chinook salmon. Also in recent years tribal fisheries have been conducted in the South Fork Salmon River. Indirect and direct mortalities are expected to occur through the execution of the fisheries. It is not likely that the mortality is selective for a particular group of fish or if it is, it would not select 25% or more of that particular group, and this action could be rated as Very Low risk. However, because the fisheries do occur during the early portion of the run creating the potential for selective impacts this action is rated *Low Risk*, even though total impacts are low and are not likely to select 25% or more of the early returning fish.

*Hatcheries*: Although hatchery strays (adult spawners) have been observed in the population since 1988, the average proportion of strays is less than 10%. Because best management practices are used in the mitigation hatchery program and natural and hatchery fish are genetically similar, this selective impact was rated *Low Risk*.

*Habitat*: Habitat changes that occurred within the population as a result of land use activities primarily resulted in large amounts of silt entering the stream. It is expected that this effect of habitat alteration is non selective and this action was rated *Very Low Risk*.

## Spatial Structure and Diversity Summary

Overall spatial structure and diversity has been rated *Moderate Risk* for the South Fork Salmon River population (Table 4). This risk rating is driven by the score for genetic variation and the possible effects of hatchery fish on genetic variation.

**Table 4. Spatial structure and diversity scoring table**

| Metric | Risk Assessment Scores | | | | |
|---|---|---|---|---|---|
| | Metric | Factor | Mechanism | Goal | Population |
| A.1.a | L (1) | L (1) | Low Risk Mean=(1.33) | Low Risk | **Moderate Risk** |
| A.1.b | VL (2) | VL (2) | | | |
| A.1.c | L (1) | L (1) | | | |
| B.1.a | L (1) | L (1) | Moderate Risk (0) | Moderate Risk | |
| B.1.b | L (1) | L (1) | | | |
| B.1.c | M (0) | M (0) | | | |
| B.2.a(1) | VL (2) | Low Risk | Low Risk (1) | | |
| B.2.a(2) | VL (2) | | | | |
| B.2.a(3) | VL (2) | | | | |
| B.2.a(4) | L (1) | | | | |
| B.3.a | L (1) | L (1) | Low Risk (1) | | |
| B.4.a | L (1) | L (1) | Low Risk (1) | | |

## Overall Viability Rating

The South Fork Salmon River spring/summer Chinook salmon population does not currently meet viability criteria because Abundance/Productivity risk is does not meet the criteria for a viable population (Table 5). The 20-year delimited recruit per spawner point estimate is 1.39, near the 1.45 required at the minimum threshold abundance. The 10-year geometric mean abundance (819) is 82% 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 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%) | | | S. Fork Salmon | |

**Figure 7. Viable Salmonid Population parameter risk ratings for the South Fork Salmon 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 – does not meet viability criteria (darkest cells are at greatest risk)*

.

## **South Fork Salmon River Spring/Summer Chinook** – Data Summary

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

**Table 5. South Fork Salmon 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 750) are bolded.**

| Brood Year | Spawners | %Wild | Natural Run | Nat. Rtns | R/S | Rel. SAR | Adj. Rtns | Adj. R/S |
|---|---|---|---|---|---|---|---|---|
| **1979** | **266** | **1.00** | **266** | **220** | **0.83** | **0.87** | **191** | **0.72** |
| **1980** | **268** | **1.00** | **268** | **343** | **1.28** | **0.58** | **200** | **0.74** |
| **1981** | **291** | **1.00** | **291** | **593** | **2.04** | **0.63** | **373** | **1.28** |
| **1982** | **256** | **0.96** | **245** | **532** | **2.07** | **0.51** | **272** | **1.06** |
| **1983** | **427** | **0.93** | **397** | **2030** | **4.75** | **0.58** | **1170** | **2.74** |
| **1984** | **381** | **0.78** | **296** | **495** | **1.30** | **1.65** | **818** | **2.15** |
| **1985** | **746** | **0.63** | **470** | **414** | **0.55** | **1.57** | **650** | **0.87** |
| **1986** | **668** | **0.83** | **553** | **1112** | **1.66** | **1.41** | **1570** | **2.35** |
| 1987 | 1,737 | 0.80 | 1393 | 455 | 0.26 | 1.83 | 831 | 0.48 |
| 1988 | 1,659 | 0.75 | 1246 | 1335 | 0.81 | 0.75 | 997 | 0.60 |
| **1989** | **501** | **0.87** | **436** | **611** | **1.22** | **1.79** | **1095** | **2.18** |
| 1990 | 892 | 0.82 | 734 | 152 | 0.17 | 4.65 | 709 | 0.79 |
| 1991 | 908 | 0.90 | 817 | 139 | 0.15 | 3.01 | 417 | 0.46 |
| 1992 | 1,582 | 0.37 | 592 | 359 | 0.23 | 1.65 | 593 | 0.37 |
| 1993 | 2,169 | 0.56 | 1220 | 954 | 0.44 | 1.61 | 1536 | 0.71 |
| **1994** | **552** | **0.67** | **367** | **130** | **0.23** | **1.04** | **135** | **0.25** |
| **1995** | **224** | **0.55** | **124** | **598** | **2.67** | **0.60** | **359** | **1.60** |
| **1996** | **367** | **0.77** | **283** | **685** | **1.86** | **0.54** | **372** | **1.01** |
| 1997 | 1,257 | 0.36 | 453 | 2419 | 1.92 | 0.30 | 715 | 0.57 |
| 1998 | 1,204 | 0.60 | 718 | 1799 | 1.49 | 0.30 | 534 | 0.44 |
| 1999 | 926 | 0.75 | 696 | | | | | |
| 2000 | 1,511 | 0.49 | 747 | | | | | |
| 2001 | 2,529 | 0.68 | 1712 | | | | | |
| 2002 | 3,021 | 0.60 | 1819 | | | | | |
| 2003 | 3,130 | 0.67 | 2085 | | | | | |

**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 | 1987-1998 | 1981-2000 | geomean |
| Point Est. | 1.44 | 1.35 | 1.14 | 1.18 | 1.05 | 1.05 | 653 |
| Std. Err. | 0.25 | 0.23 | 0.22 | 0.20 | 0.27 | 0.25 | 0.28 |
| count | 10 | 12 | 10 | 12 | 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 | 0.87 | 0.19 | n/a | n/a | 0.76 | 0.46 | 60.7 | 0.86 | 0.13 | n/a | n/a | 0.42 | 0.13 | 44.4 |
| Const. Rec | 552 | 103 | n/a | n/a | n/a | n/a | 54.3 | 550 | 84 | n/a | n/a | n/a | n/a | 46.0 |
| Bev-Holt | 4.44 | 5.94 | 721 | 309 | 0.63 | 0.26 | 56.5 | 1.69 | 0.61 | 1278 | 529 | 0.31 | -0.03 | 40.8 |
| Hock-Stk | 1.64 | 0.60 | 366 | 155 | 0.66 | 0.20 | 56.6 | 1.34 | 0.17 | 501 | 0 | 0.31 | -0.12 | 41.3 |
| Ricker | 1.74 | 0.57 | 0.00085 | 0.00033 | 0.68 | 0.24 | 57.8 | 1.38 | 0.30 | 0.00057 | 0.00022 | 0.31 | -0.08 | 41.3 |

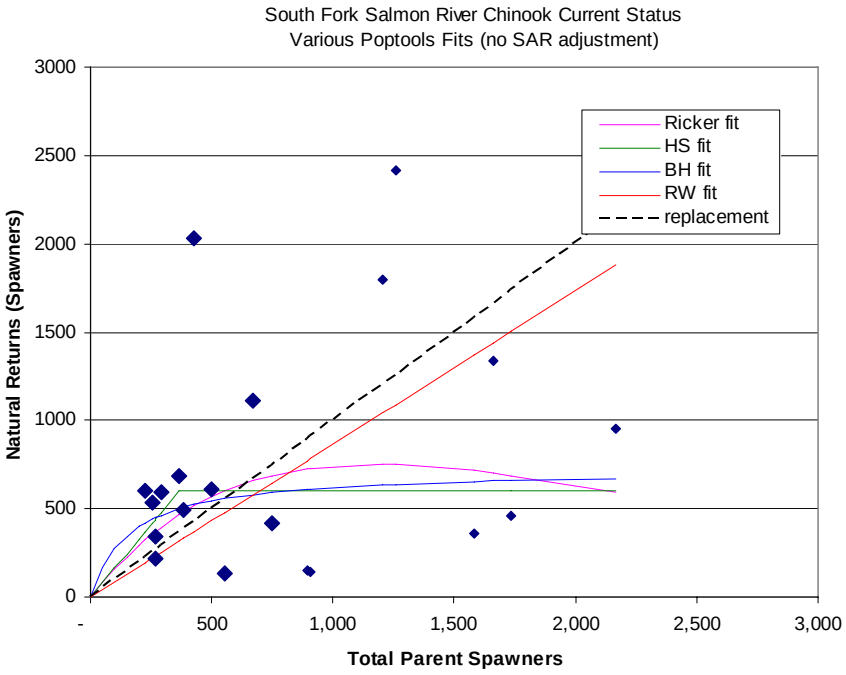


**Figure 8. Stock recruitment curves for the South Fork Salmon River Chinook population. Data not adjusted for marine survival. Points used in the current productivity calculation are bolded.**

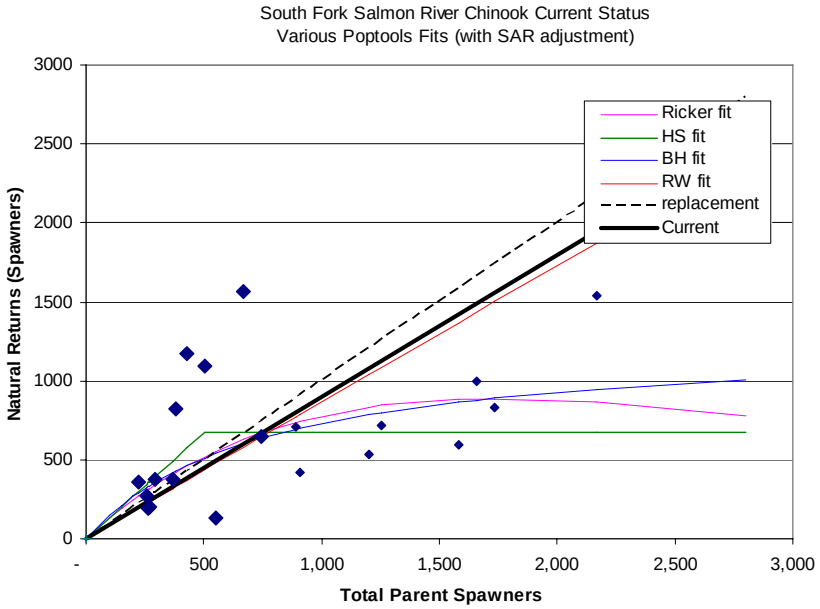


**Figure 9. Stock-recruitment curves for the South Fork Salmon River Chinook population. Data adjusted for marine survival. Points used in the current productivity calculation are bolded.**