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

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

The ICTRT classified the East Fork 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 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.

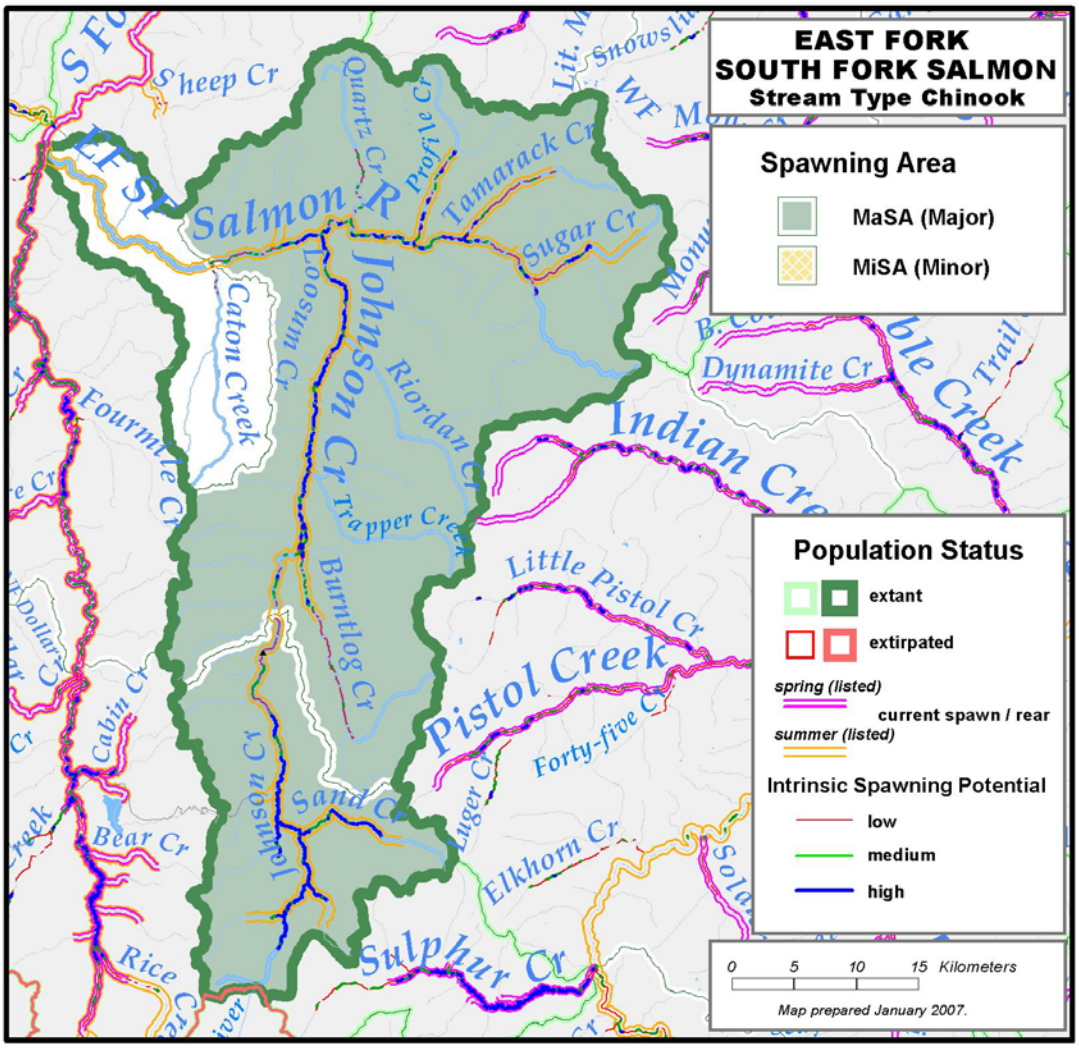


**Figure 1. East Fork South Fork Salmon chinook major and minor spawning areas.**

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

| | |
|---|---|
| Drainage Area (km2) | 1,093 |
| Stream lengths km* (total) | 421 |
| Stream lengths km* (below natural barriers) | 225 |
| Branched stream area weighted by intrinsic potential (km2) | 0.338 |
| Branched stream area km2 (weighted and temp. limited) | 0.338 |
| Total stream area weighted by intrinsic potential (km2) | 0.434 |
| Total stream area weighted by intrinsic potential (km2) temp limited | 0.434 |
| Size / Complexity category | Large / "B" (dendritic structure) |
| Number of MaSAs | 2 |
| 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 (1957 to 2003) natural abundance (number of adult spawning in natural production areas) has ranged from 58 in 1995 to 3,260 in 1960 (Figure 2). Abundance estimates are based on expanded redd counts (reference). Insert expansion methodology here

Recent year natural spawners include returns originating from naturally spawning parents, and hatchery fish from a recently initiated supplementation program. Spawners originating from naturally spawning parents have comprised an average of 97% since 1953, while the most recent 10-year average is 90% (Table 2).

Abundance in recent years has been highly variable, the most recent 10-year geomean number of natural-origin spawners was 321 (Table 2). During the period 1979-1998, returns per spawner for chinook in the East Fork South Fork population ranged from 0.20 (1990 and 1994) to 5.26 (1998). The most recent 20 year (1978-1997) SAR adjusted and delimited (at 75% of the size threshold) geometric mean of returns per spawner was 1.03 (Table 2).

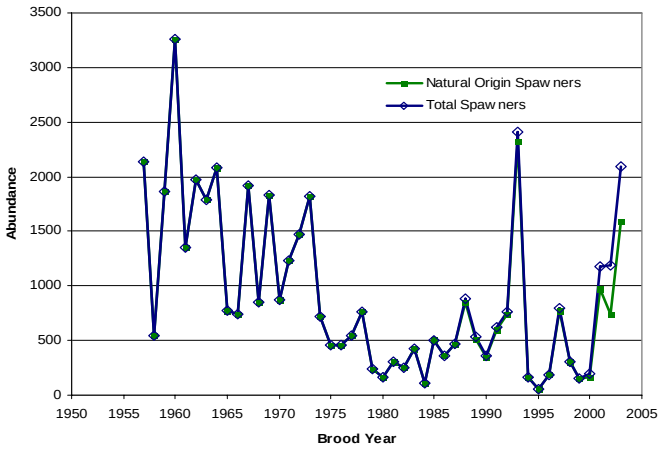


**Figure 2. East Fork South Fork abundance trends 1957-2003.**

**Table 2. East Fork South Fork abundance and productivity measures**

| | |
|---|---|
| 10-year geomean natural abundance | 321 |
| 20-year return/spawner productivity | 0.98 |
| 20-year return/spawner productivity, SAR adj. and delimited* | 1.03 |
| 20-year Bev-Holt fit productivity, SAR adjusted | 1.11 |
| 20-year Lambda productivity estimate | 1.08 |
| Average proportion natural origin spawners (recent 10 years) | 0.90 |
| 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 East Fork South Fork population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3).

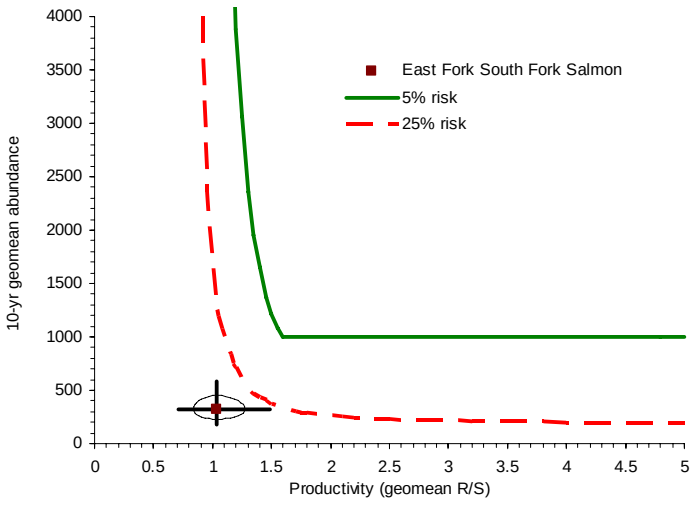


**Figure 3. East Fork South Fork Summer Chinook abundance and productivity metrics against a Hockey-Stick viability curve. Dataset adjusted for marine survival and delimited at 750 spawners. Estimate includes a 1 SE ellipse, 1.81 X SE abundance line, and 1.75 X SE productivity line.**

### *Spatial Structure and Diversity*

The ICTRT has identified two major spawning areas (MaSA) and no minor spawning areas (MiSA) within the East Fork South Fork Chinook salmon population. There are no modeled temperature limitations within either MaSA. Historically most spawning occurred in Johnson Creek and the East Fork South Fork Salmon River upstream of Johnson Creek. The East Fork South Fork Salmon River (upstream of Johnson Creek) spawning area had been extirpated by mining activities in 1940s, and reintroduction efforts began in 1990s. Chinook salmon spawning in Johnson Creek upstream of Landmark Creek was reestablished by barrier removal in 1985.

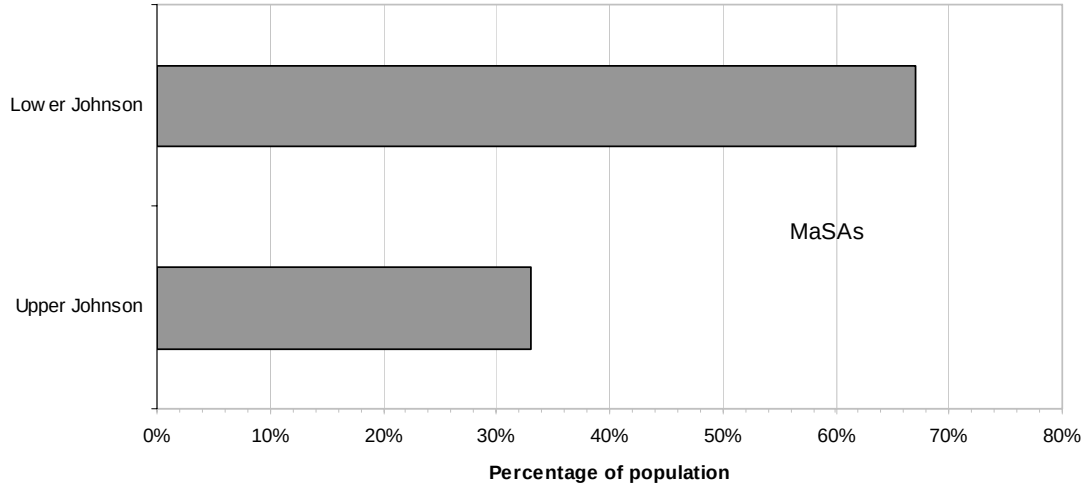


**Figure 4. Proportions of major and minor spawning areas that make up the East Fork South Fork Chinook salmon population. There are no modeled temperature limitations for the spawning areas in this population.**

Factors and Metrics

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

The East Fork South Fork Salmon/Johnson Creek population of summer Chinook has two MaSAs (Lower Johnson and Upper Johnson) and no MiSAs. Both MaSAs are occupied at both the lower and upper ends. This metric is rated *Low Risk* because there are only two MaSAs with dendritic complexity.

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

The IDFG has conducted annual spawner index counts since 1957 on the in Johnson Creek. The index area counts cover intrinsic habitat in both MaSAs. This metric is rated *Very Low Risk* because all historical MaSAs are occupied at both the lower and upper ends.

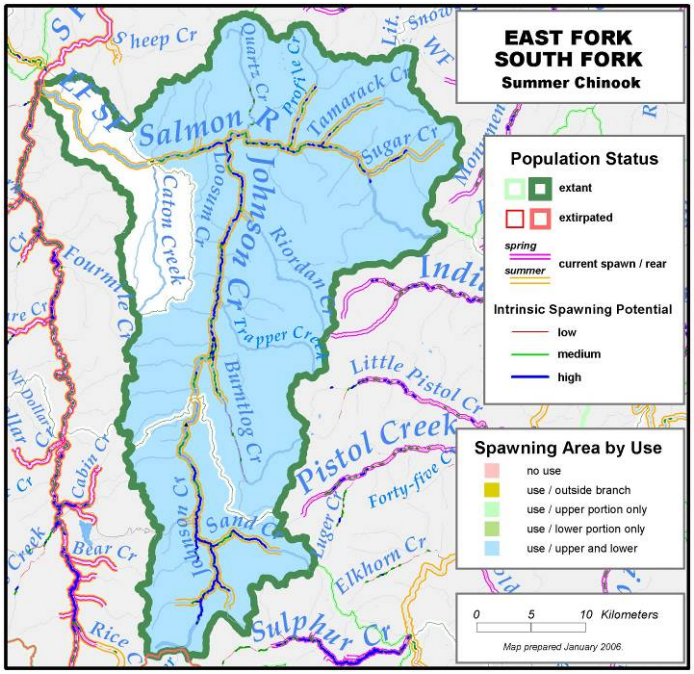


**Figure 5. East Fork South Fork Salmon River Chinook salmon distribution.**

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 loss of a life history strategy is expected to have resulted from natural or anthropogenic impacts in the basin. Major anthropogenic impacts are related to mining activity, grazing, road building and logging. The effects of sedimentation in the system are not expected to be selective against any major life history strategy. Although mining activity in the upper East Fork South Fork Salmon River resulted in extirpation of

Chinook salmon in that area, it is unlikely that those fish exhibited a life history strategy different than the remainder of the population. It appears all historic juvenile and adult life history strategies are present and the metric is rated *Very Low Risk*.

B.1.b. Phenotypic variation.
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. Since there is no direct evidence for loss or substantial change in phenotypic traits; 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. There is low to moderate inter-annual variation, and this population clusters with other South Fork Salmon River populations. This metric was rated *Low 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.

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

(2) *Out-of-MPG strays from within the ESU*. No out-of-MPG strays have been detected spawning in the population, and this sub-metric is rated *Very Low* risk.

(3) *Out of population within MPG strays*. Hatchery fish from the South Fork Salmon River mitigation program have been released into this population in the past, and those hatchery fish were all used to refound the population in the upper East Fork South Fork Salmon River. The current supplementation program on Johnson Creek uses locally derived brood stock. Because the number of out of population hatchery fish released in any year into this population generally has been small and releases were intermittent, this sub-metric is rated *Low* risk.

(4) *Within-population hatchery spawners.* Hatchery-origin spawners in the population in recent years originated from the within-population supplementation program. Proportion of hatchery spawners observed has ranged from x% to xx% per year. The supplementation program is characterized as best management practices based on the following:

- brood stock is derived mainly from natural origin recruits, and
- there is no culling or grading of parr or smolts.

Given that best management practices are used and the average hatchery fraction has been less than 20%, this sub-metric is rated *Moderate Risk*.

The overall risk rating for metric B.2.a "spawner composition" is *Moderate Risk* because of the proportion of naturally spawning within population hatchery origin (supplementation program) fish.

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

The East Fork South Fork Salmon River population intrinsic potential distribution historically was distributed across two EPA level IV ecoregions, with the Southern Forested Mountains being predominant. 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.

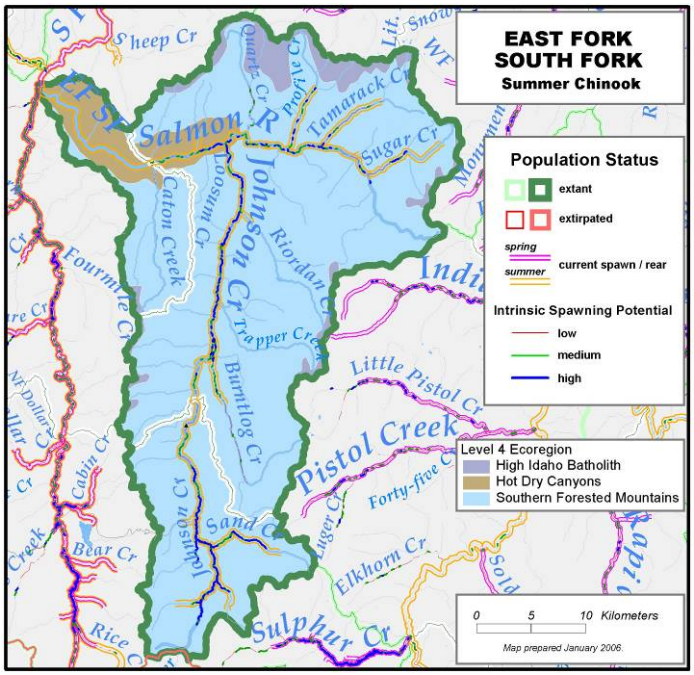


**Figure 6. East Fork South Fork Salmon River Chinook salmon population distribution across various ecoregions.**

**Table 3. East Fork South Fork 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 | 14.2 | 14.2 | 17.2 |
| Southern Forested Mountains | 85.8 | 85.8 | 82.8 |

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. 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 hatchery adult spawners have been observed in the population, the average proportion has been low. Because best management practices are used in the current supplementation program 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 effects of habitat alterations is non selective and this action was rated *Very Low Risk.*

## Spatial Structure and Diversity Summary

Overall spatial structure and diversity has been rated *Low Risk* for the East Fork South Fork Salmon River population (Table 4). This is the lowest spatial structure/diversity risk level the population could achieve because of the historic (natural) number and spatial arrangement of spawning areas and total amount of intrinsic potential habitat.

**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=1.24) | Low Risk | **Low Risk** |
| A.1.b | VL (2) | VL (2) | | | |
| A.1.c | L (1) | L (1) | | | |
| B.1.a | VL (2) | VL (2) | Low Risk | Low Risk | |
| B.1.b | L (1) | L (1) | | | |
| B.1.c | L (1) | L (1) | | | |
| B.2.a(1) | VL (2) | Moderate Risk | Moderate Risk | | |
| B.2.a(2) | VL (2) | | | | |
| B.2.a(3) | L (1) | | | | |
| B.2.a(4) | M (0) | | | | |
| B.3.a | L (1) | L (1) | Low Risk | | |
| B.4.a | L (1) | L (1) | Low Risk | | |

## Overall Viability Rating

The East Fork South Fork Salmon River 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 is at replacement (1.03). The 10-year geometric mean abundance (321) is 32% 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 has the potential to achieve the Highly Viable state because of the current low spatial structure/diversity risk.

| | | 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 South Fork Salmon | | |

**Figure 7. Viable Salmonid Population parameter risk ratings for the East Fork South Fork Summer Chinook salmon population. This population is not currently meeting 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 South Fork Summer Chinook** – Data Summary

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

Table 5. East Fork South Fork Summer 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** | **241** | **1.00** | **241** | **149** | **0.62** | **0.87** | **130** | **0.54** |
| **1980** | **161** | **1.00** | **161** | **261** | **1.62** | **0.58** | **152** | **0.94** |
| **1981** | **302** | **1.00** | **302** | **481** | **1.59** | **0.63** | **303** | **1.00** |
| **1982** | **248** | **1.00** | **248** | **344** | **1.39** | **0.51** | **176** | **0.71** |
| **1983** | **423** | **1.00** | **423** | **935** | **2.21** | **0.58** | **539** | **1.28** |
| **1984** | **114** | **1.00** | **114** | **469** | **4.12** | **1.65** | **776** | **6.80** |
| **1985** | **503** | **1.00** | **503** | **343** | **0.68** | **1.65** | **538** | **1.07** |
| **1986** | **355** | **1.00** | **355** | **636** | **1.79** | **1.41** | **899** | **2.53** |
| **1987** | **466** | **1.00** | **466** | **351** | **0.75** | **1.83** | **640** | **1.38** |
| 1988 | 886 | 0.96 | 855 | 2255 | 2.55 | 0.75 | 1685 | 1.90 |
| **1989** | **531** | **0.96** | **512** | **827** | **1.56** | **1.79** | **1482** | **2.79** |
| **1990** | **362** | **0.96** | **349** | **71** | **0.20** | **4.65** | **329** | **0.91** |
| **1991** | **622** | **0.96** | **600** | **72** | **0.12** | **3.01** | **217** | **0.35** |
| 1992 | 768 | 0.96 | 741 | 312 | 0.41 | 1.65 | 516 | 0.67 |
| 1993 | 2410 | 0.96 | 2324 | 898 | 0.37 | 1.61 | 1446 | 0.60 |
| **1994** | **167** | **0.96** | **161** | **33** | **0.20** | **1.04** | **34** | **0.21** |
| **1995** | **58** | **0.96** | **56** | **100** | **1.72** | **0.48** | **60** | **1.03** |
| **1996** | **186** | **1.00** | **186** | **165** | **0.89** | **0.54** | **90** | **0.48** |
| 1997 | 794 | 0.98 | 779 | 1250 | 1.57 | 0.30 | 370 | 0.47 |
| **1998** | **310** | **1.00** | **310** | **1633** | **5.26** | **0.30** | **485** | **1.56** |
| 1999 | 149 | 1.00 | 149 | | | | | |
| 2000 | 199 | 0.84 | 168 | | | | | |
| 2001 | 1182 | 0.82 | 965 | | | | | |
| 2002 | 1190 | 0.62 | 743 | | | | | |
| 2003 | 2093 | 0.76 | 1593 | | | | | |

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 | 1979-1998 | geomean |
| Point Est. | 1.38 | 1.00 | 1.00 | 1.03 | 1.06 | 1.08 | 321 |
| Std. Err. | 0.29 | 0.27 | 0.30 | 0.21 | 0.19 | 0.12 | 0.34 |
| count | 10 | 16 | 10 | 16 | 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 | 0.98 | 0.22 | n/a | n/a | 0.83 | 0.42 | 61.5 | 0.97 | 0.17 | n/a | n/a | 0.55 | 0.29 | 51.3 |
| Const. Rec | 347 | 85 | n/a | n/a | n/a | n/a | 65.3 | 346 | 81 | n/a | n/a | n/a | n/a | 63.2 |
| Bev-Holt | 1.46 | 0.72 | 1293 | 1312 | 0.85 | 0.30 | 62.9 | 1.11 | 0.30 | 3849 | 6456 | 0.55 | 0.26 | 53.6 |
| Hock-Stk | 1.03 | 0.22 | 886 | 1 | 0.87 | 0.30 | 63.3 | 1.00 | 0.18 | 1448 | 1139 | 0.56 | 0.21 | 53.6 |
| Ricker | 1.26 | 0.39 | 0.00052 | 0.00045 | 0.86 | 0.29 | 63.0 | 1.09 | 0.26 | 0.00023 | 0.00035 | 0.55 | 0.25 | 53.6 |

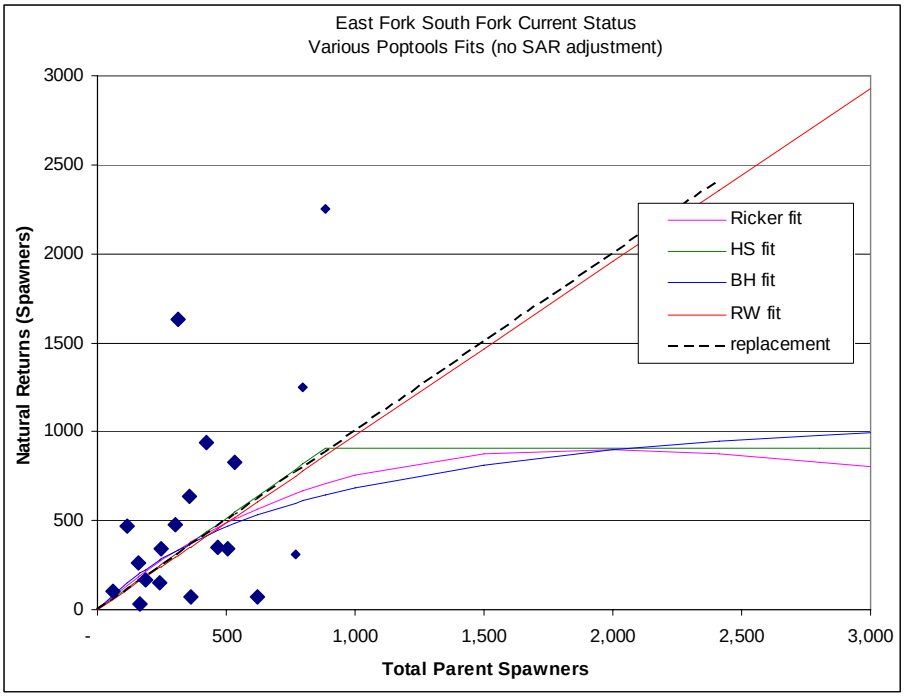


**Figure 8. Stock recruitment curves for the East Fork South Fork chinook population. Data not adjusted for marine survival. Points used in the current productivity calculation are bolded.**

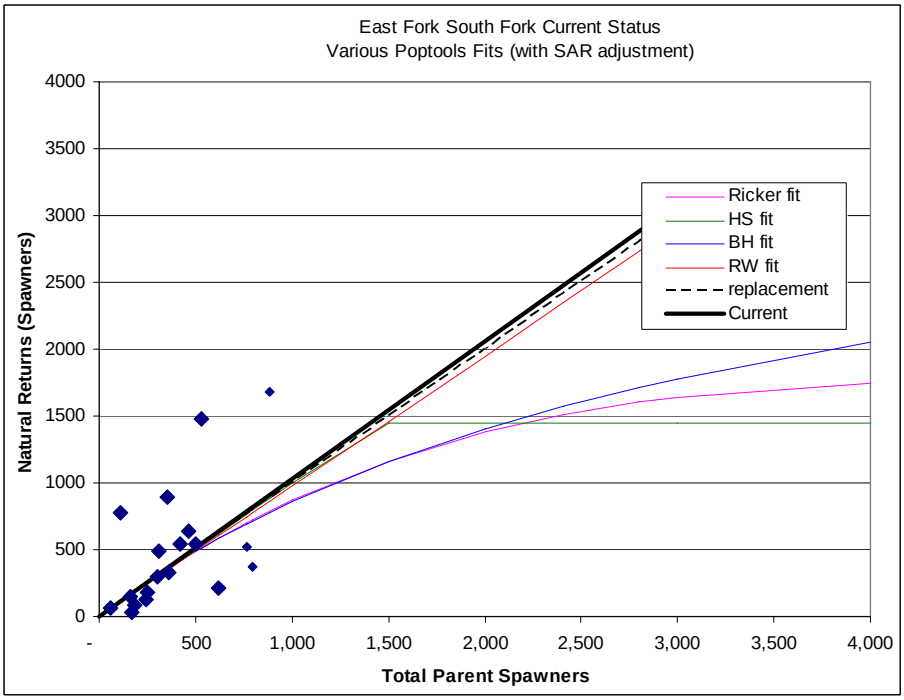


**Figure 9. Stock-recruitment curves for the East Fork South Fork chinook population. Data adjusted for marine survival. Points used in the current productivity calculation are bolded.**