Loon Creek Spring/Summer Chinook Salmon Population
Population Viability Assessment

The Loon Creek 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 Loon 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 Loon Creek population as a "basic" population (Table 1) based on historical habitat potential (ICTRT 2005). A chinook population classified as basic has a mean minimum abundance threshold criteria of 500 naturally produced spawners with a sufficient intrinsic productivity to achieve a 5% or less risk of extinction over a 100-year timeframe.

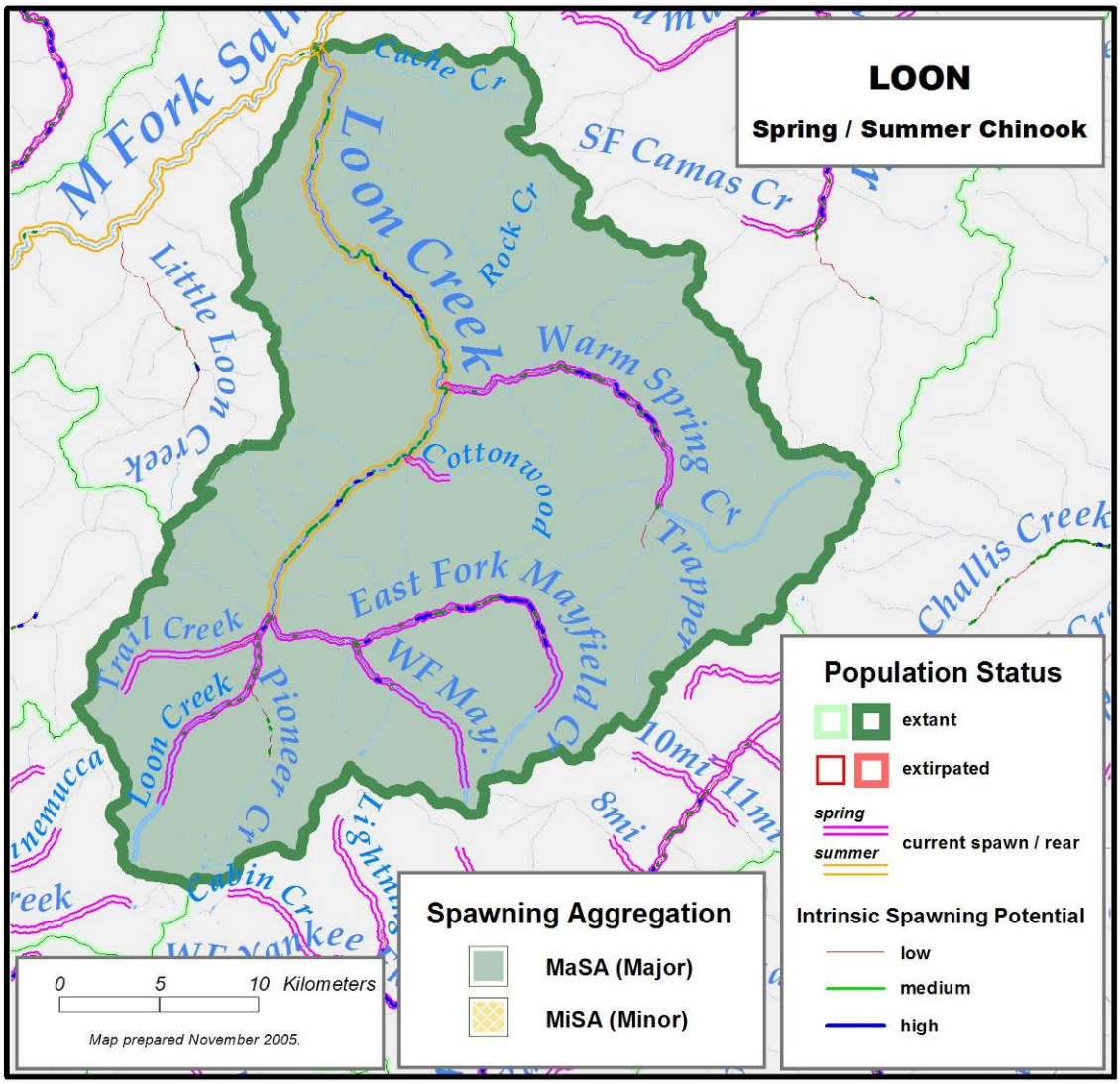

Figure 1. Loon Creek chinook major and minor spawning areas.

Table 1. Loon Creek chinook basin statistics

Drainage Area (km2)	921
Stream lengths km* (total)	122
Stream lengths km* (below natural barriers)	118
Branched stream area weighted by intrinsic potential (km2)	0.111
Branched stream area km2 (weighted and temp. limited)	0.111
Total stream area weighted by intrinsic potential (km2)	0.241
Total stream area weighted by intrinsic potential (km2) temp limited	0.241
Size / Complexity category	Basic / "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^{o}C.

Current Abundance and Productivity

Current (1953 to 2002) abundance (number of adult spawning in natural production areas) has ranged from 0 (1979, 1990, and 1995) to 1,058 in 1957 (Figure 2). Annual abundance estimates for Loon Creek were based on expanded redd counts. IDFG has consistently surveyed two index reaches within the Loon Creek drainage for spring and summer chinook spawning (IDFG #WS-6 mainstem Loon Creek and WS-7 Cabin Creek). We summed the annual counts across index areas and applied two expansion factors to generate estimated annual spawner numbers. We used results from recent year (1995-2003) comprehensive surveying efforts (Russ Thurow, USFS) to generate an expansion factor relating index area counts to an estimate of the total number of redds within the tributary habitat occupied by the population. The average annual expansion factor for Loon Creek was 1.37. We also applied the Middle Fork average fish per redd (1.82) to generate estimated spawners (Table 5). The resulting total expansion factor (index redd counts to total spawners) was 2.49.

For the return per spawner analyses, we did not include data pairs in which the parent spawner estimate was five or less.

It is assumed that since 1957 all (100%) natural spawners originated from naturally spawning parents (Table 2). There is no evidence of hatchery strays spawning in Loon Creek.

Abundance in recent years has been highly variable, the most recent 10-year geomean number of natural origin spawners was 51 (Table 2). During the period 1967-1999, returns per spawner for chinook in Loon Creek ranged from 0.02 (1991) to 17.1 (1999). The most recent 20 year (1978-1997) SAR adjusted and delimited (at 75% of the population size threshold) geometric mean of returns per spawner was 1.15 (Table 2).

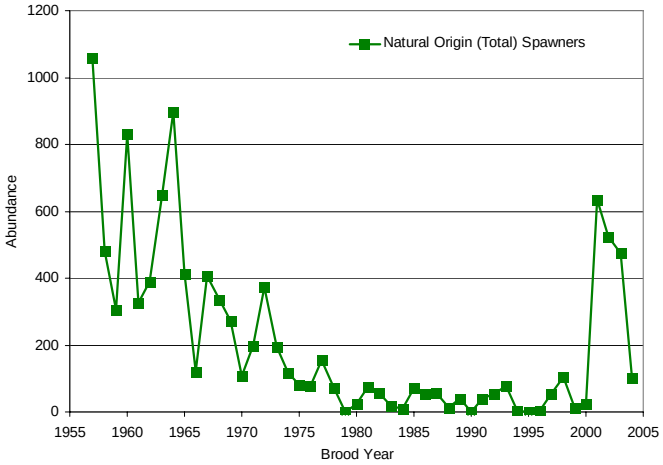

Figure 2. Loon Creek abundance trends 1957-2003.

Table 2. Loon Creek abundance and productivity measures

10-year geomean natural abundance	51
20-year return/spawner productivity	1.21
20-year return/spawner productivity, SAR adj. and delimited*	1.15
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)	100%
Reproductive success adj. for hatchery origin spawners	n/a

*Delimited productivity excludes any spawner/return pair where the spawner number exceeds 75% of the population size 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 375 spawners)
- Curve: Hockey-Stick curve
- Conclusion: The Loon Creek population is at **HIGH** risk based on current abundance and productivity. The point estimate resides below the 25% risk curve (Figure 3).

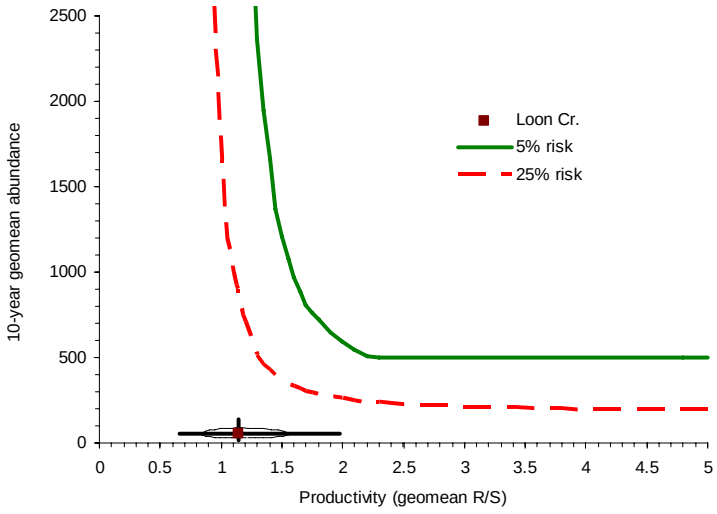

Figure 3. Loon Creek Spring /Summer Chinook abundance and productivity metrics against a Hockey-Stick viability curve. Estimate includes a 1 SE ellipse, 1.83 X SE abundance line, and 1.75 X SE productivity line.

Spatial Structure and Diversity

The ICTRT has identified one major spawning area (MaSA) and no minor spawning areas (MiSAs) within the Loon Creek Spring/Summer Chinook population. The MaSA (Loon Creek) has no modeled temperature limitations. Most spawning occurs in Loon Creek upstream of cold Springs Creek and in Warm Springs and Mayfield creeks.

Factors and Metrics

A.1.a. Number and spatial arrangement of spawning areas.
The Loon Creek population of spring/summer Chinook has one MaSA (Loon) and no MiSAs. The total branched stream area weighted by intrinsic potential is 111,050 m2. This metric is rated *High Risk* because the area outside of the one MaSA does not represent more than 75% capacity of a MaSA.

A.l.b. Spatial extent or range of population.
The IDFG has conducted annual spawner index counts since 1960 in Loon Creek from the Loon Creek Guard Station to Falconberry Ranch. 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. The MaSA is occupied at both the lower and upper ends based on recent spawner surveys.

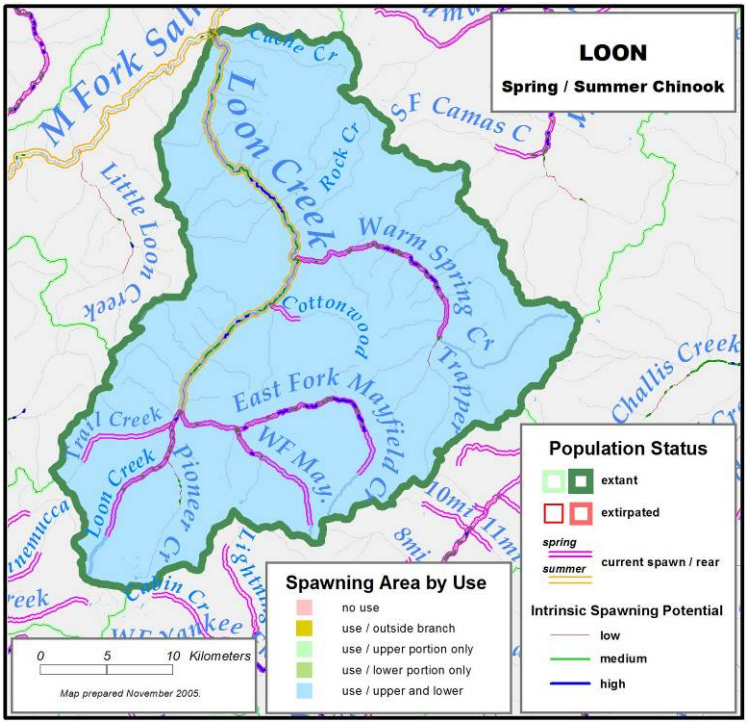

Figure 4. Loon Creek Spring/Summer Chinook distribution.

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 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. The samples available for analyses are limited and additional review of microsatellite data is necessary before making a final risk characterization, therefore this metric was tentatively 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 present 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 Loon Creek population intrinsic potential distribution historically was distributed across one EPA level IV ecoregion, with Southern Forested Mountains. The current distribution is nearly identical to the historic intrinsic distribution (Table 3 and Fig. 6), but does include some use of the Hot Dry Canyons ecosystem. There are no substantial changes in ecoregion occupancy and this metric was rated *Low Risk* for the population.

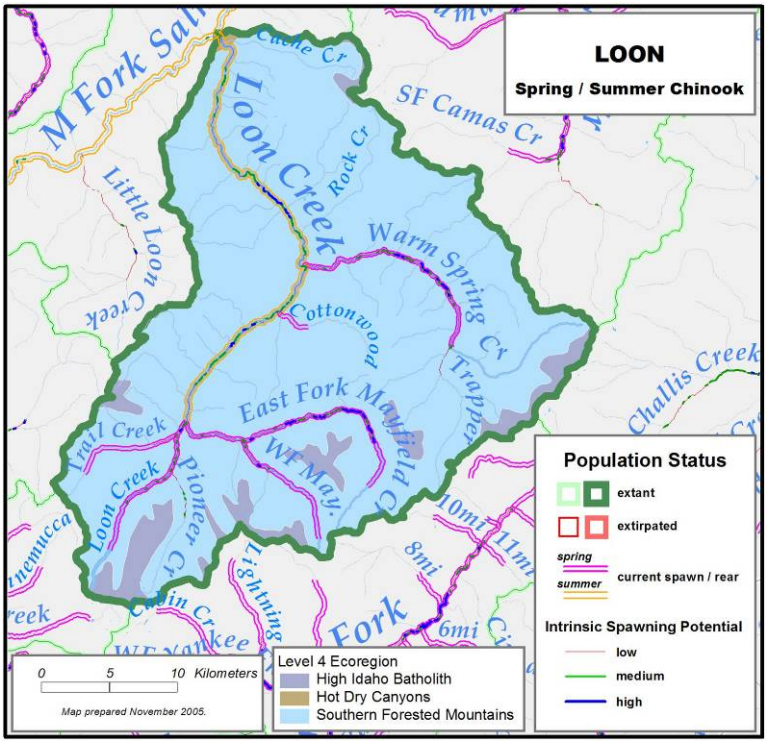

Figure 5. Loon Creek Spring/Summer chinook population distribution across various ecoregions.

Table 3. Loon Creek 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)
Southern Forested Mountains	100.0	99.5	99.5
Hot Dry Canyons	0.0	0.5	0.5

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 grazing activities, water diversions on tributary streams 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 Loon 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. Loon Creek Spring/Summer Chinook population spatial structure and diversity scoring table

Metric	Risk Assessment Scores				
	Metric	Factor	Mechanism	Goal	Population
A.1.a	H (-1)	H (-1)	Low Risk (Mean=0.67)	Low Risk	**Moderate Risk**
A.1.b	L (1)	L (1)			
A.1.c	L (1)	L (1)			
B.1.a	L (1)	L (1)	Moderate Risk	Moderate Risk	
B.1.b	L (1)	L (1)			
B.1.c	M (0)	M (0)			
B.2.a(1)	VL (2)	Very Low (2)	Very Low (2)		
B.2.a(2)	VL (2)				
B.2.a(3)	VL (2)				
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 Loon 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 (1.15) is slightly above replacement but is substantially less than the 1.9 required at the minimum threshold abundance. The 10-year geometric mean abundance is only 10% 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 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%)			**Loon Creek**	

Figure 6. Viable Salmonid Population parameter risk ratings for the Loon Creek 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).*

Loon Creek Spring/Summer Chinook – Data Summary

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

Table 5. Loon Creek Spring/Summer 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
1980	**22**	**1**	**31**	**44**	**1.98**	**0.58**	**26**	**1.2**
1981	**75**	**1**	**174**	**62**	**0.83**	**0.63**	**39**	**0.5**
1982	**57**	**1**	**83**	**51**	**0.89**	**0.51**	**26**	**0.5**
1983	**17**	**1**	**74**	**26**	**1.52**	**0.58**	**15**	**0.9**
1984	**10**	**1**	**17**	**26**	**2.62**	**1.65**	**43**	**4.3**
1985	**70**	**1**	**60**	**14**	**0.20**	**1.57**	**22**	**0.3**
1986	**52**	**1**	**31**	**29**	**0.56**	**1.41**	**41**	**0.8**
1987	**57**	**1**	**92**	**33**	**0.57**	**1.83**	**60**	**1.0**
1988	**12**	**1**	**167**	**98**	**7.87**	**0.75**	**73**	**5.9**
1989	**40**	**1**	**83**	**14**	**0.34**	**1.79**	**25**	**0.6**
1990	**0**	**1**	**9**					
1991	**40**	**1**	**31**	**1**	**0.02**	**3.01**	**3**	**0.1**
1992	**55**	**1**	**20**	**27**	**0.49**	**1.65**	**45**	**0.8**
1993	**77**	**1**	**74**	**120**	**1.56**	**1.61**	**193**	**2.5**
1994	**2**	**1**	**6**					
1995	**0**	**1**	**0**					
1996	**2**	**1**	**3**					
1997	**55**	**1**	**20**	**536**	**9.79**	**0.30**	**159**	**2.9**
1998	**105**	**1**	**46**	**503**	**4.81**	**0.30**	**149**	**1.4**
1999	**15**	**1**	**9**	**255**	**17.07**	**0.65**	**165**	**11.1**
2000	25	1	14					
2001	635	1	269					
2002	523	1	240					
2003	476	1	266					
2004	100		54					

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	1987-1998	1979-1998	geomean
Point Est.	1.42	1.21	1.50	1.15			51
Std. Err.	0.84	0.42	0.65	0.31			0.62
count	7	16	7	16			9

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	1.18	0.47	n/a	n/a	2.28	0.33	65.4	1.12	0.34	n/a	n/a	1.43	0.10	56.3
Const. Rec	45	17	n/a	n/a	n/a	n/a	63.4	43	11	n/a	n/a	n/a	n/a	52.2
Bev-Holt	50.00	0.00	47	1	1.58	0.55	66.5	50.00	225.52	44	13	0.92	0.43	55.3
Hock-Stk	1.18	0.28	836	0	2.28	0.33	68.4	1.12	0.21	931	0	1.43	0.10	59.3
Ricker	2.05	1.63	0.01167	0.01465	1.94	0.46	67.8	2.30	1.37	0.01523	0.01096	1.15	0.33	57.5

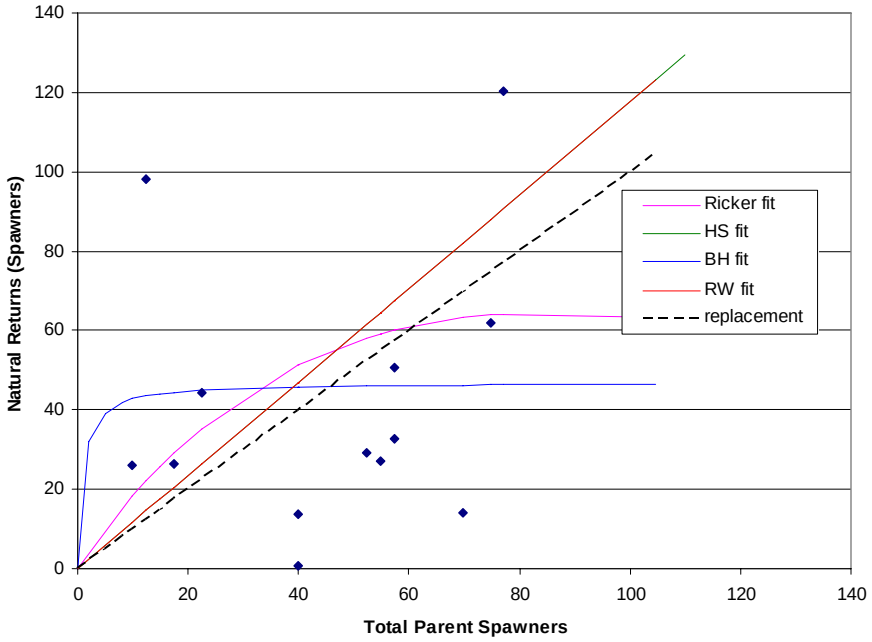

Figure 7. Stock recruitment curves for the Loon Creek Spring/Summer Chinook population. Data not adjusted for marine survival.

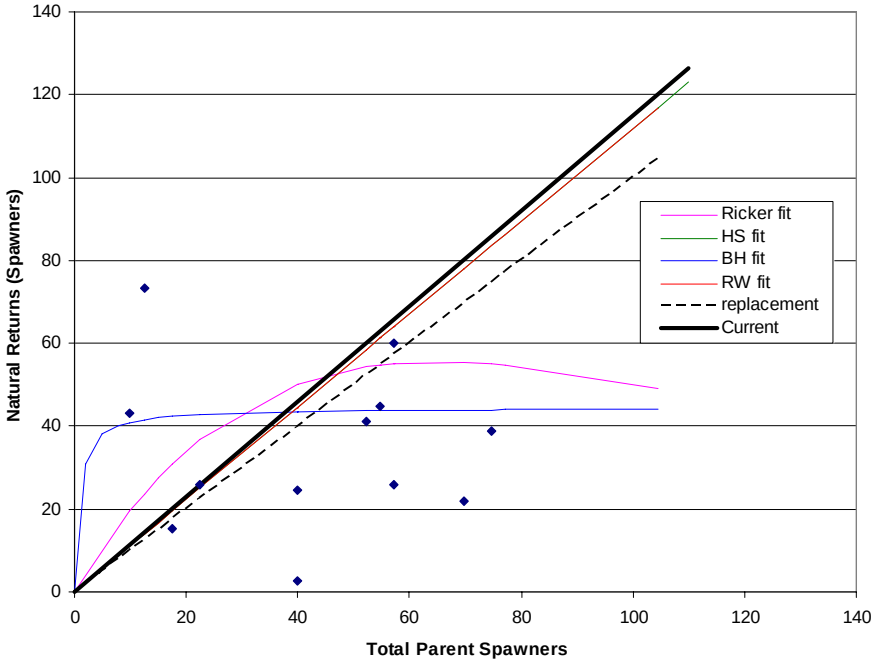

Figure 8. Stock-recruitment curves for the Loon Creek Spring/Summer Chinook population. Data adjusted for marine survival.