ESA Recovery Plan for Idaho Snake River Spring/Summer Chinook Salmon and Snake River Basin Steelhead

November 2017

CHAPTER 5

WEST COAST REGION

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | National Marine Fisheries Service

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5. Idaho Snake River Spring/Summer Chinook Salmon Status and Recovery

This chapter describes a strategy for improving the status of the spring/summer Chinook salmon major population groups (MPGs) in Idaho. These three MPGs ─ groups of populations that share similar genetic, geographic (hydrographic), and/or habitat characteristics ─ are the South Fork Salmon River MPG, Middle Fork Salmon River MPG, and Upper Salmon River MPG. By strategically targeting recovery efforts hierarchically at the population and major population group levels, and at each life stage, we can improve viability for the Idaho MPGs, thereby contributing to recovery of the Snake River spring/summer Chinook salmon ESU; the scale at which listing and delisting occur under the ESA.

Discussions in this chapter for each MPG identify:

1. Viable scenarios - where we need to go to get to recovery;
2. Current status - where we are today based on the ICTRT's (2007) viability criteria discussed in Chapter 3;
3. Limiting factors and threats - conditions that hinder viability and need to be addressed;
4. Recovery strategies and actions - activities designed to improve the status of the species by addressing the limiting factors; and
5. Population-level summaries of needs - recovery needs and actions specific to each population within an MPG.

This Plan describes the local factors that are specific to the MPGs and populations in Idaho, including habitat and hatchery concerns. Regional-level concerns, and the actions to address them (discussed in Chapter 4), apply to all the MPGs and populations in a similar manner because they occur in shared downstream environments, such as the mainstem Snake and Columbia Rivers, the estuary, and the ocean. Actions that occur at the local level are generally tailored to specific, population-level problems that lend themselves to case-by-case solutions. Section 5.1 summarizes the issues that affect all Idaho Snake River spring/summer Chinook salmon populations. Local-level limiting factors, recovery strategies and actions are discussed in Section 5.2 for the South Fork Salmon MPG, Section 5.3 for the Middle Fork Salmon MPG, and Section 5.4 for the Upper Salmon MPG. The regional and local factors must be addressed in concert, and in an integrated way because of the species' complex life cycle and the many changes that have taken place in the environment.

For full detail of the recovery strategies for Snake River spring/summer Chinook salmon populations in Oregon and Washington, please see their respective management unit plans or the comprehensive ESA Recovery Plan for Snake River Spring and Summer Chinook Salmon and Snake River Basin Steelhead.

5.1 Issues across Idaho Snake River Spring/Summer Chinook Salmon MPGs

The following issues generally apply to all Idaho Snake River spring/summer Chinook salmon MPGs and populations in a similar manner. Regional issues that affect both Snake River spring/summer Chinook salmon and Snake River steelhead populations in the mainstem Snake and Columbia Rivers, the estuary, and the ocean are discussed in Chapter 4. The larger ESA recovery plan for the species and the Estuary, Hydro, Harvest, and Ocean modules provide more detail on these issues.

5.1.1 Estuary and Plume Habitat

Over the years, human land and water management activities ─ combined with the effects of the hydropower/flood control system ─ have modified estuarine habitat conditions, resulting in a loss of habitat quality, food supplies, and access to off-channel habitats. These conditions can affect salmonid abundance, productivity, spatial structure, and diversity. Chapter 4 describes the general effects of this habitat loss on the Snake River spring/summer Chinook salmon and steelhead populations. This section focuses on the Snake River spring/summer Chinook salmon MPGs and populations in Idaho.

The loss and degradation of estuarine areas has likely had a larger impact on juvenile ocean-type salmonids (such as fall Chinook salmon) than on Snake River spring and summer Chinook salmon and other stream-type juveniles. Snake River spring/summer Chinook salmon rear in freshwater habitats and leave as smolts to travel to the ocean. They generally move through the estuary in a week or less, and through the plume in a matter of hours or days (Fresh et al. 2014). Consequently, the effects of habitat loss and alteration in the estuary and plume on these short-term visitors may be minimal compared to the effects on juveniles that reside for more time. Nevertheless, individual fish show considerable variation in residence times in different habitats and timing of estuarine and ocean entry. Such variation may be important and may affect survival at later life stages and help provide resilience to the ESU and DPS (McElhany et al. 2000; NMFS 2011; Holsman et al. 2012; Fresh et al. 2014).

5.1.2 Mainstem Columbia and Snake Rivers Hydropower System

Idaho Snake River spring/summer Chinook salmon must pass eight mainstem Columbia and Snake River dams on their journey to the ocean and back. These dams are part of the Federal Columbia River Power System (FCRPS), which includes 31 federally owned multipurpose projects on the Columbia River and its tributaries. Development and operation of the FCRPS have affected Columbia River basin anadromous salmon and steelhead viability. Hydro-related limiting factors that impact viability include mortality and delayed upstream passage (adults), direct and indirect mortality on downstream migrants (juveniles), alteration of the hydrograph (mainstem and estuary flow regime), depletion of historically available nutrients, and degraded rearing and food resources for both presmolts and smolts, increased vulnerability to predation in the Columbia River, and elevated summer water temperatures that can delay passage of adult steelhead and summer migrating Chinook salmon.

Actions implemented in recent years, including those implemented through the FCRPS biological opinion (NMFS 2008a, 2010 and 2014a), have improved operations and fish passage at hydropower facilities and dams. Together, the action have reduced the duration of juvenile outmigration to the

estuary, improved juvenile and adult passage survival and condition, and increased access to habitats. These and planned improvements will continue to move the ESU toward recovery, but additional actions will be needed to achieve ESA delisting goals.

Migrating Adults

Generally, adult passage facilities at the eight mainstem dams are considered effective. From 2012 to 2016, an average of approximately 87.3 percent of adult Snake River spring/summer Chinook salmon migrants survived the journey between Bonneville and Lower Granite Dams (conversion-rate estimates using known-origin adult fish after accounting for "natural straying" and mainstem harvest) (Table 5.1-1).

Table 5.1-1. Adult Snake River spring/summer Chinook salmon survival estimates after correction for harvest and straying based on PIT-tag conversion rates from Bonneville Dam (BON) to McNary (MCN) Dam, McNary Dam to Lower Granite (LGR) Dam, and Bonneville Dam to Lower Granite Dam. Source: http://PTAGIS.org . Note: 2016 harvest estimate unavailable, so 2011-2015 average harvest rate used to correct the 2016 survival estimate.

Species	Years	BON to MCN	MCN to LGR	BON to LGR
SR Spr/Sum Chinook	2012-2016 Avg	93.1%	94.0%	87.3%

However, problems continue to occur in some years. Hydropower and water storage development, water management operations and climate change have generally increased the frequency of high water temperatures (above 20 °C) for summer Chinook salmon and steelhead migrating in the lower Snake River during late summer and fall (EPA 2001). For example, in late July and September 2013 a combination of low summer flows, high air temperatures, and little wind created thermally stratified conditions in Lower Granite reservoir and the adult fish ladder, disrupting upstream fish passage for more than a week. Actions taken by dam operators to modify conditions at the dam, combined with cooler weather, allowed fish to resume passing the dam, but analysis indicates that about 15 percent of migrating Snake River summer-run Chinook salmon failed to pass Lower Granite Dam and most likely died without spawning. A similar situation occurred in late June and July 2015 due to unusually hot weather and low flows. Federal project managers responded by releasing cool water from Dworshak Dam several weeks earlier than usual. The U.S. Army Corps of Engineers operated temporary pumps at the Lower Granite Dam adult ladder to moderate temperatures, and, in coordination with NMFS and other co-managers, altered turbine unit and spill operations in an attempt to improve passage conditions (hydraulic attractiveness) in the fishway at Lower Granite and Little Goose Dams. The U.S. Army Corps of Engineers recently installed a structure at Lower Granite Dam to draw and deliver cooler, deeper water (from Dworshak Dam releases) into the dam's ladder entrance to improve adult passage conditions during periods of high temperatures.

Dagger Falls photo courtesy of Jerry Myers.

Migrating Juveniles

Juvenile Snake River spring and summer Chinook salmon can be killed while migrating through the mainstem dams, both directly through collisions with structures and abrupt pressure changes during passage through turbines and spillways, and indirectly through non-fatal injury and disorientation that leave fish more susceptible to predation and disease, resulting in delayed mortality. Juvenile mortality also occurs in the mainstem reservoirs. For juvenile spring Chinook salmon that survive migration downstream to the FCRPS, about half of the observed mortality through the FCRPS is believed to occur in the reservoirs. In addition, monitoring indicates that substantial mortality of in-river migrating juveniles occurs during outmigration from natal streams but before the fish reach the head of Lower Granite Dam reservoir and the FCRPS system (Faulkner et al. 2015). Construction of the mainstem dams also increased the time it takes for smolts to migrate through the lower Snake and Columbia Rivers. Migration delays are most pronounced in low flow years but still present in even the highest flow years (Williams et al. 2005). However, the addition of surface spillway weirs, and increased levels of spill at the dams during the last 10 years has greatly reduced delay for yearling fish (Smith 2014).

Recent actions have improved juvenile passage survival through the FCRPS. Survival studies show that with few exceptions, these actions are performing well and are very close to achieving, or are already achieving, the FCRPS biological opinion dam passage survival objective of 96 percent for spring-migrating yearling Chinook salmon and steelhead, and 93 percent for summer-migrating Chinook salmon and steelhead (NMFS 2014a). Chapter 4 and the larger ESA recovery plan for Snake River spring/summer Chinook salmon and Snake River Basin steelhead and 2017 Hydro Module provide more information on impacts in the mainstem hydropower system and actions underway or identified to address them.

5.1.3 Hatchery Programs

Hatchery managers continue to run hatchery programs for Snake River spring/summer Chinook salmon populations in Idaho to serve the dual purpose of providing fish for fisheries and supplement spawners to help rebuild depressed natural populations. Seven spring/summer Chinook salmon hatchery programs in Idaho currently produce fish for release in the Salmon River basin. These hatchery programs, which also include other facilities, release approximately 6.8 million spring and summer Chinook salmon per year (not including a 300,000-egg egg-box program of the Shoshone-Bannock Tribes). Spring and summer Chinook salmon are raised in the McCall, Pahsimeroi, Rapid River, and Sawtooth hatchery programs. The hatchery fish are released in Johnson Creek, East Fork South Fork Salmon River, South Fork Salmon River, Pahsimeroi River, Rapid River, Little Salmon River, Snake River below Hells Canyon Dam, Yankee Fork Salmon River, and upper Salmon River (Table 5.1-2).

Table 5.1-2. Current hatchery programs operating in Idaho that release spring/summer Chinook salmon. Programs are operated by Idaho Department of Fish and Game (IDFG), Nez Perce Tribe (NPT), and Shoshone-Bannock Tribes (SBT).

Species	Hatchery Program	Broodstock Source	Release site (# released)	Program Type*	Operator	Year Program Began	Primary Rearing Site
Summer Chinook	Johnson Creek Artificial Propagation Enhancement Program	Johnson Creek	Johnson Cr. (100,000)	Integrated conservation.	NPT	1998	McCall Hatchery
Summer Chinook	McCall Hatchery Program	SF Salmon R.	SF Salmon R. (1,000,000)	Integrated conservation and Isolated harvest.	IDFG	1974	McCall Hatchery
Summer Chinook	Pahsimeroi Hatchery Program	Pahsimeroi R.	Pahsimeroi R. (1,000,000)	Integrated conservation and Isolated harvest.	IDFG	1981	Pahsimero i Hatchery
Summer Chinook	Panther Creek	Pahsimeroi R.	Salmon River	Reintroduction	SBT	2006	Sawtooth Hatchery/ Crystal Springs Hatchery
Spring Chinook	Rapid River Hatchery Program	Rapid R., Hells Canyon	Rapid R. (2,500,000), Little Salmon R. (150,000), and Snake R. (350,000)	Isolated harvest.	IDFG	1964	Rapid R. Hatchery
Spring Chinook	Sawtooth Hatchery Program	Sawtooth	Upper Mainstem Salmon River (1,500,000)	Integrated conservation and Isolated harvest.	IDFG	1985	Sawtooth Hatchery
Spring Chinook	Yankee Fork Hatchery Program	Sawtooth/ Pahsimeroi	Yankee Fork (200,000)	Integrated conservation.	SBT	2008	Sawtooth Hatchery
Summer Chinook	Dollar Cr. Egg box Program	SF Salmon River	Dollar Cr. (300,000 eyed eggs)	Conservation	SBT	2002	Dollar Cr.
Spring Chinook	Dworshak National Fish Hatchery	Dworshak stock/ Clearwater River	North Fork Clearwater	Harvest augmentation	IDFG	1983	Dworshak National Fish Hatchery
Spring Chinook	Kooskia	Dworshak stock/ Clearwater River	Mainstem Clearwater	Harvest augmentation	NPT	1971	Kooskia National Fish Hatchery
Spring Chinook	Clearwater Hatchery	Dworshak stock/ Clearwater River	Mainstem Clearwater	Harvest augmentation	IDFG	1977 program initiated; 1991 hatchery construct-ed	Clear-water Fish Hatchery
Spring Chinook	Nez Perce Tribal Hatchery	Dworshak stock/ Clearwater River	Mainstem Clearwater	Harvest augmentation	NPT	2002	Nez Perce Tribal Hatchery

* In *integrated* programs, the intent is for the natural environment to drive the local adaptation and fitness of a fish population that spawns both in a hatchery and in the wild. Integrated programs are often used for conservation purposes. In *isolated* programs, the intent is to maintain a population (usually hatchery) that is genetically isolated from and does not interact with the natural population.

Sections 5.2 through 5.4 summarize the hatchery programs that specifically affect the Idaho Snake River spring/summer Chinook salmon MPGs. The sections include tables that list hatchery-related limiting factors, threats, and recovery strategies for each population within an MPG.

The management of hatchery programs to support species recovery and meet requirements of the ESA is complicated because of needs to simultaneously address other legal agreements regarding production

levels, agreements for mitigation levels, harvest agreements, tribal trust responsibilities, and scientific uncertainty. The hatchery programs are authorized under the Lower Snake River Compensation Plan and other mitigation programs. Production goals, release sizes, release locations, release priorities, life stage, and marking of released fish for Snake River spring/summer Chinook salmon hatchery programs are established through the *U.S. v. Oregon* management process. The programs must also comply with section 4(d) protective regulations under the ESA. NMFS will continue to regulate the hatchery actions under the ESA and will work with existing forums to review and modify specific actions to support survival of natural-origin populations.

5.1.4 Fishery Management

Snake River spring/summer Chinook salmon encounter fisheries in the ocean, Columbia River estuary, mainstem Columbia, Snake River, and Salmon River as they migrate from the ocean back to natal streams. Mortality associated with past fishery practices, particularly in the lower Columbia River, contributed significantly to the decline of Snake River spring/summer Chinook salmon and other Columbia River basin salmon runs (NRC 1996). The harvest rate on upriver spring Chinook salmon, which includes Snake River spring/summer Chinook salmon, averaged 55 percent from 1938-1973 (NMFS 2008a). Harvest rates dropped in the 1970s in response to fisheries management measures implemented in response to sharp declines in annual returns of natural-origin fish. ESA listings and subsequent fishery management changes in recent years further reduced harvest-related mortality of natural-origin Snake River spring/summer Chinook salmon, with most fisheries focusing on hatchery-origin fish. Since then, harvest rates for Snake River spring/summer Chinook salmon in all mainstem commercial, recreational, and ceremonial/subsistence fisheries have averaged just over 8 percent. Tribal harvest rates have not exceeded 10 percent since 1973, and averaged less than 3 percent from 1973 through 2012.

Today, fishery-related mortality of Snake River spring and summer Chinook salmon due to incidental take of the ESA-listed species occurs during spring and summer season fisheries in the mainstem Columbia River from the river mouth to McNary Dam (Zones 1-6) that target a mix of hatchery and natural-origin stocks. Generally, the mainstem fisheries are assumed to affect each Snake River spring/summer Chinook salmon population in the same proportion that they are represented in the entire run migrating through Zones 1-6. However, new technology (genetic techniques/marking) is increasingly becoming available that could allow managers to assess fishery effects with better population-level resolution and could help focus fisheries more specifically on targeted stocks in the future. Delayed mortality associated with catch and release varies depending on gear type, water temperature, and injuries suffered.

The 2008-2017 *U.S. v. Oregon* Management Agreement[1] provides a framework for managing mainstem fisheries that affect Snake River spring and summer Chinook salmon. The *U.S. v. Oregon*

1 *United States v. Oregon*, originally a combination of two cases, Sohappy v. Smith and *U.S. v. Orego*n (302 F. Supp. 899), legally upheld the Columbia River treaty tribes reserved fishing rights. Although the Sohappy case was closed in 1978, *U.S. v. Oregon* remains under the federal court's continuing jurisdiction serving to protect the tribes' treaty reserved fishing rights. The 2008-2017 *U.S. v. Oregon* Management Agreement provides a framework within which the parties may exercise their sovereign powers in a coordinated and systematic manner in order to protect, rebuild, and enhance upper Columbia River fish runs while providing harvests for both treaty Indian and non-treaty fisheries.

Management Agreement defines harvest limits thought to be sufficiently protective to allow for the recovery of ESA-listed species. Under the *U.S. v. Oregon* Management Agreement and the associated biological opinion, fisheries are regulated to ensure that the resulting mortality of ESA-listed Snake River spring/summer Chinook salmon does not exceed a rate of from 5.5 to 17 percent of the Columbia River mouth run size (NMFS 2008a). The *U.S. v. Oregon* Management Agreement calls for the implementation of an abundance-based management framework for Columbia River fisheries, such that allowable ESA mortality rates may increase or decrease in proportion to the abundance of natural-origin fish forecast to return each year (Table 5.1-3). Harvest exploitation rates under this management framework have been relatively low on Snake River spring and summer Chinook salmon, generally below 10 percent, but have increased in recent years due to the continued large returns of hatchery spring Chinook salmon to the Columbia River basin. These large returns triggered increased allowable harvest rates under the abundance-based sliding-scale harvest rate strategy guiding annual fishery management. Harvest has had a larger impact on the spring Chinook salmon component than on the summer Chinook salmon component, which has had lower exploitation rates.

Table 5.1-3. Abundance-based harvest rate schedule for upriver spring Chinook salmon and Snake River spring/summer Chinook salmon in spring management-period fisheries under the 2008-2017 *U.S. v. Oregon* Management Agreement (TAC 2008).

Total Upriver Snake River Spring/Summer Chinook salmon Run Size	Snake River Natural Spring/Summer Chinook Salmon Run Size[1]	Treaty Zone 6 Total Harvest Rate[2, 5]	Non-Treaty Natural Harvest Rate[3]	Total Natural Harvest Rate[4]	Non-Treaty Natural Limited Harvest Rate[4]
<27,000	<2,700	5.0%	<0.5%	<5.5%	0.5%
27,000	2,700	5.0%	0.5%	5.5%	0.5%
33,000	3,300	5.0%	1.0%	6.0%	0.5%
44,000	4,400	6.0%	1.0%	7.0%	0.5%
55,000	5,500	7.0%	1.5%	8.5%	1.0%
82,000	8,200	7.4%	1.6%	9.0%	1.5%
109,000	10,900	8.3%	1.7%	10.0%	
141,000	14,100	9.1%	1.9%	11.0%	
217,000	21,700	10.0%	2.0%	12.0%	
271,000	21,700	10.8%	2.2%	13.0%	
326,000	32,600	11.7%	2.3%	14.0%	
380,000	38,000	12.5%	2.5%	15.0%	
434,000	43,400	13.4%	2.6%	16.0%	
488,000	48,800	14.3%	2.7%	17%	

[1]If the Snake River natural spring/summer forecast is less than 10% of the total upriver run size, the allowable mortality rate will be based on the Snake River natural spring/summer Chinook salmon run size. In the event the total forecast is less than 27,000 or the Snake River natural spring/summer Chinook forecast is less than 2,700, Oregon and Washington would keep their mortality rate below 0.5% and attempt to keep actual mortalities as close to zero as possible while maintaining minimal fisheries targeting other harvestable runs.

[2]Treaty Fisheries: Zone 6 Ceremonial, subsistence, and commercial fisheries from January 1-June 15. Harvest impacts in the Bonneville Pool tributary fisheries may be included if TAC analysis shows the impacts have increased from the background levels.

[3]Non-Treaty Fisheries: Commercial and recreational fisheries in Zones 1-5 and mainstem recreational fisheries from Bonneville Dam upstream to the Hwy 395 Bridge in the Tri-Cities and commercial and recreation SAFE (Selective Areas Fisheries Evaluation) fisheries from January 1-June 15; Wanapum tribal fisheries, and Snake River mainstem recreational fisheries upstream to the Washington-Idaho border from April through June. Harvest impacts in the Bonneville Pool tributary fisheries may be included if TAC analysis shows the impacts have increased from the background levels.

[4]If the Upper Columbia River natural spring Chinook salmon forecast is less than 1,000, then the total allowable mortality for treaty and non-treaty fisheries combined would be restricted to 9% or less. Whenever Upper Columbia River natural fish restrict the total allowable mortality rate to 9% or less, then non-treaty fisheries would transfer 0.5% harvest rate to treaty fisheries. In no event would non-treaty fisheries go below 0.5% harvest rate.

[5]The Treaty Tribes and the states of Oregon and Washington may agree to a fishery for the Treaty Tribes below Bonneville Dam not to exceed the harvest rates provided for in this Agreement.

Direct and indirect mortality and other effects associated with state and tribal fisheries for spring/summer Chinook salmon and other species in the Snake River and its tributaries affect the abundance, productivity and diversity of Snake River spring/summer Chinook salmon. State of Idaho fisheries in the Snake River and its tributaries occur in areas when adult returns are sufficiently large to meet broodstock needs and allow state and tribal fisheries. The state fisheries are selective for hatchery-origin fish and require that natural-origin fish be released. Tribal fisheries conducted by the Shoshone-Bannock Tribes and Nez Perce Tribe occur in the Snake River and its tributaries, including several natural production areas where the tribes continue traditional fishing practices. The tribal

fisheries are generally non-selective for hatchery or natural-origin fish and affect the fish populations through direct and incidental mortality.

Generally, tributary fisheries by the State of Idaho, Shoshone-Bannock Tribes, and Nez Perce Tribe are managed in a manner that does not reduce the likelihood of survival and recovery of the ESU. The state and tribes conduct their fisheries for spring and summer Chinook salmon in accordance with Fisheries Management and Evaluation Plans (FMEPs) and Tribal Resource Management Plans (TRMPs).The FMEPs and TRMPs include abundance-based management frameworks that limit fishery-related mortality for the affected populations. The fisheries are evaluated in-season and post-season for compliance with the management framework. Ultimately, population-specific ESA take limits constrain fisheries by area and time. The fishing pattern emphasizes fisheries in areas of high hatchery-origin abundance, limiting fishery impacts on natural-origin populations that are relatively depressed.

Allowable harvest rates on Idaho Snake River spring/summer Chinook salmon for tributary fisheries are determined annually using abundance-based sliding scales and run predictions by fishery management area. Currently, Idaho Department of Fish and Game (IDFG) fisheries on hatchery spring/summer Chinook salmon are managed using abundance-based harvest schedules for population aggregates that limit fishery-related mortality for natural-origin populations in the mainstem Salmon River fishery, South Fork Salmon River fishery, and Upper Salmon River fishery, and an incidental mortality cap for the Little Salmon River and Snake River fisheries. The tribes generally use abundance-based management frameworks at a population level. Similar to IDFG's fisheries, the tribes apportion ESA-take accordingly to each of the affected natural-origin populations depending upon location of take and corresponding proportion of natural-origin fish of the different populations present in the fishery location. Together, the state and tribal frameworks are responsive to Total Combined ESA-take limits for each of the affected populations. Table 5.1-4 describes the total combined ESA-take limit for natural-origin populations for all parties fishing within the Salmon River basin, regardless of whether fisheries target natural-origin fish or hatchery-origin fish (NMFS 2013). Table 5.1-5 describes the total combined ESA-take limit for populations that are supplemented with hatchery fish for all parties fishing within the Salmon River basin, regardless of whether fisheries target natural-origin fish or hatchery-origin fish (NMFS 2013). Oregon and Washington fisheries also occur in the mainstem Snake River and their tributaries.

Table 5.1-4. Percentage escapement objective and harvest rate for unsupplemented natural-origin populations of Snake River spring/summer Chinook salmon (NMFS 2013).

Percent of Viable Population Threshold	Harvest Rate
0 – 30%	1% or 3 fish
30.1 – 50%	3%
50.1 – 75%	5%
75.1 – 108%	8%
> 108.1%	35% of margin

Table 5.1-5. Modified abundance-based sliding-scale harvest management framework for supplemented populations of Snake River spring/summer Chinook salmon (NMFS 2013).

Percent of Viable Population Threshold	Percent Escapement Objective	Harvest Rate
0 – 30%	99%	1%
30.1 – 50%	96%	4%
50.1 – 75%	91%	9%
75.1 – 108%	88%	12%
> 108.1%	65 – 92%	35% of the margin

The Harvest Module (NMFS 2014b) describes fishery policies, programs, and actions affecting Snake River spring/summer Chinook salmon. Limiting factors and threats specific to individual Idaho Snake River spring/summer Chinook salmon MPGs are discussed in sections 5.2.4 (South Fork Salmon River MPG), 5.3.4 (Middle Fork Salmon River MPG), and 5.4.4 (Upper Salmon River MPG).

5.1.5 Climate Change

Likely changes across the Pacific Northwest in temperature, precipitation, wind patterns, and sea-level height have profound implications for survival of Snake River salmon and steelhead populations in both their freshwater, estuarine, and marine habitats. Chapter 4 of this management unit plan and the larger ESA recovery plan for the species discuss the potential effects of climate change across the Snake River spring/summer Chinook salmon and steelhead populations. This section focuses on the Idaho Chinook salmon MPGs and populations.

Climate records show that the Pacific Northwest has warmed about 0.7 °C since 1900 (Dalton et al. 2013). As the climate changes, air temperatures in the Pacific Northwest are expected to continue to rise <1 °C in the Columbia Basin by the 2020s and 2 °C to 8 °C by the 2080s (Mantua et al. 2010). While total precipitation changes are uncertain (–4.7% to +13.5%, depending upon model), increasing air temperature will alter snow pack, stream flow timing and volume, and water temperatures in the Columbia and Snake River basin.

Modeling studies to date have focused on the effects of increased summer temperatures and late summer or fall flows on juvenile survival. One modeling study predicts an 18-34 percent reduction in parr-to-smolt survival by 2040 for some Salmon River populations of Snake River spring/summer Chinook because of higher late-summer water temperatures and lower flows (Crozier et al. 2008). A Crozier and Zabel (2013) analysis updates both the expected climate conditions and the relationship between juvenile survival, summer stream temperature, and fall stream flow. The most recent climate downscaling and hydrological models predict that, although summer stream temperatures will increase, fall precipitation may also increase in the Salmon River basin, reducing some of the impact from rising air temperatures (NMFS 2014b). Further, a study by Crozier and Zabel (2013) using recent climate projections found that four of nine populations had lower survival, four had neutral or slightly positive responses, and one population in a very cold stream had a positive response. A modeling study for the highly impacted Lemhi River found that juvenile survival decreased approximately 40 percent by 2040 and 60 percent by 2080 for a relatively dry climate scenario and approximately 10 percent for both periods under a wetter scenario (Walters et al. 2013).

Climate change is also affecting the mainstem, estuarine and marine environments. Potential impacts in these environments, discussed in Chapter 4, are expected to have negative consequences by restricting available habitat, reducing food sources, altering prey survival and productivity, and possibly altering salmon and steelhead migration patterns, growth, and survival. Increased water temperatures in the mainstem Columbia and lower Snake Rivers could create dangerous conditions for adult migrants in some years, particularly for summer Chinook salmon since they migrate in July and August. This situation occurred in 2013 when water temperatures in the fish ladder at Lower Granite Dam disrupted adult summer Chinook salmon migration for approximately one week in July. Increased water temperatures could also increase the metabolic cost of swimming and holding prior to spawning, which could increase prespawn mortality (Crozier 2012). The larger ESA recovery plan for Snake River spring/summer Chinook salmon and steelhead provides more detail on the potential impacts from climate change.

All other threats and conditions remaining equal, future deterioration of water quality, water quantity, and/or physical habitat due to climate change can be expected to cause a reduction in the number of naturally produced adult spring/summer Chinook salmon returning to Idaho population areas. This possibility reinforces the importance of maintaining habitat diversity and achieving survival improvements throughout the entire life cycle.

Chapter 4 identifies strategies and actions to address potential climate change impacts in freshwater, mainstem, estuarine, and ocean environments. Strategies and actions identified in this chapter at the population level will further protect and restore tributary habitat conditions to safeguard against potential negative consequences from climate change.

5.2 South Fork Salmon River MPG

The South Fork Salmon River MPG supports a largely genetically cohesive grouping of summer-run Chinook salmon returning to the South Fork Salmon River subbasin, as well as spring and summer Chinook salmon returning to the adjacent Little Salmon River and tributaries to the lower Salmon River mainstem. The MPG is composed of four independent populations: Little Salmon River, South Fork Salmon River Mainstem, Secesh River, and East Fork South Fork Salmon River. Three of the populations reside in the South Fork Salmon River subbasin, which provides 1,427 kilometers of stream accessible to anadromous fish. The Little Salmon River population resides in the Little Salmon subbasin, which borders the South Fork Salmon watershed and contains 593 kilometers of accessible habitat.

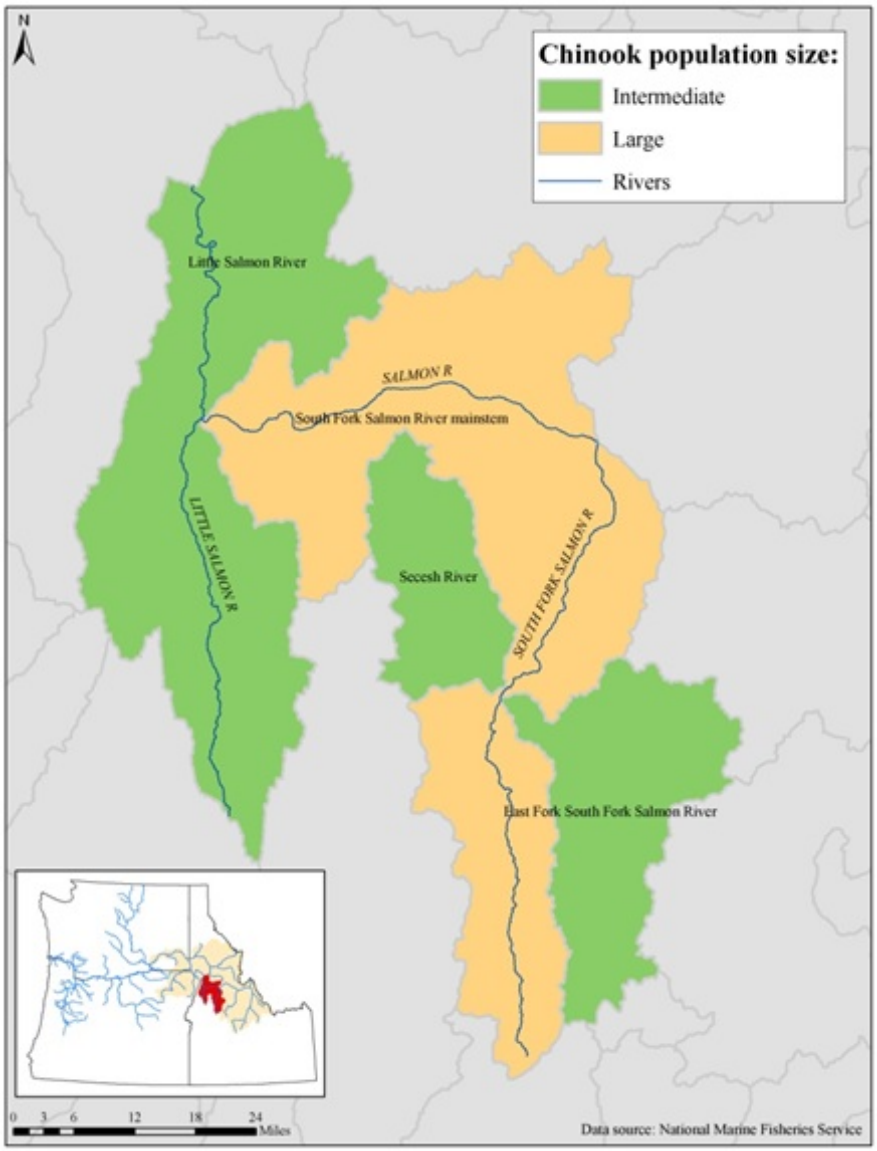

Figure 5.2-1. South Fork Salmon River spring/summer Chinook salmon MPG and independent populations.

NMFS' Interior Columbia River Basin Technical Recovery Team (ICTRT) identified the South Fork Salmon River spring/summer Chinook salmon populations as a major grouping based on genetic similarity, basin topography and common adult run-timing (ICTRT 2003). The Little Salmon River population, while included in the MPG because of geographic proximity, has been heavily influenced by Rapid River Hatchery stock. It is not genetically similar to the Chinook salmon populations in the South Fork Salmon River subbasin, and has both spring- and summer-run fish (ICTRT 2005).

The ICTRT classified the South Fork Salmon River Mainstem and East Fork South Fork Salmon River populations as Large-sized populations, and the Secesh River and Little Salmon River populations as Intermediate-sized populations (Table 5.2-1) (ICTRT 2007).

Table 5.2-1. South Fork Salmon River spring/summer Chinook salmon MPG population characteristics. Minimum abundance and productivity values represent levels needed to achieve a 95% probability of existence over 100 years (ICTRT 2007).

Population	Extant/ Extinct	Life History	Size	Minimum Abundance Threshold*	Minimum Productivity Threshold**
Little Salmon River***	Extant	Spr/Sum	Intermediate	500	2.21
Secesh River	Extant	Summer	Intermediate	750	1.76
South Fork Salmon River Mainstem	Extant	Summer	Large	1,000	1.58
East Fork South Fork Salmon River	Extant	Summer	Large	1000	1.58

* Minimum Abundance Threshold is based on estimated historical tributary spawning and rearing habitat available to a population.
** Minimum Productivity Threshold is derived from the ICTRT population viability curves, where the intrinsic productivity value on the curve corresponds to the population's minimum abundance threshold. A population's intrinsic productivity represents the geometric mean of estimates associated with low to moderate parent escapements.
*** While the Little Salmon River population is classified as an Intermediate-size population, it is treated as a Basic-size population in terms of abundance and productivity targets because the core area consists of small adjunct tributaries.

5.2.1 Viable MPG Scenarios

The ICTRT incorporated the viability criteria (ICTRT 2007) into viable recovery scenarios for each MPG. The criteria, which are explained in detail in Chapter 3, Recovery Goal and Delisting Criteria, should be met for an MPG to be considered viable, or low risk, and thus contribute to the larger objective of species' viability. These criteria are:

1. At least one-half the populations historically present (minimum of two populations) should meet viability criteria (5% or less risk of extinction over 100 years).
2. At least one population should be highly viable (less than 1% risk).
3. Viable populations within an MPG should include some populations classified as "Very Large'" or "Large," and "Intermediate" reflecting proportions historically present.

4. All major life history strategies historically present should be represented among the populations that meet viability criteria.
5. Remaining populations within an MPG should be maintained (less than 25% risk) with sufficient abundance, productivity, spatial structure, and diversity to provide for ecological functions and to preserve options for species' recovery.

The criteria suggest several viable MPG scenarios for the South Fork Salmon River MPG:

- At least one of the MPG's four populations must be viable and one must be highly viable for the MPG to meet the criteria.
- Since two of the populations are classified as Large (South Fork Salmon Mainstem and East Fork South Fork Salmon) and two are classified as Intermediate (Little Salmon and Secesh), either at least one population from each size class or the two Large populations must achieve viability.
- All life histories must be present: suggests that the Little Salmon River population, a spring run, should achieve viable status. The ICTRT recommended that the populations in the South Fork drainages should be given priority relative to meeting MPG viability objectives given the relatively small size and the high level of potential hatchery integration for the Little Salmon River population (Ford 2011).
- All remaining populations should at least achieve maintained status.

5.2.2 Current MPG Status

The ICTRT (2010) and NWFSC (2015) used the viability criteria to determine the current status of the South Fork Salmon River MPG. The NWFSC completed status reviews for all populations in the MPG (NWFSC 2015), which together determine status at the MPG-level. The current status for each population is the cumulative risk resulting from the population's abundance, productivity, spatial structure, and diversity risks.

As discussed in Section 5.2.1, at least two of the MPG's four populations must be viable with at least one highly viable for the MPG to meet the viability criteria. Currently, the South Fork Salmon River spring/summer Chinook salmon MPG does not meet the MPG-level viability criteria. All four populations are presently at overall high risk of extinction within 100 years, primarily due to high abundance and productivity risk (Table 5.2-2).

The NWFSC 2015 status review found that natural spawning abundance has increased in recent years for three of the populations (the South Fork Salmon, East Fork South Fork Salmon, and Secesh Rivers populations), but the increase was lower than in the Middle Fork Salmon River and Upper Salmon River MPGs, with the exception of the East Fork South Fork Salmon River population. The high relative increase in abundance for the East Fork South Fork Salmon River population may partially reflect a significant level of direct hatchery supplementation. The latest status review indicates that productivity has decreased in the South Fork Salmon River and East Fork Salmon River populations, with no change in the Secesh River population. Productivity estimates for the three populations, however, are generally higher than estimates for populations in other Snake River spring/summer

Chinook salmon MPGs. Combined estimates for abundance and productivity show that viability ratings remain at high risk, although survival/capacity gaps relative to moderate and low risk are smaller than for other populations in the ESU (NWFSC 2015).

Three of the four populations in the South Fork Salmon River MPG have ongoing hatchery programs, but hatchery proportions for two of the three populations have decreased marginally (NWFSC 2015). The Secesh River continues to show low hatchery proportions, reflecting some straying for hatchery programs in adjacent populations. Spatial structure/diversity risks are currently rated moderate for the South Fork Salmon River population (relatively high proportion of hatchery spawners) and low for the Secesh River, East Fork South Fork Salmon River, and Little Salmon River populations. The Little Salmon River population includes returns from large-scale hatchery releases but some of its side tributary spawning sites likely have low hatchery contributions.

Table 5.2-2. Viable Salmonid Population (VSP) risk matrix for independent populations in the South Fork Salmon River Spring/Summer Chinook salmon MPG with current status, as determined from ICTRT population viability assessments (ICTRT 2010).

		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	HR
	High (>25%)	HR	HR Little Salmon R Secesh R EFSF Salmon	HR SFSR Mainstem	HR

Viability Key: HV – Highly Viable; V – Viable; M – Maintained; and HR – High Risk; shaded cells – does not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years.

5.2.3 MPG Limiting Factors and Threats

Many limiting factors and threats affect the viability of Idaho's Snake River spring/summer Chinook salmon during their complex, wide-ranging life cycle. NMFS defines limiting factors as the biological and physical conditions that limit a species' viability (e.g., high water temperature) and threats as those human activities or natural processes that cause the limiting factors. While the term 'threats' may carry a negative connotation, these are often legitimate and necessary human activities that may at times have unintended negative consequences on fish populations. Adjusting such activities can often minimize or eliminate the negative impacts.

This section summarizes the impacts on South Fork Salmon River spring/summer Chinook salmon populations from natal habitat alteration, hatchery programs, and fisheries management. Chapter 4 discussions regional concerns for both spring/summer Chinook salmon and steelhead, including those posed by the Columbia and Snake River hydropower system, predation, competition, estuarine habitat

alterations, and climate change. Section 5.1 summarizes the factors that affect all Idaho Snake River spring/summer Chinook salmon populations.

5.2.3.1 Natal Habitat Alteration

Several parts of the South Fork Salmon River MPG include remote U.S. Forest Service land and provide high-quality, intact habitat. Habitat conditions for spring/summer Chinook salmon in many other parts of the MPG, however, have been degraded by road construction, mining, timber harvest, livestock grazing, and recreational use. This has reduced riparian function and vegetation, decreased recruitment of large woody debris, accelerated sediment loading, and increased water temperatures to critical levels in some areas. Roads or other human developments have disturbed riparian conditions along sections of the mainstem rivers and many of the major tributaries in the MPG. In addition, passage barriers restrict access to historical spawning and rearing habitat. Presently, many degraded areas are on an improving trend due to ongoing habitat restoration efforts. Table 5.2-3 identifies the habitat-related limiting factors in the population areas. Sections 5.2.5 through 5.2.8 provide more detail on the limiting factors and threats within each population area.

Table 5.2-3. Habitat-related limiting factors in South Fork Salmon River spring/summer Chinook salmon MPG.

Population	Habitat-related Limiting Factors					
	Riparian Condition	Excess Sediment	Passage Barrier	Summer Flow	High Water Temperatures	Instream Complexity
Little Salmon R.	√	√	√	√	√	√
Secesh R.		√	√			
South Fork Salmon R.	√	√			√	√
EF South Fork Salmon R.	√	√	√		√	√

5.2.3.2 Hatchery Programs

Two large hatchery programs (South Fork Salmon hatchery program and Rapid River Hatchery) exist within the South Fork Salmon River MPG. These hatchery programs release more than four million fish annually. The Rapid River hatchery program is an isolated program. The South Fork Salmon hatchery program is operated as an integration/supplementation program. A smaller supplementation program also releases fish in the MPG.

The Rapid River Fish Hatchery was constructed in 1964 by the Idaho Power Company to mitigate for losses of anadromous fish associated with the construction and operation of the Hells Canyon Complex. IDFG's current production plan for the hatchery, consistent with the Hells Canyon Settlement Agreement, is to release approximately 3 million yearling Chinook salmon smolts annually (2.489 million to Rapid River, 186,000 to the Little Salmon River, and 417,000 to the Snake River downstream of Hells Canyon Dam). Actual release numbers vary, averaging 3.12 million smolts for brood years 2006 through 2015.

The South Fork Salmon River hatchery program (McCall Fish Hatchery) was established as harvest mitigation and is funded by BPA through the LSRCP. The hatchery facility is on the North Fork Payette River, above the Hells Canyon Complex, but an adult trapping, spawning and holding facility

is located on the South Fork Salmon River. The hatchery program releases approximately 1.0 million smolts to the South Fork Salmon River each year.

A small conservation program operates on Johnson Creek, a tributary to the East Fork South Fork Salmon River. The Johnson Creek program uses only natural-origin returns for broodstock and currently has an annual target release level of 100,000 yearling smolts. Fish from this program are released into Johnson Creek.

The Secesh River population has no history of hatchery influence, except for an occasional stray from the South Fork Salmon River or Johnson Creek hatchery program.

Hatchery and Genetics Management Plans for the hatchery programs describe program operations and actions taken to support recovery and minimize ecological or genetic impacts, such as straying and other forms of competition with naturally produced fish. The FCRPS biological opinion (NMFS 2008b) requires the hatchery operators and the action agencies to provide NMFS with updated HGMPs describing site-specific applications of the "best management practices" for the hatchery programs as described in Appendices C and D of the Supplemental Comprehensive Analysis of the FCRPS (NMFS 2008c) for those mitigation hatchery programs funded by the FCRPS action agencies. The HGMPs are the basis for NMFS' biological opinions on hatchery programs under sections 7 and 10 and the 4(d) rule, which all relate to incidental and direct take of listed species.

Limiting Factors and Threats

Hatchery production has played a prominent role for spring/summer Chinook salmon populations in the South Fork Salmon River MPG. Three hatchery programs operate in the MPG: A large spring Chinook salmon mitigation program (Hells Canyon Settlement Program) operates in the Little Salmon River population on Rapid River; a summer Chinook salmon program associated with the Lower Snake River Compensation Plan releases summer Chinook salmon into the upper South Fork Salmon River population; and a smaller supplementation program operates in the East Fork South Fork Salmon River population on Johnson Creek. Matala et al. (2012) reviewed the genetic structure and diversity of the three summer Chinook salmon populations in the South Fork Salmon River MPG and concluded that, "…genetic differentiation observed through genetic distance analyses among Secesh River, Johnson Creek, and upper South Fork Salmon River is consistent with philopatric divergence among geographically proximate groups." Matala et al. (2012) determined that, despite large hatchery releases, these populations "remain largely intact." Matala et al. (2012) documented the maintenance of three historical aggregates of Chinook salmon persisting in the South Fork Salmon River with variable hatchery influence.

The ICTRT found that genetic testing could not differentiate between the wild fish in the Little Salmon population and hatchery broodstock trapped in the Snake River below Hells Canyon Dam. However, while there are no samples from the endemic population, it is reasonable to expect the Little Salmon River population to be more similar to the populations from the Hells Canyon area.

The smaller conservation program on Johnson Creek affects the East Fork South Fork Salmon River population; however, all releases of hatchery fish in the Johnson Creek and East Fork South Fork population have originated from within-population broodstock.

The McCall hatchery program requires careful planning and operation because the South Fork Salmon River population is targeted to achieve viable status to support MPG recovery. This hatchery program raises general issues of concern associated with hatchery programs and the loss of fitness that may accompany hatchery-influenced selection; however, since 1981 all broodstock for this program has been collected from the South Fork Salmon River and hatchery and supplemented stocks show little genetic differentiation. Additionally, while Van Doornik et al. (2011) documented a slight decline in the genetic variability and allelic richness over four generations in the Stolle Meadows major spawning area, he indicated that the initial values of this population were higher than all other initial values of the other sampled populations and the final values were within the ranges of final values for other Salmon River basin populations. Stolle Meadows also maintained a similar effective size as the other sampled populations. Van Doornik et al. (2011) also documented that the neighboring Secesh River population was maintaining genetic distance from the supplemented South Fork Salmon River population. The ICTRT has determined that if the hatchery program continues to use best management practices it should not preclude the population from reaching viable status.

Table 5.2-4 summarizes the historical and current limiting factors and threats from hatchery programs on the natural populations within this MPG, and identifies strategies to address them.

Table 5.2-4. South Fork Salmon River Spring/Summer Chinook salmon MPG hatchery programs, limiting factors and threats, and recovery strategies.

Population	Summary Description	Current		Hatchery Influence		Hatchery Effects on Population Viability (+ denotes a Beneficial Effect and – Denotes a Risk or Threat to Viability)	Recovery Strategy
		Limiting factors	Threats	Current	Historical		
Little Salmon River	Large hatchery program in place (Rapid River)	Reduced genetic adaptiveness	Incidental catch of natural-origin fish in mark-selective fisheries for hatchery-origin fish; Potential hatchery strays.	Smolt releases	Program operated since the 1960s. Started with out-of-population broodstock.	- loss of genetic adaptiveness from out-of-population (and MPG) broodstock.	Operate Rapid River program to minimize interactions with wild fish.
South Fork Salmon River	Large program in place (McCall)	Reduced genetic adaptiveness	Operation of weir.	Smolt releases	Program operated for over 35 years	- Hatchery program could be reducing genetic adaptiveness.	Develop gene flow standards through HGMP process.
Secesh River	No history of hatchery influence except for an occasional stray	Reduced genetic adaptiveness	Stray fish from South Fork Salmon and Johnson Creek Programs.	None	None	No effect.	Manage for natural production; Monitor for strays.
East Fork South Fork Salmon River	Small supplementation program in place (Johnson Creek)	Reduced genetic adaptiveness	Operation of weir; High pHOS.	Smolt releases	Operated periodically since 1984	Potential legacy effects from use of out-of-population broodstock, reducing genetic adaptiveness. + increase in natural spawners after years of low spawner returns. - continued high pHOS may reduce long-term fitness.	Operate to achieve conservation and evaluate supplementation.

* Proportion of hatchery-origin spawners (pHOS); proportion of natural-origin broodstock (pNOB).

5.2.3.3 Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia River, Snake River, Salmon River, and tributary reaches continue to pose a threat to the abundance, productivity, and diversity of the South Fork Salmon River spring/summer Chinook salmon MPG. However, negotiations and agreements between the different fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook salmon and other ESA-listed species.

Mainstem Columbia and Snake River Fisheries

Most harvest-related mortality for spring/summer Chinook salmon returning to natal streams in the South Fork Salmon River MPG, and other Snake River MPGs, occurs on the mainstem Columbia River. Fishery-related mortalities of Snake River spring/summer Chinook salmon occur in spring and summer season fisheries in Zones 1-6 in the mainstem Columbia River. State and tribal fisheries in Zones 1-6 are regulated under the *U.S. v. Oregon* Management Agreement and associated biological opinion to ensure that fishery-related mortality of ESA-listed Snake River spring/summer Chinook salmon does not exceed a rate of from 5.5 to 17 percent of the Columbia River mouth run size. The fishery-related mortality rate for the Snake River spring/summer Chinook salmon ESU varies annually based on abundance. Overall, fishery-related mortality rates on natural-origin Snake River spring/summer Chinook salmon have remained relatively low, generally below 10 percent for the

entire ESU. The *U.S. v. Oregon* Management Agreement allocated the majority of ESA impacts to treaty tribal fisheries (NMFS 2008b).

Tributary Fisheries

Fishery-related mortality of natural-origin spring and summer Chinook salmon returning to the South Fork Salmon River MPG occurs in state tributary fisheries targeting hatchery-origin fish in the mainstem Salmon River and the South Fork Salmon and Little Salmon Rivers. State fisheries on the South Fork Salmon River target hatchery-origin adults returning to the South Fork Salmon River from the summer Chinook salmon program that rears fish at McCall Hatchery and releases them in the South Fork Salmon River. State fisheries also target hatchery-origin spring Chinook salmon returning to Rapid River Hatchery in the Little Salmon River (Table 5.2-5). State fisheries on spring/summer Chinook salmon do not currently occur within the Secesh River and East Fork South Fork Salmon River.

Tribal fisheries also affect the abundance, productivity, and diversity of natural-origin spring/summer Chinook salmon returning to the South Fork Salmon River MPG. Tribal fisheries could potentially occur in all South Fork Salmon River MPG populations, depending on expected population-specific abundance. While the tribal harvests are generally nonselective for hatchery or natural-origin fish, the tribes limit fishery-related mortality of natural-origin populations by implementing an abundance-based management framework that has been authorized under the ESA. Under the framework, the allowable fishery-related mortality rate on populations in the South Fork Salmon River MPG generally ranges from 1 – 8 percent of the expected return; however, higher rates are allowed if abundance is greater than 108 percent of viable. When abundance of the natural-origin run is low, allowable harvest rates are also very low. The tribes conduct monitoring and evaluation to assess the abundance of spring Chinook salmon and to determine fishery effort and catch.

Table 5.2-5. Fisheries on spring/summer Chinook salmon populations in the South Fork Salmon River MPG.

Population	State Fisheries	Tribal Fisheries	Discussion
Little Salmon R.	X	X	State fisheries target hatchery-origin Chinook salmon returning to Rapid River Hatchery
South Fork Salmon R.	X	X	State fisheries target hatchery-origin Chinook salmon reared at McCall Hatchery and released in South Fork Salmon River
Secesh River		X	No hatchery releases in river.
East Fork South Fork Salmon R.		X	Hatchery-origin spring Chinook salmon releases from Johnson Creek Hatchery do not currently support a state fishery.

Summary of Fishery-related Limiting Factors and Threats

Historical and Current Limiting Factors

- Direct mortality associated with fisheries that target specific stocks.
- Indirect mortality of fish harvested incidentally to targeted species or stock.
- Delayed mortality of fish that encounter gear but are not landed, or that die after being caught and released.

- Selective effects on timing, size, age (including larger, older fish), and/or distribution due to type of gear or fishing technique and/or location.
- Reduced marine-based nutrient supply and carrying capacity.

Historical Threats

- Past Columbia and Snake River mainstem fisheries.
- Past Salmon River and tributary fisheries. While harvest would have occurred in the Salmon River and tributaries, few, if any, published catch data are available for these fisheries.

Current Threats

- Fisheries targeting harvestable hatchery stocks or other species.
- Targeted fisheries.
- Harvest methods and timing.
- Illegal harvest (poaching).

5.2.3.4 Other Threats and Limiting Factors

South Fork Salmon River spring and summer Chinook salmon populations are also affected by threats posed by the Columbia and Snake River hydropower system, predation and competition, estuarine habitat alterations, and climate change. Chapter 4 and Section 5.1 summarize the factors that affect all Idaho Snake River spring/summer Chinook salmon populations.

5.2.4 MPG Recovery Strategy

5.2.4.1 Proposed Population Status

The recovery strategy for this major population group includes achieving a proposed status for each population within the South Fork Salmon River spring/summer Chinook salmon MPG. There are multiple viable MPG scenarios for the South Fork Salmon River, as described above in section 5.2.1. To provide focus for this recovery plan, NMFS and the State of Idaho have selected a proposed status for each population, matching one of the viable MPG scenarios. The proposed status selections to achieve MPG-level viability are described below and in Table 5.2-6; however, the recovery scenario remains flexible and will be updated in the future depending on how the populations respond to changes over time. Any viable MPG scenario satisfying the criterion in 5.2.1 is acceptable for achieving the recovery goal.

Table 5.2-6. Viable Salmonid Population (VSP) risk matrix for independent salmonid populations in the South Fork Salmon River MPG. This scenario illustrates one way to achieve a viable MPG.

		Spatial Structure/Diversity Risk			
		Very Low	Low	Moderate	High
Abundance/ Productivity Risk	Very Low (<1%)	HV	Secesh R HV	V	M
	Low (1-5%)	V	V	SFSR Mainstem V	M
	Moderate (6 – 25%)	M	EFSF Salmon M	Little Salmon R M	HR
	High (>25%)	HR	HR	HR	HR

Viability Key: HV – Highly Viable; V – Viable; M – Maintained; and HR – High Risk; shaded cells – does not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years.

Little Salmon River Population

The Little Salmon River population is included in the South Fork Salmon River MPG based on geographic proximity, but it does not share common attributes with the core South Fork Salmon River production area. Historically, the population consisted of wild summer-run Chinook salmon in Rapid River, as well as spawning in other tributaries to the lower Salmon River. Currently, the Little Salmon River watershed and tributaries to the lower Salmon River mainstem consist of wild spring-run Chinook salmon. There are substantial releases of spring-run hatchery fish into this system from the Rapid River Hatchery. Genetic testing could not differentiate between the wild fish in this population and hatchery broodstock trapped in the Snake River below Hells Canyon Dam, suggesting the population has been greatly influenced by hatchery releases.

The viability of this MPG is considered more dependent on production from summer-run populations within the South Fork Salmon River drainage than on the minor amount of spring-run production scattered in the Little Salmon and lower Salmon River tributaries (ICTRT 2007). Additionally, a large portion of the historic habitat in the population lies outside of the core spawning reaches in the major and minor spawning areas. As a result, while the Little Salmon River population is classified as an Intermediate-size population based on total historic habitat potential, the ICTRT (2007) considers it a Basic-size population in terms of abundance and productivity criteria. Finally, this population has significant impacts from tribal and nontribal harvest and from continued hatchery operations. For these reasons, the proposed status for the Little Salmon River population is ***Maintained***, with a moderate (25% or less) risk of extinction over 100 years.

Secesh River Population

The Secesh River population has the fewest impacts from human land uses, the fewest harvest impacts and very little hatchery influence. Because this Intermediate-size population has fewer limiting factors to address than do others in the MPG, the population's proposed status is ***Highly Viable,*** with a very low (less than 1%) risk of extinction over 100 years.

South Fork Salmon Population

The South Fork Salmon Mainstem population is a Large-size population with the highest current abundance and productivity in the MPG. The habitat is recovering from the impacts of past land uses and is generally highly productive, although more restoration projects are needed to fully address past and present land uses, such as the extensive road system. The population faces a moderate risk from hatchery influences and harvest. However, if the hatchery programs continue to use best management practices, this moderate risk should not preclude the population from reaching viable status. The proposed status for this population is ***Viable,*** with a low (1-5%) risk of extinction over 100 years.

East Fork South Fork Salmon River Population

The East Fork South Fork is also a Large-size population with improving habitat conditions, yet current abundance is less than a third of the South Fork Salmon Mainstem population abundance. Spring/summer Chinook salmon spawning in one branch of this population was extirpated in the 1940s by sediment and pollutants from mining activities, contributing to the population's low abundance. For these reasons, the proposed status for the East Fork South Fork Salmon River population is ***Maintained,*** with only a moderate (25% or less) risk of extinction over 100 years.

If each population achieves its proposed status, shown in Table 5.2-6, the South Fork Salmon River MPG will be viable. Other combinations, however, could also achieve MPG-level viability. Thus, we will continue to monitor the status of the populations and adjust the MPG-level recovery scenario over time based on how the populations respond to recovery efforts.

5.2.4.2 Recovery Strategies and Actions

The recovery strategy for the South Fork Salmon River MPG increases abundance and productivity for all populations. The VSP risk matrix (Table 5.2-2 and Table 5.2-6), shows that each population requires a decrease in abundance/productivity risk to reach its proposed status of highly viable (very low risk), viable (low risk), or maintained (moderate risk). The current spatial structure/diversity risk for each population, on the other hand, is acceptable for each population to achieve its proposed status. Thus, the recovery strategy for this MPG also prevents any further impacts to spatial structure or diversity.

Increases in population abundance and productivity will come from the cumulative positive impacts of recovery actions targeting every life stage. This recovery plan groups recovery actions in the following categories: natal habitat, hatchery programs, mainstem Snake and Columbia Rivers and hydropower system, fisheries management, Columbia River estuary and plume, competition and predation, and climate change. Because all of the populations in this MPG are currently at high risk, recovery actions to increase survival will be needed from all categories.

Natal Habitat

Natal habitat for spring/summer Chinook salmon populations in the South Fork Salmon River MPG has been degraded by human land uses. Opportunities exist to increase abundance and productivity through habitat restoration. Priority spawning and rearing habitat recovery actions in the MPG focus on improving abundance and productivity by reducing fine sediment loads, improving riparian areas and processes, and restoring fish access to historical habitat. Specific information is available in each

population chapter that follows about the limiting factors and stream reaches that should be targeted to achieve these improvements.

The strategies are:

1. Reduce and prevent sediment delivery. This will be accomplished primarily through improvements to the road systems in areas where sediment is delivered to the stream. Improvements include appropriate road maintenance, road obliteration, road relocation and road resurfacing.
2. Improve riparian function in selected areas. The mainstem rivers and many of the major tributaries in this MPG have roads or other human-made disturbances located within the riparian zone, and riparian function has been reduced. Projects should be pursued to improve riparian function in the selected areas identified in the population-level recovery plans.
3. Remove or replace fish passage barriers where they are blocking access to high quality spring/summer Chinook salmon habitat. Install fish screens on diversion ditches located in areas with high spring/summer Chinook salmon densities.

These three strategies address the primary habitat limiting factors in the MPG. The population summaries in sections 5.2.5 through 5.2.8 identify other actions for specific populations in specific areas, but these actions address the primary limiting factors identified at this time.

Hatchery Programs

The intent of the hatchery recovery strategy for the South Fork Salmon River spring/summer Chinook salmon MPG is to promote recovery by reducing the fitness and diversity risks the hatchery programs may present. Key aspects of the population-specific hatchery recovery strategies for this MPG include: (1) Manage populations currently without hatchery production for natural production. (2) Reduce ecological and genetic risks of South Fork Salmon River hatchery program consistent with achieving the proposed status of viable for the South Fork Salmon River population. (3) Continue to evaluate influence of hatchery programs on all populations.

Key hatchery strategies to support recovery:

- Manage the MPG for natural production in Secesh River and other areas where appropriate (e.g., upstream of weir on Rapid River).
- In the South Fork Salmon River and Little Salmon River populations, minimize the ecological and genetic risks of releasing hatchery fish to achieve the proposed status levels of viable for the South Fork Salmon River population and maintained for the Little Salmon River population. This may involve the use of weirs where appropriate or other methods agreed to by co-managers and funding agencies.
- Manage for agreed-upon levels of gene flow (determined through the HGMP process) in populations where it can be controlled and investigate methods to manage adults where there are no weirs or other infrastructure that can be used.
- Continue to manage the Johnson Creek hatchery program for conservation, using only natural-origin returns for broodstock.

- Monitor for stray rates and sources; if needed, develop actions to reduce straying.

Table 5.2-7. Hatchery programs in South Fork Salmon River spring/summer Chinook salmon MPG and recovery strategies.

Population	Recovery Strategy
Little Salmon River	Operate Rapid River program to minimize interactions with wild fish
South Fork Salmon River	Develop gene flow standards through HGMP process; Continue use of Dollar Creek egg box program
Secesh River	Manage for natural production; Monitor for strays
East Fork South Fork Salmon River	Operate to achieve conservation and evaluate supplementation

Fishery Management

While past fisheries contributed to the reduced viability of the South Fork Salmon River spring/summer Chinook salmon MPG, harvest now presents less risk to the MPG because of management agreements and regulations. Based on the fishery management protocols under *U.S. v. Oregon* agreements, FMEPs and TRMPs, the fishery mortality rates for natural-origin spring Chinook salmon are managed at levels intended to support the recovery of natural-origin populations belonging to this MPG.

The overall fisheries strategy for the South Fork Salmon River MPG is to continue the abundance-based management framework for managing mainstem and tributary fisheries to limit ESA impacts on natural-origin Snake River spring/summer Chinook salmon. Fishery opportunities will continue to be responsive to annual population abundance and recovery criteria, while remaining consistent with tribal trust responsibilities and formal agreements. Fisheries in the Columbia River mainstem will continue to comply with criteria developed through negotiation in *U.S. v. Oregon*. Tributary fisheries for Snake River spring/summer Chinook salmon will continue to be managed to support natural production and not reduce the likelihood of survival and recovery of the ESU.

The strategy also calls to refine monitoring and research efforts. More and improved data are needed to monitor and manage population-specific impacts on natural-origin spring/summer Chinook salmon and catch and release impacts in recreational fisheries.

Specific elements of the fisheries management strategy include:

- Continue marking all hatchery-origin juveniles (e.g., fin clips, genetic marking, and internal or coded wire tags).
- Conduct genetic marking to assess fishery effects with better population-level resolution and to focus fisheries on targeted stocks.
- Where possible, develop a population-specific sliding scale for harvest management based on natural-origin returns and designed to minimize impacts to natural-origin fish.
- Continue to coordinate harvest among all co-managers to ensure that the collective impacts to each population are consistent with recovery goals, and associated management plans and biological opinions.

- Continue to implement and improve creel surveys and other monitoring of fisheries to assess and manage impacts on natural-origin returns. The creel surveys should provide reasonable estimates of total harvest as well as population-specific harvest where possible.
- Use genetic stock identification, when available and appropriate, and/or PIT-tag studies to determine population-specific impacts from mainstem Columbia, Snake and Salmon River fisheries. This will provide more accurate estimates of population-specific impact in mixed stock fisheries and assist in future management

Additional Out-of-MPG Threats

Natal habitat restoration and other actions taken within the MPG will not alone produce the increases in survival needed for the South Fork Salmon River spring/summer Chinook salmon MPG to achieve viability. Improvements in survival must also come from recovery actions implemented downstream of the MPG, including from rearing and migration habitat through the mainstem Salmon River, and in the Snake and Columbia River migration corridor, Columbia River estuary, and ocean. Actions being taken to improve survival in the mainstem migration corridor may be particularly important. These issues and strategies are discussed in Chapter 4 and Section 5.1, and in the Estuary, Hydro, Harvest, and Ocean Modules to the recovery plan.

5.2.5 Little Salmon River Spring/Summer Chinook Salmon Population

The Little Salmon River spring/summer Chinook salmon population is currently not viable, with a high abundance/productivity and high spatial structure/diversity risk status. Its proposed status is Maintained, which requires that it be improved to have no more than moderate abundance/productivity risk.

Current Status	Proposed Status
High Risk	Maintained

Adequate abundance data to perform a full status assessment was not available. Consequently, the current status rating is tentative and based on the status of other populations in the MPG, and the limited amount of information on abundance available for this population.

Population Status

This section compares the Little Salmon River population's current status to its proposed status. The population's current status is based on the ICTRT's population status assessment (ICTRT 2010) and NWFSC status review (NWFSC 2015), which identify population risk in terms of four viability parameters: abundance, productivity, spatial structure, and diversity. This section focuses primarily on population abundance (the total number of adults) and productivity (the ratio of returning adults to the parental spawning adults). It also summarizes spatial structure (the amount and nature of available habitat) and diversity (genetic traits) concerns identified by the ICTRT and NWFSC. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The ICTRT distinguished the Little Salmon spring/summer Chinook salmon run as an independent population (ICTRT 2003, 2005) and included it in the South Fork Salmon River MPG based on geographic proximity (ICTRT 2005). The Little Salmon River spring/summer Chinook salmon population includes the Little Salmon River subbasin, the lower Salmon River mainstem from the Little Salmon River to Whitebird Creek, and tributaries to the lower Salmon River, particularly Whitebird Creek and Slate Creek (Figure 5.2-2). Spring/summer Chinook salmon from the Snake River basin do not spawn in rivers as large as the main Salmon River and generally exhibit stream-type life history characteristics, rearing for a year in their natal streams.

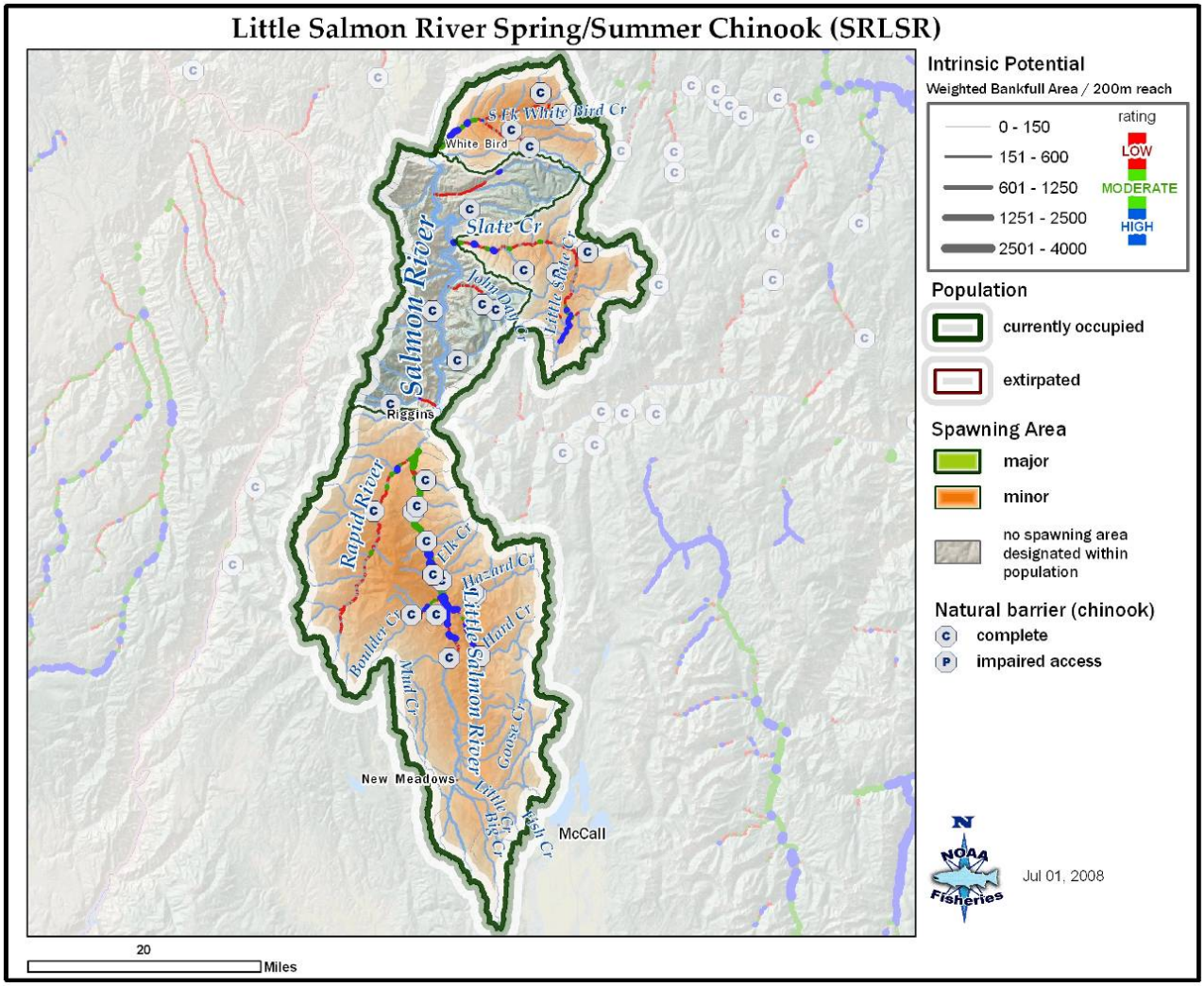

Figure 5.2-2. Little Salmon River Spring/Summer Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006). Moderate to high potential may exist in the upper meadow portions of the drainage, which are presently inaccessible due to a passage barrier in the canyon near Round Valley. Note: The farthest upstream barrier on the Little Salmon River is a high-gradient cascades which may have historically allowed Chinook passage before construction of Highway US-95 adjacent to the stream.

Historically the Little Salmon River population ranged across four diverse ecoregions: South Clearwater Forested Mountains, Southern Forested Mountains, Canyons and Dissected Uplands, and Wallowa/Seven Devils Mountains. All historically occupied ecoregions are currently occupied.

The Little Salmon River population contains both spring- and summer-run fish, and includes three minor spawning areas, with each capable of supporting between 50 and 500 spawners. Although this population has the historic habitat capacity of an Intermediate-size population, it is treated as a Basic-size population in terms of abundance and productivity targets because the core area consists of small adjunct tributaries. Most of these tributaries have spring-run fish, except for Rapid River, which has summer-run fish upstream of a hatchery weir. The Rapid River Hatchery, 2.5 miles upstream from the

confluence with the Little Salmon River, produces spring-run fish. Naturally produced summer-run Chinook salmon are trapped and released above the hatchery trap on Rapid River.

The Rapid River Hatchery supports a spring Chinook salmon segregated hatchery mitigation program. The program started with out-of-MPG brood stock trapped below Hells Canyon Dam on the Snake River and the hatchery fish returning to the Little Salmon River are not considered part of the Snake River spring/summer Chinook salmon ESU.

Most current natural spawning in this population occurs in the Little Salmon River drainage, with spring Chinook salmon spawning in the mainstem Little Salmon River and some of its tributaries upstream of Rapid River, and summer Chinook salmon spawning in Rapid River upstream of the hatchery weir. In addition to the Little Salmon River drainage, spawning is presumed to occur in some tributaries to the lower main Salmon River based on the presence of juveniles as documented through snorkel surveys. Juvenile Chinook salmon have been observed in Whitebird, Slate, and John Day Creeks in 2004, 2005 and 2006 (ICTRT 2010). A complete barrier half way up the Little Salmon River blocks access for spring Chinook salmon to the upper meadows area of the drainage.

Abundance and Productivity

An empirical assessment of abundance/productivity risk was not completed for the Little Salmon River population because of the lack of abundance and productivity data. A qualitative determination was made that abundance/productivity risk is high, based on the current status of the ESU (threatened) and the limited abundance information for the population. High risk for abundance/productivity is not adequate to achieve the proposed status of maintained for the population.

Spatial Structure

The Little Salmon River spring/summer Chinook salmon population has no identified major spawning areas, systems capable of supporting at least 500 spawners. Its three minor spawning areas, Little Salmon River, Whitebird Creek and Slate Creek, each support less than 500 spawners. The lack of major spawning areas in the population structure creates some inherent extinction risk. The large gap between the Slate Creek and Little Salmon River minor spawning areas also creates inherent risk. However, the current spawning distribution mirrors historical distribution. Therefore, the spatial structure risk rating is moderate. A moderate risk rating is adequate to achieve the proposed status for this population.

Diversity

NWFSC (2015) rates diversity risk as low for this population. Substantial numbers of hatchery Chinook salmon are released into the Little Salmon River. However, some of its side tributary wild Chinook spawning sites likely have low hatchery contributions, and the weir at the Rapid River prevents hatchery Chinook from advancing to the spawning reaches in that watershed.

Summary

The Little Salmon River population does not currently meet viability criteria. It is very likely that the abundance/productivity risk needs to be reduced to attain the proposed status of maintained. The combined spatial structure/diversity risk is adequate to attain the proposed status.

Table 5.2-8 summarizes the abundance/productivity and spatial structure/diversity risks for the Little Salmon River population. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.2-8. Viable Salmonid Population parameter risk ratings for the Little Salmon River spring/summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	HR	Little Salmon River

Viability Key: HV – Highly Viable; V – Viable; M – Maintained; and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes the limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 summarizes the regional-level factors that affect all Idaho Snake River spring/summer Chinook salmon and steelhead populations. Section 5.1 summarizes limiting factors and threats to all Idaho Snake River spring and summer Chinook salmon MPGs and populations.

Natal Habitat

Habitat Conditions

Many areas occupied by the Little Salmon River spring/summer Chinook salmon population are degraded from the historic condition. Spring/summer Chinook salmon use the mainstem Salmon River for upstream and downstream migration. A limited amount of juvenile rearing occurs in the Little Salmon River, generally near the river's mouth or in lower reaches of the tributaries to the Little Salmon River. Spring/summer Chinook salmon occupy only a small portion of the total salmonid habitat within the population boundaries because many of the tributaries do not provide suitable or accessible habitat for spring/summer Chinook salmon based on gradient, stream size and barriers. The most significant barrier is half way up the Little Salmon River, blocking access for Chinook salmon to the low-gradient meadow habitat in the upper Little Salmon River. Several reaches in the population area are either currently occupied or believed to be potentially accessible suitable habitat. Figure 5.2-3 compares stream reaches with relative suitability, or intrinsic potential, for spring/summer Chinook salmon spawning and rearing to stream reaches with current spawning and rearing habitat. Intrinsic potential refers to the suitability of a stream reach to support spawning and rearing under historical

unimpaired conditions as inferred from stream characteristics such as channel size, gradient and valley width (Cooney and Holzer 2006).

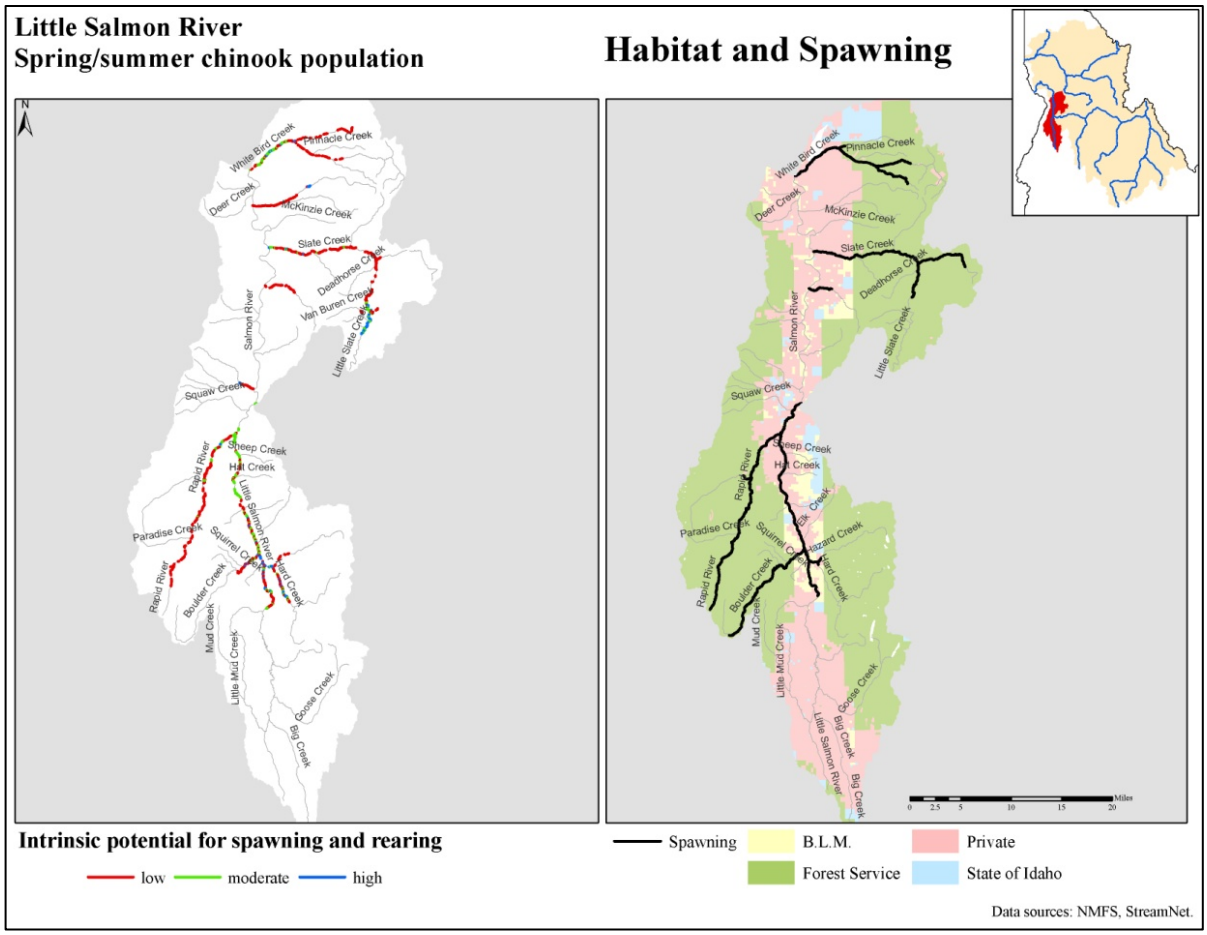

Figure 5.2-3. Little Salmon River stream reaches with intrinsic potential for spawning and rearing spring/summer Chinook salmon and currently occupied spring/summer Chinook salmon habitat. [Note: The Streamnet website contains the latest spring and summer Chinook distribution maps: www.streamnet.org.]

The larger anadromous fish-producing tributaries for this population include Rapid River, Boulder Creek, Slate Creek, White Bird Creek and the lower portions of the Little Salmon River. Habitat conditions in these tributaries range from near pristine in the upper Rapid River drainage, to significantly altered along the Little Salmon River. Highway 95, which parallels most of the Little Salmon River, has reduced riparian area function. Habitat conditions in each tributary area are summarized below.

White Bird Creek is a fifth-order tributary to the Salmon River, flowing into the Salmon River at RM 53.6. The lower reach flows through a confined canyon with a stream gradient of 2 to 3 percent. Land use in the watershed includes livestock grazing, timber harvest, road construction, recreation, water use, agriculture, and urban development. These past and present activities have created marginal habitat conditions, including warm summer water temperatures, suspended sediment, lack of large woody debris, inadequate pool frequency and quality, and poor streambank and riparian condition. Stream temperatures are the most limiting condition for spring/summer Chinook salmon, particularly

in the lower reaches of the stream. Riparian vegetation in the White Bird Creek watershed consists of a narrow fringe limited by the narrow valley, roads, urban development, and rocky bluffs.

The Slate Creek watershed covers approximately 83,034 acres. It is a priority watershed for spring/summer Chinook salmon under the terms and conditions of NMFS 1995 and 1998 biological opinions on PACFISH-amended U.S. Forest Service Land and Resource Management Plans. All accessible streams in the watershed are designated critical habitat. Spring/summer Chinook salmon use the first 11.5 miles of Slate Creek, as well as the confluence of Slate Creek and the Salmon River, and the confluences of Basin Creek and North Fork Slate Creek with Slate Creek. Several other tributaries to main Slate Creek have not been surveyed, but there is the potential for spring/summer Chinook salmon to be present. In Idaho's 2008 Integrated Water Quality Report, the majority of this watershed either fully supports beneficial uses or is unassessed (IDEQ 2008a). Both natural and anthropogenic disturbances, including roads, trails, mining, grazing, and timber harvest have altered the water quality, cover and shelter, riparian vegetation, and water temperatures in this watershed. Road densities of approximately 2.2 mi/mi^2 affect salmonid habitat by increasing sedimentation, blocking migration at stream crossings, altering riparian and floodplain habitat, and interfering with slope hydrology through subsurface flow disruption. In lower Slate Creek tributaries, the main riparian impacts have been from roads and timber harvest. Encroachment of U.S. Forest Service road #354 into the floodplain and stream channel along the mainstem of Slate Creek has increased sediment delivery, reduced woody debris, and eliminated portions of the floodplain. Elevated stream temperatures observed in Slate Creek, particularly the lower portion, may be due, in part, to loss of riparian vegetation from streamside roads.

Rapid River is a major tributary to the Little Salmon River and is largely in a natural condition due to being almost completely under public ownership, with the upper portion of the watershed in wilderness. The lower two miles of Rapid River have not been assessed for water quality, but may be impacted by residential development in the floodplain and riparian zones.

Boulder Creek, another important tributary to the Little Salmon River, is largely on U.S. Forest Service lands. It is listed as supporting beneficial uses in Idaho's integrated water quality report (IDEQ 2008a). While it contains some potential high quality habitat, the Boulder Creek watershed has an extensive road network and a high level of timber harvest. Boulder Creek also contains some water diversions, which could affect habitat, and the potential for high quality habitat may be naturally limited by stream gradient in some areas.

The Little Salmon River originates at 6,280 feet elevation on Blue Bunch Ridge and stretches 51 miles to join the main Salmon River at Riggins. The watershed is located at the 45th parallel, about 500 miles inland from the Pacific Ocean. The Little Salmon River displays a wide range in streamflow. A U.S. Geological Survey (USGS) stream gaging station (USGS 13316500) maintained at the mouth of the Little Salmon River in Riggins since 1951 shows a mean annual streamflow of 775 cfs. The mean monthly high flow (2,374 cfs) occurs in May, while the mean monthly low flow (219 cfs) occurs in September (USGS 1951-2008). On January 1, 1997, an extreme flood event (50-year flood) occurred in the Little Salmon River. The average flow for that day was estimated at 8,000 cfs, with the flow peaking at 10,500 cfs.

Water quality is impaired in the upper Little Salmon River watershed. In 2006, Idaho Department of Environmental Quality developed Clean Water Act Total Maximum Daily Loads (TMDLs) for both temperature and nutrients in the section of the Little Salmon River below New Meadows. In 2014 the Idaho Department of Environmental Quality (IDEQ) found that Mud and Little Mud Creeks exceeded state standards for sediment and East Branch Goose Creek exceeded the standards for bacteria. The TMDLs were developed to bring the creeks into compliance with the state standards (IDEQ 2014).

Increasing levels of recreation pose a threat to aquatic habitat in this area. Illegal all-terrain vehicle use (ATV) has been identified as a resource concern in parts of the subbasin. Erosion, rutting, soil compaction, and damage to vegetation has been documented as ATV users pioneer cross-country trails to access new areas (Payette National Forest 2003, p. III-169). Along the Little Salmon River, recreational fishing has also begun to impact stream habitat. Much of the fishing is concentrated along a few miles of river, most of which is privately owned and managed. Although the influx of anglers over the last few years has benefited the local economy, it has also concentrated impacts on streambanks and private property in the areas fished. Impacts include damage to riparian vegetation and garbage and sewage dumped directly into the river (Ecovista 2004, p. 104).

Current Habitat Limiting Factors and Threats

NMFS determined the habitat limiting factors for each population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds. Based on these reports, identified in the following habitat descriptions, and on discussions with local fisheries experts and watershed groups, we conclude that the habitat limiting factors are those described below.

1. *Degraded riparian condition.*

Lack of properly functioning riparian habitat, decreased recruitment of large woody debris, and floodplain and channel encroachment from roads and development have affected spring/summer Chinook salmon abundance and productivity. Degraded riparian condition is a primary habitat-related limiting factor for the Little Salmon River population. Riprap and bank barbs have been installed along numerous reaches of the Little Salmon River to keep the river from eroding stream banks adjacent to private property and roads. Residential development has resulted in encroachment on the floodplain and in the riparian areas.

Similar concerns were also identified in the Salmon River Subbasin Management Plan (Ecovista 2004, p.71-72), which cited the inadequacy of shade-providing, bank-stabilizing riparian vegetation as a common factor limiting the condition of salmonid rearing habitat throughout the Little Salmon. The plan further suggests that the lack of a properly functioning riparian corridor, floodplain and channel encroachment, and upper meadow water diversions have adversely impacted water temperature, flow regimes, and channel morphology. However, spring/summer Chinook salmon cannot access the upper meadows area of the Little Salmon River due to a passage barrier on the Little Salmon River below Round Valley.

2. *Excess sediment.*

Excess amounts of both coarse and fine sediment are degrading habitat quality in this population area. The mainstem Little Salmon River downstream from RM 24 has limited amounts of good spring/summer Chinook salmon spawning habitat due to the dominant large-sized substrate. Coarse sediment was transported downstream during a 1997 flood, and remains in the channel and side channels. The steep stream gradient of these river reaches and high flushing flows reduce sediment deposition, but also flush suitable salmonid spawning gravels downstream. The limited suitable gravels that do occur are primarily in deposition areas along the river margins or behind boulders. These gravel deposition areas also have potential for increased fine sediment and may be highly cemented or compacted.

Excess fine sediment sources include irrigation and agriculture practices above RM 24 on the Little Salmon River and timber harvest throughout the drainage. Approximately 47 percent of the Little Salmon River drainage has been classified as highly impacted by timber management activities, with an extensive logging road system constructed to support timber harvest. Only 20 percent of the Little Salmon River has not been impacted by timber harvest (NPCC 2004, p. 3-39).

The 2008 Idaho Water Quality Integrated Report did not list the mainstem Little Salmon River for sediment (Figure 4.2-6) because the assessments of the Little Salmon River show full support of beneficial uses (IDEQ 2008a). However, IDEQ listed this part of the watershed for habitat alteration to recognize that coarse sediment, transported as part of the 1997 flood, impacted habitat conditions. Several 303(d) listed tributaries are located upstream of occupied tributaries (IDEQ 2014).

3. *Passage barriers and fish entrainment.*

High gradient cascades on the Little Salmon River prevent Chinook salmon from migrating upstream beyond Round Valley Creek (IDFG 2013). Anecdotal reports exist regarding historical anadromous fish passage into the upper Little Salmon River before construction of the road segment adjacent to this passage barrier. For example, the Nez Perce Tribe historic accounts describe Round Valley and the meadows above the barrier as traditional fishing areas used by the tribe to capture Chinook salmon. Making the falls passable would open additional habitat for Chinook. However, because of current highly degraded stream habitat conditions above the barrier, the Plan does not at this time include altering the falls to create passage as a high priority habitat action for the population.

Road culverts present partial and full barriers to fish passage on tributaries to the Little Salmon River. However, because many tributaries to the Little Salmon River are high gradient and do not provide suitable spring/summer Chinook salmon habitat, fish passage barriers on some these tributaries may not impact the Chinook salmon. Road-related fish passage barriers on tributaries should be inventoried and removed on a priority basis.

Spring/summer Chinook salmon also become stranded in unscreened irrigation ditches. While some fish screens have been installed in this watershed, the status of most diversions is not known. Diversions downstream from the Little Salmon River barrier should be inventoried to assess the risk of entrainment of smolts.

4. Low summer flows.

Water withdrawals for agricultural in the upper Little Salmon meadows reduce summer base flows in the main Little Salmon River, leading to a decrease in available habitat in Little Salmon River and to elevated stream temperatures. Figure 5.2-4 compares the average monthly flows from gage data to estimated unimpaired flows at the mouth of the Little Salmon River.

Unimpaired flows were estimated by adding estimates of monthly consumptive water use from irrigation to the monthly gaged flows. Figure 5.2-4 shows that from July through September measured flows at the Little Salmon gage are substantially less than estimated unimpaired flows. Water rights in the Little Salmon River basin exist for a cumulative 679 cfs maximum diversion rate, which is greater than mean base flows for the Little Salmon River.

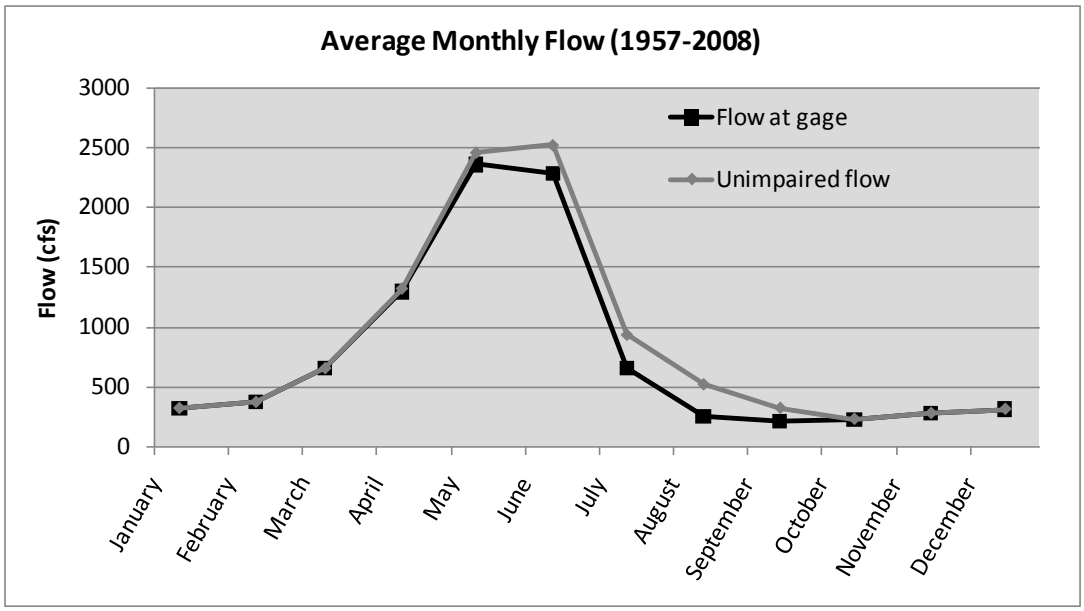

Figure 5.2-4. Mean monthly flow for the Little Salmon River at USGS gage at Riggins (USGS 13316500). The unimpaired flow at Riggins includes the gage flow added to estimated consumptive water use from irrigation.

Approximately 89 percent of irrigated acres in the basin occur in the upper meadows, above the passage barrier at RM 24 of the mainstem Little Salmon River and above the mouth of Round Valley Creek. The estimated consumptive use from irrigation taking place above Round Valley Creek during the growing season is 108 cfs. Water withdrawals in the upper meadows thus contribute to reduced flow and elevated temperature downstream in occupied habitat in the Little Salmon River.

Water withdrawals on tributaries to the main Salmon River that support Chinook salmon spawning may reduce base flows in these tributaries, negatively impacting spawning and rearing habitat.

5. High water temperatures.

The Little Salmon River begins its descent through the canyon (which is currently occupied spring/summer Chinook salmon critical habitat) with warm, temperature-impaired water during the irrigation season. The river water cools as it descends to the confluence with the Salmon River. During the summer irrigation season, the upper meadows reaches of the Little Salmon River have high

water temperatures that are suboptimal for salmonids. As the Little Salmon River flows towards its confluence with the Salmon River, Hazard and Hard Creeks, Boulder Creek, and Rapid River contribute significant discharges of cooler water. Consequently, water temperature decreases as the mainstem Little Salmon River flows downstream towards the mouth.

Tributaries with cooler water, particularly larger ones, create localized cool water plumes and mixing zones at the mouths of the creeks, providing important holding and rearing habitat in the Little Salmon River. Cool water tributaries within the Little Salmon River basin provide potential refugia for migrating adult spring/summer Chinook salmon, and for rearing and migrating juveniles. In addition, these cold-water zones help adult salmon conserve energy for spawning and may have a positive effect on pre-spawning survival (Bermann and Quinn 1991). Maintaining high water quality and access to tributaries of the Little Salmon River is important for the survival and recovery of this population.

Three permanent BLM water temperature stations at river miles 0.53, 10.31, and 24.7 on the Little Salmon River showed summer 7-day average daily maximum from 1994-2000 (BLM 2000). Temperatures for stations 0.53 and 10.31 ranged from 18 to 21 °C during spring/summer Chinook salmon spawning periods. During salmon rearing periods, the 7-day average daily maximum ranged from 19 to 24 °C. The Little Salmon River in the upper meadows area had regular summer 7-day average daily maximum in the sub-optimal or lethal range of 23 to 25 °C. Higher temperatures and lowered flows from the upper meadows are the result of reduced streambank cover and water diversions. Temperatures in the Little Salmon River cool as the river flows downstream and tributaries such as Hazard Creek, Boulder Creek, and Rapid River deliver cooler water to the mainstem.

Between Little Salmon RM 24 and the mouth of Hazard Creek, there is a 4.5-mile section of accessible critical habitat that does not support salmonid migration, spawning, or rearing (BLM 2000), likely due to high water temperatures. Below the mouth of Hazard Creek, the large volume and cooler temperatures of Hazard Creek partially mitigate the impaired waters of the Little Salmon River. Summer snorkeling surveys found very few juvenile rainbow trout/steelhead upriver from Hazard Creek, while downriver from Hazard Creek the river had significantly more rainbow trout/steelhead (BLM 2000). The temperature difference in the Little Salmon River above and below Hazard Creek likely has a similar impact on juvenile spring/summer Chinook salmon distribution.

Given the high stream temperatures, IDEQ prepared a temperature TMDL in 2006 for the Little Salmon River upstream from Round Valley Creek. IDEQ has not developed a TMDL for temperature below RM 24 because water temperatures generally remain below 22 °C and support cold-water aquatic life (IDEQ 2006). Although colder water coming in from tributaries does decrease the temperature of the Little Salmon River, elevated temperatures remain a threat to habitat quality for spring/summer Chinook salmon. Implementing IDEQ’s temperature TMDL for the upper meadows section of the Little Salmon River should improve downstream Chinook salmon habitat conditions.

Potential Habitat Limiting Factors and Threats

Several potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Little Salmon River watershed.

1. Damage to riparian habitat by unrestricted all-terrain vehicle use.
2. Spread of noxious weeds that can increase soil erosion and decrease native plant density.
3. Concentrated fishing along the lower Little Salmon River, which could damage streambanks, riparian vegetation, and water quality.

Hatchery Programs

The Rapid River Hatchery releases up to approximately three million yearling Chinook salmon smolts annually (2.489 million to Rapid River, 186,000 to the Little Salmon River, and 417,000 to the Snake River downstream of Hells Canyon Dam). Actual release numbers vary, averaging 3.1 million smolts for brood years 2006 through 2015. These large releases of spring-run hatchery fish from Rapid River Hatchery have influenced the Little Salmon River population. The ICTRT found that genetic testing could not differentiate between the wild fish in this population and hatchery broodstock trapped in the Snake River below Hells Canyon Dam. The hatchery releases have reduced genetic adaptiveness of the Little Salmon River population. Hatchery-related limiting factors and threats for Little Salmon River spring/summer Chinook salmon are discussed at the MPG level in Section 5.2.3.2.

Fisheries

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, Salmon River and Little Salmon River pose a threat to Little Salmon River spring/summer Chinook salmon, and to other South Fork Salmon River populations. State fisheries targeting hatchery-origin spring Chinook salmon returning to Rapid River Hatchery occur in the Little Salmon River. Tribal fisheries also occur. Overall, however, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Little Salmon River spring/summer Chinook salmon and other South Fork Salmon River populations are discussed at the MPG level in Section 5.2.3.3.

Predation/Competition

Potential Predation Limiting Factor and Threat

- Invasive species. Non-native brook trout are found in some tributaries within this population and may compete with, or prey on, spring/summer Chinook salmon.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve Chinook salmon productivity rates. Habitat recovery actions should focus on areas that are either currently occupied or are believed to be potentially accessible suitable habitat (see Figure 5.2-3). This focuses habitat restoration actions in the areas that have the highest potential to assure the population attains its proposed status of maintained.

Priority areas for this population are tributaries with known spawning and rearing: Rapid River, Slate Creek, Whitebird Creek, and Boulder Creek. The Rapid River drainage is described as being in near natural condition. The actions described below should be applied to the Slate Creek, Whitebird Creek, and Boulder Creek watersheds to best benefit spring and summer Chinook salmon. There is also a great deal of habitat restoration work that can be done on the Little Salmon River. However, potential restoration projects in the river channel or floodplain should be reviewed to assure the projects will be stable during the high water flows that tend to scour the bed and banks of this reach.

Habitat Recovery Actions

1. Reduce road-related impacts on tributaries to the Little Salmon River and main Salmon River through a combination of road closures, obliterations, decommissioning, relocations, reconstructions, and maintenance. Road-related impacts include degraded riparian areas and sediment delivery to streams.
2. Inventory stream crossings (e.g. bridges and culverts) and replace those on a priority basis that block Chinook salmon from accessing suitable habitat or that deliver sediment to Chinook salmon habitat. Inventory diversion structures downstream of the Little Salmon River barrier to determine the risk of entrainment of smolts.
3. Reduce floodplain and channel encroachment by roads or development. In areas not prone to frequent scouring of the channel and streambanks by flood events, restore degraded riparian conditions.
4. Reduce the impacts of water diversions in the population to minimize habitat loss and elevated temperatures caused by reduced base flows. Inventory diversions on stream reaches accessible to steelhead in the Little Salmon River, Whitebird Creek, and Slate Creek watersheds to ensure diversions are screened according to NMFS criteria.
5. Encourage private landowners to restrict grazing in riparian areas, and restrict livestock grazing in riparian areas on public lands.
6. Local governments should restrict future growth along the mainstem Little Salmon River and mainstem Salmon River to minimize the need for instream and streambank stabilization projects involving hardening the stream banks (such as with riprap or bank barbs).

Implementation of Habitat Actions

Implementation of habitat actions for this population will occur primarily through the work of the U.S. Forest Service, IDFG, IDEQ, the Nez Perce Tribe, and county soil and water conservation districts.

Other entities working on habitat restoration in this population include Idaho Department of Water Resources (IDWR), BPA, BLM, NMFS, and private landowners. Between these groups, there is an excellent representation of tribal, local, state, and federal entities that manage land and other resources within the watersheds.

The Payette National Forest has implemented many restoration activities on their lands including road obliteration, culvert removal and channel restoration (Payette National Forest 2007a). The Nez Perce Tribe has been active in this area in designing and implementing projects on both public and private lands. Due to the large percentage of private land ownership and rural development in the area, much of the potential habitat improvement projects for the Little Salmon River population will rely heavily upon the voluntary cooperation of private landowners. This private land ownership occurs primarily in the lower reaches of the Little Salmon and Lower Salmon River tributaries.

No specific habitat projects are currently identified for this population. Specific habitat-related recovery actions, however, are identified and scheduled continuously based on available funding and set priorities. Additional habitat actions will be identified and prioritized through the adaptive management process for each 5-year implementation period.

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the South Fork Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs present. For the Little Salmon River population, the strategy includes operating Rapid River hatchery in a manner that minimizes the ecological and genetic risks of releasing hatchery fish to achieve the population's proposed status level of Maintained. Section 5.2.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

Harvest-related risks to populations in the South Fork Salmon River MPG will continue to be controlled through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.2.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.2.6 Secesh River Summer Chinook Salmon Population

The Secesh River summer Chinook salmon population is currently not viable, with a high abundance/productivity risk. Its proposed status is Highly Viable, which requires a very low abundance/productivity risk.

Current Status	Proposed Status
High Risk	Highly Viable

Population Status

This section compares the Secesh River population's current status to its proposed status. The population's current status is based on the ICTRT's 2010 population status assessment and NWFSC 2015 status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns identified by the ICTRT and NWFSC. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and more recent status review (NWFSC 2015).

Population Description

Summer Chinook salmon returning to the Secesh River (including its tributaries Lake and Lick Creeks) are considered an independent population for several reasons: (1) spawners in this watershed are genetically distinguished from other South Fork Salmon River populations; (2) the main spawning areas are more than 30 km apart from spawning areas in adjacent populations; and (3) timing of juvenile migration is highly differentiated from other locations sampled in the South Fork Salmon River (ICTRT 2003). The Secesh River population is an Intermediate-size population, consisting of one major spawning area (Upper Secesh) and one minor spawning area (Lower Secesh) (Figure 5.2-5). This population contains summer run fish. Most spawning occurs in the upper mainstem Secesh River and Lake Creek (ICTRT 2010).

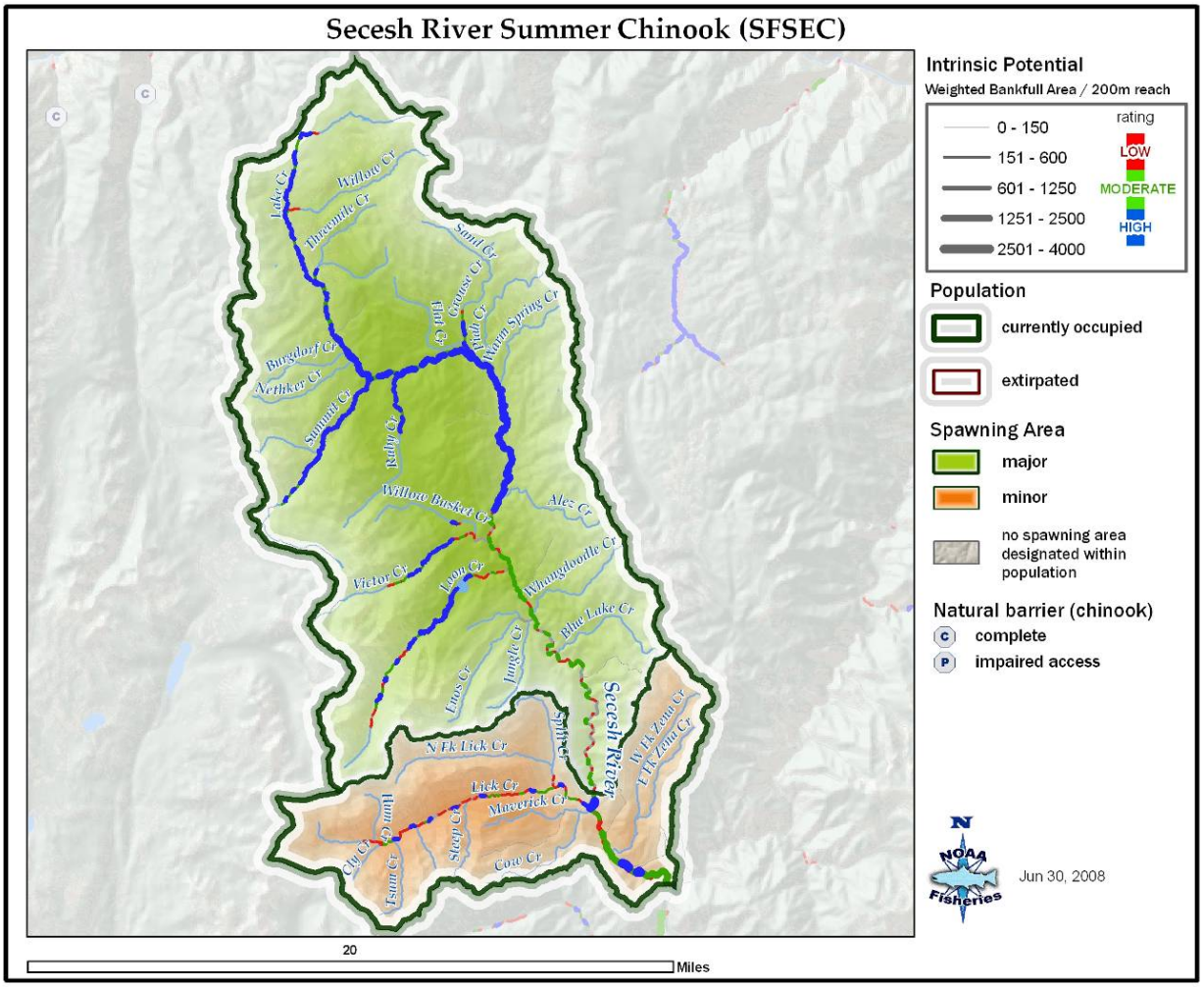

Figure 5.2-5. Secesh River summer Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

The proposed status for the Secesh River population is highly viable. For the population to achieve a 1 percent or less risk (very low risk) of extinction over 100 years, productivity would need to be at or greater than 2.75 recruits per spawner at the minimum abundance threshold of 750 spawners. The 10-year geometric mean adult spawner abundance for 2005-2014 is 472 fish. Based on recent adult spawner recruit series, the recruit-per-spawner geometric mean productivity estimate is 1.25, which is less than the 2.75 productivity required for highly viable status at the minimum abundance threshold (NWFSC 2015).

The ICTRT viability criteria for population abundance and productivity are also expressed as a viability curve – minimum combinations of current natural-origin abundance (measured as spawners) and productivity (measured as brood year spawner-to-spawner ratios) that correspond to a particular risk level. This is shown graphically in Figure 5.2-6 for moderate risk and low risk. The proposed very low risk (highly viable) is not shown on the graph but would be above the green line. Abundance and productivity risk for this population is currently high.

Spatial Structure

The population's spatial structure risk is rated as low. This is primarily because the historic spawning area for the population is still occupied and the one major spawning area for the population is very sizable. The low risk rating for this population is adequate to reach the proposed overall status of highly viable for the population.

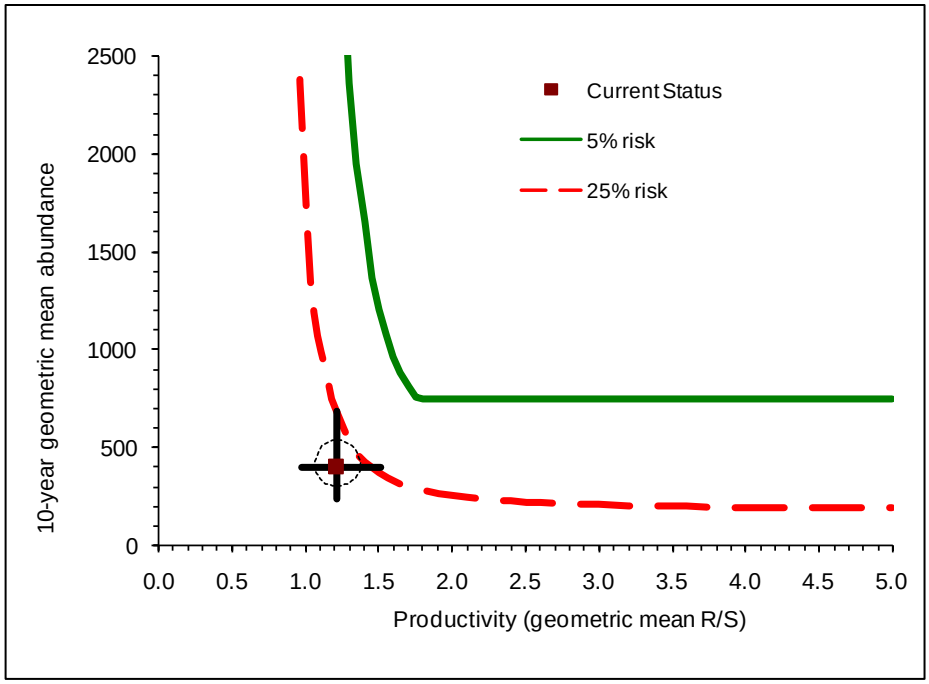

Figure 5.2-6. Secesh River current abundance and productivity compared to the ICTRT's viability curve. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. MFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Diversity

It appears that all historic life history strategies are present and no phenotypic traits have been lost within the population. No major selective pressures, straying or hatchery influences were identified that might threaten these traits in the future. All of the diversity metrics are rated low or very low risk, resulting is a cumulative rating of low risk. This is adequate to achieve the population's overall proposed status.

Summary

The Secesh River summer Chinook salmon population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the Secesh River population cannot reach its proposed status. The combined spatial structure risk/diversity risk is currently low and does not preclude attainment of the viability criteria for the population.

Table 5.2-9 summarizes the population's abundance/productivity and spatial structure/ diversity risks. A complete version of the ICTRT's draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.2-9. Viable Salmonid Population parameter risk ratings for the Secesh River summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	Secesh River	HR	HR

Viability Key: HV – Highly Viable; V – Viable; M – Maintained; and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to the Population

This section describes the limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, and plume, and by climate change. Chapter 4 summarizes the regional-level factors that affect all Idaho Snake River spring/summer Chinook salmon and steelhead populations. Section 5.1 summarizes threats and limiting factors at the species level.

Natal Habitat

Habitat Conditions

The Secesh River subwatershed encompasses approximately 170,000 acres. The Secesh River originates at the confluence of Summit and Lake Creeks and enters the main South Fork Salmon River about one mile downstream of the East Fork South Fork Salmon River. Channel gradients range from less than 1 percent along Lake Creek and the upper Secesh Meadows to over 10 percent in canyon sections. Summer discharge readings range from highs of several thousand cubic feet per second (cfs) in May and June to lows of about 100 cfs in September. Tributary streams to the Secesh River generally exhibit Rosgen Type A and B morphology. Type-A streams are entrenched and exhibit low sinuosity and a low width/depth ratio. Type-B streams are moderately entrenched, showing moderate width/depth ratio and moderate sinuosity.

Over 98 percent of the Secesh River watershed is under federal ownership, the majority administered by the Payette National Forest. Land uses in this watershed have included dispersed recreation, livestock grazing, timber management, and mining. Residential development has occurred on private inholdings near Secesh Meadows, Burgdorf, and upper Lake Creek. Wildfire is a common disturbance in the watershed, and in 2007 roughly one-quarter of the watershed burned in the East Zone Complex fire (Payette National Forest 2009).

Salmonid habitat in the Secesh River is in relatively good shape compared to other populations in the South Fork Salmon River MPG, but has been somewhat degraded by human land uses. The U.S. Forest Service evaluated salmonid habitat components in the Secesh River using the NMFS Matrix of Pathways and Indicators (NMFS 1996). It identified the following habitat indicators as "functioning at risk" for the Secesh River watershed: water temperature, large woody debris, floodplain connectivity, peak and base flows, drainage network increases, road density and location, disturbance history and regime, riparian conservation areas, and integration of species and habitat conditions. Roads in the Willow Creek and Three Mile Creek drainages, and unconsolidated mining tailings along the banks of Lake Creek, continue to be a source of sediment delivery to Lake Creek and the Secesh River. Intragravel quality is "functioning appropriately" across the Secesh River basin with the exception of Threemile Creek, which continues to be influenced by unconsolidated mine spoils nearby. The other habitat indicators are considered to be "functioning appropriately" in the Secesh River watershed (Payette National Forest 2007a). An EPA-approved TMDL has been developed for the Secesh River and tributaries to meet bull trout spawning temperatures due to lack of shade and excess solar exposure (IDEQ 2014). Temperatures are generally acceptable for Chinook salmon spawning and rearing.

Current Habitat Limiting Factors and Threats

NMFS determined the habitat limiting factors for each population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds. Based on these reports, and on discussions with local fisheries experts and watershed groups, we identified the following habitat limiting factors for the Secesh River summer Chinook salmon population:

1. *Excess sediment*.

Watersheds occupied by this population have been degraded from historic condition, and sediment is believed to be limiting summer Chinook salmon productivity. Accelerated sediment delivery and stream channel modification associated with road construction, mining, livestock grazing, dispersed camping, recreational motorized use, and past timber harvest have contributed to degraded fish habitat conditions in the watershed. Large-scale dredging of Lake Creek occurred in the late 19th and early 20th centuries. Significant hydraulic and placer mining also took place in the watershed, including operation of numerous small underground mines (Payette National Forest 2003, p. III-233). Recovery from mining and logging activities in the Threemile and Willow Creek subwatersheds is reportedly slow. However, sediment delivery to streams is decreasing due to mitigation of past actions, reclamation of small mines, and gravelling of roads. Overall habitat conditions in the Secesh River watershed are reportedly on an improving trend, with respect to sediment delivery (Wagoner and Burns 2001, p. 52). No streams in the Secesh River watershed are listed for sediment on the Clean Water Act 303(d) list.

In addition to the direct effects of mining operations on stream habitat, roads have also historically contributed high levels of sediment to streams in the Secesh River watershed. Most roads within the watershed were originally developed to facilitate mineral exploration and development. Design specifications were limited to the shortest distance, easiest route, and least cost. Environmental considerations were minimal or non-existent. Most of these legacy roads currently serve little or no

purpose in relation to mineral exploration and development, yet they deliver sediment to streams through surface erosion. Following the Burgdorf Junction Fire, the Burned Area Emergency Rehabilitation Team recommended decommissioning 23.7 miles of these mining roads in the watershed (Payette National Forest 2007a).

The Payette National Forest has identified several opportunities to accelerate the rate of stream habitat improvement in the Secesh River watershed by decreasing road-related sediment delivery to streams. Some examples include the following roads: Marshal Meadows (Forest Road [FR] #325), Josephine Lake (FR #315), Grouse Creek (FR #325), Chimney Rock (FR #335), and Forest Highway #48 from Ponderosa Campground to Oompaul Creek. The Payette National Forest has also identified the following roads as needing stabilization and overall improvements to water management: (1) roads in Cow/Maverick Creeks; (2) the Crystal Mountain Mine access road; and (3) the abandoned/closed roads east of Corduroy Burgdorf Road. Finally, the Payette National Forest has identified the need for erosion control and reestablishment of vegetation on disturbed areas at Chinook Campground (Payette National Forest 2007a).

2. Passage barriers

Five culverts at road stream-crossings and one water diversion have been identified as passage barriers to salmonids in the Secesh watershed (BOR 2013). The culverts creating passage barriers are on Burgdorf, Jeneatte, Willow, and Threemile Creeks. The water diversion barrier is on Zena Creek. None of these streams has potential for Chinook salmon spawning, but removing the barriers could give Chinook salmon access to additional rearing habitat.

Potential Habitat Limiting Factors and Threats

Several potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Secesh River watershed.

1. Loss of habitat function and quality. An area of Secesh Meadows adjacent to important spawning and rearing habitat is currently being developed into a subdivision (Payette National Forest 2003). Without sufficient planning, this residential development could encroach into the low-gradient meadows that support most of the spawning for this population. Development could degrade the ecological function and ability of the meadows to support summer Chinook salmon in this key production area.
2. Riparian area degradation. The Secesh River watershed is becoming a popular destination for dispersed recreation, providing opportunities for hunting, fishing, ATV use, motorcycling, snowmobiling, hiking, skiing, mountain biking, and camping (Payette National Forest 2003, p. III-232). The increasing level of recreational ATV use is becoming a primary concern in the watershed, leading to additional vegetation loss and ground disturbance (Wagoner and Burns 2001, p. 44), which could lead to increased sediment delivery to streams.
3. Invasive plants. A number of invasive plants have been introduced into the watershed, particularly along the main travel ways. The primary weed of concern is Canada thistle, which currently occurs in small, scattered populations (Payette National Forest 2003, p. III-231). The spread of invasive plants can lead to increased soil erosion.

Hatchery Programs

The Secesh River population has no history of hatchery influence, except for an occasional stray from the South Fork Salmon River hatchery program. The stray hatchery fish from the South Fork Salmon hatchery program could potentially reduce genetic adaptiveness of the Secesh River population. Hatchery-related limiting factors and threats for Secesh River summer Chinook salmon are discussed at the MPG level in Section 5.2.3.2.

Fishery Management

State fisheries on summer Chinook salmon do not currently occur within the Secesh River drainage since there are no hatchery releases to support a fishery. Fisheries in the Columbia River estuary, mainstem Columbia, Snake River and Salmon River pose a threat to the population. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Secesh River summer Chinook salmon, and other South Fork Salmon River populations, are discussed at the MPG level in Section 5.2.3.3.

Predation and Competition

Current Predation Limiting Factor

Invasive species

The Salmon River subbasin assessment identified the presence of non-native brook trout as a concern in the Secesh River basin (NPCC 2004). Macneal et al. (2009) found high concentrations of brook trout in Summit Creek. At a selection of sites in the Salmon River basin, Levin et al. (2002) found that juvenile Chinook salmon survival in streams without brook trout was nearly double the survival in streams with brook trout. Brook trout may affect Chinook salmon through several mechanisms. Brook trout are known to aggressively defend feeding territories and outcompete anadromous salmon (Hutchison and Iwata 1997). Some studies indicate that competition between adult brook trout and Chinook salmon parr may affect growth rates and survival of juvenile salmon (Meekan et al. 1998; Einum and Fleming 2000), with brook trout outcompeting juvenile Chinook salmon for limited food and habitat. However, Macneal et al. (2009) compared feeding behaviors and aggressive encounters between brook trout and juvenile Chinook salmon in a watershed in the South Fork Salmon River basin and found minimal competition for prey. Brook trout may also affect Chinook salmon through direct consumption; brook trout are voracious predators, frequently consuming juvenile salmonids (Sigler and Sigler 1987, as cited in Levin et al. (2002); Karas 1997), and also preying on salmon eggs (Karas 1997). Finally, increasing numbers of brook trout could be in part due to replacement, with brook trout becoming more established in areas historically occupied by native species as the native species' population numbers fall and habitat conditions worsen (Dunham et al. 2002).

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following types of habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve summer Chinook salmon productivity rates.

1. Improve and rehabilitate roads to reduce sediment delivery.
2. Reclaim or rehabilitate abandoned mine sites to reduce sediment delivery.
3. Fix passage barriers at road stream crossings.

Implementation of Habitat Actions

This population is primarily on public land. The habitat portion of the recovery plan for the Secesh River population will be primarily implemented by the Payette National Forest and the Nez Perce Tribe. Valley County will also have a role in reducing the threats from development in the floodplain, particularly on private land in Secech Meadows. The IDFG is responsible for management of fish and wildlife in Idaho, and will also be involved in population recovery. These groups have a record of implementing salmon conservation projects and programs in this drainage and in other areas within the state.

Many habitat restoration projects have already been completed in the Secesh River drainage, including numerous projects to reduce sediment input into streams, such as graveling roads and other road improvements. Projects implemented by the Payette National Forest in the watershed have reduced sediment delivery and created fish passage. These projects included road graveling, road decommissioning, and a replacement of a Grouse Creek culvert with a bridge. The Nez Perce Tribe decommissioned 36 miles of road in the Secesh River watershed between 1996 and 2012 (NPT 2013).

Table 5.2-10 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs. Specific projects are planning continuously based on available funding and established priorities. During Plan implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.2-10. Habitat Recovery Actions Identified for the Secesh River Summer Chinook Salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Passage	Address 2 barriers	BPA Contract # 2007-127-00: East Fork of South Fork Salmon River Passage Restoration*	N/A
Sediment	Improve 20 road miles		

* Since fish passage cannot currently be restored through the old Stibnite Mine Site on the East Fork South Fork Salmon River (due to lack of landowner consent), the Nez Perce Tribe and U.S. Forest Service have proposed several other high priority habitat restoration actions throughout the South Fork Salmon watershed, to be funded under this BPA habitat restoration contract.

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 5.2-10 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined.

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the South Fork Salmon River spring/summer Chinook salmon MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs present. As part of this strategy, the Secesh River populations will continue to be managed for natural production. The strategy also calls for monitoring of stray rates and sources, and actions to reduce straying where needed. Section 5.2.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

Harvest-related risks to populations in the South Fork Salmon River MPG will continue to be controlled through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.2.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Predation Recovery Strategy and Actions

The following action is intended to improve productivity rates for Secesh River summer Chinook salmon by addressing impacts from brook trout.

1. Manage brook trout to minimize their occurrence.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Secesh River summer Chinook salmon population survival, beyond those already identified in this recovery plan, will likely be in the mainstem river migration corridors (the Salmon River, Snake River, and Columbia River). Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.2.7 South Fork Salmon River Summer Chinook Salmon Population

The South Fork Salmon River summer Chinook salmon population is currently not viable. The population is at a high risk of extinction, with a high abundance/productivity risk and moderate spatial structure/diversity risk. Its proposed status is Viable, which requires a maximum of low abundance/productivity risk and moderate spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Viable

Population Status

This section compares the South Fork Salmon River population's proposed status to its current status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC 2015 status review. This section focuses primarily on population abundance and productivity, and compares the population's current status to the proposed status in terms of both abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and recent status review (NWFSC 2015).

Population Description

This population includes the entire length of the mainstem South Fork Salmon River, but not its major tributaries, the Secesh River or the East Fork South Fork Salmon River. The population also includes the Salmon River and its tributaries between the South Fork Salmon River and the Little Salmon River. The ICTRT (2003) distinguished these spawning areas as an independent population based on genetic similarity, basin topography, and common adult run timing. Nearly all current spawning in this population occurs in the mainstem South Fork Salmon River upstream of the East Fork South Fork Salmon River (ICTRT 2010). The two areas of concentrated spawning are Poverty Flats and Stolle Meadows. The South Fork Salmon River Mainstem population is a Large-size population with a Branched Discontinuous C type spawning complexity. This population contains only summer run fish, and includes two major spawning areas (Middle South Fork Salmon and Upper South Fork Salmon), which are currently occupied, and two minor spawning areas (Crooked and Warren), which are currently unoccupied, shown in Figure 5.2-7 (ICTRT 2010). Hatchery fish are released into this population as part of a segregated harvest augmentation program, operated out of the McCall Fish Hatchery and based on within-population stock.

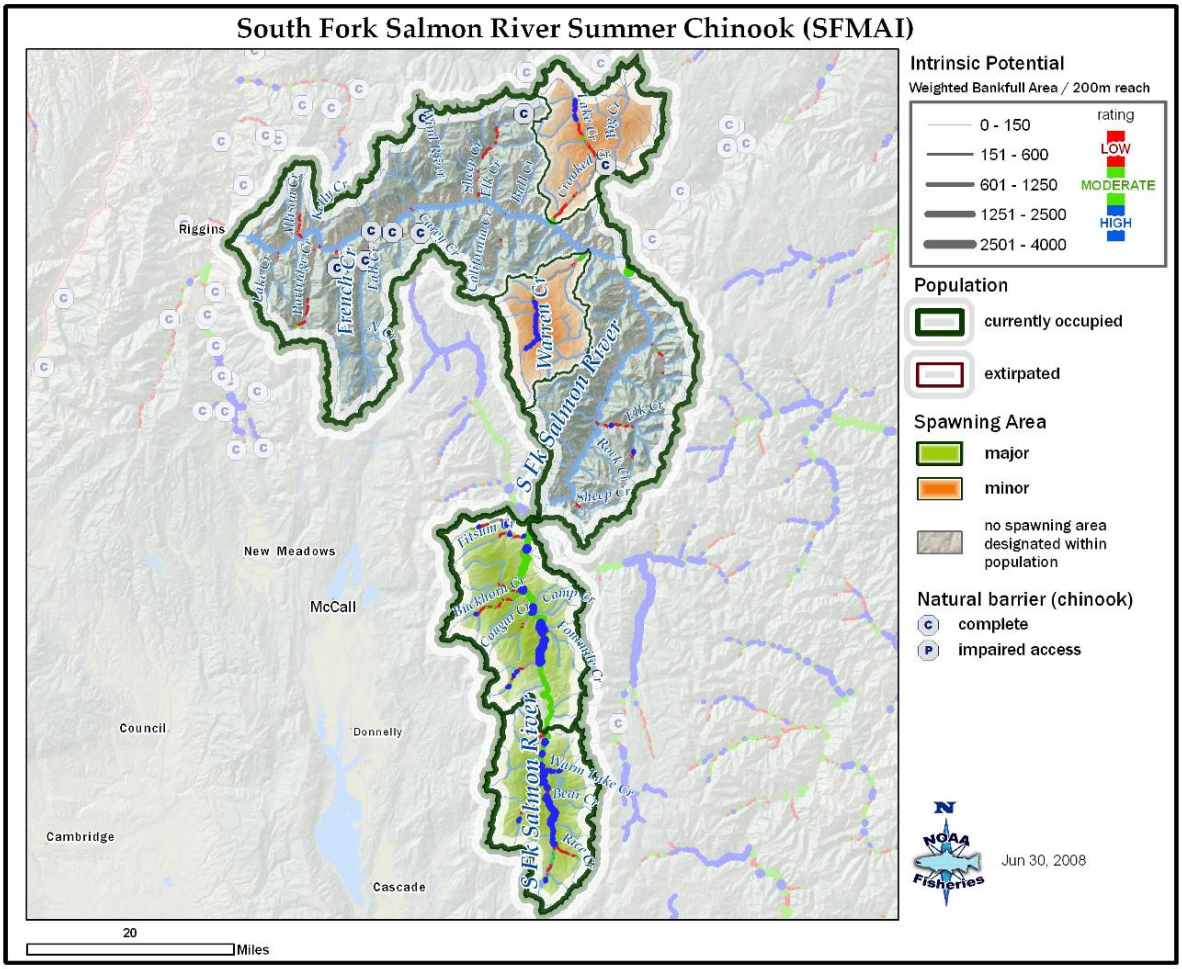

Figure 5.2-7. South Fork Salmon River summer Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

As a Large-size population, the viability target abundance for this population is a minimum mean of 1,000 naturally produced spawners. At this minimum viability target abundance, the productivity target is 1.58 recruits per spawner. The ICTRT has determined that the population would achieve a 5 percent or less risk of extinction over a 100-year period at this abundance and productivity.

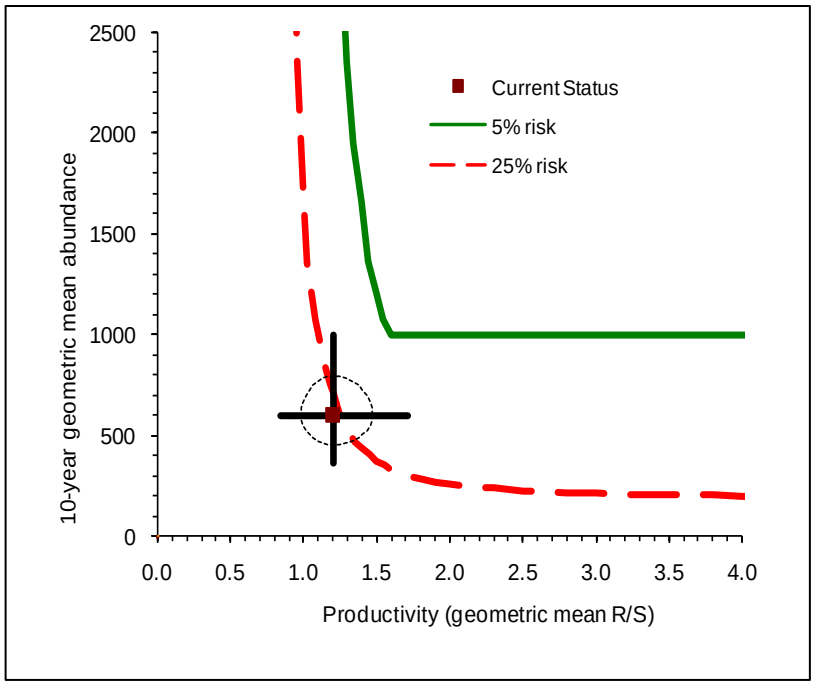

Figure 5.2-8. South Fork Salmon River current abundance and productivity compared to the ICTRT's viability curve. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural-origin abundance (measured as spawners) and productivity (measured as brood year spawner-to-spawner ratios) that correspond to a particular risk level. This is shown graphically in Figure 5.2-8. For the South Fork Salmon River population, the proposed status of viable can be attained with any combination of abundance and productivity that is above the green line. The 10-year geometric mean adult spawner abundance for this population for 2005-2014 is 791 fish. The recruit-per-spawner geometric mean productivity estimate is 1.21, not far below the 1.58 productivity required at the minimum abundance threshold (NWFSC 2015). The population is currently rated at high risk for abundance and productivity.

Spatial Structure

The spatial structure risk for this population is low because the population structure includes multiple spawning areas, current distribution matches historic distribution in major spawning areas, and there has been no increase in gaps between spawning areas. This spatial structure risk rating is adequate for the population to achieve its overall proposed status.

Diversity

The combined diversity risk for this population is moderate. This is driven primarily by one metric, within-population hatchery spawners, which is rated as high risk. In recent years, there have been substantial returns from hatchery-reared fish that were released into the upper section of the South Fork population as part of a within-population mitigation hatchery program. Over the most recent 20-year period, hatchery-reared fish averaged nearly 40 percent of total spawners (ICTRT 2010). The

hatchery program uses best management practices but nonetheless creates a genetic diversity risk. However, the other diversity metrics are primarily rated low risk, leading to a moderate combined diversity risk. A combined diversity rating of moderate risk is adequate for the population to attain its overall proposed status.

Summary

The South Fork Salmon River summer Chinook salmon population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the population cannot reach its proposed status of viable. The combined spatial structure risk/diversity risk is moderate and does not preclude attainment of the proposed overall status for the population.

The abundance/productivity and spatial structure/diversity risks are summarized in Table 5.2-11. A complete version of the ICTRT draft population viability assessment is available at http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.2-11. Viable Salmonid Population parameter risk ratings for the South Fork Salmon River Mainstem summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	South Fork SR Mainstem	HR

Viability Key: HV – Highly Viable; V – Viable; M – Maintained; and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes the limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 summarizes the regional-level factors that affect all Idaho Snake River spring/summer Chinook salmon and steelhead populations. Section 5.1 summarizes concerns specific to Idaho Snake River spring and summer Chinook salmon MPGs and populations.

Natal Habitat

Habitat Conditions

The watersheds in this population are primarily in federal ownership (Figure 5.2-9). The lower portion of the main Salmon River contains a large amount of private land, but does not overlap with the primary spawning and rearing areas for the population. The majority of the area consists of steep forested mountain slopes, transitioning to drier slopes with shrubs and grasses along the Salmon River canyon.

Timber harvest, road construction, mining, and livestock grazing have disturbed habitat conditions in the lower South Fork Salmon River basin and in tributaries to the main Salmon River included in this population. In the upper South Fork Salmon River drainage, timber harvest and road construction were identified as the primary disturbances (Wagoner and Burns 2001). Although the South Fork Salmon River was heavily grazed in the earlier part of the twentieth century, predominantly by sheep, grazing is currently restricted to pack and saddle stock in localized areas. Past timber harvest occurred throughout the South Fork Salmon River and an extensive forest road system was built to support timber harvest. A long history of mining has altered the upper portion of the Warren Creek drainage. The Payette National Forest (2007b) reported four mines with current, approved operating plans in the analysis area that conduct mineral exploration (the Big Four, Rescue, Larson Gulch and Crystal mines). These are all lode mines with total disturbances of 2-6 acres.

Watersheds occupied by this population have been degraded from historic conditions by human land uses. Roads increased delivery of sediment to streams, and roads and mining altered channel morphology. The South Fork Salmon River mainstem is subject to high levels of fine sediment due to the geologically unstable nature of the watershed, legacy effects from past road building and timber harvest, and wildfires. Restoration efforts have taken place to reduce the level of sediment in the South Fork Salmon River, such as decommissioning of national forest roads, but additional focused efforts could result in further reductions in sediment loading. There is also a threat of additional sedimentation occurring due to ongoing land uses in the basin, which could retard previous restoration efforts (NPCC 2004; Ecovista 2004).

In recent years, wildfire has had a much greater impact on stream habitat in the South Fork Salmon River than human land uses. Wildfire is a natural ecosystem process to which salmonids are adapted, but which nonetheless has localized negative impacts on habitat quality and availability. The Cascade Complex Wildfire burned in the South Fork Salmon River from July to November of 2007. Four separate ignitions converged into one major wildfire and burned 302,459 acres in the middle and upper watersheds of the South Fork Salmon River. This complex of wildfires burned with varying intensities, with the some of the highest intensity fire in the upper watersheds of the South Fork Salmon River. The Boise National Forest conducted fire suppression activities and Burned Area Emergency Response actions in 22 subwatersheds, many of which contained spring/summer Chinook salmon or potential Chinook salmon habitat. The Cascade Complex Wildfire burned through riparian areas on nearly all streams within the fire perimeter, burning at high or moderate severity in more than half of the 37 square miles of the total riparian area within the fire perimeter.

Effects of the wildfires to salmonids in the South Fork Salmon River include loss of vegetation, hydrophobic soil conditions in areas of high burn intensity, increased stream temperatures from reduced shade, and increased sediment input. Vegetative loss has resulted in unstable soil and slope conditions, resulting in increased sediment input to streams. Revegetation has begun in some areas, starting with grasses and shrubs, which are expected to stabilize soils within approximately 10 years. Regrowth of trees on many slopes is expected to occur in the long term. With the recovery of shade-producing shrubs and trees, stream temperatures are expected to return to pre-fire conditions. Reconnaissance of the Cascade Complex Wildfire indicates that fire consumed very little of the large woody debris in the riparian areas that burned at moderate to high severity.

The Payette National Forest has evaluated salmonid habitat components in both the lower and upper South Fork Salmon River using the NMFS Matrix of Pathways and Indicators (Payette National Forest 2007a). In both the upper and lower South Fork Salmon River mainstem and its tributaries, the Payette National Forest determined that substrate embeddedness is “functioning at unacceptable risk.” In the lower South Fork Salmon River mainstem, which is generally more remote, temperature, chemical contaminants, physical barriers, streambank condition, and road density are all “functioning at risk.” In the upper South Fork and its tributaries, chemical contaminants, physical barriers, off-channel habitat, refugia, width/depth ratio, streambank condition, floodplain connectivity, road density, riparian conservation areas, and temperature are all “functioning at risk” ─ although elevated temperatures may reflect a natural temperature regime in the South Fork Salmon River drainage (Payette National Forest 2007a).

In an earlier watershed assessment for the South Fork Salmon River, NPCC (2004) identified the primary limiting factors for summer Chinook salmon habitat in the main South Fork Salmon River drainage as increased levels of fine sediment and reduced riparian habitat quality. This assessment identified secondary limiting factors as the presence of brook trout and two areas of inaccessible habitat due to passage barriers (NPCC 2004, p. 3-33). The Salmon River Subbasin Management Plan further documented that localized degraded riparian areas exist in the South Fork Salmon River (Ecovista 2004). This plan identified the lack of shade-providing, bank-stabilizing riparian vegetation as a common factor limiting the condition of salmonid rearing habitat throughout the South Fork Salmon River watershed (Ecovista 2004, p. 70).

Figure 5.2-9 estimates the relative suitability, or "intrinsic potential," of stream reaches in this population to support summer Chinook salmon spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006), compared to current spawning and rearing areas.

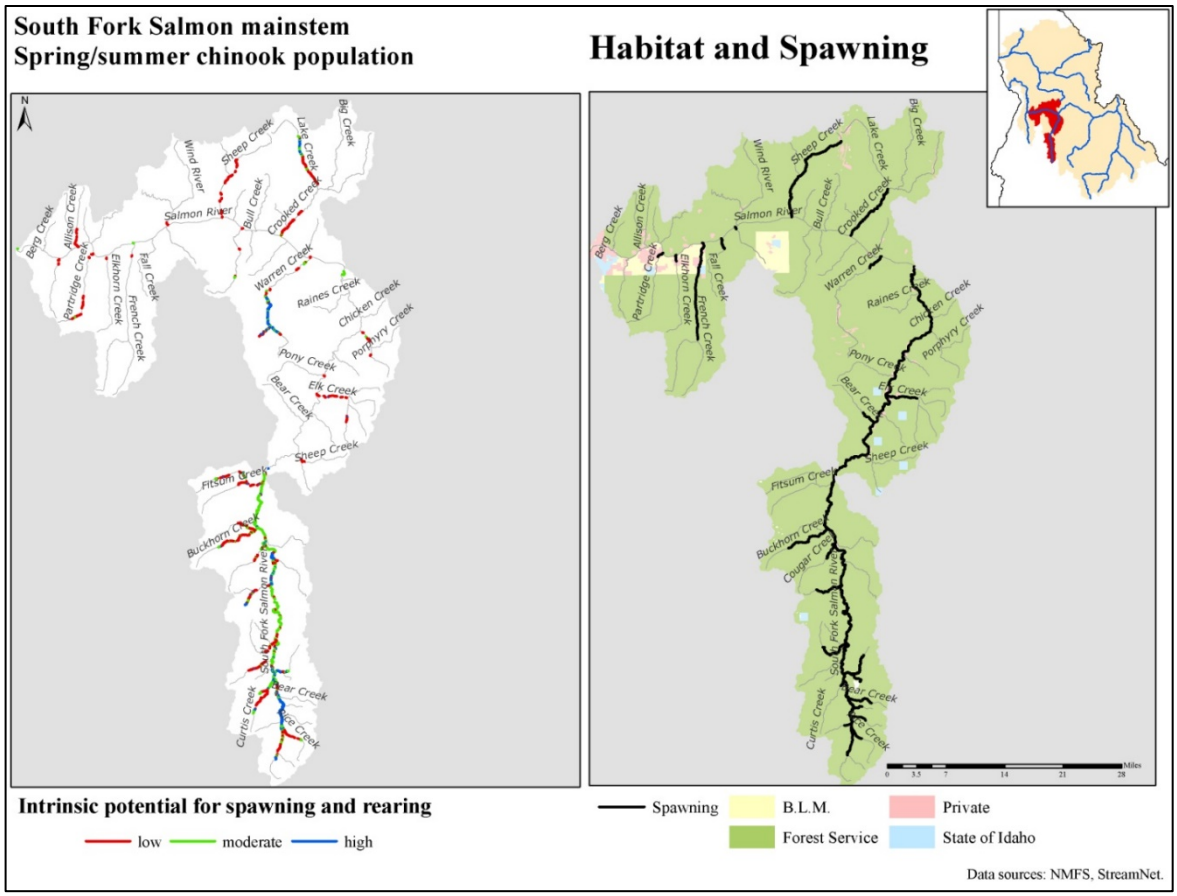

Figure 5.2-9. Land ownership, intrinsic potential, and current spawning areas. [Note: The Streamnet website contains the latest spring and summer Chinook distribution maps: www.streamnet.org.]

Current Habitat Limiting Factors and Threats

NMFS determined the habitat limiting factors for each population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds. Based on these reports, and on discussions with local fisheries experts and watershed groups, we conclude that the habitat limiting factors for the South Fork Salmon River summer Chinook salmon population include the following.

1. *Excess sediment.*

The Idaho Department of Environmental Quality has developed TMDLs for sediment for areas containing a majority of the spawning and rearing habitat in the South Fork Salmon River. The sediment TMDLs were originally completed in 1992, reviewed in 2003, and then reviewed again in 2009 and 2012. Recent trends for sediment have been improving; so many stream reaches are now listed as fully supporting beneficial uses. IDEQ has removed all stream reaches listed for sediment from the 303(d) list, with the exception of the mainstem South Fork Salmon River. Despite improvements, IDEQ's 2008 integrated water quality report states that the existing road system still contributes large quantities of sediment to the South Fork Salmon River during storm events (IDEQ 2008a).

In 2012, the IDEQ revised sediment targets for the South Fork Salmon River TMDL to more closely reflect natural conditions in the watershed. The targets are based on the Payette and Boise National Forest watershed condition indicators for the watershed (IDEQ 2014). Continued management of sediment loading through implementation of the 1991 sediment TMDL is necessary to prevent the existing roads and other sediment sources from impacting current water quality.

2. Channel alteration.

The Warren Creek watershed, one of the population's two unoccupied minor spawning areas on the main Salmon River, is currently on the 303(d) list for physical substrate habitat alterations. A long history of mining significantly altered upper Warren Creek, through the Warren Meadows area and upstream into its tributaries. Mining began in the drainage in the 1800s, with the greatest disturbance occurring from placer and lode mining occurring in the 1930s when much of the Warren Meadows area was dredge mined. Dredge mining drastically altered the stream channel and substrate. Large quantities of sediment washed downstream during this time. Roads associated with mining claims were constructed, many of which still exist and continue to produce sediment (Nelson and Burns 2001, pp. 42-47).

Legacy dredge mining impacts in upper Warren Creek limit the stream's current value as summer Chinook salmon habitat. However, a steep section of Warren Creek near the confluence with the Salmon River creates a passage barrier for migrating adult summer Chinook salmon in most years. Because returning adult Chinook salmon cannot consistently reach the Warren Meadows area, addressing the habitat alterations in upper Warren Creek is a low priority for this summer Chinook salmon population.

3. High water temperature.

Fourteen named streams in the South Fork Salmon River basin, including the mainstem South Fork Salmon River, were added to the 303(d) listing for temperature in 2003. IDEQ completed TMDLs for these streams. A 2012 review found that, with the exception of Trail Creek and possibly Profile Creek, all the streams in the analysis lack shade resulting in excess solar load (IDEQ 2014).

Crooked Creek is one of the population's two minor spawning areas on the main Salmon River, but there is no current summer Chinook salmon spawning in the drainage. Water temperature data indicate that the upper portion of Crooked Creek has elevated water temperatures that might affect salmonid spawning (IDEQ 2002). Parts of Crooked Creek were substantially impacted by past dredge mining and other land uses that reduced riparian vegetation and shade. A 2002 water temperature TMDL developed by IDEQ for Crooked Creek (Figure 5.2-10) calls for regrowth of riparian vegetation to provide natural levels of shade. Because the Crooked Creek watershed is under predominantly federal ownership, with over half of the drainage in the Gospel-Hump Wilderness, shade levels are likely to recover naturally over time and do not require habitat restoration actions.

Potential Habitat Limiting Factors and Threats

Several potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the South Fork Salmon River. These concerns include the following:

1. Mineral exploration and development. Without sufficient water quality conservation measures, new mining operations could release sediment and toxic chemicals into surface waters.
2. Wildfire. Severe wildfires can increase sediment delivery to streams and stream temperatures.
3. Invasive plants. The spread of invasive plants can lead to increased soil erosion and decrease native plant density.

Hatchery Programs

The South Fork Salmon River hatchery program (McCall Fish Hatchery) releases approximately 1.0 million smolts to the South Fork Salmon River each year. These releases from the McCall Hatchery affect the South Fork Salmon River summer Chinook salmon population. The McCall Hatchery program raises general issues of loss of fitness due to hatchery-influenced selection; however, since 1981 all broodstock for this program has been collected from the South Fork Salmon River. Hatchery-related limiting factors and threats for South Fork Salmon River summer Chinook salmon are discussed at the MPG level in Section 5.2.3.2.

Fishery Management

State fisheries on the South Fork Salmon River target hatchery-origin adults returning to the South Fork Salmon River from the summer Chinook salmon program that rears fish at McCall Hatchery and releases them in the South Fork Salmon River. Tribal fisheries can also occur. The fish are also harvested in fisheries in the Columbia River estuary, mainstem Columbia, Snake River and Salmon River. All the fisheries pose a threat to the population. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for South Fork Salmon River summer Chinook salmon, and other South Fork Salmon River MPG populations, are discussed at the MPG level in Section 5.2.3.3.

Predation and Competition

Potential Predation Limiting Factor and Threat

Invasive species. Non-native brook trout have been found in tributaries to the South Fork Salmon River and could compete with or prey on summer Chinook salmon.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve summer Chinook salmon productivity rates.

1. Reduce sediment loading through road decommissioning, road improvements, road relocation, and riparian enhancement projects in selected areas. Many miles of National Forest road have

already been decommissioned in order to reduce sediment delivery to streams. Additional reductions in sediment delivery can also be realized by paving the approaches to bridges in areas likely to deliver sediment.

2. Address localized areas where riparian function is most limited, including those segments of stream where roadbeds have been constructed adjacent to or within the immediate floodplain.

Implementation of Habitat Actions

Most of land in this population is publically owned, including almost all of land along upper South Fork mainstem where most spawning and rearing occurs. Responsibility for implementation of the habitat portion of the recovery plan for this population lies largely within the jurisdiction of the U.S. Forest Service. On federal lands, following the existing Land and Resource Management Plan should provide the protection needed for this population. The Nez Perce Tribe has also been active in implementing recovery projects for summer Chinook salmon in the South Fork Salmon River, including opening up access to seven miles of habitat by fixing passage barriers (NPT 2013).

Table 5.2-12 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not include related projects planned by the U.S. Forest Service and others. The list of specific projects is updated continuously based on available funding and established priorities. During the Plan implementation process, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.2-12. Habitat Recovery Actions Identified for the South Fork Salmon River Summer Chinook Salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Sediment	Improve 98 road miles	BPA Contract # 2007-127-00: East Fork of South Fork Salmon River Passage Restoration*	N/A
Degraded Riparian Condition and High Water Temperature	Improve 2 riparian acres		

* Since fish passage cannot currently be restored through the old Stibnite Mine Site on the East Fork South Fork Salmon River (due to lack of landowner consent), the Nez Perce Tribe and U. S. Forest Service have proposed several other high priority habitat restoration actions throughout the South Fork Salmon watershed, to be funded under this BPA habitat restoration contract.

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 5.2-12 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined.

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the South Fork Salmon River spring/summer Chinook salmon MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs present. As part of this MPG-level strategy, the hatchery strategy for the South Fork Salmon River population is to minimize the ecological and genetic risks of releasing hatchery fish to achieve the population's proposed status level of viable. The strategy also calls for the development of gene flow standards through the HGMP process, the evaluation of the influence of hatchery programs on all populations, and for the monitoring of stray rates and sources and actions to reduce straying where needed. Section 5.2.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

Harvest-related risks to populations in the South Fork Salmon River MPG will continue to be controlled through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.2.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to South Fork Salmon River population survival, beyond those already identified in this recovery plan, will likely be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.2.8 East Fork South Fork Salmon River Summer Chinook Salmon Population

The East Fork South Fork Salmon River summer Chinook salmon population is currently not viable, due to high abundance/productivity risk. Its proposed status is Viable or Maintained, which requires that it have no more than moderate abundance/productivity risk.

Current Status	Proposed Status
High Risk	Viable or Maintained

Population Status

This section compares the East Fork South Fork Salmon River population's proposed status to its current status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC 2015 status review. The section focuses primarily on population abundance and productivity, but also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the ICTRT's 2010 full status assessment and the NWFSC's 2015 status review.

Population Description

The ICTRT classified the East Fork South Fork Salmon River population as a Large-size population. The population includes the entire East Fork South Fork Salmon River and its major tributary Johnson Creek. This population contains summer-run fish and consists of two major spawning areas (Upper Johnson and Lower Johnson) (Figure 5.2-10). The Lower Johnson major spawning area includes the upper East Fork South Fork. Johnson Creek fish have distinct juvenile mainstem migration timing, which is the main basis for designation as an independent population, differentiated from other South Fork Salmon River populations. Summer Chinook salmon in the upper East Fork South Fork Salmon River were extirpated by mining operations early in the 1940s. Fish returning to this part of the drainage historically may have constituted an independent population. However, it is unlikely that those fish exhibited a life history strategy different from Chinook salmon in the rest of the drainage (ICTRT 2010), and this area has therefore been included in the East Fork South Fork Salmon River population.

Historically, most spawning occurred in the Johnson Creek mainstem and the East Fork South Fork Salmon River mainstem upstream of Johnson Creek. Many tributaries to these rivers have steep gradients in their lower reaches, precluding access by summer Chinook salmon. Currently most spawning occurs in Johnson Creek. Spawning in the East Fork South Fork Salmon River upstream of Johnson Creek was extirpated in the 1940s by sediment and pollutants from mining activities, and reintroduction efforts did not begin until the 1990s. Barriers to upstream adult migration also eliminated spawning in upper Johnson Creek, but summer Chinook salmon spawning upstream of Landmark Creek was reestablished by barrier removal in 1985 (ICTRT 2010).

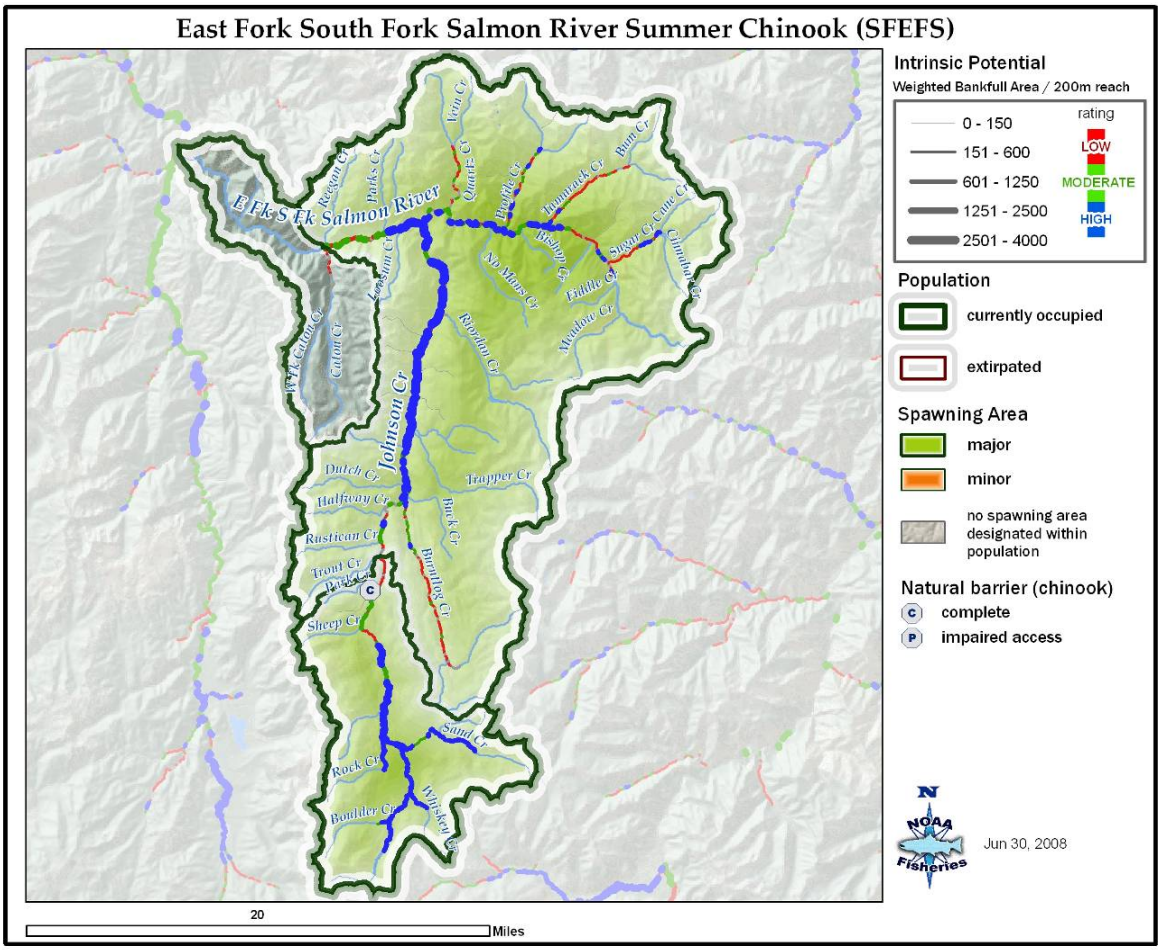

Figure 5.2-10. East Fork South Fork Salmon River Summer Chinook Salmon Population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Hatchery supplementation occurs in both Johnson Creek and the East Fork South Fork Salmon River. All releases of hatchery fish in the East Fork South Fork population have originated from within-MPG broodstock. In 1998, the Nez Perce Tribe established an experimental, integrated supplementation program in Johnson Creek, founded from the local indigenous summer Chinook salmon, in order to reduce the population's risk of extirpation. The supplementation program traps and collects natural adult salmon in Johnson Creek for artificial spawning and rearing at the McCall Hatchery and releases up to 100,000 smolts yearly back into Johnson Creek (IDFG 2011). Prior to initiation of that supplementation program, sporadic releases of small numbers of within-MPG hatchery fish occurred in Johnson Creek.

The East Fork South Fork Salmon River has also received Chinook salmon from the McCall Hatchery over the past decade (ICTRT 2003). IDFG has stocked South Fork Salmon River adults from the McCall Hatchery into the East Fork South Fork Salmon River upstream of Bradley Pit (which is upstream from Sugar Creek). Bradley Pit is a manufactured upstream barrier to adult summer Chinook salmon migration created by excavation of the river channel for gold mining. The high stream gradients at the upstream end of excavation of the river channel create the barrier. Since hatchery

supplementation began, some adult summer Chinook salmon have been returning to spawn in the East Fork South Fork Salmon River but are limited from passing upstream further than Bradley Pit.

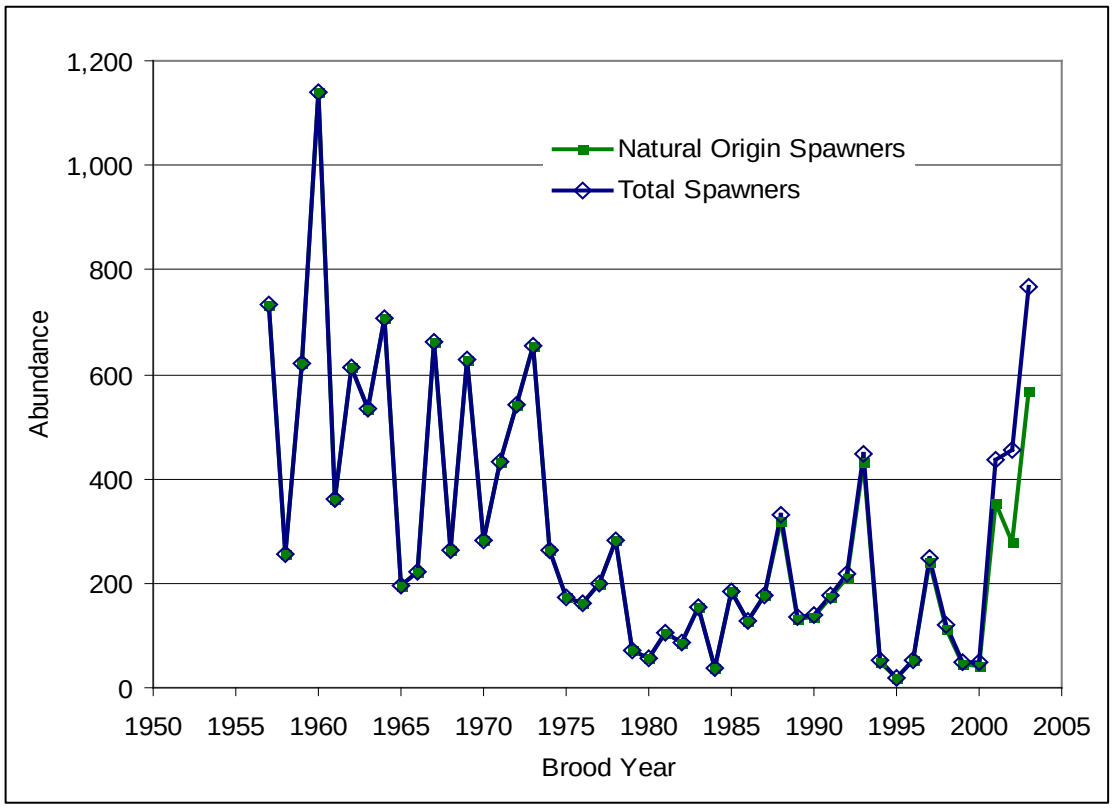

Figure 5.2-11. East Fork South Fork Salmon River summer Chinook salmon abundance trends 1957-2003.

Abundance and Productivity

The viability target abundance and productivity for a Large population is to achieve a mean abundance threshold criteria of 1000 naturally produced spawners with a productivity exceeding 1.58 recruits per spawner. At this abundance and productivity, the population would achieve a 5 percent or less risk of extinction over a 100-year timeframe, considered viable (low risk) status. To reach the proposed status of maintained (a 25% or less risk of extinction over 100 years), the population would need a minimum mean of roughly 250 spawners, also with a productivity exceeding 1.58. For this population the 10-year geometric mean for natural adult spawner abundance for 2005-2014 is 162 fish (Figures 5.2-11 and 5.2-12), significantly less than the minimum threshold of spawners for moderate risk status. The return-per-spawner geometric mean productivity is 1.15, less than the 1.58 required at the minimum abundance threshold (NWFSC 2015).

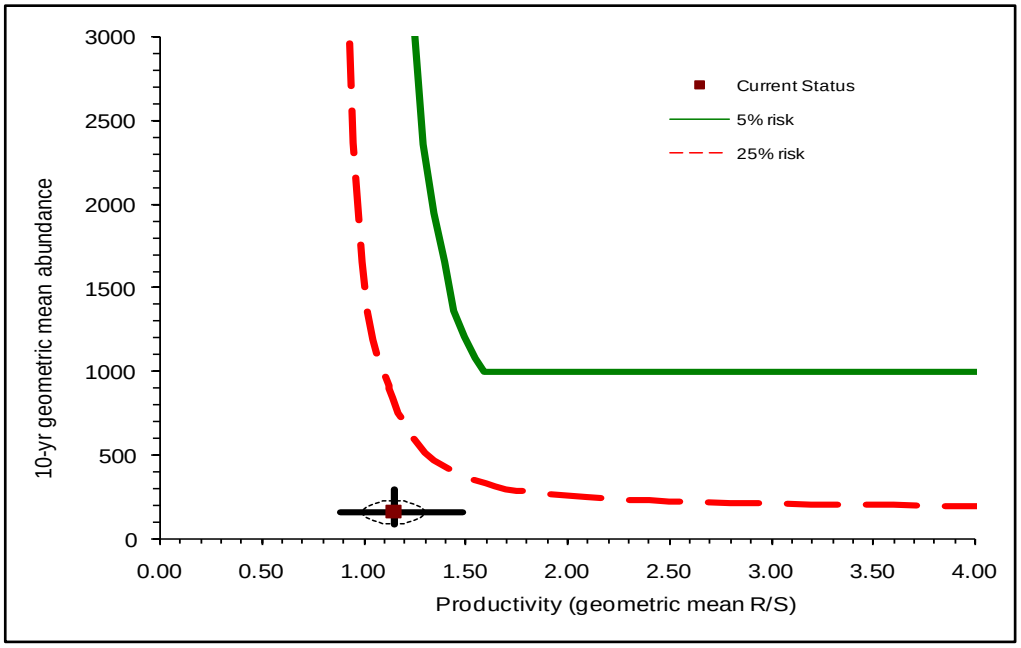

Figure 5.2-12. East Fork South Fork Salmon River Summer Chinook abundance/productivity compared to ICTRT viability curve. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

The ICTRT viability criteria for population abundance and productivity are also expressed as a viability curve – minimum combinations of current natural-origin abundance (measured as spawners) and productivity (measured as brood year spawner-to-spawner ratios) that correspond to a particular risk level. As seen in Figure 5.2-12, the proposed risk level can be achieved with various combinations of abundance and productivity. For the East Fork South Fork population, viability can be attained with any combination of abundance and productivity that is above the green line. The proposed status of maintained can be achieved with any combination that is above the red dashed line. Improvement in abundance and productivity will need to occur before this population can achieve its proposed status.

Spatial Structure

The two spawning areas for this population are configured in a way that results in a low risk rating. The population also currently occupies both of its historic major spawning areas. This results in a combined spatial structure risk of low, which is adequate to meet the population's proposed status.

Diversity

Spawner composition for this population is rated moderate risk because hatchery-origin fish from the supplementation program are spawning naturally within the population. Over the most recent 10-year period, hatchery-reared fish averaged 19 percent of total spawners (ICTRT 2010). The hatchery program uses best management practices and increases the abundance of the population but nonetheless creates a moderate genetic diversity risk. This is offset by low risk ratings for all of the other diversity metrics (e.g. out of ESU/MPG spawners, distribution across habitat types, genetic and phenotypic variation and major life history strategies). The combined diversity risk is low for this population, which is adequate to meet the proposed status for the population.

Summary

The East Fork South Fork Salmon River summer Chinook salmon population does not meet the proposed status because the abundance and productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the East Fork South Fork Salmon River summer Chinook salmon population cannot reach its proposed status of maintained. The combined spatial structure risk/diversity risk is currently low and does not preclude attainment of the proposed status for the population.

The summary of the abundance/productivity and spatial structure/diversity risks are shown in Table 5.2-13. A complete version of the ICTRT draft population viability assessment is available at http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.2-13. Viable Salmonid Population parameter risk ratings for the East Fork South Fork Salmon River Summer Chinook Salmon 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	HR
	High (>25%)	HR	East Fork South Fork Salmon River	HR	HR

Viability Key: HV – Highly Viable; V – Viable; M – Maintained; and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes the limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 summarizes the regional-level factors that affect all Idaho Snake River spring/summer Chinook salmon and steelhead populations.

Natal Habitat

Habitat Conditions

The East Fork South Fork Salmon River watershed covers approximately 250,000 acres and enters the mainstem South Fork Salmon River near the confluence of the Secesh River. Most of the East Fork South Fork Salmon River watershed is administered by the U.S. Forest Service, with lands managed by both the Boise and Payette National Forests. Private land in the East Fork South Fork Salmon River includes small parcels of land along Johnson Creek, large mines in the headwater drainages (Stibnite and Cinnabar Mines), and the town of Yellow Pine. Predominant land uses occurring in this watershed include timber harvest, road construction, and large-scale mining (Wagoner and Burns 2001).

Extensive cattle grazing also historically occurred in Johnson Creek, but grazing allotments have now been retired and Johnson Creek livestock grazing reduced to a small number of horses.

Past land uses have degraded salmonid habitat for this population. The U.S. Forest Service has evaluated salmonid habitat components in the East Fork South Fork drainage using the NMFS Matrix of Pathways and Indicators (NMFS 1996). The agency staff identified only two habitat indicators as "functioning appropriately" in the watershed: water temperature and peak and base flows. Indicators classified as "functioning at unacceptable risk" included chemical contamination/nutrients, large woody debris, pool frequency and quality, large pools, and width to depth ratio. Other habitat indicators were classified as "functioning at risk" (Wagoner and Burns 2001, p. 166). Habitat conditions are described below in more detail for the population's two major streams: the East Fork South Fork Salmon River itself, and its major tributary, Johnson Creek.

East Fork South Fork Salmon River

The East Fork South Fork Salmon River is confined in a deep V-shaped canyon for much of its length. Short stretches of low gradient channel, where the canyon widens for short distances, occur in reaches downstream of Yellow Pine and upstream of Quartz Creek. Tributary streams within the drainage generally exhibit Rosgen Type A and B morphology. Type-A streams are entrenched and exhibit low sinuosity and a low width/depth ratio. Type-B streams are moderately entrenched, showing moderate width/depth ratio and moderate sinuosity.

Large-scale historic mining altered stream channel conditions in the upper East Fork South Fork Salmon River drainage. The U.S. Forest Service and mine operators have since undertaken significant restoration work. The overall channel condition of the upper East Fork South Fork is relatively good (Kuzis 1997), although the upper stretch of the river has a low number of pools and lacks large woody debris. Widened channels and excessive median and lateral bar formation are evidence of past sediment inputs. In the upper portions of Sugar and Tamarack Creeks, pools have been filled by inputs of sediment from historic mining activity. The unstable nature of the geologic units in the area, and resulting high natural sediment inputs, has also contributed to the low number of pools. Despite lack of pools and large woody debris, stream channels in the upper East Fork South Fork have shown significant natural recovery from historic mining impacts (Kuzis 1997). However, habitat in the East Fork South Fork Salmon River above Bradley Pit (upstream of the Sugar Creek confluence) is inaccessible to returning adult summer Chinook salmon because historic mining excavation of the stream channel has created a passage barrier.

Two reaches of the East Fork South Fork Salmon River are currently listed as impaired on the IDEQ's Clean Water Act 303(d) list. The section of the upper East Fork South Fork Salmon River above Sugar Creek is listed as not supporting beneficial uses based on IDEQ's combined habitat/biota bioassessment, reported in the 2008 Water Quality Combined Report (IDEQ 2008a). The lower segment of the East Fork South Fork Salmon River, from the confluence with Johnson Creek to the mouth, is listed as impaired by sediment. The IDEQ issued a TMDL for sediment in the South Fork Salmon River basin in 1991, but additional actions to reduce sediment loading are needed to remove the lower segment of the East Fork South Fork Salmon River from the 303(d) list. All other East Fork South Fork Salmon River and Johnson Creek segments listed for sediment on the 2002 303(d) list were

removed from the list in 2008. These reaches were removed because they had attained the surrogate targets for cobble embeddedness and showed an improving trend in sediment conditions. However, it is likely that the existing road system contributes large quantities of sediment to streams throughout of the East Fork South Fork Salmon River watershed during storm events. These storm-related pulses of sediment to streams suggest a need for continued implementation of IDEQ's 1991 South Fork Salmon River sediment TMDL. Additional actions should be taken by the U.S. Forest Service or others to ensure that the existing road system and other sediment sources do not affect current water quality.

Johnson Creek

Johnson Creek is the largest tributary of the East Fork South Fork Salmon River, covering approximately 140,000 acres. Johnson Creek is a fifth order stream. The main channel flows through an open valley with short steeper sections (e.g. Deadhorse Rapids). Discharge ranges from peak flows of 2,000 to 4,000 cfs to a winter low of 50 to 100 cfs (USGS 2013).

Primary land uses in Johnson Creek have been dispersed recreation, timber management, livestock grazing, and mineral development. Over half the watershed is inventoried roadlesss area (Payette National Forest 2003). Outside the roadless areas, land uses such as roads and recreation have led to localized areas of accelerated sediment delivery, stream channel modification, and streambank degradation. Lower Johnson Creek is currently listed as impaired for high water temperatures on the IDEQ's Clean Water Act 303(d) list (IDEQ 2014). Past wildfires have also increased sedimentation in some areas. In addition to sediment concerns, aquatic habitat has been degraded from natural conditions in the form of limited pool habitat, low bank stability, and low levels of large woody debris (Payette National Forest 2003, p. III-334-335). The Salmon River Subbasin Management Plan identified the lack of functioning large woody debris as a primary factor currently affecting channel structure in Johnson Creek, stating that it contributed to reduced habitat quality for salmonids (Ecovista 2004, p. 38).

The Johnson Creek watershed is open to mineral activities and prospecting, with several hundred mining claims existing in the watershed. Although few claims are active, mineral development is taking place the Lower Johnson Creek subwatershed (Payette National Forest 2003, pp. 336 and 347) and could pose a potential threat to habitat quantity and quality in upcoming years.

Current Habitat Limiting Factors and Threats

NMFS determined the habitat limiting factors for each population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds. Based on these reports, and on discussions with local fisheries experts and watershed groups, we conclude that the habitat limiting factors for the East Fork South Fork Salmon River summer Chinook salmon population include the following.

1. High instream sediment and degraded riparian areas

Habitat quality is limited in this population by high instream sediment and degraded riparian areas, primarily caused by the watershed's extensive road system. A great deal of progress has been made in reducing sediment across the South Fork Salmon River basin, and most stream reaches listed as impaired by sediment have now been removed from the 303(d) list, including Johnson Creek and much of the East Fork South Fork (IDEQ 2008a). The upper East Fork South Fork Salmon River and

Johnson Creek are both on an improving trend for sediment, but the lower East Fork South Fork is still on the 303(d) list for sediment. A primary source of sediment delivery to streams is from roads built within the riparian zones. Additional projects or changes in road management will likely be required to further reduce sediment delivery. For example, the main roads along Johnson Creek and the East Fork South Fork are maintained by Valley County, and appropriate best management practices for road maintenance are not being followed. During road maintenance, sediment is side-cast into riparian areas and eventually delivered to the stream channel.

Historic mining sites also deliver sediment pulses downstream into summer Chinook salmon habitat. For example, an earthen dam that blew out at the historic Stibnite mine site delivers sediment from Blowout Creek into Meadow Creek with every large-scale precipitation event. Meadow Creek is a tributary to the East Fork South Fork upstream from the Bradley Pit. Adult summer Chinook salmon are being stocked above the barrier in the East Fork South Fork and Meadow Creek, and sediment pulses from Blowout Creek could degrade this habitat.

2. Reduced habitat quality and elevated water temperatures due to degraded riparian areas.

Large woody debris recruitment has been reduced by the elimination of riparian vegetation. The extensive road system in the East Fork South Fork Salmon River watershed includes many miles of road running parallel to streams in riparian areas. This and other disturbances to riparian areas have reduced large woody debris recruitment. If riparian vegetation is reestablished, large woody debris recruitment should naturally recover over time. Re-establishment of riparian vegetation should also reduce summer stream temperatures over time. Johnson Creek, along with Sand and Trout Creeks, is 303(d)-listed for temperature, and high temperatures have also been observed in tributaries to the upper East Fork South Fork Salmon River (BOR 2013; IDEQ 2014). Past mining activities in the upper East Fork modified stream channels such that riparian vegetation and shade levels are low in some tributaries.

3. Passage barriers.

The most significant summer Chinook salmon passage barrier within the population is Bradley Pit. Bradley Pit is an old mining pit that was constructed mid-channel in 1955 in the upper East Fork South Fork Salmon River above the Sugar Creek confluence. High stream gradients at the upstream end of excavation pit have created an upstream migration barrier to returning adult Chinook salmon.

Road-related fish passage barriers on tributaries also exist and should be inventoried and removed on a priority basis. In the Johnson Creek watershed, 14 road stream-crossing culverts have been identified as barriers to fish passage (BOR 2013). Because many tributaries to Johnson Creek and the East Fork South Fork Salmon River are high gradient and do not provide suitable summer Chinook salmon habitat, fish passage barriers on these tributaries may not impact the population. Passage barriers on tributaries to the East Fork South Fork upstream from the Bradley Pit will not be a priority for removal until passage for summer Chinook salmon is established through the Bradley Pit itself.

Potential Habitat Limiting Factors and Threats

Several potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the East Fork South Fork Salmon River. These concerns include the following:

1. Mining exploration and development. Without sufficient water quality conservation measures, new mining operations could release sediment and toxic chemicals into surface waters. Historic mining sites may also be releasing toxic heavy metals into surface waters.
2. Recreation, which could affect riparian areas if it is not managed.
3. Spread of invasive plants that can increase soil erosion and decrease native plant density. A number of invasive plants have been introduced into the East Fork South Fork Salmon River, particularly along the main travel ways. The primary weed of concern in the East Fork South Fork Salmon River is spotted knapweed, which currently occurs in small, scattered populations (Payette National Forest 2003, p. III-260).

Hatchery Programs

A small hatchery conservation program operates on Johnson Creek and releases fish into the East Fork South Fork Salmon River. The Johnson Creek Hatchery uses only natural-origin returns for broodstock, and currently has an annual target release level of 100,000 yearling smolts. This small conservation program affects genetic adaptiveness of the East Fork South Fork Salmon River population; however, all releases of hatchery fish in the population area have originated from within-MPG broodstock. Hatchery-related limiting factors and threats for East Fork South Fork Salmon River summer Chinook salmon are discussed at the MPG level in Section 5.2.3.2.

Fishery Management

Hatchery-origin Chinook salmon releases from Johnson Creek Hatchery do not currently support a state fishery in the East Fork South Fork Salmon River, but tribal fisheries can occur. Fisheries in the Columbia River estuary, mainstem Columbia, Snake River and Salmon River, however, pose a threat to the population. Negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for East Fork South Fork Salmon River summer Chinook salmon, and other South Fork Salmon River MPG populations, are discussed at the MPG level in Section 5.2.3.3.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve summer Chinook salmon productivity rates:

1. Restore riparian processes and functions in localized areas of the East Fork South Fork Salmon River drainage by improving riparian vegetation and decreasing sediment delivery.
2. Decommission or obliterate non-essential roads within riparian areas to allow regrowth of riparian vegetation. For permanent roads in riparian areas, appropriate maintenance practices will decrease sediment delivery to streams.

3. Identify and rehabilitate abandoned mining sites and roads to reduce impacts on water quality (sediment and toxic heavy metal contaminants) and fish habitat for listed species.
4. Eliminate fish passage barriers that are blocking summer Chinook salmon from accessing potential habitat.
5. Complete additional monitoring in the upper East Fork South Fork Salmon River to determine the reasons that beneficial uses are not supported, and prepare and implement a TMDL to improve the water quality.

Implementation of the Habitat Actions

Most of land in the East Fork South Fork Salmon River is in federal ownership, so responsibility for implementation of the habitat portion of the recovery plan for this population lies within the jurisdictions of the U.S. Forest Service. On federal lands, following the existing Land and Resource Management Plan should provide the protection needed for this population. The Boise National Forest will implement the Johnson Creek Watershed Improvement Project, which includes decommissioning roads along tributary streams and reducing dispersed recreation along Johnson Creek. The Nez Perce Tribe has also been active in implementing habitat improvement projects in the watershed, particularly road obliteration projects. The U.S. Forest Service and other entities have also completed numerous habitat restoration projects. Types of habitat restoration projects include riparian planting, riparian and wetland fencing, road decommissioning, and stream barrier replacement and removal. Habitat has also been protected through acquisitions, conservation easements, and other methods.

Table 5.2-14 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not represent a full list of projects. Specific projects are planning continuously based on available funding and established priorities. During Plan implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.2-14. Habitat Recovery Actions Identified for the East Fork South Fork Salmon River Summer Chinook Salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Barriers	Replace 4 culverts in the Johnson Creek watershed	BPA Contract # 2007-127-00: East Fork of South Fork Salmon River Passage Restoration	N/A
Sediment	Decommission 10 miles of road in the Johnson Creek watershed		
Riparian Condition and Water Temperature	Revegetate 2 riparian acres		

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 5.2-14 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined.

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the South Fork Salmon River spring/summer Chinook salmon MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs present. As part of this MPG-level strategy, the hatchery strategy for the East Fork South Fork Salmon River population is to continue managing the Johnson Creek hatchery program for conservation using only natural-origin returns for broodstock. The strategy also calls for monitoring of stray rates and sources, and actions to reduce straying where needed. Section 5.2.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

Harvest impacts will continue to be controlled through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.2.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to East Fork South Fork Salmon River population survival, beyond those already identified in this recovery plan, will likely be in the mainstem river migration corridors (the Salmon River, Snake River, and Columbia River). Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.3 Middle Fork Salmon River MPG

The Middle Fork Salmon River MPG consists of spring and summer Chinook salmon returning to the Middle Fork Salmon River basin, in addition to spring Chinook salmon returning to Chamberlain Creek and other nearby tributaries on the mainstem Salmon River. The MPG includes nine independent populations, shown in Figure 5.3-1: (1) Big Creek, (2) Lower Middle Fork Salmon River Mainstem (below Indian Creek), (3) Upper Middle Fork Salmon River Mainstem (above Indian Creek and including the Indian Creek, Marble Creek, Pistol Creek and Rapid River drainages), (4) Camas Creek, (5) Loon Creek, (6) Sulphur Creek, (7) Bear Valley Creek, (8) Marsh Creek, and (9) Chamberlain Creek. The ICTRT classified Big Creek as a Large-size population; Bear Valley, Chamberlain Creek and the Upper Middle Fork as Intermediate-size populations; and the remaining populations as Basic-size (Table 5.3-1) (ICTRT 2007). No population in the MPG has received hatchery supplementation and there is no history of hatchery-origin spring and summer Chinook salmon spawning in this group of populations.

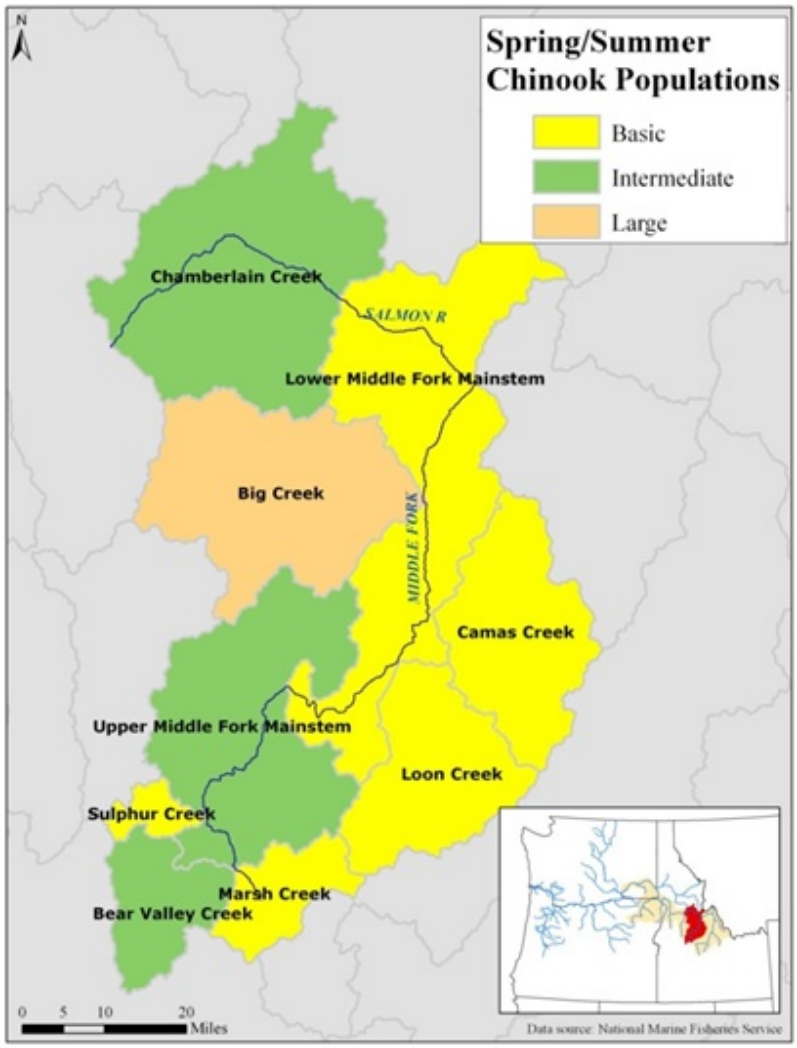

Figure 5.3-1. Middle Fork Salmon River spring/summer Chinook salmon major population group (MPG) and independent populations. Colors indicating population size based on historic habitat potential.

The ICTRT classified these fish as a major population group based on genetic differentiation and geographic isolation from other populations in the Salmon River. Although genetic data are limited, spring and summer Chinook salmon spawning in the Middle Fork Salmon River basin appear to be genetically differentiated from other Salmon River populations (see Neville et al. 2006, 2007). The Chamberlain Creek population on the main Salmon River is genetically divergent from all other populations in the ESU (ICTRT 2003) but is included in the Middle Fork MPG based on geographic proximity (ICTRT 2005). The Middle Fork Salmon River basin and Chamberlain Creek are separated by a large distance from spring/summer Chinook salmon spawning locations in the South Fork Salmon River and in the Upper Salmon River. The spring-run type predominates in this MPG, but summer-run fish are present in Loon Creek, Big Creek, Camas Creek, and the lower Middle Fork Salmon River mainstem. Later-spawning Chinook salmon have also been observed in the lower reaches of other Middle Fork tributaries, such as Rapid River and Camas Creek; this later spawn timing (with some live fish still on redds into September) matches that of summer-run fish in the Middle Fork Salmon River basin (Thurow 2014).

Table 5.3-1. Middle Fork Salmon River spring/summer Chinook salmon MPG population characteristics. Minimum abundance and productivity values represent levels needed to achieve a 95% probability of existence over 100 years (ICTRT 2007).

Population	Extant/ Extinct	Life History	Size	Minimum Abundance Threshold*	Minimum Productivity Threshold**
Chamberlain Cr	Extant	Spring	Intermediate	500	2.21
Big Creek	Extant	Spr/Sum	Large	1,000	1.58
Lower MF Salmon	Extant	Spr/Sum	Basic	500	2.21
Camas Creek	Extant	Spr/Sum	Basic	500	2.21
Loon Creek	Extant	Spr/Sum	Basic	500	2.21
Upper MF Salmon	Extant	Spring	Intermediate	750	1.76
Sulphur Creek	Extant	Spring	Basic	500	2.21
Bear Valley Creek	Extant	Spring	Intermediate	750	1.76
Marsh Creek	Extant	Spring	Basic	500	2.21

* Minimum Abundance Threshold is based on estimated historical tributary spawning and rearing habitat available to a population. Current abundance is measured as the 10-year geometric mean of the natural origin spawners for comparison to the minimum abundance threshold. The ICTRT recognized that alternative life-cycle based approaches can also be used to estimate abundance.

** Minimum Productivity Threshold is derived from the ICTRT population viability curves, where the intrinsic productivity value on the curve corresponds to the population's minimum abundance threshold. A population's intrinsic productivity represents the geometric mean of estimates associated with low to moderate parent escapements. The ICTRT recognized alternative methods for estimating current intrinsic productivity, including using a simple geometric mean of return-per-spawner estimates from low to moderate parent escapements over the most recent 20 brood cycles.

5.3.1 Viable MPG Scenarios

The ICTRT incorporated the viability criteria (ICTRT 2007) into viable recovery scenarios for each MPG. The criteria, which are explained in detail in Chapter 3, Recovery Goal and Delisting Criteria, should be met for an MPG to be considered viable, or low risk, and thus contribute to the larger objective of species' viability. These criteria are:

1. At least one-half the populations historically present (minimum of two populations) should meet viability criteria (5% or less risk of extinction over 100 years).

2. At least one population should be highly viable (less than 1% risk).
3. Viable populations within an MPG should include some populations classified as "Very Large'" or "Large," and "Intermediate" reflecting proportions historically present.
4. All major life history strategies historically present should be represented among the populations that meet viability criteria.
5. Remaining populations within an MPG should be maintained (less than 25% risk) with sufficient abundance, productivity, spatial structure and diversity to provide for ecological functions and to preserve options for species' recovery.

The criteria suggest several viable MPG scenarios for the Middle Fork Salmon MPG:

- At least five of the nine historical populations must meet viability criteria, one of which must meet highly viable criteria.
- The five viable populations should include at least the one Large population (Big Creek) and two of the three Intermediate populations (Upper Middle Fork Salmon River, Chamberlain Creek, and/or Bear Valley Creek).
- All life histories must be present: requires that the Big Creek population, a summer run, achieve viable status.
- All remaining populations should at least achieve maintained status.

5.3.2 Current MPG Status

The ICTRT (2010), and more recently the NWFSC (2015) used the viability criteria to determine the current status of the MPG based on status assessments for all populations in the MPG. This section summarizes the ICTRT's 2010 and NWFSC's 2015 findings.

The viability criteria call for at least five or the nine populations in the Middle Fork Salmon River MPG to achieve viable status, with at least one highly viable. Currently, the MPG does not meet the MPG-level viability criteria. All but one population (Chamberlain Creek) in the MPG rate at overall high risk of extinction. The Chamberlain Creek population rates as maintained, primarily due to an increase in natural-origin abundance (NWFSC 2015).

The current status for each population is the cumulative risk resulting from the population's abundance, productivity, spatial structure and diversity risks. Eight of the MPG's populations are at high abundance and productivity risk. The Chamberlain Creek population is at moderate abundance/ productivity risk (NWFSC 2015) (Table 5.3-2).

Natural spawner abundance increased in the Chamberlain, Big, Camas, Sulphur, Marsh, and Bear Creek populations and Upper Middle Fork Salmon River population since the last status review but, with the exception of the Chamberlain Creek population, the increases were not enough to lower abundance/ productivity risk. Sulphur Creek was the only population in the MPG to show increases in both abundance and productivity, which remain at low levels. One population, Loon Creek, decreased in both abundance and productivity. As in the previous ICTRT assessment, abundance/productivity

estimates for Bear Valley Creek and Chamberlain Creek are the closest to meeting viability minimums among the populations.

The Chamberlain Creek, March Creek, and Bear Valley Creek populations achieved a spatial structure/ diversity rating of low risk. Spatial structure/diversity risk ratings for the other Middle Fork Salmon River populations are moderate, largely driven by moderate ratings for genetic structure assigned by the ICTRT because of uncertainty arising from the lack of direct samples from within the component populations. Hatchery proportions for populations in the Middle Fork Salmon River MPG are based on carcass recoveries and remain very low, indicating straying rates as there are no direct hatchery release programs in the river basin. The Lower Middle Fork Salmon River Mainstem population remains at high risk for spatial structure loss (NWFSC 2015).

Table 5.3-2. Viable Salmonid Population (VSP) risk matrix for independent populations in the Middle Fork Salmon River spring/summer Chinook salmon MPG with current status, as determined from ICTRT population viability assessments (ICTRT 2010).

		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	Chamberlain M	M	HR
	High (>25%)	HR	Bear Valley Marsh	Big Creek Lower Middle Camas Loon Upper Middle Sulphur	HR

Viability Key: HV – Highly Viable; V – Viable; M – Maintained; and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years.

5.3.3 MPG Limiting Factors and Threats

Many limiting factors and threats impact the viability of Idaho's Snake River spring/summer Chinook salmon during their complex, wide-ranging life cycle. This section summarizes the impacts on Middle Fork Salmon River spring/summer Chinook salmon populations from natal habitat alteration, hatchery programs and fisheries management. Chapter 4 summarizes the regional-level factors that affect all Idaho Snake River spring/summer Chinook salmon and steelhead populations. Limiting factors and threats specific to individual Middle Fork Salmon River spring/summer Chinook salmon populations are discussed in the Population Summaries in Sections 5.3.5 through 5.3.13.

5.3.3.1 Natal Habitat Alteration

Public forestlands cover much of the Middle Fork Salmon River MPG, with large portions protected in the Frank Church ─ River of No Return Wilderness Area. As a result, most natal habitat for these spring/summer Chinook salmon populations remains in good to excellent condition and protected from

human impacts. Still, some small, localized areas in the MPG display degraded habitat conditions associated with road development, past mining, livestock grazing, irrigation diversions, timber harvest, and off-highway vehicles and other recreational use. Presently, many degraded areas are on an improving trend due to ongoing habitat restoration. Table 5-3.3 identifies the habitat-related limiting factors in the MPG. Section 5.3.5 provides more detail on the limiting factors and threats within each population area. Although habitat conditions are degraded in small, localized areas within the Middle Fork Salmon River (as shown in Table 5.3-3), habitat conditions throughout most of this MPG are in excellent condition. The key limiting factors affecting these populations are from outside of natal spawning and rearing areas.

Table 5.3-3. Habitat-related limiting factors in Middle Fork Salmon River spring/summer Chinook salmon MPG.

Population	Habitat-related Limiting Factors				
	Riparian Condition	Excess Sediment	Passage Barriers	Summer Flow	Instream Complexity
Chamberlain Cr					
Big Creek		√	√	√	√
Lower MF Salmon					
Camas Creek	√		√	√	√
Loon Creek			√		
Upper MF Salmon					
Sulphur Creek				√	
Bear Valley Cr		√			
Marsh Creek	√			√	√

5.3.3.2 Hatchery Programs

While Idaho Snake River basin hatcheries produce large numbers of Chinook salmon to meet mitigation and trust/treaty obligations, and provide large harvest and conservation benefits, there currently are no hatchery releases within the Middle Fork Salmon River MPG. The MPG also receives few hatchery stray from neighboring MPGs. Stray rates in all Middle Fork Salmon River MPG populations are consistently less than 1 percent (IDFG 2014). Thus, straying of hatchery-origin fish from neighboring MPGs poses only a potential threat to spring/summer Chinook salmon populations in the Middle Fork Salmon River MPG.

The Middle Fork Salmon River MPG serves as a genetic diversity “control” for the Snake River spring/summer Chinook salmon ESU. It also serves as an abundance and productivity control because these factors can be evaluated without the confounding factor of hatchery fish contributing to returns or to natural production.

Table 5.3-4 summarizes the historical and current limiting factors and threats from hatchery programs on the natural populations within this MPG, and identifies strategies to address them.

Table 5.3-4. Middle Salmon Spring/Summer Chinook salmon MPG hatchery programs, limiting factors and threats, and recovery strategies.

Population	Summary/Description	Current		Hatchery Influence		Hatchery Effects on Population Viability (+ denotes a Beneficial Effect and – Denotes a Risk or Threat to Viability)	Recovery Strategy
		Limiting factors	Threats	Current	Historical		
Lower Middle Fork Salmon River	No hatchery program	None	None	None	None	No effect	Manage for natural production; Monitor for strays.
Big Creek	No hatchery program						
Camas Creek	No hatchery program						
Loon Creek	No hatchery program						
Upper Middle Fork Salmon River	No hatchery program						
Sulphur Creek	No hatchery program						
Bear Valley Creek	No hatchery program						
Marsh Creek	No hatchery program						
Chamberlain Creek	No hatchery program						

5.3.3.3 Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries continue to pose a threat to the abundance, productivity and diversity of the Middle Fork Salmon River spring/summer Chinook salmon MPG. Spring/summer Chinook salmon from the MPG's nine populations (Lower Middle Fork Salmon River, Upper Middle Fork Salmon River and Chamberlain, Big, Camas, Loon, Sulphur, Bear Valley, and Marsh Creeks) pass through these fisheries during their migration from the ocean and back. However, negotiations and agreements between the different fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook salmon and other ESA-listed species.

Mainstem Columbia and Snake River Fisheries

Most fishery-related mortality for spring and summer Chinook salmon returning to the Middle Fork Salmon River MPG is due to incidental take that occurs on the mainstem Columbia River in Zones 1-6 during spring and summer season fisheries. State and tribal fisheries in Zones 1-6 are regulated under the *U.S. v. Oregon* Management Agreement and associated biological opinion to ensure that fishery-related mortality of ESA-listed Snake River spring/summer Chinook salmon does not exceed a rate of from 5.5 to 17 percent of the Columbia River mouth run size. The *U.S. v. Oregon* Management Agreement allocated the majority of ESA impacts to treaty tribal fisheries (NMFS 2008b).

The fishery-related mortality rate for the Snake River spring/summer Chinook salmon ESU varies annually based on abundance. Harvest of summer Chinook salmon has been more constrained than that of spring Chinook salmon, resulting in lower exploitation rates on summer Chinook salmon returning to the MPG. Overall, fishery-related mortality rates on natural-origin Snake River spring/summer Chinook salmon have remained relatively low, generally below 10 percent for the entire ESU. Mainstem fishery harvest rates on returning Snake River spring and summer Chinook salmon averaged approximately 8 percent on the spring-run component and 3 percent on the summer-run component for the period 1980-2006 (ICTRT 2010).

Tributary Fisheries

Fishery-related mortality of natural-origin spring and summer Chinook salmon returning to the Middle Fork Salmon River MPG occurs in state tributary fisheries targeting hatchery-origin fish in the mainstem Salmon River. No state fisheries target spring/summer Chinook salmon within the Middle Fork Salmon River MPG because there are no hatchery releases and natural-origin fish abundance levels are not high enough to warrant the fisheries. No open sport fisheries for wild Chinook salmon have occurred in the Middle Fork Salmon River MPG since 1978.

Tribal fisheries also affect the abundance, productivity and diversity of natural-origin spring/summer Chinook salmon returning to the Middle Fork Salmon River MPG. Returning natural-origin spring/summer Chinook salmon are exposed to tribal fisheries on the Salmon River, Bear Valley Creek, Chamberlain Creek, Marsh Creek, and other locations where the tribes continue traditional fishing practices. While the tribal harvests are generally nonselective for hatchery or natural-origin fish, the tribes limit fishery-related mortality of natural-origin populations by implementing an abundance-based management framework that has been authorized under the ESA. Under the framework, the allowable fishery-related mortality rate on populations in the Middle Fork Salmon River MPG generally ranges from 1 – 8 percent of the expected return; however, allowable harvest rates are very low when abundance of the natural-origin run is low. The tribes conduct monitoring and evaluation to assess the abundance of spring Chinook salmon and to determine fishery effort and catch.

Summary of Fishery-related Limiting Factors and Threats

Historical and Current Limiting Factors

- Direct mortality associated with fisheries that target specific stocks.
- Indirect mortality of fish harvested incidentally to targeted species or stock.
- Delayed mortality of fish that encounter gear but not landed, or that die after being caught and released.
- Selective effects on timing, size, age (including larger, older fish) and/or distribution due to type of gear or fishing technique and/or location.
- Reduced marine-based nutrient supply and carrying capacity.

Historical Threats

- Past Columbia and Snake River mainstem fisheries.
- Past Salmon River and tributary fisheries. While harvest would have occurred in the Salmon River and tributaries, few published catch data are available for these fisheries.

Current Threats

- Fisheries targeting harvestable hatchery stocks or other species.
- Targeted fisheries.
- Harvest methods and timing.
- Illegal harvest (poaching).

5.3.3.4 Other Threats and Limiting Factors

Middle Fork Salmon River spring and summer Chinook salmon and steelhead populations are affected by threats posed by the Columbia and Snake River hydropower system, predation and competition, estuarine habitat alterations and climate change. Chapter 4 and Section 5.1 summarize the factors that affect all Idaho Snake River spring/summer Chinook salmon populations.

5.3.4 MPG Recovery Strategy

5.3.4.1 Proposed Population Status

The recovery strategy for this major population group includes achieving a proposed status for each population within the MPG. There are multiple viable MPG scenarios for the Middle Fork Salmon River spring/summer Chinook salmon MPG, as described in section 5.3.1. To provide focus for this recovery plan, NMFS and the State of Idaho have selected a proposed status for each population, matching one of the viable MPG scenarios. The selections are described below and shown in Table 5.3-5; however, the recovery scenario remains flexible and will be updated depending on how the populations respond to changes over time. Any viable MPG scenario satisfying the criterion in 5.3.1 is acceptable for achieving the recovery goal.

Table 5.3-5. Viable Salmonid Population (VSP) risk matrix for independent salmonid populations in the Middle Fork Salmon River spring/summer Chinook salmon MPG. This scenario illustrates one way to achieve a Viable MPG.

		Spatial Structure/Diversity Risk			
		Very Low	Low	Moderate	High
Abundance/ Productivity Risk	Very Low (<1%)	HV	Big Creek HV	V	M
	Low (1-5%)	V	Chamberlain Bear Valley Marsh V	Loon V	M
	Moderate (6 – 25%)	M	M	Lower Middle Camas Upper Middle Sulphur M	HR
	High (>25%)	HR	HR	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years.

Big Creek Population

As described previously, the Big Creek population must achieve at least viable status under any viable MPG scenario because it is the only Large-size population. This population provides a large amount of suitable spring/summer Chinook salmon habitat, most of which is in excellent condition, and has a higher recent productivity than all but two other populations in the MPG. As a result, the population is

targeted to achieve a proposed status of ***Highly Viable***, with very low (less than 1%) risk of extinction over 100 years.

Bear Valley Creek Population

Bear Valley Creek is one of three Intermediate-size populations, two out of three of which must achieve at least viable status. Bear Valley Creek has been selected as one of these two populations because it has extensive unconfined valley bottom habitat in good condition and highly suitable for spring/summer Chinook salmon, has a relatively high recent productivity, and is more easily accessible for monitoring purposes than other Middle Fork populations. There is a high demand for Tribal and non-Tribal recreational harvest opportunities in this watershed. The proposed status for the Bear Valley Creek population is ***Viable,*** with a low (1-5%) risk of extinction over 100 years. This status level will accommodate some degree of harvest impact to the population.

Chamberlain Creek Population

Chamberlain Creek is an Intermediate-size population, so it fulfills the need for at least two Intermediate-size populations to reach viable status. Chamberlain Creek is also an important population because it provides spatial connectivity between the South Fork Salmon, Middle Fork, and Upper Salmon MPGs. Furthermore, the population is genetically unique in the ESU and has the highest estimated recent productivity in the MPG. The proposed status for this population is ***Viable,*** with a low risk of extinction over 100 years.

Marsh Creek Population

March Creek is a Basic-size population that occupies extensive low-gradient meadow habitat in good condition, similar to Bear Valley Creek. Compared to Sulphur Creek, the other Basic-size population in the Middle Fork headwaters, Marsh Creek spawning and rearing habitat is less isolated (with greater connectivity to Bear Valley Creek) and is more extensive. The proposed status for this Basic-size population is ***Viable,*** with a low risk of extinction over 100 years.

Loon Creek Population

The Loon Creek population provides geographic connectivity between the Middle Fork headwaters and lower tributaries, it has a comparatively higher recent productivity estimate than the remaining Basic-size populations within the MPG, and its summer-run component contributes to a diversity of life history strategies. The proposed status for this population is ***Viable,*** with a low risk of extinction over 100 years.

Upper Middle Fork Salmon River Population

The Upper Middle Fork Salmon River population is composed of a number of smaller tributaries (Indian Creek, Pistol Creek, Marble Creek and Rapid River) and the upper mainstem Middle Fork Salmon River rather than a core, contiguous spawning area. The proposed status for this Intermediate-size population is ***Maintained,*** with only a moderate (25% or less) risk of extinction over 100 years.

Lower Middle Fork Salmon River Population

Spring/summer Chinook salmon spawning in this population is primarily restricted to the Lower Middle Fork Salmon River and Horse Creek, a tributary to the mainstem Salmon River. Tributaries in

this population typically are small, high gradient streams, which provide good juvenile rearing habitat but not suitable spring/summer Chinook salmon spawning habitat. The proposed status for this Basic-size population is ***Maintained,*** with a moderate risk of extinction over 100 years.

Sulphur Creek Population

Although it supports spring Chinook salmon spawning in high elevation meadows and lies entirely within the Frank Church ─ River of No Return Wilderness Area, Sulphur Creek has the least amount of potential habitat of any of the Middle Fork Salmon River populations. Compared to Marsh Creek, the other Basic-size population in the Middle Fork Salmon headwaters, Sulphur Creek spawning habitat is more isolated from other populations. The proposed status for this Basic-size population is ***Maintained,*** with a moderate risk of extinction over 100 years.

Camas Creek Population

Camas Creek has the lowest recent productivity estimate of the Middle Fork Salmon River populations. The proposed status for this Basic-size population is ***Maintained,*** with a moderate risk of extinction over 100 years.

If each population achieves its proposed status, shown in Table 5.3-5, the Middle Fork Salmon River MPG will be viable. Other combinations, however, could also achieve MPG-level viability. Thus, we will continue to monitor the status of the populations and adjust the MPG-level recovery scenario over time based on how the populations respond to recovery efforts.

5.3.4.2 Recovery Strategies and Actions

The recovery strategy for the Middle Fork Salmon River MPG increases abundance and productivity for all populations. The VSP risk matrix (Table 5.3-2) shows that each population requires a decrease in abundance/productivity risk to reach its proposed status of highly viable (very low risk), viable (low risk), or maintained (moderate risk). The current spatial structure/diversity risk for each population, on the other hand, is acceptable for all populations, except for Big Creek, to achieve their proposed status. The moderate current spatial structure/diversity risk for many of the Middle Fork Salmon River populations is due to lack of phenotypic or genotypic data. Additional data collection and analysis may show that diversity risk for these populations is lower than moderate risk. The recovery strategy for this MPG is therefore to increase abundance and productivity, and to further analyze diversity risk.

Increases in population abundance and productivity will come from the cumulative positive impacts of recovery actions targeting every life stage. However, because spawning and rearing habitats throughout much of this MPG are in excellent condition and protected by wilderness designations, increases in population abundance and productivity will generally need to come from recovery actions downstream from the Middle Fork Salmon River, such as in the mainstem Columbia and lower Snake River corridor.

Natal Habitat

Most natal habitat for the spring/summer Chinook salmon populations in the Middle Fork Salmon MPG is currently in good to excellent condition, protected from human impacts by the Frank Church ─ River Of No Return Wilderness, which encompasses much of the basin. As a result, the MPG

continues to retain abundant, diverse high quality and connected habitats to support recovering populations. The primary habitat recovery goal is to protect the current high quality of exiting habitat. However, while improvements to abundance and productivity for the Middle Fork Salmon River populations will generally come from recovery actions directed at the other Hs, there are some opportunities to generate small increases in abundance and productivity through habitat restoration. Priority spawning and rearing habitat recovery actions in this MPG are summarized as follows:

1. For some populations, specific actions have been identified to improve habitat, such as road decommissioning, rehabilitating historic mining areas, evaluating and improving water diversions, and encouraging beaver activity.
2. In populations where nonnative brook trout are established, manage brook trout to minimize their occurrence and reduce potential competition with spring/summer Chinook salmon.
3. Investigate the potential for increasing population productivity through nutrient supplementation.

These priorities address the habitat-related limiting factors in the MPG. The population summaries in section 5.3.5 identify other actions for specific populations in specific areas, but these actions address the limiting factors identified at this time.

Hatchery Programs

The hatchery recovery strategy is to continue to manage the Middle Fork Salmon River spring/summer Chinook salmon MPG for natural production and protect the MPG from risks posed by other hatchery programs.

Key hatchery strategies to support recovery**:**

- Continue to monitor the status and trend of natural productivity in all populations.
- Continue to monitor the productivity and source of hatchery-origin fish in these populations, emphasizing populations where hatchery strays have been observed.

Fishery Management

While past fisheries contributed to the reduced viability of the Middle Fork Salmon River spring/summer Chinook salmon MPG, harvest impacts are now managed through harvest agreements and regulations. No state fisheries target spring/summer Chinook salmon within the Middle Fork Salmon River MPG because there are no hatchery releases and natural-origin fish abundance levels are not high enough to warrant the fisheries. Returning natural-origin spring/summer Chinook salmon are exposed to tribal fisheries; however, the tribes limit fishery-related mortality of natural-origin populations by implementing an abundance-based management framework that has been authorized under the ESA. Based on the fishery management protocols under *U.S. v. Oregon* agreements, FMEPs and TRMPs, the fishery mortality rates for natural-origin spring/summer Chinook salmon are managed at levels intended to support the recovery of natural-origin populations belonging to this MPG.

The overall fisheries strategy for the Middle Fork Salmon River MPG is to continue the abundance-based approach for managing mainstem and tributary fisheries to limit ESA impacts on natural-origin

Snake River spring/summer Chinook salmon. Fishery opportunities will continue to be responsive to annual population abundance and recovery criteria, while remaining consistent with tribal trust responsibilities and formal agreements. Fisheries in the Columbia River mainstem will continue to comply with criteria developed through negotiation in *U.S. v. Oregon*. Tributary fisheries for Snake River spring/summer Chinook salmon will continue to be managed to support natural production and not reduce the likelihood of survival and recovery of the ESU.

The fisheries strategy also calls to refine monitoring and research efforts. More and improved data are needed to monitor and manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries.

Specific elements of the fisheries management strategy include:

- Continue marking all hatchery-origin juveniles (e.g., fin clips, genetic marking, internal or coded wire tags).
- Where possible, develop a population-specific sliding scale for harvest management based on natural-origin returns and designed to minimize impacts to natural-origin fish.
- Continue to coordinate harvest among all co-managers to ensure that the collective impacts to each population are consistent with recovery goals.
- Continue to implement and improve creel surveys and other monitoring of fisheries to assess and manage impacts on natural-origin returns. The creel surveys should provide reasonable estimates of total harvest as well as population-specific harvest where possible.
- Use genetic stock identification, when available and appropriate, and/or PIT-tag studies to determine population-specific impacts from mainstem Columbia, Snake, and Salmon River fisheries. This will provide more accurate estimates of population-specific impact in mixed stock fisheries and assist in future management
- Continue implementing fisheries in the mainstem Columbia that comply with management agreements developed under the jurisdiction of *U.S. v. Oregon* and associated biological opinions.

Additional Out-of-MPG Strategies and Actions

Very few habitat restoration actions are needed in the Middle Fork Salmon River MPG, much of which is located in wilderness areas. While the Middle Fork Salmon River populations retain important building blocks for recovery: (1) abundant, diverse and high quality connected habitat; (2) genetic diversity and no evidence of genetic bottlenecks; (3) high life history diversity; and (4) resiliency, or the ability to respond and rebuild when conditions are more favorable ─ improvements in survival will also need to come from recovery actions downstream of natal habitat and throughout the life cycle. These issues and strategies are discussed in Chapter 4 and Section 5.1, and in the Estuary, Hydro, Harvest, and Ocean Modules to the recovery plan. Monitoring programs and improvements to survival models over the life of the recovery plan to improve recovery efforts are an important part of the recovery process.

5.3.5 Big Creek Spring/Summer Chinook Salmon Population

The Big Creek spring/summer Chinook salmon population is currently not viable, with a high abundance/productivity and moderate spatial structure/diversity risk status. Its proposed status is Highly Viable, which requires a minimum of very low abundance/productivity risk and low spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Highly Viable

Population Status

This section compares the Big Creek population's current status to its proposed status. The population's current status is based on the ICTRT (2010) population status assessment and NWFSC (2015) status review, which identifies population risk in terms of four viability parameters: abundance, productivity, spatial structure, and diversity. This section focuses primarily on population abundance (the total number of adults) and productivity (the ratio of returning adults to the parental spawning adults). It also summarizes spatial structure (the amount and nature of available habitat) and diversity (genetic traits) concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The ICTRT (2003) distinguished Big Creek spring/summer Chinook salmon as an independent population based on drainage size and historical abundance. The population is classified as Large-size, with the potential to achieve a minimum annual mean of 1,000 spawners. Extensive spawning surveys exist for this population, with some index reaches surveyed annually since 1957 and all potential spawning habitats in the population surveyed annually starting in 1995. The Big Creek population exhibits non-linear type spawning complexity. This population contains both spring- and summer-run fish and consists of three major spawning areas: Lower Big Creek, Upper Big Creek, and Monumental Creek (Figure 5.3-2). Current spawning distribution mirrors historical distribution, such that all major spawning areas are occupied at both the lower and upper ends based on recent spawner surveys; however, current abundance remains very low in some reaches. The major adult life history strategy is spring-run timing in the upper reaches and summer-run timing in the lower reaches. The drainage is only moderately isolated from the spawning habitat in the lower mainstem Middle Fork Salmon River.

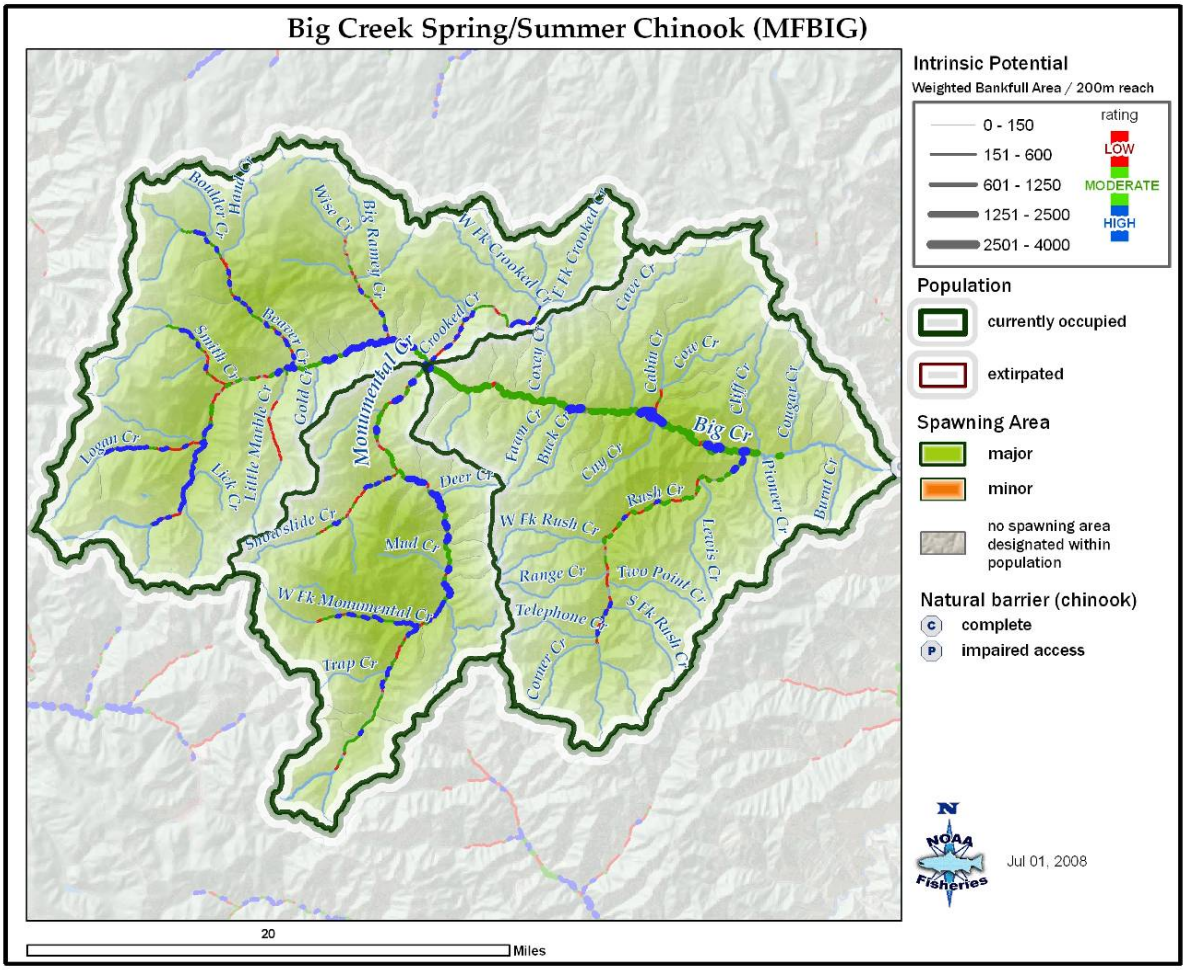

Figure 5.3-2. Big Creek Spring/Summer Chinook Salmon Population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

The viability target abundance and productivity for this population is to achieve a mean abundance threshold criteria of 1,000 naturally produced spawners with a productivity of 2.30 (ICTRT 2007). In contrast, the recent (2005-2014) 10-year geometric mean adult spawner abundance for the Big Creek spring/summer Chinook salmon population is 164 fish. Based on recent adult spawner recruit series, the recruit-per-spawner gemometric mean productivity estimate is 1.10, less than the 2.30 productivity required for highly viable status at the minimum abundance threshold (NWFSC 2015). The abundance/productivity risk for the population is therefore high.

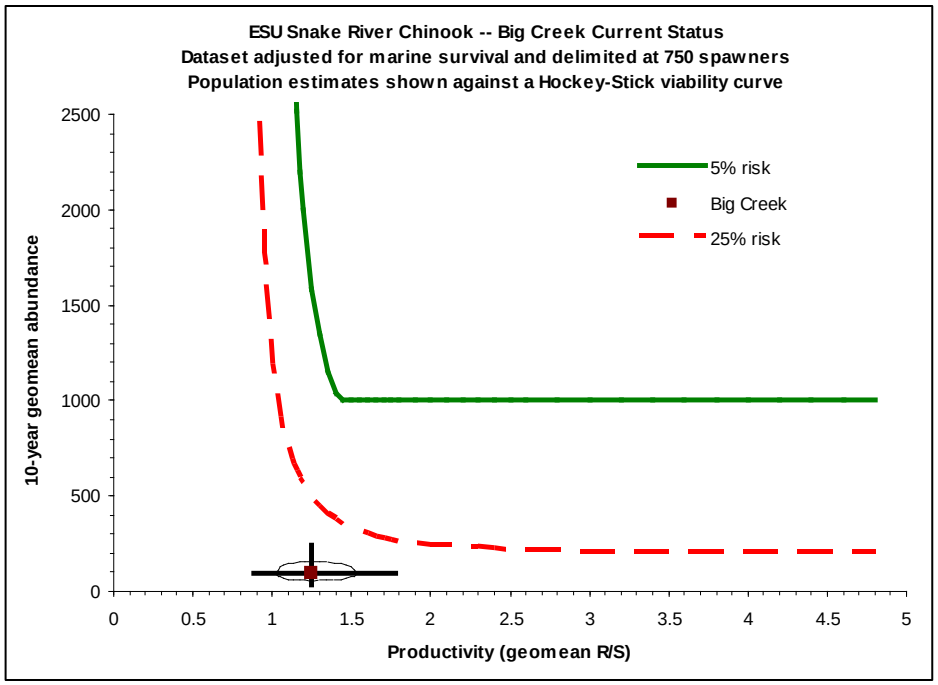

Figure 5.3-3. Big Creek spring/summer Chinook abundance and productivity curve. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural-origin abundance (measured as spawners) and productivity (measured as brood year spawner-to-spawner ratios) that correspond to a particular risk level. As shown in Figure 5.3-3, the proposed risk level can be achieved with various combinations of abundance and productivity. For the Big Creek population, viable status can be attained with any combination of abundance and productivity that is above the green line. The level of very low risk, required to achieve a proposed status of highly viable, is not shown graphically in Figure 5.3-3, but would require a combination of abundance and productivity even higher above the green curve.

Spatial Structure

The Big Creek population is a Large-size population with a non-linear type spawning complexity. The population contains both spring- and summer-run fish and includes three major spawning areas, located in Lower Big Creek, Upper Big Creek, and Monumental Creek. All three major spawning areas are currently occupied, with distribution mirroring historic distribution. Thus, this population is rated at very low risk for spatial structure. This is adequate to attain the proposed status for this population.

Diversity

From a limited number of samples, it appears that the Big Creek population may have low genetic diversity and may have lost some of its historic genetic diversity. The ICTRT (2010) gave the Big Creek population a moderate risk rating for diversity driven by the genetic variation score (metric B.1.c.), and the limited amount of genetic samples available. This diversity risk level needs to be lowered to attain the proposed overall status for this population. However, as more genetic data becomes available, the risk for the genetic variation metric could be revised to low or very low.

Summary

The Big Creek spring/summer Chinook salmon population does not currently meet the proposed status because the abundance/productivity risk is not suitable to meet the criteria for a very low risk population. A reduction in the level of risk related to abundance/productivity needs to occur before the population can reach its proposed status.

The Big Creek spring/summer Chinook salmon population is currently rated at moderate risk for the combined spatial structure and diversity risk. This is not adequate to attain the proposed status of highly viable for the population. The risk is driven by the moderate risk assigned by diversity, which is influenced by a very limited number of samples. With additional sampling it is very possible the actual risk for the genetic variation metric will be revised to low or very low. This would reduce the combined spatial structure/diversity risk to low or very low, which would be suitable to attain the proposed status.

Table 5.3-6 summarizes the abundance/productivity and spatial structure/diversity risks for the Big Creek population. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.3-6. Viable Salmonid Population parameter risk ratings for the Big Creek spring/summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	Big Creek	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the Big Creek population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 summarizes the regional-level factors that impact both Idaho Snake River spring/summer Chinook salmon and steelhead populations. Section 5.1 summarizes limiting factors and threats that affect all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

Natal Habitat

The population occupies Big Creek and its tributaries. Nearly the entire population is contained within the Frank Church ─ River Of No Return Wilderness area and managed by the U.S. Forest Service.

Several privately owned parcels also exist in the watershed. Elevations in the Big Creek watershed range from about 3,400 feet at the confluence of Big Creek and the Middle Fork Salmon River to over 9,000 feet on some peaks. Much of the area consists of steep canyon lands that drain into Big Creek. Wildfire is a common disturbance. Big Creek has a snow dominated hydrologic regime with peak runoff occurring in May and June, a transition in July, low flows beginning in August, and base flows in January and February.

Wilderness recreation is the predominant use in this area. The upper portions of Big Creek and tributary Monumental Creek have been influenced the most by human activity compared to other parts of the population area, primarily through mining and related activities such as road building and clearing of trees. Over 700 acres of land in upper Big Creek are privately owned in the Edwardsburg-Big Creek town site. Another 160 acres of private land are at Mile-Hi, near Coxey Creek, and 525 acres of private land are in the Monumental Creek headwaters.

Current Habitat Limiting Factors and Threats

NMFS identified the following habitat limiting factors for each population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups.

1. Excess sediment and potential toxic contaminants.

Most watersheds occupied by the Big Creek population are located in designated wilderness areas. With the exception of small reach-scale, localized anthropogenic disturbance, these watersheds have primarily not been degraded from reference condition and are considered in excellent condition. However, localized portions of the Big Creek watershed have been affected by legacy mining and associated road development. The most significant occurrences are in Upper Big Creek and Monumental Creek, where habitat quality has been affected by accelerated sediment delivery and instream channel modification (Payette National Forest 2003). Numerous placer and lode deposits were prospected and worked in the area, but most are abandoned now with the exception of Golden Hand, Velvet Quartz, Fourth of July, and Snowshoe Mines (Payette National Forest 2007). Upper Monumental Creek was previously identified on the Clean Water Act 303(d) list as impaired by sediment and metals (Payette National Forest 2003), but since has been delisted (IDEQ 2008a). The Payette National Forest established a monitoring site on Mule Creek (tributary to Monumental Creek) to monitor the immediate effects of the Thunder Mountain Mines, specifically the Dewey Mine and discharge into Monumental Creek by way of Mule Creek. This site has shown a downward trend in cobble embeddedness (Nelson et al. 2006).

2. Passage barriers due to roads and mining activities.

The FCRPS Habitat Expert Panel identified seven passage barriers in the upper Big Creek watershed, although most barriers primarily affect steelhead, not spring and summer Chinook salmon (BOR 2013). Passage barriers are generally associated with roads and mining activities. A defunct diversion dam originally associated with the Snowshoe Mine is located on Crooked Creek. The degree to which this dam may be blocking or inhibiting access to potential spring/summer Chinook salmon spawning habitat upstream is currently unknown.

3. Low summer streamflows, passage barriers and fish entrainment due to water diversions.

Several water rights exist in the Big Creek drainage for irrigation, power generation, domestic use, and mining (IDWR 2009). The majority of the diversions are in the upper reaches of Big, Logan, Government, and Crooked Creeks (Figure 5.3-4). Cumulative water rights add up to approximately 9 percent of modeled August low flows for Big Creek[2], indicating that water diversions may have only a small impact on habitat availability in the lower sections of Big Creek. However, in the upper tributaries where the diversions are located, water diversions may be reducing the amount of available habitat and limiting growth of juvenile spring/summer Chinook salmon. In these reaches, maximum diversion rates account for 15-38 percent of modeled August low flows[3]. It is unknown whether these diversions leave adequate instream flow for spawning and rearing, allow for fish passage, or have screens in place to prevent fish entrainment in diversion ditches.

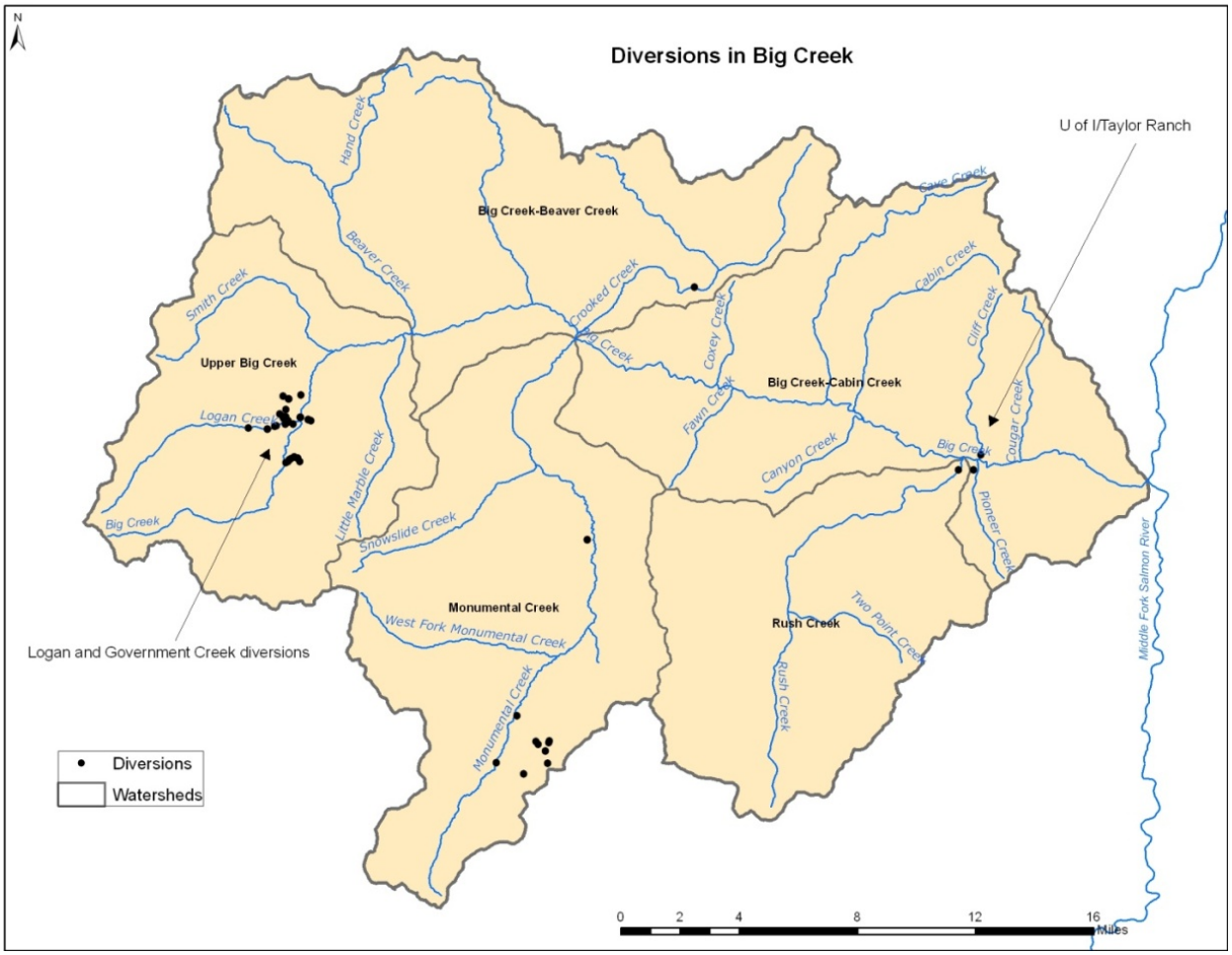

Figure 5.3-4. Diversion in the Big Creek watershed.

[2] Total diversions in Big Creek amount to approximately 7% and 9% of the August 50% and 80% exceedence flows (Q50 and Q80) calculated using StreamStats basin characteristics and equations (http://water.usgs.gov/osw/streamstats/).
[3] Total diversions in Big Creek, Logan Creek, Government Creek, and Crooked Creek amount to 28%, 36%, 15%, and 38% of potential August 80% exceedence flows for these creeks, respectively, calculated using StreamStats basin characteristics and equations.

4. Nutrient deficiency.

Pacific salmon and steelhead once contributed large amounts of marine-derived carbon, nitrogen, and phosphorus to freshwater ecosystems in the Pacific Northwest through the disintegration of spawned-out carcasses. Nutrients from salmon carcasses have a cascading effect through the food chain, increasing invertebrate production, which provides more food for fish. These nutrients are no longer available in historic quantities because far fewer adult fish are returning to freshwater streams. Lack of sufficient stream nutrients can be a limiting factor in the recovery of salmonid populations, particularly in nutrient-poor watersheds (HSRG 2009).

Productivity in the Salmon River is often nutrient-limited, and reductions in the amount of marine-derived nutrients delivered by spawning salmon and steelhead could be exacerbating the degree of oligotrophication (Kohler et al. 2008; Ebel et al. 2014). Furthermore, one study has suggested that during periods of low adult abundance, juvenile Chinook salmon in Idaho may actually export more nutrients than their parents imported (Kohler et al. 2013). More research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Potential Habitat Limiting Factors and Threats

Several potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in Big Creek.

1. New mineral exploration and development.
2. Spread of invasive plants that can increase soil erosion and decrease native plant density.
3. Off-highway vehicle use. Assuring that off-highway vehicle use is restricted to existing U.S. Forest Service roads and trails will likely minimize impacts.

Hatchery Programs

Currently, there are no hatchery releases within the Big Creek population area or other parts of the Middle Fork Salmon River MPG, and few hatchery fish stray to the area from neighboring MPGs. Hatchery-related limiting factors and threats for Big Creek spring/summer Chinook salmon and other Middle Fork Salmon River populations are discussed at the MPG level in Section 5.3.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries pose a threat to Big Creek spring/summer Chinook salmon, and to other Middle Fork Salmon River populations. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Big Creek spring/summer Chinook salmon and other Middle Fork Salmon River populations are discussed at the MPG level in Section 5.3.3.3.

Predation/Competition

Current Limiting Factor

NMFS identified the following predation/competition limiting factor for this Chinook salmon population.

1. *Invasive species.*

Non-native brook trout are present in Big Creek and limit spring/summer Chinook salmon production through predation and competition. At a selection of sites in the Salmon River basin, including Big Creek, Levin et al. (2002) found that juvenile Chinook salmon survival in streams without brook trout was nearly double the survival in streams with brook trout.

Brook trout may impact spring/summer Chinook salmon through several mechanisms. Brook trout are known to aggressively defend feeding territories and outcompete anadromous salmon (Hutchison and Iwata 1997). In some studies, competition between brook trout and Chinook salmon parr appears related to the larger size of brook trout affecting growth rates and survival of juvenile salmon (Meekan et al. 1998; Einum and Fleming 2000), with brook trout outcompeting juvenile Chinook salmon for limited food and habitat. However, Macneal et al. (2009) compared feeding behaviors and aggressive encounters between brook trout and juvenile Chinook salmon in a watershed in the South Fork Salmon River basin and found minimal competition for prey. Brook trout may also impact Chinook salmon through direct consumption; brook trout are voracious predators, frequently consuming juvenile salmonids (Sigler and Sigler 1987, as cited in Levin et al. (2002); Karas 1997). Brook trout also appear to be an important predator of salmon eggs (Karas 1997). For example, salmon eggs have been found to represent between 38 percent and 95 percent of the diet of brook trout in a tributary to Lake Ontario (Johnson and Ringler 1979; Johnson 1981). Finally, increasing numbers of brook trout could be in part due to replacement, with brook trout becoming more established in areas historically occupied by native species as the native species' population numbers fall and habitat conditions worsen (Dunham et al. 2002).

Through snorkel surveys, IDFG has observed brook trout in upper reaches of the Big Creek watershed since 1984 when surveys began (IDFG 2010), but it is not known how common the species was before this time. Thus, it is not known how long the presence of brook trout has potentially been affecting the Big Creek population. Removal of brook trout may be a consideration for long-term improvements in spring/summer Chinook salmon abundance/productivity in the Big Creek watershed, particularly if future studies on brook trout removal demonstrate positive impacts to spring/summer Chinook salmon populations. The IDFG rules currently include a daily bag limit of 25 brook trout for streams in the Middle Fork Salmon River, in order to encourage harvest.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve spring/summer Chinook salmon productivity rates.

1. Identify and rehabilitate abandoned mined lands and decommission or rehabilitate roads to reduce impacts to water quality (sediment, and potentially toxic contaminants) and fish habitat for listed fish species. There are 80 miles of non-system roads in the Upper Big Creek drainage. Unused roads that lead to mineral claims can be put into long-term storage or have storm damage risk reduction work such as: installing water bars, addressing water on the road, addressing unstable fill slopes or cut slopes.
2. Replace undersized culverts to reduce risks of sediment delivery from culvert failure.
3. Review existing water rights and diversions to assure there are no barriers to fish passage, screening is adequate to prevent mortality, and remaining instream flows are adequate.
4. Review existing fords to assure that impacts to habitat are minimized.
5. Investigate whether nutrient deficiency is limiting population productivity and whether nutrient supplementation actions in natal habitat could provide a short-term increase to population productivity. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this type of action.

Implementation of Habitat Actions

The Big Creek habitat portion of the recovery plan will primarily be implemented by the Payette National Forest, the Nez Perce Tribe, and IDFG. These parties have a record of implementing salmon conservation projects and programs in this drainage and in other areas within the state. The Payette National Forest is responsible for roads, off-highway vehicle (OHV) use on U.S. Forest Service land, and diversion of water on or across U.S. Forest Service land. IDFG is responsible for management of fisheries in Idaho. The Nez Perce Tribe is actively pursuing habitat restoration projects with the Payette National Forest in this watershed. Big Creek is a priority area for restoration for the Payette National Forest, and the U.S. Forest Service is currently in the analysis and planning phase for restoration work in the watershed, which would include mine rehabilitation, riparian restoration, road decommissioning, and culvert replacements.

Table 5.3-7 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not represent a full list of projects. Specific projects are planning continuously based on available funding and established priorities. During Plan implementation, NMFS will work with the various partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.3-7. Habitat Recovery Actions Identified for the Big Creek Spring/Summer Chinook salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Barriers	Address 3 barriers	BPA Contract # 2007-127-00: East Fork of South Fork Salmon River Passage Restoration	N/A
Sediment Toxic Contaminants (*Potential Limiting Factor*)	Improve 5 road miles, and 102.6 riparian acres		

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 5.3-7 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined (TBD).

Hatchery Recovery Strategy and Actions

The hatchery strategy for the Big Creek spring/summer Chinook salmon population is to continue to manage for natural production, and to protect the population and MPG from risks posed by other hatchery programs, especially hatchery strays. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Predation/Competition Recovery Strategy and Actions

The following action is intended to improve productivity rates for Big Creek spring/summer Chinook salmon by addressing impacts from brook trout.

1. Manage brook trout populations to reduce brook trout abundance and distribution.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Big Creek population survival, beyond those already identified in this chapter, may be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.3.6 Bear Valley Spring Chinook Salmon Population

The Bear Valley spring Chinook salmon population is currently not viable, with a high abundance/productivity risk and low spatial structure/diversity risk status. The population supports spring-run Chinook salmon. Its proposed status is Viable, which requires that abundance/ productivity be improved to achieve a minimum of low abundance/productivity risk. The current spatial structure/diversity risk status is sufficient for the population to attain the proposed status.

Current Status	Proposed Status
High Risk	Viable

Population Status

This section compares the Bear Valley Creek population's current status to its proposed status. The population's current status is based on the ICTRT (2010) population status assessment and NWFSC"s (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The ICTRT (2003) distinguished Bear Valley Creek spring Chinook salmon as an independent population based on high genetic separation from Middle Fork Salmon River tributaries Marsh Creek and Camas Creek. The population contains spring-run fish.

The Bear Valley Creek population utilizes three major spawning areas (Lower Bear Valley Creek, Upper Bear Valley Creek, and Elk Creek) with a branched continuous C-Trellis type spawning complexity. All three major spawning areas are located in one EPA level IV ecoregion (Southern Forested Mountains). Spring Chinook salmon currently spawn in the three major spawning areas, all of which have high intrinsic potential for spring Chinook salmon spawning and rearing. All historic spawning areas, modeled by the ICTRT as intrinsic potential, are currently occupied, such that there has likely been no loss of historic habitat (ICTRT 2010). Current spawning occurs primarily in West Fork Elk Creek, Elk Creek, and Bear Valley Creek upstream of Fir Creek. In addition to these stream reaches and to the potential habitat delineated by the ICTRT's intrinsic potential model (Figure 5.3-5), spawning and rearing is also known to occur in the lower sections of Bearskin, Casner, Cub, Mace, Sheep Trail, Cache, Sack, Pole, Wyoming, Cold, and Fir Creeks.

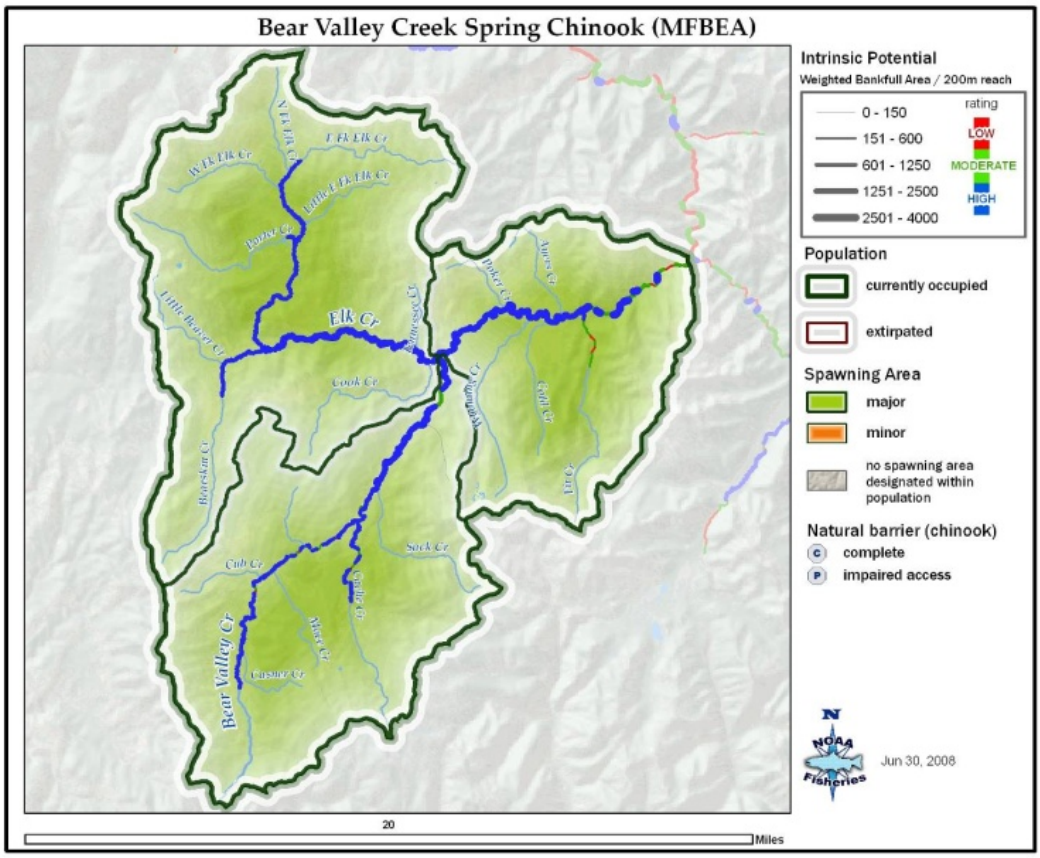

Figure 5.3-5. Bear Valley Creek Spring Chinook Salmon Population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

As an Intermediate-size population, viable status for Bear Valley Creek can be achieved with a mean minimum abundance of 750 natural-origin spawners at a productivity of 1.76 recruits per spawner. In contrast, the recent (2005-2014) 10-year geometric mean adult spawner abundance was 474 fish. The geometric mean delimited recruit-per-spawner productivity estimate was 1.37 (NWFSC 2015). All returning adults are natural spawners with no hatchery strays observed in the watershed.

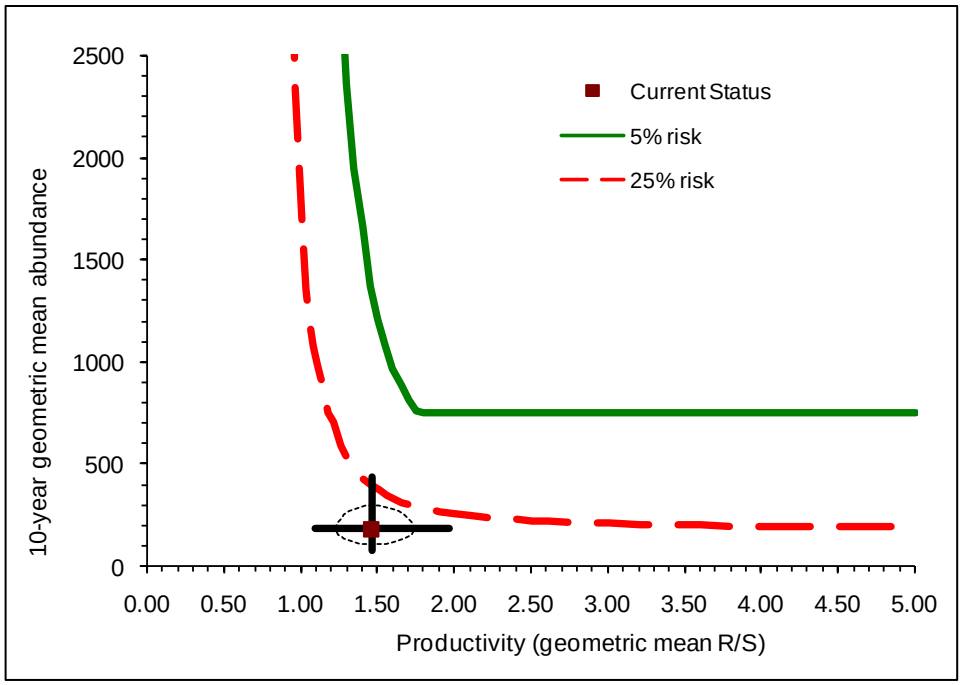

Figure 5.3-6. Bear Valley Creek spring Chinook salmon current estimate of abundance and productivity compared to the viability curve for the population. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural-origin abundance and productivity that correspond to a particular risk level. The proposed risk level for the Bear Valley Creek population can be attained with any combination of abundance and productivity above the green line shown in Figure 5.3-6.

Spatial Structure

All three major spawning areas in the Bear Valley Creek population are occupied, such that current distribution mirrors historical range. All three of the ICTRT's spatial structure risk metrics are rated very low risk. Thus spatial structure risk does not preclude the population for attaining its proposed status.

Diversity

All of the ICTRT's diversity matrices are rated low risk or very low risk and are suitable for the population to attain is proposed status.

Summary

The Bear Valley Creek spring Chinook salmon population is currently rated high risk. The current rating is driven by a high risk rating for abundance/productivity. Without survival increases that lead to increases in abundance and productivity, the Bear Valley Creek population cannot reach its proposed status of viable. The Bear Valley Creek spring Chinook salmon population combined spatial structure and diversity is rated as low. The low risk rating for spatial structure/diversity is adequate to attain the proposed status for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 5.3-8. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 5.3-8. Viable Salmonid Population parameter risk ratings for the Bear Valley Creek spring Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	high (>25%)	HR	Bear Valley Creek	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors. Section 5.1 summarizes the limiting factors and threats that affect all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

Natal Habitat

The Bear Valley Creek watershed has a mean elevation of 7,080 feet and falls within the Southern Forested Mountain ecoregion. It drains an area of 192 square miles before joining the Middle Fork Salmon River. The entire watershed is managed by the U.S. Forest Service, with 62 percent inventoried roadless area and 31 percent of its area within the Frank Church ─ River of No Return Wilderness.

Bear Valley Creek has a natural snow and rain hydrologic regime. The basin receives approximately 30 inches of precipitation annually, the majority falling as snow throughout the winter. Snow melts into runoff or groundwater recharge from late April through early July with a characteristic peak streamflow occurring in late May to early June, and base flows in January and February. Bear Valley riparian areas have sandy soils formed from deep colluvial, alluvial, and glacial deposits that receive water throughout the year from upland deep seepage and interflow. Estimated bankfull and base flow discharges at the Bear Valley gage (USGS 13309000) are 1,890 cfs and 107 cfs (IDEQ 2008b).

Stream gradients in Bear Valley Creek create a critical link between watershed hydrology, historic land use, and salmon habitat degradation due to sedimentation. Approximately 41 percent of watershed streams are steep gradient, source areas where sediments are entrained, 47 percent are low gradient

depositional reaches in the valley bottoms (meadows), and 12 percent are considered transport reaches capable of removing, without adding to, sediment loads. Depositional reaches will rely on high flows over time to remove excess sediment.

Spring Chinook salmon habitat is affected by current and past land uses in the watershed including dispersed recreation, road building, livestock grazing, timber management, dredge mining, and watershed restoration. Localized impacts to watershed conditions have occurred in the form of accelerated sediment delivery, stream channel modification, streambank degradation, passage barriers, and non-native fish species (USDA 2003).

Current Habitat Limiting Factors and Threats

NMFS identified the following habitat limiting factors for each population based on multiple data sources and reports on stream conditions across Idaho's watersheds, and on discussions with local fisheries experts and watershed groups.

1. *Excess sediment.*

In their 2008 Integrated Water Quality Monitoring and Assessment Report, IDEQ found that the majority of stream reaches in Bear Valley Creek (84.24 miles) did not have water quality problems and fully supported beneficial uses. However, IDEQ listed Bear Valley Creek from Cache Creek to Elk Creek (11.24 miles) as impaired by sediment and Bear Valley Creek from Elk Creek down to the Marsh Creek confluence (7.36 miles) as impaired by both sediment and high temperature. Bear Skin Creek (1.83 miles) was also listed as impaired by sedimentation (IDEQ 2008a). The 2011 Bear Valley Creek 4b justification document addressed pollutant concerns for the basin, showing that numerous actions had been implemented or were underway to reduce the amount of sediment entering stream reaches (IDEQ 2014).

Excess sediment has entered the basin primarily through two sources: first, erosion of sediment tailings from dredge mining in upper Bear Valley Creek in the late 1950s; and second, removal of stabilizing vegetation and bank erosion caused by grazing on Bear Valley and Elk Creeks and their tributaries. Roads are not a significant source of sediment. Sediment entrainment from past mining overburden and stream bank erosion, in conjunction with low stream gradients with limited capacity for transporting the legacy sediments, have reduced pool habitat and left spawning gravels impaired by fine sediments (IDEQ 2008b).

In 1989, the Shoshone-Bannock Tribes completed rehabilitation of the mining areas and by 2001 all grazing allotments had been purchased and retired. Both of these efforts were funded by the Bonneville Power Administration. Recent rehabilitation efforts by the U.S. Forest Service, IDFG, Trout Unlimited, Borah High School, and NMFS, including bank stabilization and road maintenance, have further reduced excess sediment inputs. With the rehabilitation efforts and reduction of threats, instream sediment conditions are improving (IDEQ 2014).

Habitat conditions in some areas have shown measureable habitat improvements. Physical and biological surveys conducted in 2004 and 2007 by IDEQ's Beneficial Use Reconnaissance Program (BURP) teams documented positive changes in one section of upper Bear Valley. This reach was

previously the greatest source of excess sediment in Bear Valley Creek because of historic dredge mining and a failed reclamation attempt in the 1960s (IDEQ 2008b). The BURP teams found surface fines of 20-23 percent and bank stability of 97 percent, both comparable to reference levels and no longer considered to be contributing excess sediment to this or lower gradient downstream reaches. Width-to-depth ratios were higher than reference, indicating that Bear Valley Creek is wider and shallower than less-impacted streams. In addition, through 2004, the number of spring Chinook salmon redds and macroinvertebrates showed an upward trend. Although difficult to quantify, these data suggest that restoration efforts and a reduction in surface fines have led to increased spawning and rearing habitat with possible gains in spring Chinook salmon abundance and productivity.

Due to the improving sediment conditions, it is likely that the impaired waters in the Bear Valley Creek watershed will attain water quality standards in a reasonable time using passive restoration. With U.S. Forest Service leadership, this is a reasonable approach. Adaptive management, supplemented with ongoing monitoring, should be adequate to assure attainment of sediment reduction goals.

2. Reduced habitat function and quality due to loss of beaver activity.

Some degraded meadow areas exhibit reduced habitat function and loss of pool complexes due to loss of beaver dams that increase pool habitat, catch fine sediments, raise water tables, and reconnect channels to floodplains. Beaver ponds provide pool-type juvenile rearing habitat capable of improving growth rates and overwinter survival in both anadromous and resident juvenile salmonids. Pools also provide high-water refugia (Pollock et al. 2003, 2007).

3. Nutrient Deficiency.

Pacific salmon and steelhead once contributed large amounts of marine-derived carbon, nitrogen, and phosphorus to freshwater ecosystems in the Pacific Northwest through the disintegration of spawned-out carcasses. Nutrients from salmon carcasses have a cascading effect through the food chain, increasing invertebrate production, which provides more food for fish. These nutrients are no longer available in historic quantities because far fewer adult fish are returning to freshwater streams. Lack of sufficient stream nutrients can be a limiting factor in the recovery of salmonid populations, particularly in nutrient-poor watersheds (HSRG 2009). Productivity in the Salmon River is often nutrient-limited, and reductions in the amount of marine-derived nutrients delivered by spawning salmon and steelhead could be exacerbating the degree of oligotrophication (Kohler et al. 2008; Ebel et al. 2014). Furthermore, one study has suggested that during periods of low adult abundance, juvenile Chinook salmon in Idaho may actually export more nutrients than their parents imported (Kohler et al. 2013). More research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Bear Valley Creek watershed. One concern identified for this drainage is the spread of invasive plants that can increase soil erosion and decrease native plant density. This concern should be managed so that habitat in Bear Valley Creek can continue to recover.

Hatchery Programs

Currently, there are no hatchery releases within the Bear Valley Creek population area or other parts of the Middle Fork Salmon River MPG, and few hatchery fish stray to the area from neighboring MPGs. Hatchery-related limiting factors and threats for Bear Valley Creek spring Chinook salmon and other Middle Fork Salmon River populations are discussed at the MPG level in Section 5.3.3.2.

Fisheries

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries pose a threat to Bear Valley Creek spring Chinook salmon, and to other Middle Fork Salmon River spring and summer Chinook salmon populations. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Bear Valley spring Chinook salmon are discussed at the MPG level in Section 5.3.3.3.

Predation/Competition

Current Limiting Factors

NMFS identified the following predation/competition limiting factor for the spring Chinook salmon population.

1. Invasive species.

Non-native brook trout, an invasive species, are present in Bear Valley Creek. At a selection of sites in the Salmon River basin including Bear Valley Creek, Levin et al. (2002) found that juvenile Chinook salmon survival in streams without brook trout was nearly double the survival in streams with brook trout. Currently, brook trout occupy the mainstem upper and lower Bear Valley and Elk Creeks and most of their tributaries. Through snorkel surveys, IDFG has observed brook trout to be common in Bear Valley Creek since 1984 when surveys began (IDFG 2010), but we do not know how common the species was before this time. Thus, we do not know for how long the presence of brook trout has potentially been affecting the Bear Valley spring Chinook salmon population. The limiting factors discussion in Section 5.3.5.1 for the Big Creek spring/summer Chinook salmon population describes research findings on how brook trout can affect Chinook salmon abundance and productivity.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve spring Chinook salmon productivity rates.

1. Protect existing habitat to allow sediment levels and bank stability to return to reference conditions over time and to prevent any new degradation that could negatively affect abundance, productivity, or spatial structure.
2. Encourage additional beaver activity in the Bear Valley Creek watershed.
3. Investigate whether nutrient deficiency is limiting population productivity, and whether nutrient supplementation actions in natal habitat could provide a short-term increase to

population productivity. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this type of action.

Implementation of Habitat Actions

Implementation of the habitat actions for this population will occur primarily through efforts of the U.S. Forest Service, interested tribes, and local stakeholder groups. Following the existing U.S. Forest Service Land and Resource Management Plan should provide the protection to habitat needed for this population. IDFG has management authority for fish and wildlife in this area.

No specific habitat projects have been identified at this time for the Bear Valley Creek population. However, actions are updated continuously based on available funding and established priorities. Habitat actions to support population recovery will be identified and prioritized through the adaptive management process for each 5-year implementation period.

Hatchery Recovery Strategy and Actions

The hatchery strategy for the Bear Valley Creek spring Chinook salmon population is to continue to manage for natural production, and to protect the population and MPG from risks posed by other hatchery programs, especially hatchery strays. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Predation Recovery Strategy and Actions

The following action is intended to improve productivity rates for Bear Valley Creek spring Chinook salmon by addressing impacts from brook trout. The presence of brook trout is secondary to sediment issues. However, removal of brook trout may be a consideration for long-term improvements in spring Chinook salmon abundance/productivity in the Bear Valley Creek watershed, particularly if future studies on brook trout removal demonstrate positive impacts to spring Chinook salmon populations. The IDFG rules currently include a daily bag limit of 25 brook trout for streams in the Middle Fork Salmon River, in order to encourage harvest.

1. Manage brook trout populations to reduce brook trout abundance and distribution.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Bear Valley Creek population survival, beyond those already identified in this chapter, may be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers

hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.3.7 Chamberlain Creek Spring Chinook Salmon Population

The Chamberlain Creek spring Chinook salmon population is currently not viable, with a moderate abundance/productivity risk and low spatial structure/diversity risk status. The population supports spring-run Chinook salmon. Its proposed status is Viable, which requires a minimum of low abundance/productivity risk. The current spatial structure/diversity risk level is sufficient for the population to attain the proposed status.

Current Status	Proposed Status
Moderate Risk	Viable

Population Status

This section compares the Chamberlain Creek population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) and NWFS's (2015) population status assessments. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns identified by the ICTRT and NWFSC. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the ICTRT 2010 full status assessment and NWFSC 2015 status review.

Population Description

The population extends along the main Salmon River from Chamberlain Creek downstream to the South Fork Salmon River and consists of spring-run fish returning to one major spawning area and three minor spawning areas (Figure 5.3-7). Although Intermediate in size based on historical habitat potential, this population may be treated as "Basic" for abundance and productivity criteria due to core area considerations (ICTRT 2010). Because much of the potential habitat is outside of the population's single major spawning area, the minimum abundance threshold has been adjusted downward to reflect a more realistic biological scenario. A Chinook salmon 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 percent or less risk of extinction over a 100-year timeframe.

The Chamberlain Creek population falls in a significant geographic position, providing connectivity between three MPGs (South Fork Salmon River, Middle Fork Salmon River, and Upper Salmon River). This population also has unique, persistent genetic characteristics. The Chamberlain Creek population modeled historic distribution ("intrinsic potential habitat") is distributed across three EPA level IV ecoregions, with the Southern Forested Mountains being predominant. Current spawning, on the other hand, includes significantly more utilization of the Hot Dry Canyons ecoregion (ICTRT 2010).

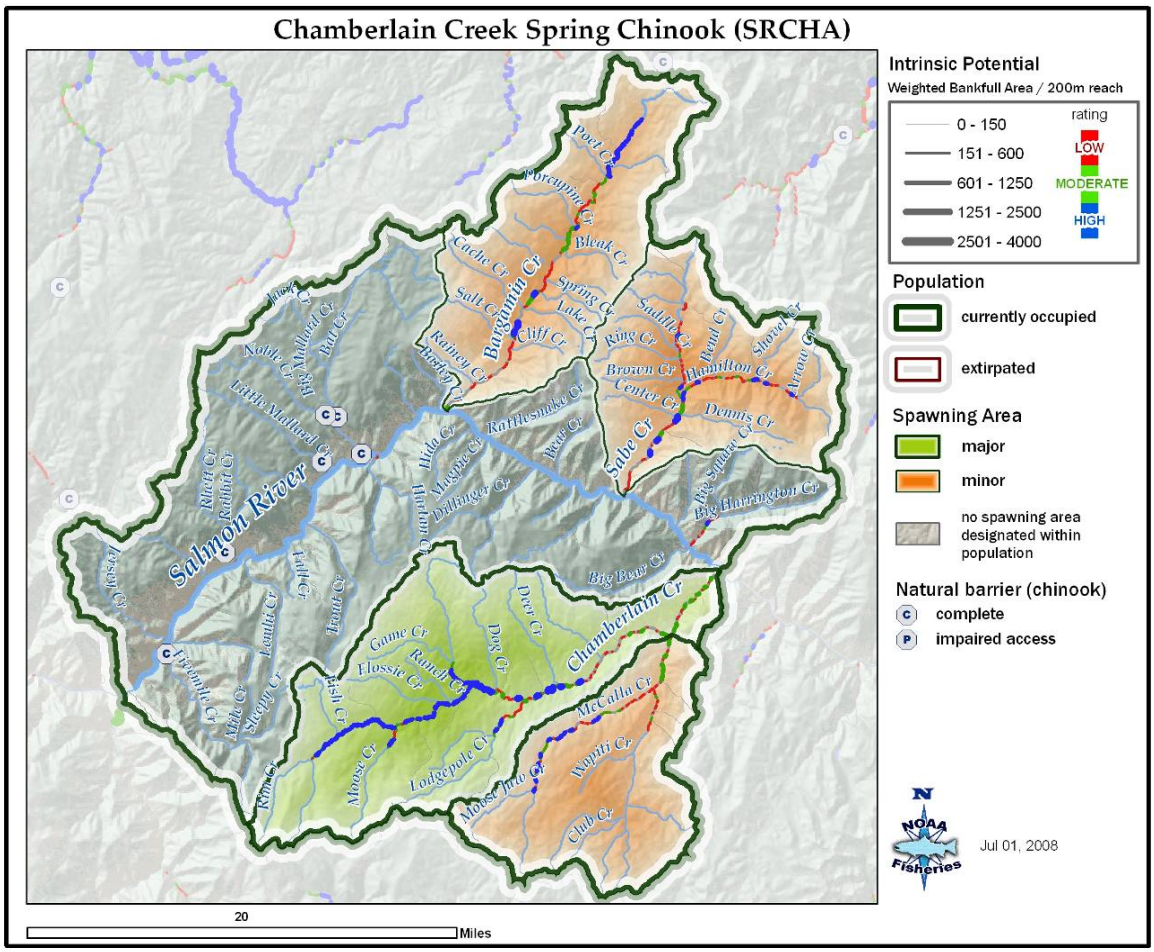

Figure 5.3-7. Chamberlain Creek spring Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

As seen in Figure 5.3-8, the proposed risk level can be achieved with various combinations of abundance and productivity. For the Chamberlain Creek population, the proposed viable status can be attained with any combination of abundance and productivity that is above the green line. As a Basic-size population, viable status for Chamberlain Creek can be achieved with a mean minimum abundance of 500 natural-origin spawners at a productivity of 2.21 recruits per spawner.

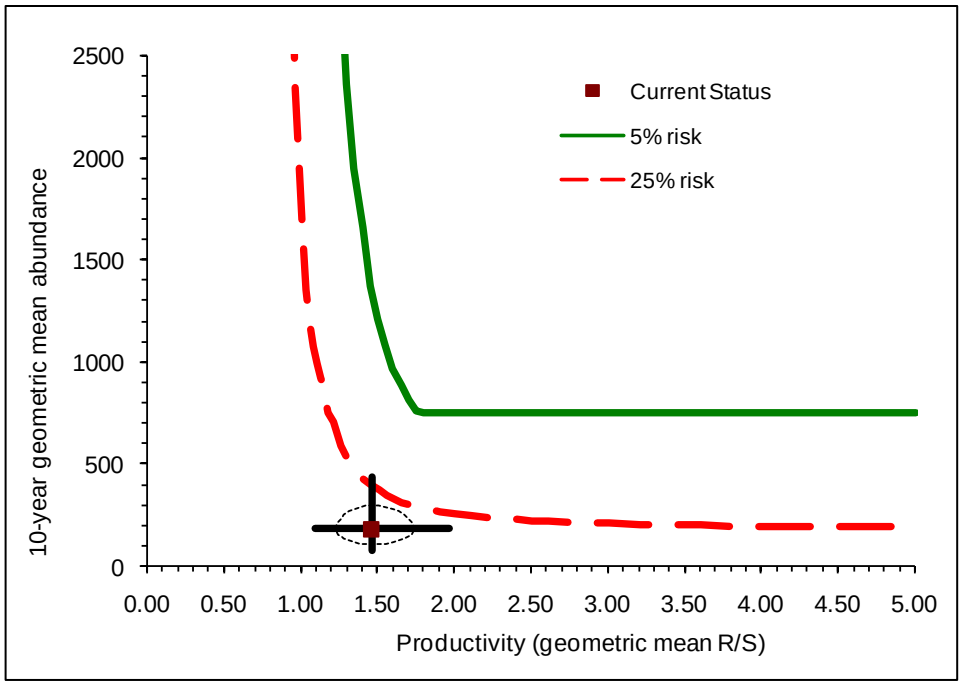

Figure 5.3-8. Chamberlain Creek spring Chinook current abundance and productivity. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015), demonstrating that Chamberlain Creek is now at moderate abundance/productivity risk.]

In comparison, the recent (2005-2014) 10-year geometric mean adult spawner abundance for the Chamberlain Creek spring Chinook salmon population is 641 fish. Based on recent adult spawner recruit series, the recruit-per-spawner geometric mean productivity estimate is 2.26 (NWFSC 2015). The abundance/productivity risk for the population is currently rated as moderate.

Spatial Structure

The ICTRT has identified one major spawning area and three minor spawning areas within the Chamberlain Creek spring Chinook salmon population. The limited number, size, and spatial arrangement of spawning areas give the population an inherent moderate risk. This risk is tempered by the fact that all of the spawning areas are occupied, leading to an overall moderate risk rating for spatial structure. Moderate spatial structure risk is adequate for the population to attain its proposed viable status.

Diversity

There was adequate genetic information available to assign a very low risk rating to this population. Currently the Chamberlain Creek spring Chinook salmon population is at low diversity risk because of adequate genetic structure and the lack of hatchery influence.

Summary

The Chamberlain Creek spring Chinook salmon population's overall viability rating is maintained. The population does not currently meet viability criteria for its proposed status of viable because

abundance/productivity risk is moderate. The combined spatial structure/diversity risk is currently low and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 5.3-9. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 5.3-9. Viable Salmonid Population parameter risk ratings for the Chamberlain Creek spring Chinook salmon population. The population does not meet population-level viability criteria.

		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	Chamberlain Cr M	M	HR
	High (>25%)	HR	HR	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors. Section 5.1 summarizes limiting factors and threats for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

Natal Habitat

The Chamberlain Creek spring Chinook salmon population occupies Chamberlain Creek and its tributaries and the mainstem Salmon River and tributaries between Chamberlain Creek and the South Fork Salmon Mainstem population. Nearly the entire population is contained within the Frank Church ─ River of No Return Wilderness Area. Most of the watershed is managed by the U.S. Forest Service, with small private inholdings.

With the exception of small, reach-scale anthropogenic impacts, these watersheds are generally not degraded from historical conditions. Outfitter/guide operation and recreation are the primary land uses, as ground-disturbing activities generally do not occur in Chamberlain Creek basin. Recent U.S. Forest Service inspection reports of recreation camps noted few impacts to natural resources (Payette National Forest 2007). The area is not roaded (Wagoner and Burns 2001). Although the fire regime

closely resembles natural conditions, fire activity within the watershed during the last decade has burned reasonably large areas.

Recreation use along trail corridors has led to the recent establishment and spread of noxious weeds in the drainage, with populations of spotted knapweed and rush skeletonweed posing the most potential to negatively impact habitat quality and quantity in the Chamberlain Creek drainage (NPCC 2004). Based on recreation and trail use, the Payette National Forest has identified Middle Chamberlain, McCalla Creek, and Lower Whimstick Creek as subwatersheds that have an inherently high risk of weed establishment and spread (Payette National Forest 2003).

Elevated water temperatures occur in streams in this population but are likely natural and not related to human causes (NPCC 2004). In the non-wilderness areas within the population boundaries, impacts to aquatic habitat include channel structure alterations, altered rearing habitats, altered hydrology and riparian areas, and chemical contamination from legacy mining (NPCC 2004). However, all current spawning and ICTRT-identified intrinsic potential for spawning and rearing are in the wilderness areas, so spring Chinook salmon are likely not limited by any of these factors.

Current Habitat Limiting Factors and Threats

NMFS identified the following habitat limiting factor for the Chamberlain Creek spring Chinook salmon population by reviewing multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups.

1. Nutrient Deficiency.

Nutrients from salmon carcasses have a cascading effect through the food chain, increasing invertebrate production, which provides more food for fish. These nutrients are no longer available in historic quantities because far fewer adult fish are returning to freshwater streams. Lack of sufficient stream nutrients can be a limiting factor in the recovery of salmonid populations, particularly in nutrient-poor watersheds (HSRG 2009). Productivity in the Salmon River is often nutrient-limited, and reductions in the amount of marine-derived nutrients delivered by spawning salmon and steelhead could be exacerbating the degree of oligotrophication (Kohler et al. 2008; Ebel et al. 2014). Furthermore, one study has suggested that during periods of low adult abundance, juvenile Chinook salmon in Idaho may actually export more nutrients than their parents imported (Kohler et al. 2013). More research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat.

1. Invasive plants. The spread of invasive plants can increase soil erosion and decrease native plant density.
2. Degraded habitat function and water quality. Recreational use can impact riparian vegetation, increase sediment delivery, and spread noxious weeds.

Hatchery Programs

Currently, there are no hatchery releases within the Chamberlain Creek spring Chinook salmon population area or other parts of the Middle Fork Salmon River MPG, and few hatchery fish stray to the area from neighboring MPGs. Hatchery-related limiting factors and threats for Chamberlain Creek spring Chinook salmon and other Middle Fork Salmon River populations are discussed at the MPG level in Section 5.3.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries pose a threat to Chamberlain Creek spring Chinook salmon, and to other Middle Fork Salmon River spring and summer Chinook salmon populations. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Chamberlain Creek spring Chinook salmon are discussed at the MPG level in Section 5.3.3.3.

Predation/Competition

Potential Predation Limiting Factors and Threats

NMFS identified the following potential predation limiting factor for the spring Chinook salmon population.

1. Invasive species. Non-native brook trout have rarely been seen in the Chamberlain Creek spring Chinook salmon population boundaries (IDFG 2010), but are common in other watersheds in the Salmon River basin, and could spread to the Chamberlain Creek population at some point and compete with or prey on spring Chinook salmon. Section 5.3.5.1 for the Big Creek spring/summer Chinook salmon population describes research findings on how brook trout can impact spring Chinook salmon abundance and productivity.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve spring Chinook salmon productivity rates.

1. Investigate whether nutrient deficiency is limiting population productivity and whether nutrient supplementation actions in natal habitat could provide a short-term increase to population productivity. Ongoing studies by NOAA’s Northwest Fisheries Science Center are exploring the potential benefits from this type of action.

Implementation of Habitat Actions

Responsibility for implementation of habitat actions for this population lies within the jurisdiction of the U.S. Forest Service. Following the existing U.S. Forest Service Land and Resource Management Plan should provide the protection needed for this population. IDFG has management responsibility for fish and wildlife in this area.

No specific habitat projects have been identified at this time for the Chamberlain Creek spring Chinook salmon population. However, actions are updated continuously based on available funding and established priorities. Habitat actions to support population recovery will be identified and prioritized through the adaptive management process for each 5-year implementation period.

Hatchery Recovery Strategy and Actions

The hatchery strategy for the Chamberlain Creek spring Chinook salmon population is to continue to manage for natural production, and to protect the population and MPG from risks posed by other hatchery programs, especially hatchery strays. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon, and catch and release impacts in recreational fisheries. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Chamberlain Creek population survival, beyond those already identified in this chapter, may be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.3.8 Marsh Creek Spring Chinook Salmon Population

The Marsh Creek population is currently not viable, with a high abundance/productivity risk and low spatial structure/diversity risk status. The population supports spring-run Chinook salmon. Its targeted proposed status is Viable, which requires a minimum of low abundance/productivity risk. The current spatial structure/diversity risk level is sufficient for the population to attain the proposed status.

Current Status	Proposed Status
High Risk	Viable

Population Status

This section compares the Marsh Creek population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and the NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The ICTRT classified the Marsh Creek population as a Basic-size population based on historical habitat potential (ICTRT 2005). The Marsh Creek population has a Branched Continuous C type spawning complexity. This population of spring-run Chinook salmon has one major spawning area (Marsh Creek) (Figure 5.2-9). The Marsh Creek population produces a relatively large number of juvenile migrants per spawner; however, due to the short growing season, size of juvenile migrants is small and they tend to have poor survival during mainstem river migration, including transportation in barges

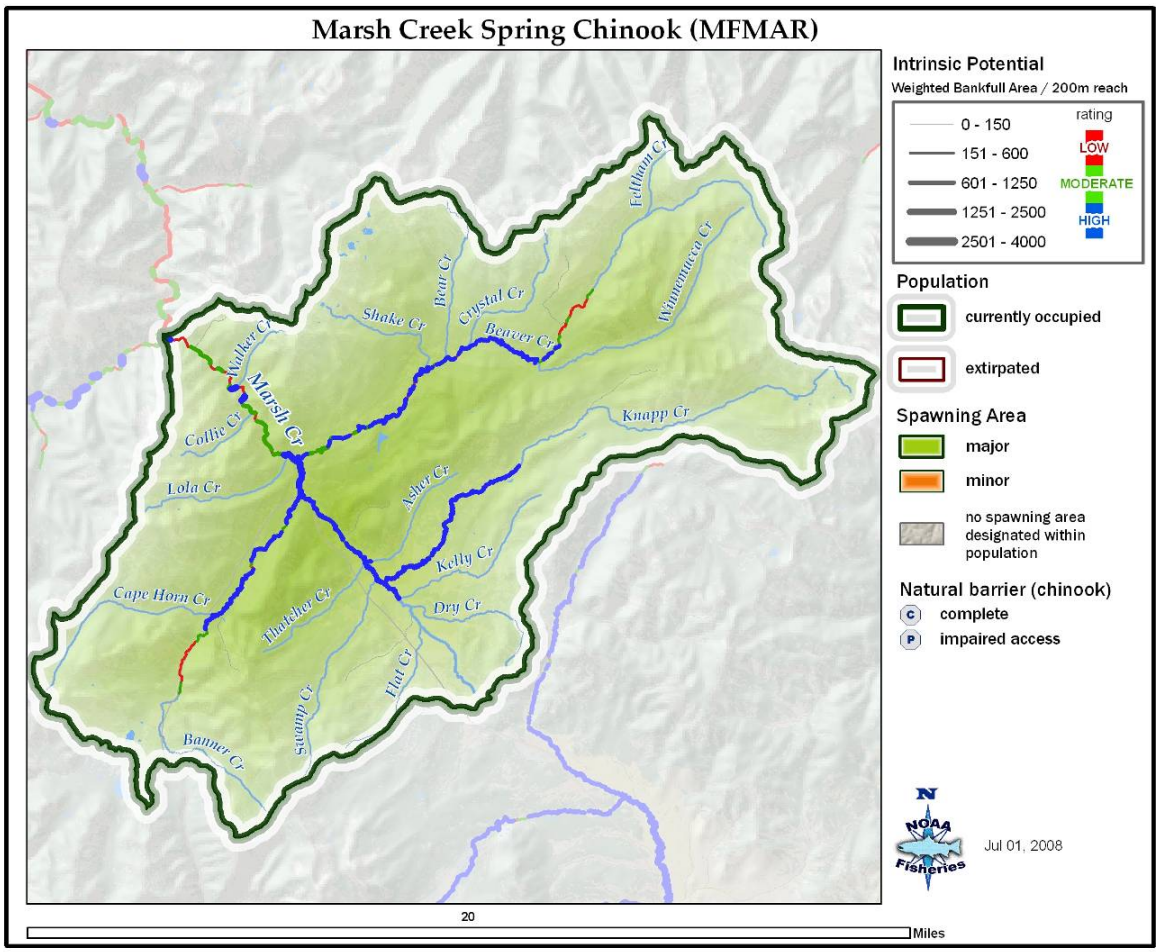

Figure 5.3-9. Marsh Creek spring Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural-origin abundance and productivity that correspond to a particular risk level. Figure 5.3-10 shows how a particular risk level can be achieved with various combinations of abundance and productivity. For the Marsh Creek population, the proposed status can be attained with any combination of abundance and productivity that achieves a level of no more than 5 percent risk. As a Basic-size population, viable status for Marsh Creek can be achieved with a mean minimum abundance of 500 naturally produced spawners with a productivity of 2.21 recruits per spawner.

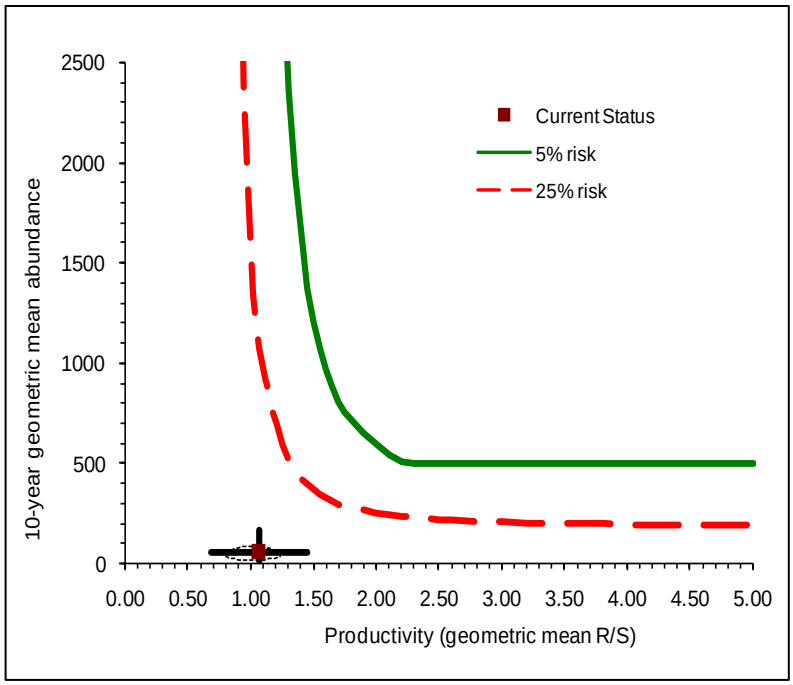

Figure 5.3-10. Marsh Creek abundance and productivity curve. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

In contrast, the recent 10-year (2005-2014) geometric mean adult spawner abundance for the Marsh Creek spring Chinook salmon population is 253 fish. Based on recent adult spawner recruit series, the recruit-per-spawner geometric mean productivity estimate is 1.21, significantly less than the 2.21 productivity required at the minimum abundance threshold (NWFSC 2015). The abundance/ productivity risk for the population is therefore high and needs to be improved to attain the proposed status for this population.

Spatial Structure

The Marsh Creek population of spring Chinook salmon consists of just one major spawning area (Marsh Creek), and this limited spatial structure creates some inherent risk for the population's viability. However, the total branched stream area is nearly the equivalent of two major spawning areas, with potential habitat distributed across several branches. Furthermore, current spawning distribution mirrors the historical range, and Marsh Creek is occupied at both the lower and upper ends based on recent spawner surveys. Therefore, overall spatial structure is rated at low risk. This is adequate to achieve the proposed status for this population.

Diversity

All of the ICTRT's diversity matrices are rated low risk or very low risk and are suitable for the population to attain its proposed status.

Summary

The Marsh Creek spring Chinook salmon population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the Marsh Creek population cannot reach its proposed status. The combined spatial structure risk/diversity risk is currently low and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 5.3-10. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 5.3-10. Viable Salmonid Population parameter risk ratings for the Marsh Creek spring Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	Marsh Creek	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors. Section 5.1 summarizes limiting factors and threats for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

Natal Habitat

The Middle Fork Salmon River starts at the confluence of Marsh and Bear Valley Creeks, making Marsh Creek one of the two upper most tributaries of the Middle Fork Salmon River. The Marsh Creek drainage encompasses 144 square miles and has a mean elevation of 7,490 feet, maximum elevation of 9,610 feet, and a minimum elevation of 6,140 feet at the confluence of Marsh and Bear Valley Creeks. Mean annual precipitation in the drainage is 28.5 inches, so it is relatively wet compared to most other Salmon River and Middle Fork Salmon River drainages. Most of the precipitation is in the form of snow, and peak streamflow usually occurs in late May or early June during the spring snowmelt. Streamflow gradually decreases from June through December with lowest flows occurring in January through March. Flows begin to increase in April when low elevation snow begins to melt. The growing season is short due to the high elevation so relatively little water is diverted for irrigation.

The U.S. Forest Service administers 99.6 percent of the drainage, and approximately 25 percent is in the Frank Church ─ River Of No Return Wilderness and is thus subject to very few human caused habitat impacts. The 75 percent of the drainage that is outside of the wilderness is subject to livestock grazing and off-highway vehicle use. Livestock grazing on U.S. Forest Service land is regulated and has been reduced since the 1990s but off-highway vehicle use is unregulated, unmonitored, and is likely increasing. Forest management in the Marsh Creek drainage is mostly for resource protection and has little adverse impact on habitat in the short term, and may have long-term benefits.

Although historic mining and grazing degraded habitat in parts of the Middle Fork Salmon River drainage, habitat condition have since improved through natural processes. Habitat in the Marsh Creek drainage within the wilderness is considered to be in very good condition and is likely stable or improving. Habitat in the non-wilderness sections of the drainage is subject to livestock grazing and off-road vehicle use. Marsh Creek is listed on the 303(d) list for temperature and a TMDL has been completed. The temperature standards exceeded included both the salmonid spawning criterion of 13 °C instantaneous or 9 °C daily average.

Fish monitoring data for Marsh Creek tend to support the assumption that habitat is in good condition. Juvenile spring Chinook salmon trapping data collected since 1994 indicate that egg-to-parr survival is very high. Juvenile spring Chinook salmon have access to all suitable habitat in the Marsh Creek drainage. All suitable spawning habitat was occupied during 2001-2003 when the Marsh Creek population had more than 400 spawners each year. In contrast, during years when adults returning to Marsh Creek are less abundant, spawners are often absent from Knapp Creek. The number of juvenile spring Chinook salmon migrating downstream from upper Marsh Creek and Knapp Creek is directly related to number of redds in those reaches (Figure 5.3-11). This relationship (more adults produce more parr) suggests that the quality and quantity of the natal habitat in Marsh Creek is generally not limiting population recovery.

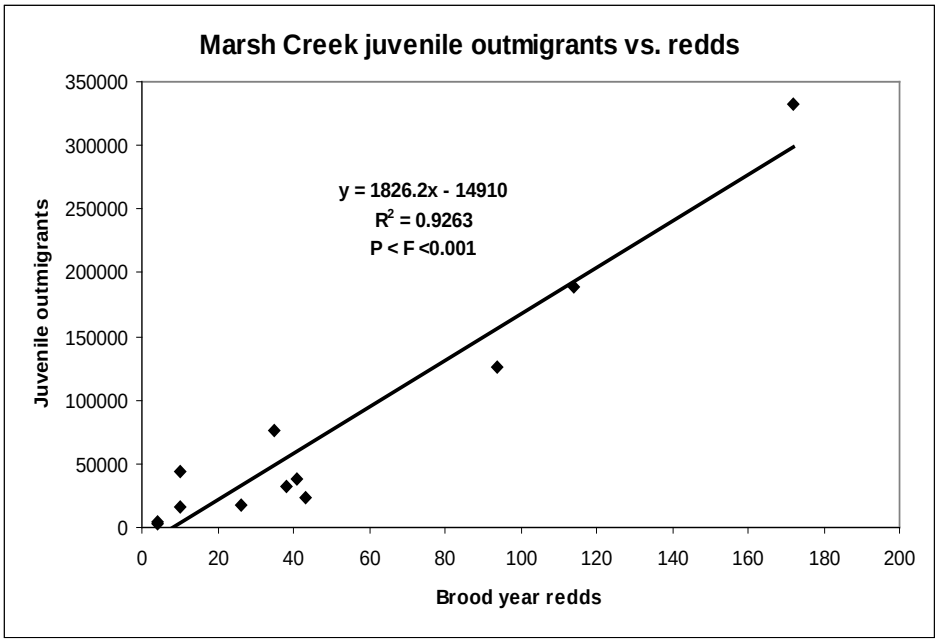

Figure 5.3-11. Marsh Creek juvenile outmigrants versus redds.

Nonetheless, some improvements in habitat quality and availability may be possible and could increase population productivity. The Marsh Creek spring Chinook salmon population is unique in the Middle Fork Salmon River major population group in that intensive monitoring of juvenile spring Chinook salmon production (number and size of out-migrants) and downstream migration survival has been ongoing since 1994. Migration monitoring results suggest that survival from the juvenile trap in Marsh Creek to Lower Granite Dam, ocean survival, and overall population productivity are all related to size of out-migrants when they leave Marsh Creek (Figure 5.3-12). Monitoring results further suggest that size of out-migrants is dependent on population density and streamflow. Increases in habitat availability could reduce rearing density, which could lead to larger-sized out-migrants, which in turn could increase out-of-basin survival and overall population productivity. Increases in habitat availability might come from more extensive beaver pond complexes or from increased access to riparian wetlands.

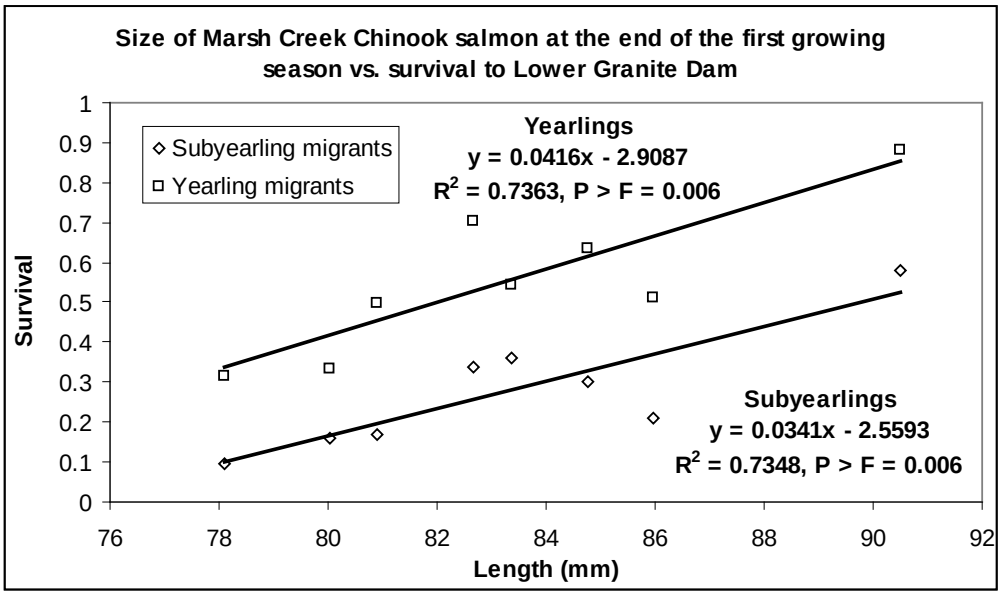

Figure 5.3-12. Size of juvenile spring Chinook outmigrants versus survival in the migration corridor.

Current Habitat Limiting Factors and Threats

NMFS identified the following habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups.

1. Degraded riparian conditions.

Approximately 75 percent of the Marsh Creek drainage lies outside of designated wilderness and is subject to various uses that could affect fish habitat (NPCC 2004). Livestock grazing on U.S. Forest Service lands in the Marsh Creek drainage has declined since the 1990s; however, grazing still causes visible impacts to upland and riparian habitat. The off-highway vehicle use also impacts riparian habitat. Although road density in the Marsh Creek drainage is low, roads run along most of the length of Marsh Creek and several tributaries.

2. Low streamflows and entrainment.

There are two irrigation water rights on Knapp Creek with a combined maximum diversion rate of 13.97 cfs. Although it is likely that far less water is being diverted than this maximum amount, use of these water rights could cause substantial impacts to fish. Water diversions may not bypass adequate flows or have adequate screens in place to prevent entrainment of juvenile migrants.

3. Reduced habitat function and quality due to loss of beaver activity.

Extensive beaver pond complexes, which are indicative of high quality habitat, are not present in many meadows areas of the Marsh Creek drainage. Loss of beaver activity has reduced pool habitat and degraded stream channel function and connectivity to adjacent floodplains. As riparian habitat continues to recover from past habitat perturbations, beaver populations may recover, which could increase quantity and quality of spring Chinook salmon rearing habitat.

4. Nutrient deficiency.

Productivity in the Salmon River is often nutrient-limited, and reductions in the amount of marine-derived nutrients delivered by spawning salmon and steelhead could be exacerbating the degree of oligotrophication (Kohler et al. 2008; Ebel et al. 2014). Furthermore, one study has suggested that during periods of low adult abundance, juvenile Chinook salmon in Idaho may actually export more nutrients than their parents imported (Kohler et al. 2013). More research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Marsh Creek watershed. Potential concerns identified for this drainage include:

1. Invasive plants. The spread of invasive plants can increase soil erosion and decrease native plant density.

Hatchery Programs

Currently, there are no hatchery releases within the Marsh Creek spring Chinook salmon population area or other parts of the Middle Fork Salmon River MPG, and few hatchery fish stray to the area from neighboring MPGs. Hatchery-related limiting factors and threats for Marsh Creek spring Chinook salmon and other Middle Fork Salmon River populations are discussed at the MPG level in Section 5.3.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries pose a threat to Marsh Creek spring Chinook salmon, and to other Middle Fork Salmon River spring and summer Chinook salmon populations. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake

River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Marsh Creek spring Chinook salmon are discussed at the MPG level in Section 5.3.3.3.

Predation/Competition

Current Predation Limiting Factors

NMFS identified the following predation limiting factor.

1. Invasive species.

Non-native brook trout currently occupy Marsh Creek and most of its tributaries. Through snorkel surveys, IDFG has observed brook trout to be common in Marsh Creek since 1984 when surveys began (IDFG 2010), but we do not know how common the species was before this time. Thus, we do not know for how long the presence of brook trout has potentially been affecting the Marsh Creek spring Chinook salmon population. Management of brook trout may be a consideration for long-term improvements in spring Chinook salmon abundance/productivity in the Marsh Creek watershed, particularly if future studies on brook trout removal demonstrate positive impacts to Chinook salmon populations. The IDFG rules currently include a daily bag limit of 25 brook trout for streams in the Middle Fork Salmon River, in order to encourage harvest. Section 5.3.5.1 for the Big Creek spring/summer Chinook salmon population describes research findings on how brook trout can affect Chinook salmon abundance and productivity.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve spring Chinook salmon productivity rates.

1. Implement the Middle Fork Salmon River Subbasin Assessment and temperature TMDL for Marsh Creek.
2. Investigate water diversions for potential water conservation opportunities and to prevent fish entrainment.
3. Update ESA section 7 consultation on grazing allotments.
4. Encourage additional beaver activity in the Marsh Creek drainage.
5. Assure that OHV is restricted to existing U.S. Forest Service roads and trails.
6. Investigate whether nutrient deficiency is limiting population productivity and whether nutrient supplementation actions in natal habitat could provide a short-term increase to population productivity. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this type of action.

Implementation of Habitat Actions

The Marsh Creek habitat portion of the recovery plan will primarily be implemented by the Salmon-Challis National Forest, IDWR, and IDFG. The Salmon-Challis National Forest is responsible for OHV use, grazing, and diversion of water on or across U.S. Forest Service lands in the Marsh Creek

drainage. The Idaho Department of Water Resources administers the water acquisition program that rents or purchases water rights to improve fish habitat. IDFG is responsible for management of fish and wildlife. These groups have a record of implementing salmon conservation projects and programs in this drainage and in other areas within the state.

No specific short-term habitat projects have been identified at this time for the Marsh Creek population. However, actions are updated continuously based on available funding and established priorities. Habitat actions to support population recovery will be identified and prioritized through the adaptive management process for each 5-year implementation period.

Hatchery Recovery Strategy and Actions

The hatchery strategy for the Marsh Creek spring Chinook salmon population is to continue to manage for natural production, and to protect the population and MPG from risks posed by other hatchery programs, especially hatchery strays. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon, and catch and release impacts in recreational fisheries. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Predation/Competition Strategies and Actions

The following action is intended to improve productivity rates for Marsh Creek spring Chinook salmon.

1. Manage brook trout populations to reduce brook trout abundance and distribution.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Marsh Creek population survival, beyond those already identified in this chapter, may be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.3.9 Loon Creek Spring/Summer Chinook Salmon Population

The Loon Creek spring/summer Chinook salmon population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its proposed status is Viable, which requires a minimum of low abundance/productivity risk. The current spatial structure/diversity risk level is sufficient for the population to attain the proposed status.

Current Status	Proposed Status
High Risk	Viable

Population Status

This section compares the Loon Creek population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and the NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

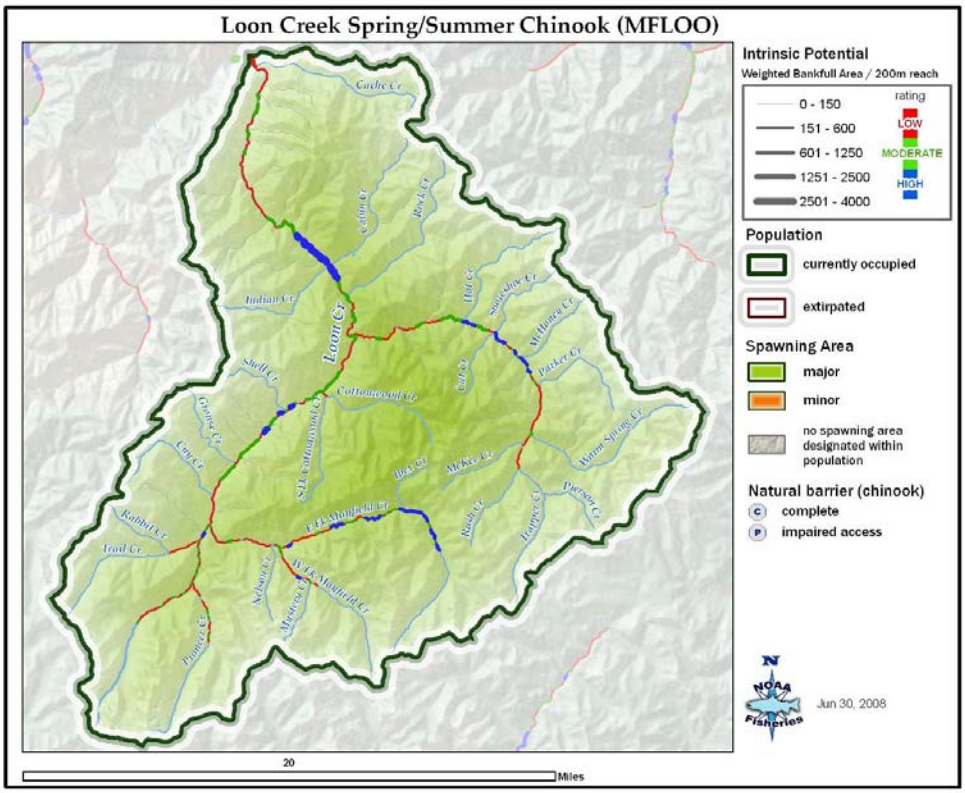

Figure 5.3-13. Loon Creek spring/summer Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Population Description

The ICTRT (2003) identified Loon Creek spring/summer Chinook salmon as an independent population based on isolation and drainage size. The Loon Creek population is a Basic-size population based on historic habitat potential, with a Branched Continuous C type spawning complexity. The population contains both spring- and summer-run fish, and consists of one major spawning area (Figure 5.3-13). Current spawning occurs throughout Loon Creek and in Warm Springs and Mayfield Creeks.

The Loon Creek population is distributed across the Southern Forested Mountains EPA level IV ecoregion. The current distribution is nearly identical to the estimated historic distribution ("intrinsic potential" habitat in Figure 5.3-13) (ICTRT 2010).

Abundance and Productivity

The viability target abundance and productivity for this population is to achieve a mean abundance threshold of 500 naturally produced spawners with a productivity of 2.21 recruits per spawner. The recent 10-year (2005-2014) geometric mean adult spawner abundance for the Loon Creek spring/summer Chinook salmon population is 54 fish. Based on the recent adult spawner recruit series, the recruit-per-spawner geometric mean productivity estimate is 0.98, which is less than the 2.21 productivity required at the minimum abundance threshold (NWFSC 2015). The cumulative abundance/productivity risk for the population is therefore high.

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural-origin abundance (measured as spawners) and productivity (measured as brood year spawner-to-spawner ratios) that correspond to a particular risk level. The Loon Creek population of Snake River spring/summer Chinook salmon needs to be above the green line in Figure 5.3-14 to achieve low risk.

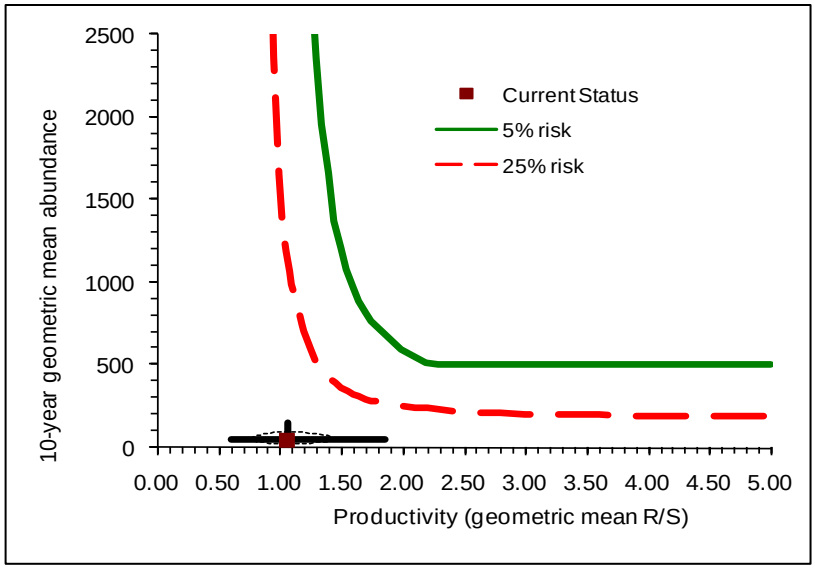

Figure 5.3-14. Loon Creek Spring /Summer Chinook abundance and productivity curve. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Spatial Structure

The Loon Creek population consists of just one major spawning area, and this limited spatial structure creates some inherent risk for the population's viability. However, the cumulative risk for spatial structure is tempered by the fact that the entire historical range of the population is still occupied. The cumulative risk for spatial structure is moderate risk, which is adequate for the population to achieve its proposed status.

Diversity

The moderate diversity risk rating assigned to this population is driven by the genetic variation score, which in turn is influenced by a very limited number of samples. As more genetic data becomes available, it is very possible the actual risk for the genetic variation metric will be revised to low or very low. The moderate risk rating for diversity does not preclude the population from attaining its proposed status.

Summary

The Loon Creek spring/summer Chinook salmon population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the Loon Creek population cannot reach its proposed status of viable. The combined spatial structure risk/diversity risk is currently moderate and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 5.3-11. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 5.3-11. Viable Salmonid Population parameter risk ratings for the Loon Creek spring/summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	Loon Creek	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the Loon Creek spring/summer Chinook salmon population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors. Section 5.1 summarizes limiting factors and threats for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

Natal Habitat

The Loon Creek population is located primarily in wilderness area watersheds generally considered in excellent condition. However, portions of the Loon Creek drainage lie outside the wilderness area and have been degraded to various degrees by historic land use activities such as mining, grazing, logging, and road building (NPCC 2004). Currently no waterbodies are identified on the Clean Water Act 303(d) list for this population.

As in other Middle Fork Salmon River watersheds, recreation use along trail corridors has likely led to the establishment and spread of noxious weeds in the drainage. Spread of noxious weeds has the potential to negatively impact habitat quality by altering riparian vegetation and increasing sediment inputs in Loon Creek.

There is one grazing allotment for 40 horses from June 1 through October 31 using a three-pasture rotation. The permittee has been in compliance with the permit and stubble height in late September exceeds four inches according to the annual report.

Water diversions exist in the Loon Creek population for power generation, domestic use, irrigation, and mining (IDWR 2009). The cumulative maximum diversion rate for these water rights is 19 cfs, but most of the water is used for power generation and later returns to the stream. It is therefore unlikely that water diversions are cumulatively reducing habitat availability in Loon Creek through reduced flow. However, the largest diversion on Loon Creek is unscreened and may entrain fish.

There are historic mine sites in the area that may negatively affect fish habitat through chemical contamination or delivery of sediment to streams. For example, the abandoned Parker Mill, associated with past gold mining, is located directly adjacent to Warm Springs Creek, a tributary to Loon Creek. There is limited information on this site, other than that the mill utilized a cyanide vat leach process between 1905 and 1941 and that the site burned over in a wildfire in 2007 (Morgan 2010). This site may be contributing chemical contamination to Warm Springs Creek.

Current Habitat Limiting Factors and Threats

NMFS identified the following habitat limiting factors for the Loon Creek population based on multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. These habitat limiting factors for the Loon Creek spring/summer Chinook salmon population are considered to have a minor impact on the fish population.

1. Passage barriers.

Water diversions on the mainstem of Loon Creek at the Diamond D Ranch create partial fish passage barrier.

2. Nutrient deficiency.

Some Salmon River tributaries are nutrient-limited, and reductions in the amount of marine-derived nutrients delivered by spawning salmon and steelhead could be exacerbating the degree of oligotrophication (Kohler et al. 2008; Ebel et al. 2014). Furthermore, one study has suggested that during periods of low adult abundance, juvenile Chinook salmon in Idaho may actually export more nutrients than their parents imported (Kohler et al. 2013). More research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Loon Creek watershed. Potential concerns identified for this drainage include:

1. Water diversions. Existing water diversion structures should be reviewed to assure that appropriate fish screens are in place and that adequate water is left instream for fish passage.
2. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.
3. Historic mine sites. Existing mine sites should be reviewed to assure they are not a source of sediment or hazardous materials into water bodies.

Hatchery Programs

Currently, there are no hatchery releases within the Loon Creek spring/summer Chinook salmon population area, or other parts of the Middle Fork Salmon River MPG, and few hatchery fish stray to the area from neighboring MPGs. Hatchery-related limiting factors and threats for Loon Creek spring/summer Chinook salmon are discussed at the MPG level in Section 5.3.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries pose a threat to Loon Creek spring/summer Chinook salmon, and to other Middle Fork Salmon River spring and summer Chinook salmon populations. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Loon Creek spring/summer Chinook salmon are discussed at the MPG level in Section 5.3.3.3.

Predation/Competition

Potential Predation Limiting Factors and Threats

NMFS identified the following potential predation limiting factor for the spring/summer Chinook salmon population.

1. Invasive species. Non-native brook trout have rarely been seen in the Loon Creek drainage (IDFG 2010), but are common in other parts of the Middle Fork Salmon River basin and could spread to Loon Creek at some point and compete with or prey on spring/summer Chinook salmon. Section 5.3.5.1 for the Big Creek spring/summer Chinook salmon population describes research findings on how brook trout can impact Chinook salmon abundance and productivity.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve spring/summer Chinook salmon productivity rates.

1. Replace the existing water diversion structure that is a partial barrier to fish passage on mainstem Loon Creek.
2. Investigate whether nutrient deficiency is limiting population productivity and whether nutrient supplementation actions in natal habitat could provide a short-term increase to population productivity. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this type of action.
3. Review existing water diversions to determine if adequate fish screens are in place; provide adequate screening where needed to prevent mortality.

Implementation of Habitat Actions

Responsibility for implementation of habitat actions for this population lies within the jurisdiction of the U.S. Forest Service. Following the existing U.S. Forest Service Land and Resource Management Plan should provide the protection needed for this population. IDFG has management authority for fish and wildlife in this area.

No specific habitat projects have been identified at this time for the Loon Creek population. However, actions are updated continuously based on available funding and established priorities. Habitat actions to support population recovery will be identified and prioritized through the adaptive management process for each 5-year implementation period.

Hatchery Recovery Strategy and Actions

The hatchery strategy for the Loon Creek spring/summer Chinook salmon population is to continue to manage for natural production, and to protect the population and MPG from risks posed by other hatchery programs, especially hatchery strays. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon, and catch and release impacts in recreational fisheries. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Loon Creek population survival, beyond those already identified in this chapter, may be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations, and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.3.10 Upper Middle Fork Salmon River Spring Chinook Salmon Population

The Upper Middle Fork Salmon River spring Chinook salmon population includes the mainstem Middle Fork Salmon River upstream from Indian Creek and its tributaries, including Indian Creek, Pistol Creek, Marble Creek and Rapid River. The population supports spring-run Chinook salmon, as well as a later-spawning run in some tributaries (e.g. Rapid River) that spawns at a similar time as summer-run Chinook salmon in the Middle Fork Salmon River. The population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its proposed status is to reach a level where it can be Maintained, which requires no more than moderate abundance/productivity and spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Maintained

Population Status

This section compares the Upper Middle Fork Salmon River population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The Upper Middle Fork Salmon River spring Chinook salmon population is an Intermediate-size population with a Branched Discontinuous C type spawning complexity. The ICTRT (2010) classified this population as a spring-run, but it also includes a component of later-spawning fish that return to the lower reaches of tributaries such as Rapid River. Researchers have observed Chinook salmon spawning in these lower reaches as late as September, similar to the spawn timing of summer-run Chinook salmon in other Middle Fork populations (Thurow 2014). Most spawning and rearing occurs in Indian, Pistol, Little Pistol and Marble Creeks and the Rapid River, but some spawning also occurs in the mainstem Middle Fork Salmon River.

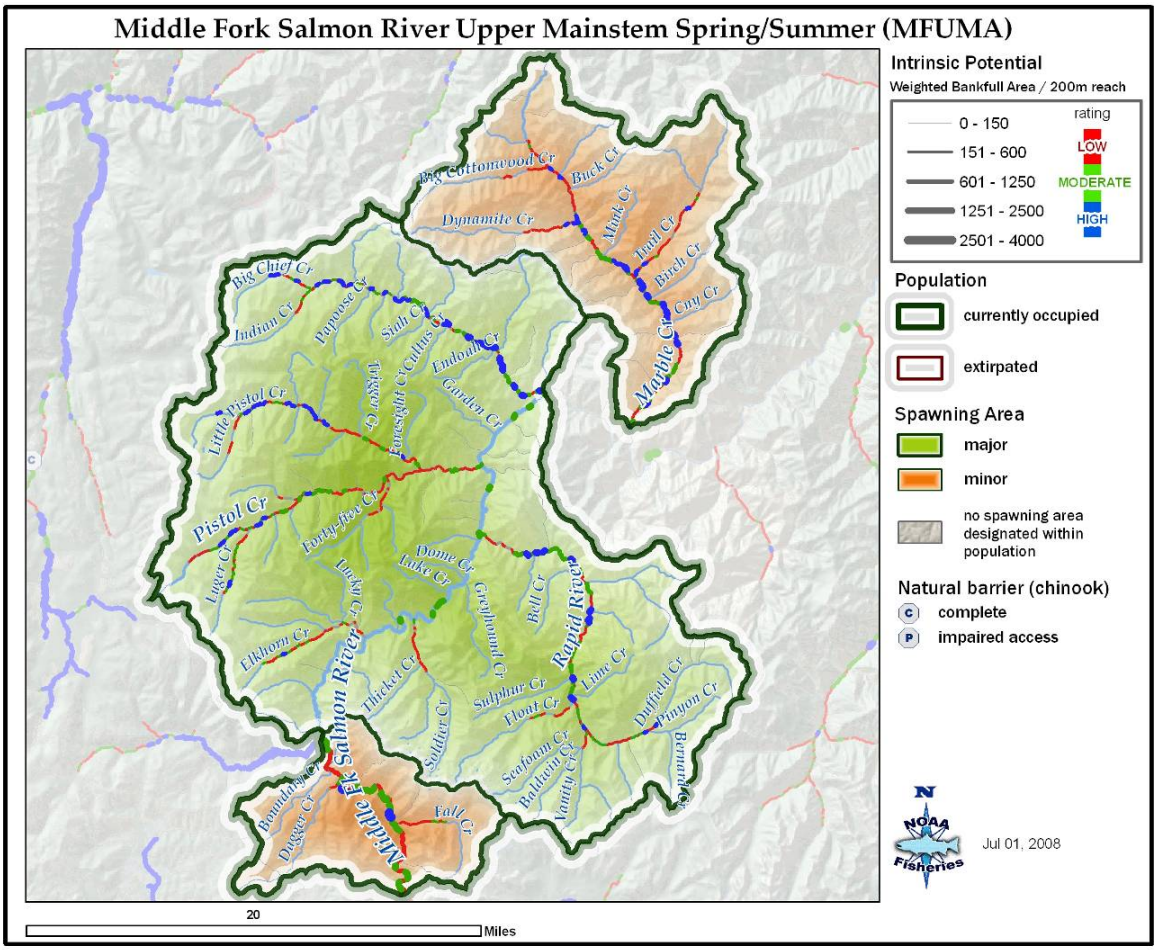

Figure 5.3-15. Upper Middle Fork Salmon River spring Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

The ICTRT classified the population as Intermediate, based on historical habitat potential (ICTRT 2003; 2005). The abundance and productivity viability targets for an Intermediate-size population are to achieve a mean abundance threshold criteria of 750 naturally produced spawners with a productivity of 1.76. The recent 10-year (2005-2014) geometric mean adult spawner abundance for the Upper Middle Fork Salmon River spring/summer Chinook salmon population is 71 fish. Based on the recent adult spawner recruit series, the recruit-per-spawner geometric mean productivity estimate is 0.50, which is less than the 2.21 productivity required at the minimum abundance threshold (NWFSC 2015). The cumulative abundance/productivity risk for the population is therefore high.

Spatial Structure

The Upper Middle Fork Salmon River population consists of just one major spawning area and two minor spawning areas that add up to less than 75 percent of the capacity of a major spawning area. This limited spatial structure creates some inherent risk for the population's viability. This is partially offset by a low risk rating for the spatial extent of the population because current spawning distribution

mirrors the historical distribution. These combine for a cumulative rating for spatial structure of low risk, which is adequate to attain the proposed status for the population.

Diversity

The moderate diversity risk assigned to this population is driven by the genetic variation score, which in turn is influenced by an absence of data assessing genetic variation. It is very possible that the actual risk for the genetic variation metric is low or very low. The overall rating of moderate risk for this population does not preclude attainment of the proposed status for this population.

Summary

The Upper Middle Fork Salmon River spring Chinook salmon population does not currently meet viability criteria because the abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the population cannot reach its proposed status. The cumulative spatial structure risk/diversity risk is moderate, which is adequate for the population of meet its proposed status.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 5.3-12. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 5.3-12. Viable Salmonid Population parameter risk ratings for the Upper Middle Fork spring Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	Upper Middle Fork	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors. Section 5.1 summarizes limiting factors and threats for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

Natal Habitat

Much of the Upper Middle Fork Salmon River population is located in designated wilderness, where most waterways are considered in excellent condition. Due in large part to their remoteness and protected status, watersheds in the entire Middle Fork Salmon River drainage are not significantly impacted by habitat fragmentation associated with land uses, development, and habitat conversion (NPCC 2004). The 2008 Clean Water Act 303(d) list for the Upper Middle Fork Salmon River basin lists Elkhorn Creek as being impaired by sedimentation and high temperatures, but IDEQ subsequently found that conditions in the Elkhorn Creek watershed are comparable to wilderness conditions and recommended that Elkhorn Creek be delisted for sediment and temperature (IDEQ 2008b). The IDEQ listed all other streams in the Upper Middle Fork Salmon River population as wilderness waters or unassessed waters (IDEQ 2008a).

Although most habitat in the Upper Middle Fork Salmon River population is in good shape, several minor impacts from human land uses have occurred. Legacy mining effects have contributed low levels of chemical contamination into Upper Marble Creek (Wagoner and Burns 2001). The protected status of the Upper Middle Fork Salmon River has prevented the widespread impacts of grazing, but there are active sheep grazing allotments with identified impacts in the upper portions of the Upper Middle Fork Salmon River watershed. However, measurements of rangeland condition in these watersheds indicate low to very low overall vulnerability to grazing impact (NPCC 2004). Timber harvest has been limited in the Upper Middle Fork Salmon River, occurring on only 18 percent of the land base. Water rights exist for several small diversions for irrigation, mining, power, and domestic use on private land and U.S. Forest Service administration sites (IDWR 2009). Because the diversions are on streams without intrinsic potential for spring Chinook salmon spawning and rearing, and all have maximum diversion rates of less than 1 cfs, impacts to spring Chinook salmon habitat are likely low. It is unknown whether these diversions are adequately screened. Impacts from recreational use in the wilderness portions of the population are minimal and well controlled by existing regulations. Nonetheless, recreation use along trail corridors has led to the recent establishment and spread of noxious weeds in the drainage. Populations of spotted knapweed and rush skeletonweed could negatively affect habitat quality in the Upper Middle Fork Salmon River by leading to increased soil erosion (NPCC 2004).

In summary, streams in the wilderness sections of the Upper Middle Fork Salmon River are well protected. In the non-wilderness portions of the Upper Middle Fork Salmon River, streams are recovering from historic activities, such as mining, through passive restoration. These streams are largely upstream of tributary habitat with potential for spring Chinook salmon.

Current Habitat Limiting Factors and Threats

NMFS identified the following habitat limiting factors for the Upper Middle Fork Salmon River spring Chinook salmon population based on multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. This analysis indicates that habitat limiting factors for the population exist, but are minor.

1. Nutrient deficiency.

Some Salmon River tributaries are nutrient-limited, and reductions in the amount of marine-derived nutrients delivered by spawning salmon and steelhead could be exacerbating the degree of oligotrophication (Kohler et al. 2008; Ebel et al. 2014). Furthermore, one study has suggested that during periods of low adult abundance, juvenile Chinook salmon in Idaho may actually export more nutrients than their parents imported (Kohler et al. 2013). More research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Upper Middle Fork Salmon River watershed. Potential concerns identified for this drainage include:

1. Water diversions. It is unknown whether the handful of small water diversions in the Upper Middle Fork Salmon River population bypass adequate flows, provide for fish passage, and have adequate screening in place.
2. Grazing impacts to riparian habitat. Assuring that the ESA section 7 consultations on U.S. Forest Service grazing allotments remain current should minimize any effects from grazing.
3. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.
4. Impacts from recreational use. Impacts to spring Chinook salmon habitat from recreational use are currently minimal but should continue to be monitored.

Hatchery Programs

Currently, there are no hatchery releases within the Upper Middle Fork Salmon River spring Chinook salmon population area, or other parts of the Middle Fork Salmon River MPG, and few hatchery fish stray to the area from neighboring MPGs. Hatchery-related limiting factors and threats for Upper Middle Fork Salmon River spring Chinook salmon are discussed at the MPG level in Section 5.3.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries pose a threat to Upper Middle Fork Salmon River spring Chinook salmon, and to other Middle Fork Salmon River spring and summer Chinook salmon populations. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Upper Middle Fork Salmon River spring Chinook salmon are discussed at the MPG level in Section 5.3.3.3.

Predation/Competition

Potential Predation Limiting Factors and Threats

NMFS identified the following potential predation limiting factor for the spring Chinook salmon population.

1. Invasive species. Non-native brook trout have rarely been seen in the Upper Middle Fork Salmon River population (IDFG 2010), but are common in Bear Valley Creek and Marsh Creek, immediately upstream, and could spread eventually to the Upper Middle Fork Salmon River and compete with or prey on spring/summer Chinook salmon. Section 5.3.5.1 for the Big Creek spring/summer Chinook salmon population describes research findings on how brook trout can affect Chinook salmon abundance and productivity.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve spring Chinook salmon productivity rates.

1. Investigate whether nutrient deficiency is limiting population productivity and whether nutrient supplementation actions in natal habitat could provide a short-term increase to population productivity. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this type of action.
2. Conduct investigations to determine if existing diversions provide adequate fish passage and have adequate fish screening.

Implementation of Habitat Actions

Responsibility for implementation of the recovery plan for this population lies within the jurisdiction of the U.S. Forest Service. Following the existing U.S. Forest Service Land and Resource Management Plan should provide the protection needed for this population. IDFG has management responsibility for fish and wildlife in this area.

No specific habitat projects have been identified for the Upper Middle Fork Salmon River population. However, actions are updated continuously based on available funding and established priorities. Habitat actions to support population recovery will be identified and prioritized through the adaptive management process for each 5-year implementation period.

Hatchery Recovery Strategy and Actions

The hatchery strategy for the Upper Middle Fork Salmon River spring Chinook salmon population is to continue to manage for natural production, and to protect the population and MPG from risks posed by other hatchery programs, especially hatchery strays. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Upper Middle Fork Salmon River population survival, beyond those already identified in this chapter, may be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.3.11 Lower Middle Fork Salmon River Spring/Summer Chinook Salmon Population

The Lower Middle Fork Salmon River spring/summer Chinook salmon population occupies the Middle Fork Salmon River below Indian Creek to the confluence with the main Salmon River, and the main Salmon River downstream to Chamberlain Creek. The population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its proposed status is Maintained, which requires that it have no more than moderate abundance/ productivity and spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Maintained

Population Status

This section compares the Lower Middle Fork Salmon River population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The Lower Middle Fork Salmon River spring/summer Chinook salmon population occupies the Middle Fork Salmon River from the confluence with the main Salmon River to Indian Creek, and the main Salmon River downstream to Chamberlain Creek (Figure 5.3-16). The major tributary on the main Salmon River is Horse Creek.

Spring and summer Chinook salmon spawning in the Middle Fork Salmon River below Indian Creek were classified as an independent population based on isolation from spawning areas in tributaries to the Middle Fork Salmon River. Independence was supported by qualitative habitat differences (hydrology, temperature, elevation, and substrate). The ICTRT classified the Lower Middle Fork population as a Basic-size population. Spawning within the population boundaries is primarily restricted to the mainstem Middle Fork Salmon River and Horse Creek. Tributaries to the mainstem rivers within this population typically are small and high gradient, although some provide suitable parr rearing habitat for spring/summer Chinook salmon. Horse Creek is the largest tributary in the population area and supports most of the recently documented spawning in the population (ICTRT 2010). This population likely historically supported both spring- and summer-run fish. Most of the mainstem river habitat in the population likely supported summer-run Chinook salmon, while upper tributary habitat likely supported spring-run Chinook salmon. Spawning in the mainstem Middle Fork Salmon River has been very limited in recent decades. Summer-run fish spawning in the lower Middle Fork Salmon River may be phenotypically unique since they are able to spawn in very large substrate in late September (R. Thurow, Rocky Mountain Research Station, pers. comm. 2-9-2017).

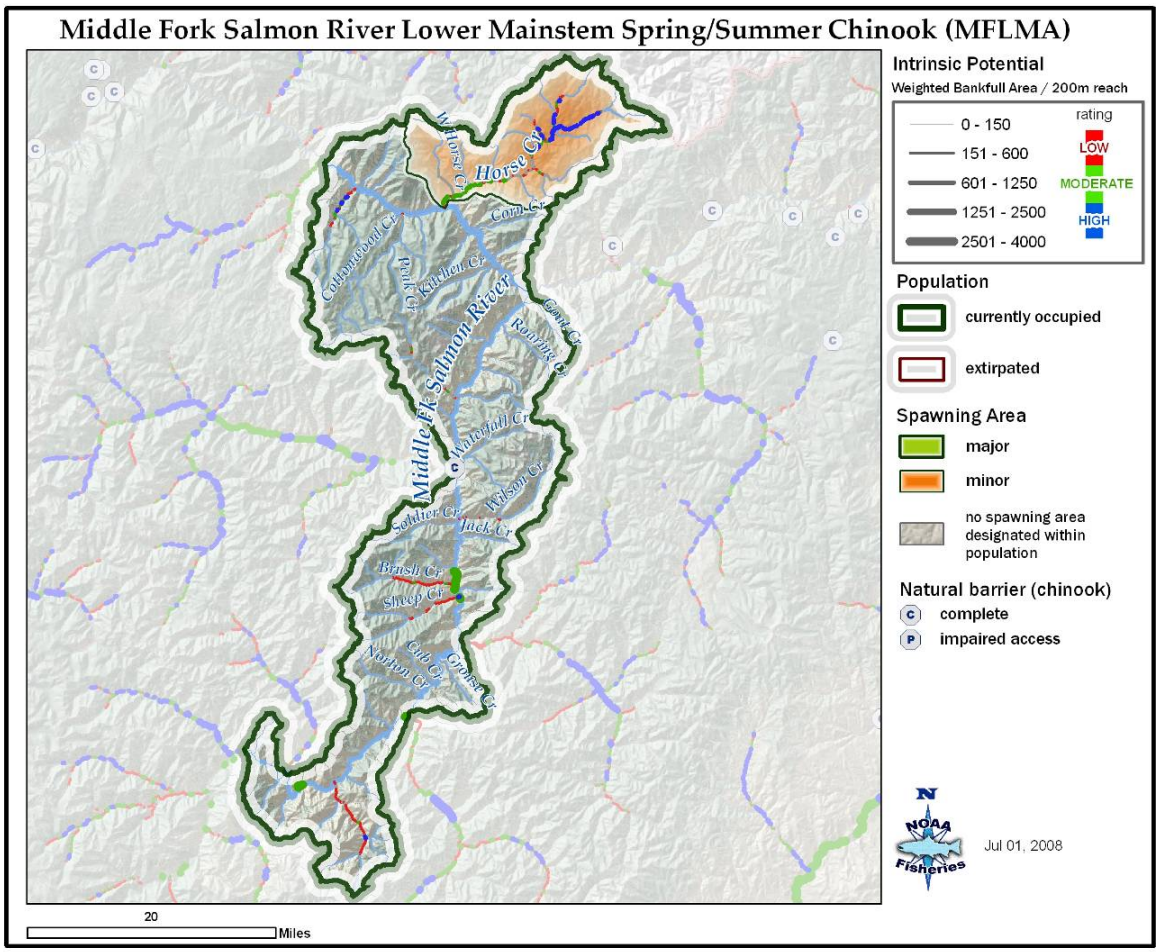

Figure 5.3-16. Lower Middle Fork Salmon River spring/summer Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

The population's intrinsic potential habitat historically was distributed across one EPA level IV ecoregion (Southern Clearwater Forested Mountains – 100%). There is a substantial difference in estimated historic ecoregion occupancy and current occupancy as the population is now primarily distributed in the Hot Dry Canyons and Southern Forested Mountains ecoregions.

Abundance and Productivity

The viability target abundance and productivity for this population is to achieve a mean abundance threshold criteria of 500 naturally produced spawners with a productivity of 2.21 recruits per spawner. Although some long-term abundance trend data exists for the population, there is not enough data available to calculate the standard trend metrics used for other populations (NWFSC 2015). The abundance/productivity risk will need to be reduced before the population can achieve its proposed status.

Spatial Structure

The Lower Middle Fork population includes one minor spawning area (Horse Creek) and no major spawning areas. The number and spatial arrangements of spawning areas creates inherent risk for this

population because there is no major spawning area. The cumulative spatial structure risk is rated at moderate and is adequate for the population to meet its proposed status.

Diversity

The moderate rating assigned to this population is driven by the genetic variation score, which in turn is influenced by a very limited number of samples. It is very possible that the actual risk for the genetic variation metric is low or very low. However, distribution across habitat types risk is rated at moderate, so the cumulative risk for the diversity would not likely change even if the genetic variation score is lowered. A moderate diversity risk is adequate for the population to achieve its proposed status.

Summary

The Lower Middle Fork Salmon River spring/summer Chinook salmon population does not currently meet viability criteria because the abundance/productivity risk is likely high. Without survival increases that lead to increases in abundance and productivity, the population cannot reach its proposed status of maintained. The combined spatial structure risk/diversity risk is currently moderate and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 5.3-13. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 5.3-13. Viable Salmonid Population parameter risk ratings for the Lower Middle Fork Salmon River spring/summer Chinook salmon population. The population does not meet population-level viability criteria.

		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 ↑	HR
	High (>25%)	HR	HR	Lower Middle Fork	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors. Section 5.1 summarizes limiting factors and threats for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

Natal Habitat

Habitat Conditions

The watersheds occupied by the Lower Middle Fork Salmon River spring/summer Chinook salmon population (Middle Fork Salmon River below Indian Creek) are located in wilderness areas, where most waterways are considered in excellent condition. Due in large part to their remoteness and protected status, watersheds in the entire Middle Fork Salmon River drainage are not significantly impacted by habitat fragmentation associated with land uses, development, and habitat conversion. Approximately 99 percent of these watersheds are classified as having low impacts due to habitat fragmentation (NPCC 2004). Less than 1 percent of the total stream length in the Lower Middle Fork Salmon River watersheds has been identified as being impaired by sedimentation (NPCC 2004). There are currently no water bodies identified on the Clean Water Act 303(d) list for this population (IDEQ 2008a).

Water is diverted from several tributaries in the Lower Middle Fork population for irrigation, mining, power, domestic use, and stock water (IDWR 2009). Many of these diversions are on streams without intrinsic potential for spring/summer Chinook salmon spawning and rearing and have maximum diversion rates of less than 1 cfs, such that impacts to spring/summer Chinook salmon habitat are likely low. However, a handful of larger water rights may impact spring/summer Chinook salmon habitat by reducing instream flow in tributaries with potential habitat or by blocking access to tributary habitat. Furthermore, it is unknown whether any of these diversions are adequately screened.

Recreation use along trail corridors has led to the recent establishment and spread of noxious weeds in the drainage, with populations of spotted knapweed and rush skeletonweed posing the most potential to negatively impact habitat quality in the Lower Middle Fork, through increased soil erosion (NPCC 2004).

Current Habitat Limiting Factors and Threats

NMFS identified the following habitat limiting factors for the Lower Middle Fork Mainstem population based on multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. This analysis indicates that habitat-limiting factors for the population exist, but are minor.

1. Nutrient deficiency.

Some Salmon River tributaries are nutrient-limited, and reductions in the amount of marine-derived nutrients delivered by spawning salmon and steelhead could be exacerbating the degree of oligotrophication. Some evidence suggests that Salmon River tributaries are nutrient-limited (Kohler et al. 2008; Ebel et al. 2014). Furthermore, one study has suggested that during periods of low adult abundance, juvenile Chinook salmon in Idaho may actually export more nutrients than their parents imported (Kohler et al. 2013). More research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Lower Middle Fork Mainstem watershed. Potential concerns identified for this drainage include:

1. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.
2. Water diversions. It is unknown whether water diversions in the Lower Middle Fork population bypass adequate flows, provide for fish passage, and have adequate fish screening.

Hatchery Programs

Currently, there are no hatchery releases within the Lower Middle Fork Salmon River spring/summer Chinook salmon population area, or other parts of the Middle Fork Salmon River MPG, and few hatchery fish stray to the area from neighboring MPGs. Hatchery-related limiting factors and threats for Lower Middle Fork Salmon River spring/summer Chinook salmon are discussed at the MPG level in Section 5.3.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries pose a threat to Lower Middle Fork Salmon River spring/summer Chinook salmon, and to other Middle Fork Salmon River spring and summer Chinook salmon populations. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Lower Middle Fork Salmon River spring/summer Chinook salmon are discussed at the MPG level in Section 5.3.3.3.

Predation/Competition

Potential Predation Limiting Factors and Threats

NMFS identified the following potential predation limiting factor for the spring/summer Chinook salmon population.

1. Invasive species. Non-native brook trout have rarely been seen in the Lower Middle Fork Salmon River population (IDFG 2010), but are common in Big Creek, Bear Valley Creek, and Marsh Creek. The fish could potentially spread to the Lower Middle Fork Salmon River and compete with or prey on spring/summer Chinook salmon. Section 5.3.5.1 for the Big Creek spring/summer Chinook salmon population describes research findings on how brook trout can affect Chinook salmon abundance and productivity.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve spring/summer Chinook salmon productivity rates.

1. Investigate whether nutrient deficiency is limiting population productivity and whether nutrient supplementation actions in natal habitat could provide a short-term increase to population productivity. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this type of action.
2. Investigate whether water diversions in key population areas provide fish passage and have adequate screening in place; repair passage and provide screening where needed.

Implementation of Habitat Actions

Responsibility for implementation of habitat actions this population lies within the jurisdiction of the U.S. Forest Service. Following the existing U.S. Forest Service Land and Resource Management Plan should provide the protection needed for this population. IDFG has management responsibility for fish and wildlife in this area.

No specific habitat projects have been identified for the Lower Middle Fork Salmon River population. However, actions are updated continuously based on available funding and established priorities. Habitat actions to support population recovery will be identified and prioritized through the adaptive management process for each 5-year implementation period.

Hatchery Recovery Strategy and Actions

The hatchery strategy for the Lower Middle Fork Salmon River spring/summer Chinook salmon population is to continue to manage for natural production, and to protect the population and MPG from risks posed by other hatchery programs, especially hatchery strays. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Lower Middle Fork Salmon River population survival, beyond those already identified in this chapter, may be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level

strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.3.12 Sulphur Creek Spring Chinook Salmon Population

The Sulphur Creek spring Chinook salmon population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its proposed status is Maintained, which requires no more than moderate abundance/productivity and spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Maintained

Population Status

This section compares the Sulphur Creek population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The Sulphur Creek spring Chinook salmon population occupies Sulphur Creek and its tributaries. It was defined as an independent population based upon its isolation from other spawning areas and its size (ICTRT 2003, p. 23). The Sulphur Creek population intrinsic potential habitat historically was distributed across one EPA level IV ecoregion (Southern Forested Mountains – 100%). There are no substantial changes in ecoregion occupancy.

The Sulphur Creek population is a Basic-size population with a Branched Continuous A type spawning complexity. This population contains spring-run fish, and consists of one major spawning area (Figure 5.3-17).

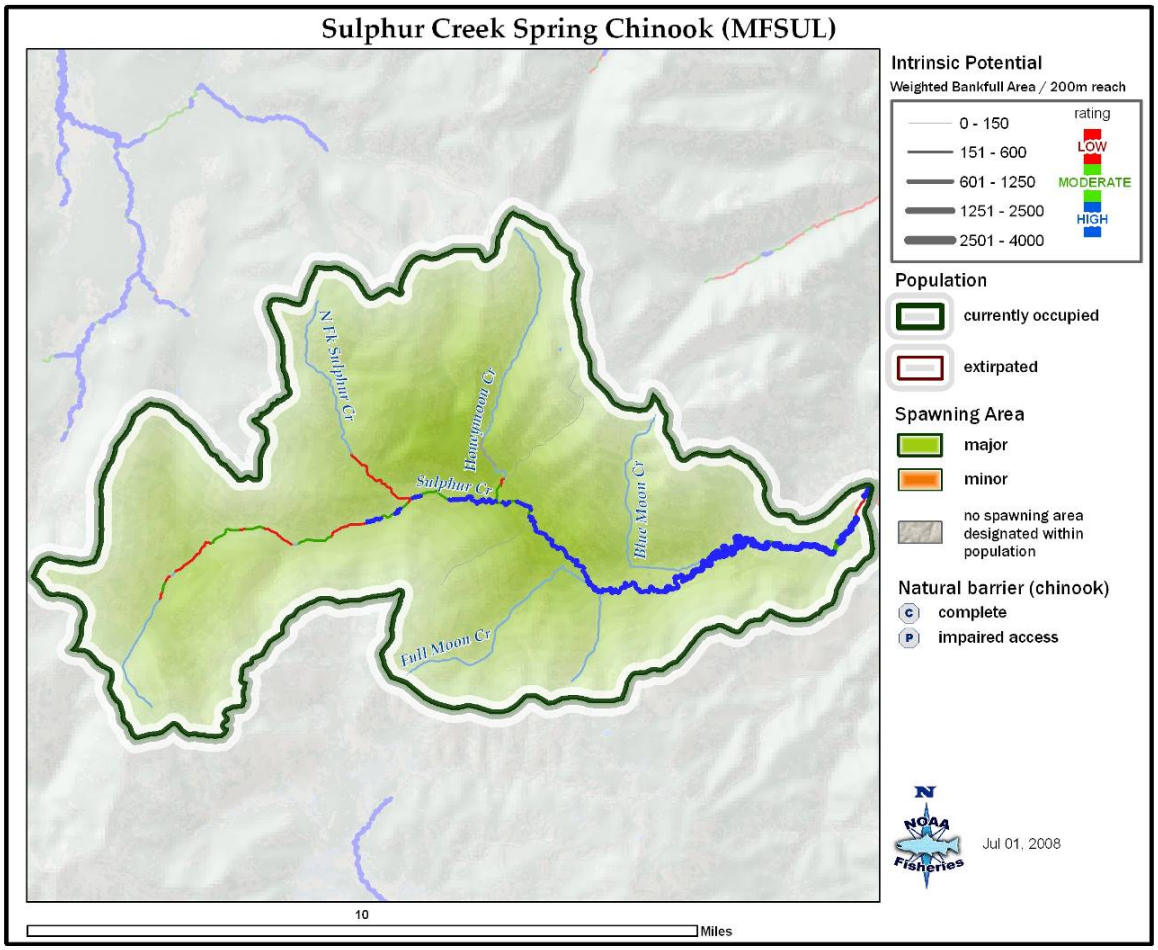

Figure 5.3-17. Sulphur Creek spring Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural-origin abundance and productivity that correspond to a particular risk level. As seen in Figure 5.3-18, a proposed risk level can be achieved with various combinations of abundance and productivity. For the Sulphur Creek population, the proposed status of maintained can be attained with any combination of abundance and productivity that is above the red dashed line. As a Basic-size population, Sulphur Creek can achieve viable (low risk) status (the green line) with a mean minimum abundance of 500 natural-origin spawners at a productivity of 2.21.

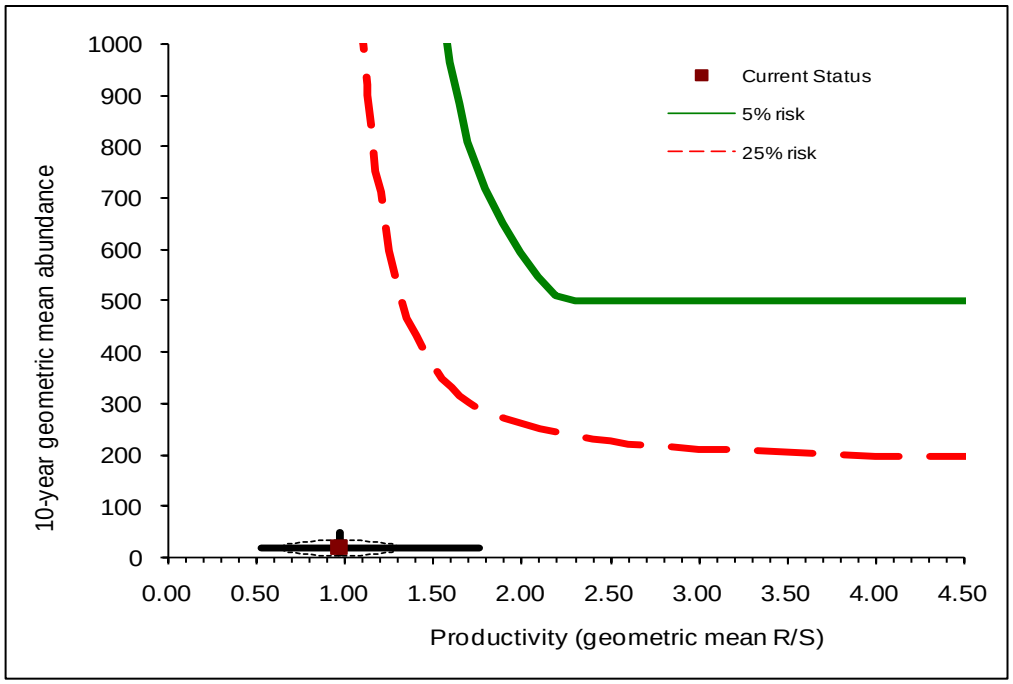

Figure 5.3-18. Sulphur Creek Abundance and Productivity Curve. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Currently, the 10-year (2005-2014) geometric mean adult spawner abundance is 67 fish, and the return-per-spawner geometric mean productivity is 0.92, both substantially lower than the minimum thresholds for either maintained or viable status (NWFSC 2015). By comparison, Pirtle and Keating (1955) reported a total of 544 Chinook salmon redds in Sulphur Creek in 1955. The abundance/productivity risk for the population is rated as high.

Spatial Structure

The Sulphur Creek population consists of just one major spawning area, and this limited spatial structure creates some inherent risk for the population's viability. However, the cumulative risk for spatial structure is tempered by the very low risk in the population that is due to the fact that the entire historic range is still occupied. The cumulative risk for spatial structure is rated as low.
This is adequate to meet the proposed status for the population.

Diversity

The moderate rating assigned to this population is driven by the genetic variation score, which is influenced by the relatively small amount of available data assessing genetic variation. As more genetic data becomes available, it is possible that the risk rating for the genetic variation metric could be lowered to low or very low. The cumulative risk assigned to spatial structure and diversity has been rated moderate risk. This is adequate to meet the proposed status for the population.

Summary

The Sulphur Creek spring Chinook salmon population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in

abundance and productivity, the Sulphur Creek population cannot reach its proposed status. The spatial structure risk/diversity risk is currently moderate and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in Table 5.3-14. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 5.3-14. Viable Salmonid Population parameter risk ratings for the Sulphur Creek spring Chinook salmon population. The population does not meet population-level viability criteria.

		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 ↑	HR
	High (>25%)	HR	HR	Sulphur Creek	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors. Section 5.1 summarizes limiting factors and threats for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

Natal Habitat

Sulphur Creek lies almost completely within the Frank Church ─ River of No Return Wilderness Area. Although now largely protected as wilderness, the Sulphur Creek watershed suffered some stream habitat degradation from past land uses. Historic livestock grazing has reportedly resulted in localized accelerated erosion, upland compaction, and streambank degradation, but conditions are on an improving trend. The area is now primarily closed to sheep and cattle grazing (USDA 2010). No waterbodies are currently identified on the Clean Water Act 303(d) list for this population (IDEQ 2008a).

Since most of the Sulphur Creek watershed lies within the Frank Church ─ River Of No Return Wilderness Area, current land use in the Sulphur Creek area focuses primarily around wilderness-oriented, dispersed recreation. The Sulphur Creek watershed displays the most extensive unroaded and unconfined valley bottom meadow habitat of any Middle Fork Salmon River tributary. However, water diversions for irrigation, storage, and power are located on private land within the wilderness (IDWR

2009). Few invasive plants have been located within the drainage, although spotted knapweed is considered the primary weed of concern. Habitat in Sulphur Creek includes extensive pond complexes associated with beaver and indicative of high quality habitat.

Current Habitat Limiting Factors and Threats

NMFS identified the following habitat limiting factors for the Sulphur Creek population based on multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. The analysis suggests that habitat limiting factors for the population exist, but are minor.

1. Low streamflows due to water diversions, fish passage and entrainment.

Water rights exist for close to 5 cfs to be diverted from Blue Moon Creek for irrigation, domestic use, power, and a storage pond on private land within the wilderness (IDWR 2009). While the ICTRT does not list Blue Moon as having intrinsic potential for spring Chinook salmon, current distribution maps indicate that Blue Moon Creek is used by spring Chinook salmon for both spawning and rearing (StreamNet 2009). It is unknown whether the diversions on Blue Moon Creek currently leave adequate instream flow for spawning and rearing, allow for fish passage, or have screens in place to prevent fish entrainment in diversion ditches.

2. Nutrient deficiency.

Some Salmon River tributaries are nutrient-limited, and reductions in the amount of marine-derived nutrients delivered by spawning salmon and steelhead could be exacerbating the degree of oligotrophication (Kohler et al. 2008; Ebel et al. 2014). Furthermore, one study has suggested that during periods of low adult abundance, juvenile Chinook salmon in Idaho may actually export more nutrients than their parents imported (Kohler et al. 2013). More research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Sulphur Creek watershed. Potential concerns identified for this drainage include:

1. Grazing impacts to riparian habitat. Assuring that the ESA section 7 consultations on U.S. Forest Service grazing allotments remain current should minimize any effects from grazing.
2. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.

Hatchery Programs

Currently, there are no hatchery releases within the Sulphur Creek spring Chinook salmon population area or other parts of the Middle Fork Salmon River MPG, and few hatchery fish stray to the area from neighboring MPGs. Hatchery-related limiting factors and threats for Sulphur Creek spring Chinook salmon are discussed at the MPG level in Section 5.3.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries pose a threat to Sulphur Creek spring Chinook salmon, and to other Middle Fork Salmon River spring and summer Chinook salmon populations. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Sulphur Creek spring Chinook salmon are discussed at the MPG level in Section 5.3.3.3.

Predation/Competition

Potential Predation Limiting Factors and Threats

NMFS identified the following potential predation limiting factor for the spring Chinook salmon population.

1. Invasive species. Non-native brook trout have rarely been seen in Sulphur Creek (IDFG 2010), but are common in the Bear Valley Creek and Marsh Creek areas, immediately upstream. The fish could potentially spread to the Sulphur Creek area and compete with or prey on spring Chinook salmon. Section 5.3.5.1 for the Big Creek spring/summer Chinook salmon population describes research findings on how brook trout can impact Chinook salmon abundance and productivity.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve spring Chinook salmon productivity rates.

1. Evaluate existing water diversions to assure that diversions bypass adequate flows, provide for fish passage, and have adequate screening in place.
2. Investigate whether nutrient deficiency is limiting population productivity and whether nutrient supplementation actions in natal habitat could provide a short-term increase to population productivity. Ongoing studies by NOAA’s Northwest Fisheries Science Center are exploring the potential benefits of this type of action.

Implementation of Habitat Actions

Responsibility for implementation of habitat actions for this population lies within the jurisdiction of the U.S. Forest Service. Following the existing U.S. Forest Service Land and Resource Management Plan should provide the protection needed for this population. IDFG has management responsibility for fish and wildlife in this area.

No specific habitat projects have been identified for the Sulphur Creek spring Chinook salmon population. However, actions are updated continuously based on available funding and established priorities. Habitat actions to support population recovery will be identified and prioritized through the adaptive management process for each 5-year implementation period.

Hatchery Recovery Strategy and Actions

The hatchery strategy for the Sulphur Creek spring Chinook salmon population is to continue to manage for natural production, and to protect the population and MPG from risks posed by other hatchery programs, especially hatchery strays. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Sulphur Creek population survival, beyond those already identified in this chapter, may be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.3.13 Camas Creek Spring/Summer Chinook Salmon Population

The Camas Creek spring/summer Chinook salmon population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its proposed status is Maintained, which requires no more than moderate abundance/productivity and spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Maintained

Population Status

This section compares the Camas Creek population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (2015).

Population Description

The ICTRT (2003) distinguished Camas Creek spring/summer Chinook salmon as an independent population based on genetic and geographic isolation. The population was classified as a Basic-size population based on historical habitat potential. A Basic-size population's minimum threshold abundance is 500 adult returning spawners. There is one major spawning area (Camas Creek) and one minor spawning area (Yellowjacket Creek) within this population and all historically occupied areas are still occupied (Figure 5.3-19). Almost all current spawning occurs in Camas Creek, with some spawning in West Fork Camas Creek and an occasional redd found in Yellowjacket Creek.

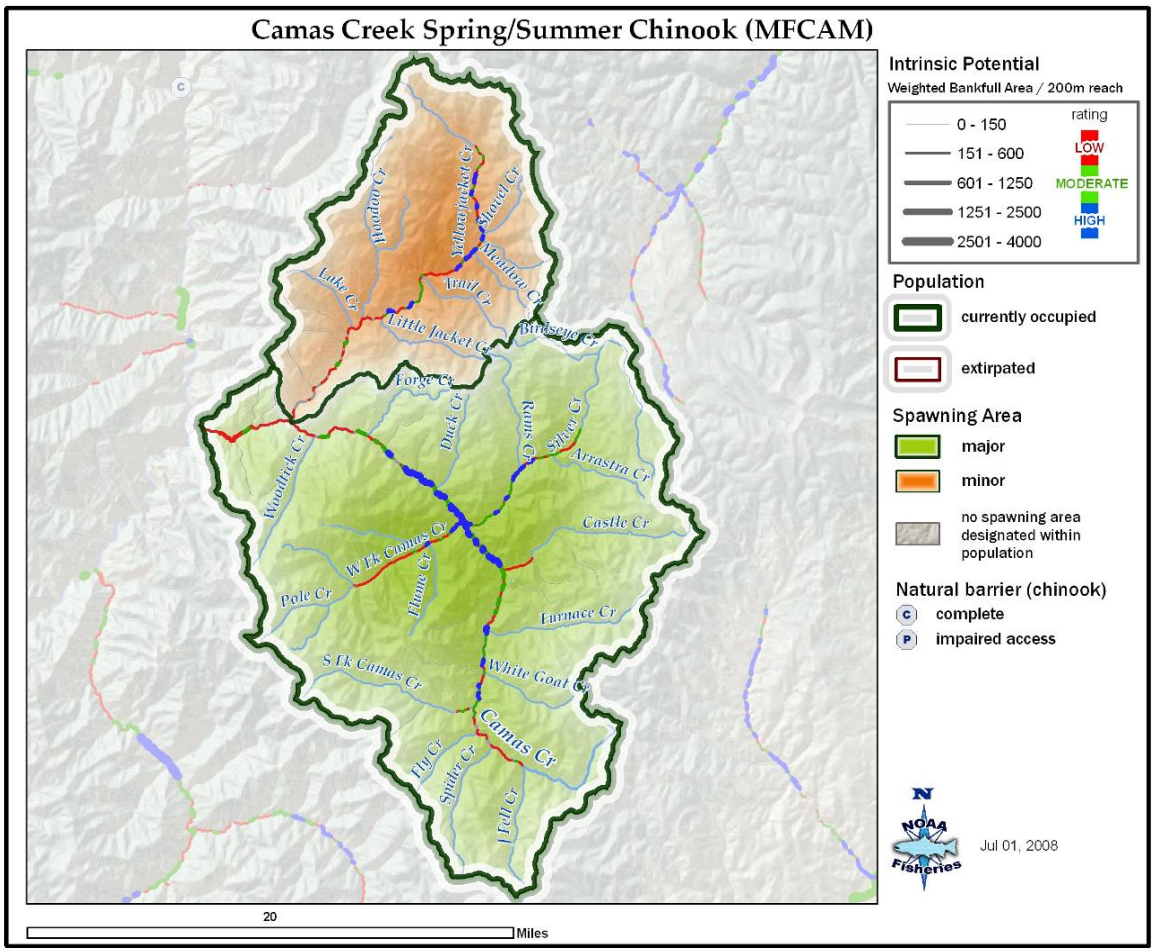

Figure 5.3-19. Camas Creek Spring/Summer Chinook salmon Population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

The ICTRT viability criteria for population abundance and productivity are expressed as a viability curve – minimum combinations of current natural-origin abundance and productivity that correspond to a particular risk level. As seen in Figure 5.3-20, a proposed risk level can be achieved with various combinations of abundance and productivity. For the Camas Creek population, the proposed status of maintained can be attained with any combination of abundance and productivity that is above the red dashed line in Figure 5.3-20. As a Basic-size population, Camas Creek can achieve viable (low risk) status (the green line) with a mean minimum abundance of 500 natural-origin spawners at a productivity of 2.21. In contrast, the recent 10-year (2005-2014) geometric mean adult spawner abundance for the Camas Creek spring/summer Chinook salmon population is 38 fish. Based on recent adult spawner recruit series, the recruit-per-spawner geometric mean productivity estimate is 0.80, which is less than the 2.21 productivity required at the minimum abundance threshold (NWFSC 2015). Current abundance and productivity are also well below the minimums needed for a maintained status. The abundance/productivity risk for the population is therefore high.

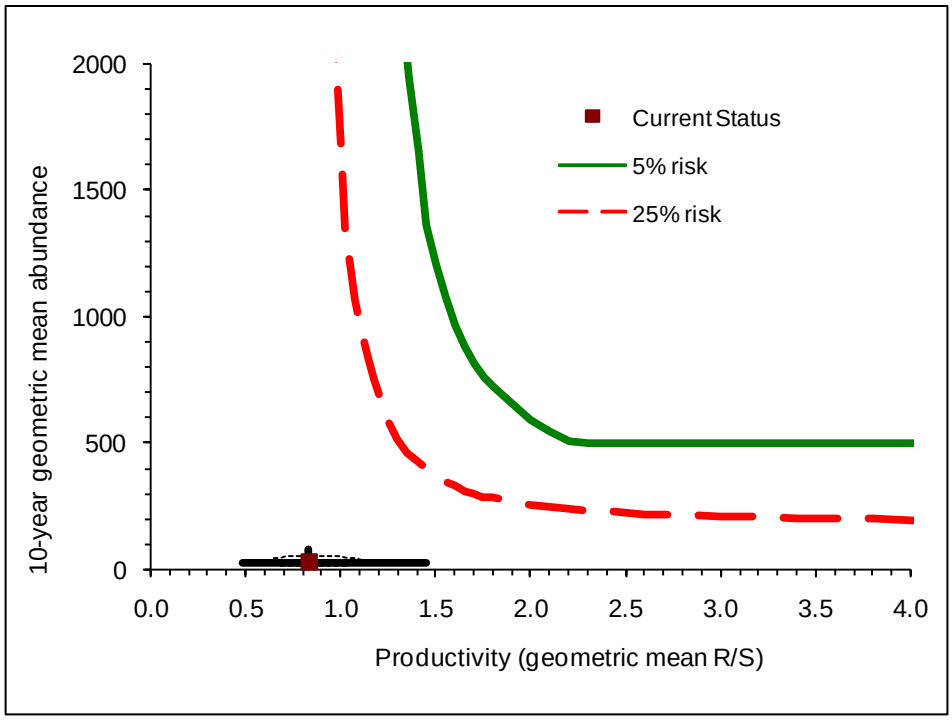

Figure 5.3-20. Camas Creek abundance and productivity curve. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Spatial Structure

This population includes one major spawning area (Camas Creek) and one minor spawning area (Yellowjacket Creek). Current spawning distribution mirrors historical range. The major spawning area is occupied at both the lower and upper ends based on recent spawner surveys. Therefore, this population is rated as low risk for spatial structure. This is adequate to achieve the proposed status.

Diversity

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 moderate risk rating assigned to diversity risk for this population is driven by the genetic variation score, 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. All other diversity risks for this population are rated as low or very low. The moderate risk rating for diversity does not preclude the population from attaining its proposed status.

Summary

The Camas Creek spring/summer Chinook salmon population does not currently meet viability criteria because abundance/productivity risk is high. Without survival increases that lead to increases in abundance and productivity, the Camas Creek population cannot reach its proposed status. The combined spatial structure risk/diversity risk is currently moderate and does not preclude attainment of the viability criteria for the population.

The summary of the abundance/productivity and spatial structure/diversity risk is shown in

Table 5.3-15. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm.

Table 5.3-15. Viable Salmonid Population parameter risk ratings for the Camas Creek spring/summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	Camas Creek	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and HR – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors. Section 5.1 summarizes limiting factors and threats for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

Natal Habitat

Camas Creek drains approximately 400 square miles and flows into the Middle Fork Salmon River at RM 35. The lower eight miles of Camas Creek and the headwaters of Camas Creek are within the Frank Church – River Of No Return Wilderness. Approximately 260 miles of perennial streams drain the Camas Creek system, 250 miles of which are on land administered by the U.S. Forest Service, with the remaining 10 miles of stream on private lands.

Roughly half of the Camas Creek watershed is in the Frank Church ─ River of No Return Wilderness, and overall road density in the drainage is only 0.25 miles per square mile. Most (and possibly all) road crossings are stream fords or bridges, and no impassible road crossings have been identified in anadromous fish habitat (SNF 1994).

Mining activity has probably occurred throughout the Camas Creek watershed, but noticeable impacts of past mining are mostly confined to the Yellowjacket and Silver Creek watersheds, and lower Camas Creek (near Duck Creek). There are 676 acres of patented mining lands in the watershed and test drilling and surface sampling with shovels still occurs on some of the private lands (SNF 1994). Recent commercial-scale mining activity is confined to one open pit gold mine that operated from 1992 to 2000 on 24 acres of private and U.S. Forest Service land in the Yellowjacket Creek

subwatershed (SCNF 2004). Placer mining is prohibited in the Middle Fork Salmon River drainage (Public Law 96-312), but future open pit or subsurface mining on private land is a potential threat to anadromous fish and habitat in the Camas Creek watershed.

Current Habitat Limiting Factors and Threats

NMFS identified the following habitat limiting factors for the Camas Creek population based on multiple data sources and reports on stream conditions, and through discussions with local fisheries experts and watershed groups. This analysis indicates that habitat limiting factors for the population exist, but are relatively minor.

1. Low streamflows due to water diversions, fish entrainment.

Water diversions reduce streamflow in the Yellowjacket Creek, Duck Creek, Silver Creek, and Castle Creek drainages. The maximum diversion rate of all water rights in the Yellowjacket Creek drainage is less than 10 percent of base flow, and 70 percent of those water rights are associated with mines that are not currently in production, so water use probably has a minimal impact on spring/summer Chinook salmon production in the Yellowjacket Creek drainage. However, the one operating water diversion in Yellowjacket Creek is unscreened, so fish may be entrained and killed in the diversion.

The impact of water diversions on flow in the Silver Creek, Duck Creek, and Castle Creek drainages may be enough to reduce spring/summer Chinook salmon production in those drainages. Most of these diversions are on U.S. Forest Service lands and are undergoing ESA section 7 consultation, which should minimize impacts on spring/summer Chinook salmon. The Silver, Duck, and Castle Creek drainages contain only 4.2 percent of rearing habitat (measured as smolt capacity) for the Camas Creek spring/summer Chinook salmon population, so even relatively severe impacts on habitat in these drainages would probably have a small effect on the population.

Water use in tributaries of Camas Creek probably reduces flow in mainstem Camas Creek by less than 5 percent of base flow and likely has a minimal impact on spring/summer Chinook salmon production. There is one small private hydropower diversion within the spawning and rearing areas that reduces flow in a 1.1-mile reach of Castle Creek.

2. Degraded habitat conditions and reduced fish passage.

Much of the mainstem of Camas Creek and several of the major tributaries including Yellow Jacket Creek, Castle Creek, Duck Creek and Silver Creek were identified as temperature limited in the 2012 water quality integrated report (IDEQ 2014) and are included in the Middle Fork Salmon River Temperature TMDL to improve temperatures and fully support salmonid spawning.

Other localized habitat perturbations in the Camas Creek drainage include: a dam that blocks migration into Rams Creek (Silver Creek drainage), a dam and pond that could raise water temperatures and impair migration in Silver Creek, heavy grazing of riparian habitat on private land in the Silver Creek drainage, channel modifications on private land in the Duck Creek drainage (tributary of mainstem Camas Creek), and past cattle trampling of spring and summer Chinook salmon redds in mainstem

Camas Creek. Although locally severe, these habitat perturbations impact a small percentage (less than 5%) of spring/summer Chinook salmon spawning and rearing habitat in the Camas Creek drainage.

3. Reduced habitat function and quality due to loss of beaver activity.

The extent of beaver pond complexes in the Camas Creek drainage is not known, but may be less than optimal in terms of habitat function. In the mid-1990s, private landowners apparently removed a substantial number of beavers from the Silver Creek drainage, resulting in adverse impacts on salmonid habitat (Smith 2008). There is currently a considerable amount of beaver activity in lower Silver Creek (Rose 2008), so the beaver population, and stream habitat, might be recovering. The Camas Creek drainage is open to beaver trapping during the trapping season and beaver perceived to be a nuisance can be removed during any time of the year, so salmonid habitat in the Camas Creek drainage is likely to continue to be adversely impacted by beaver removal.

4. Nutrient deficiency.

Some Salmon River tributaries are nutrient-limited, and reductions in the amount of marine-derived nutrients delivered by spawning salmon and steelhead could be exacerbating the degree of oligotrophication (Kohler et al. 2008; Ebel et al. 2014). Furthermore, one study has suggested that during periods of low adult abundance, juvenile Chinook salmon in Idaho may actually export more nutrients than their parents imported (Kohler et al. 2013). More research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Camas Creek watershed. Potential concerns identified for this drainage include:

1. Grazing impacts to riparian habitat. Assuring that the ESA section 7 consultations on U.S. Forest Service grazing allotments remain current should minimize any effects from grazing.
2. Excess sediment and reduced water quality and quantity from new mineral exploration and mining activity.

Hatchery Programs

Currently, there are no hatchery releases within the Camas Creek spring/summer Chinook salmon population area, or other parts of the Middle Fork Salmon River MPG, and few hatchery fish stray to the area from neighboring MPGs. Hatchery-related limiting factors and threats for Camas Creek spring/summer Chinook salmon are discussed at the MPG level in Section 5.3.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River and tributaries pose a threat to Camas Creek spring/summer Chinook salmon, and to other Middle Fork Salmon River spring and summer Chinook salmon populations. However, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake

River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Camas Creek spring/summer Chinook salmon are discussed at the MPG level in Section 5.3.3.3.

Predation/Competition

Potential Predation Limiting Factors and Threats

NMFS identified the following potential predation limiting factor for the spring/summer Chinook salmon population.

1. Invasive species. Non-native brook trout have rarely been seen in the Camas Creek population (IDFG 2010), but are common in other parts of the Middle Fork Salmon River basin and could eventually spread to Camas Creek and compete with or prey on spring/summer Chinook salmon. Section 5.3.5.1 for the Big Creek spring/summer Chinook salmon population describes research findings on how brook trout can affect Chinook salmon abundance/productivity.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve spring/summer Chinook salmon productivity rates.

1. Continue to improve grazing management to minimize the impacts of redd trampling and riparian vegetation impacts.
2. Implement the Middle Fork Salmon River Temperature TMDL to improve salmonid spawning temperatures.
3. Continue to improve irrigation and water withdrawal practices to minimize the impacts of water diversions.
4. Investigate whether nutrient deficiency is limiting population productivity and whether nutrient supplementation actions in natal habitat could provide a short-term increase to population productivity. Ongoing studies by NOAA's Northwest Fisheries Science Center are exploring the potential benefits of this type of action.
5. Encourage additional beaver activity in the Camas Creek watershed.

Implementation of Habitat Actions

Responsibility for implementation of habitat actions for this population lies within the jurisdiction of the U.S. Forest Service. Following the existing U.S. Forest Service Land and Resource Management Plan should provide the protection needed for this population. The IDFG has management responsibility for fish and wildlife in this area.

No specific habitat projects have been identified for the Camas Creek population. However, actions are updated continuously based on available funding and established priorities. Habitat actions to support population recovery will be identified and prioritized through the adaptive management process for each 5-year implementation period.

Hatchery Recovery Strategy and Actions

The hatchery strategy for the Camas Creek spring/summer Chinook salmon population is to continue to manage for natural production, and to protect the population and MPG from risks posed by other hatchery programs, especially hatchery strays. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.3.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

As discussed previously, the best remaining opportunities for additional improvement to Camas Creek population survival, beyond those already identified in this chapter, may be in the mainstem Salmon, Snake and Columbia River migration corridor. Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.4 Upper Salmon River MPG

The Upper Salmon River MPG consists of spring and summer Chinook salmon returning to the Upper Salmon River basin upstream of the mouth of the Middle Fork Salmon River. The MPG includes nine independent populations, of which one (Panther Creek) is considered functionally extirpated: (1) North Fork Salmon River, (2) Lemhi River, (3) Salmon River Lower Mainstem (below Redfish Lake Creek), (4) Pahsimeroi River, (5) East Fork Salmon River, (6) Yankee Fork, (7) Valley Creek, (8) Salmon River Upper Mainstem (above Redfish Lake Creek), and (9) Panther Creek (extirpated). As shown in Figure 5.4-1, all four population size classes, based on historic intrinsic production potential, are represented in the MPG. Characteristics of the nine independent populations are listed in Table 5.4-1.

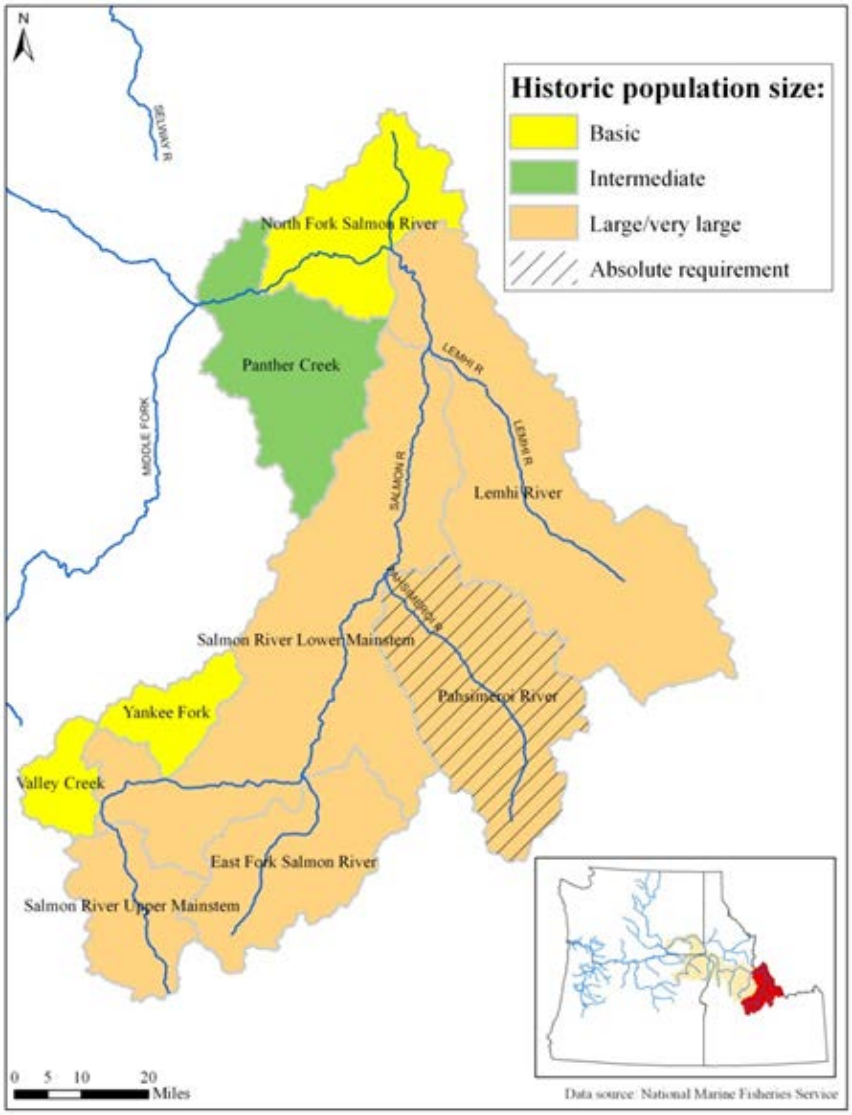

Figure 5.4-1. Upper Salmon River spring/summer Chinook salmon major population group (MPG) and independent populations, with colors indicating population size based on historic habitat potential. Hash marks indicate that the Pahsimeroi River population must be included among the low risk populations under any viable MPG scenario.

The Upper Salmon River MPG supports a genetically divergent grouping of spring/summer Chinook salmon. Populations in this area include both spring and summer adult run timing. This MPG encompasses a large, diverse geographic area. Spawning aggregates in the area do not represent a genetically homogeneous group; however, because spawning locations are interspersed along the mainstem Salmon River, further division based on geographic isolation would be difficult. Therefore, the ICTRT classified spring/summer Chinook salmon upstream of the mouth of the Middle Fork Salmon River as a single major grouping (ICTRT 2003).

Table 5.4-1. Characteristics of independent populations in the Upper Salmon River spring/summer Chinook salmon MPG. Minimum abundance and productivity values represent levels needed to achieve a 95% probability of existence over 100 years (low risk status).

Population	Extant/ Extinct	Life History	Size	Minimum Abundance Threshold*	Minimum Productivity Threshold**
North Fork Salmon River	Extant	Spring	Basic	500	1.90
Lemhi River	Extant	Spring	Very Large	2,000	1.2
Salmon River lower mainstem (below Redfish Lake Creek)	Extant	Spr/Sum	Very Large	2,000	1.2
Pahsimeroi River	Extant	Summer	Large	1,000	1.45
East Fork Salmon River	Extant	Spr/Sum	Large	1,000	1.45
Yankee Fork Salmon River	Extant	Spring	Basic	500	1.90
Valley Creek	Extant	Spring	Basic	500	1.90
Salmon River upper mainstem (above Redfish Lake Creek)	Extant	Spring	Large	1,000	1.45
Panther Creek	Functionally extirpated		Intermediate	750	1.60

* Minimum Abundance Threshold is based on estimated historical tributary spawning and rearing habitat available to a population. Current abundance is measured as the 10-year geometric mean of the natural origin spawners for comparison to the minimum abundance threshold. The ICTRT recognized that alternative life-cycle based approaches can also be used to estimate abundance.

** Minimum Productivity Threshold is derived from the ICTRT population viability curves, where the intrinsic productivity value on the curve corresponds to the population's minimum abundance threshold. A population's intrinsic productivity represents the geometric mean of estimates associated with low to moderate parent escapements. The ICTRT recognized alternative methods for estimating current intrinsic productivity, including using a simple geometric mean of return-per-spawner estimates from low to moderate parent escapements over the most recent 20 brood cycles.

5.4.1 Viable MPG Scenarios

The ICTRT incorporated the viability criteria (ICTRT 2007) into viable recovery scenarios for each MPG. The criteria, which are explained in detail in Chapter 3, Recovery Goal and Delisting Criteria, should be met for an MPG to be considered viable, or low risk, and thus contribute to the larger objective of species' viability. These criteria are:

1. At least one-half the populations historically present (minimum of two populations) should meet viability criteria (5% or less risk of extinction over 100 years).
2. At least one population should be highly viable (less than 1% risk).
3. Viable populations within an MPG should include some populations classified as "Very Large'" or "Large," and "Intermediate" reflecting proportions historically present.

4. All major life history strategies historically present should be represented among the populations that meet viability criteria.
5. Remaining populations within an MPG should be maintained (less than 25% risk) with sufficient abundance, productivity, spatial structure and diversity to provide for ecological functions and to preserve options for species' recovery.

The criteria suggest several viable MPG scenarios for the Upper Salmon River MPG:

- At least five of the nine historical populations must meet viability criteria, one of which must meet highly viable criteria.
- The five viable populations should include at least three Large (Pahsimeroi, East Fork Salmon River, and/or Salmon River upper mainstem) or Very Large (Lemhi River and/or Salmon River lower mainstem) populations and one Intermediate (Panther Creek) population. However, because the one Intermediate-size population in the MPG is considered functionally extirpated, a larger-size population may be substituted for it. Thus, four of the five Large and Very Large-size populations must meet viability criteria.
- All life histories must be present: requires that the Pahsimeroi River population, the only summer run, achieve viable status.
- All remaining populations should at least achieve maintained status.

5.4.2 Current MPG Status

The ICTRT (2010) and NWFSC (2015) used the viability criteria to determine the current status of the MPG. The status assessments for all populations in the MPG inform the MPG-level criteria. The current status for each population is the cumulative risk resulting from the population's abundance, productivity, spatial structure and diversity risks.

The viability criteria call at least five of the nine populations in the Upper Salmon River spring/ summer Chinook salmon MPG to achieve viable status, with at least one highly viable. Currently, the MPG does not meet the MPG-level viability criteria. All eight extant populations in the MPG remain at overall high risk. Table 5.4-2 is a risk matrix showing how the abundance/productivity and spatial structure/diversity risks contribute to the overall risk level for each population.

The NWFSC (2015) status review showed strong positive abundance and productivity trends for most populations in the MPG; with the exception of the Salmon River Lower Mainstem population, which saw a decline in abundance, and the Lemhi River population which has shown a relatively flat trend in total abundance since 1995. The Upper Salmon River Upper Mainstem population (above Redfish Lake Creek) and Pahsimeroi River population have the highest abundance/productivity of the populations. The estimated productivity for the Yankee Fork Salmon River population decreased since the prior review, and was the lowest of all populations in the MPG. All of the populations remain at high abundance/ productivity risk (NWFSC 2015).

Spatial structure and diversity ratings vary considerably across the MPG. Four of the eight populations (North Fork Salmon River, Upper Salmon River Lower Mainstem, Valley Creek and Upper Salmon River Upper Mainstem) are rated at low or moderate risk for overall spatial structure/diversity and could achieve viable status with improved abundance and productivity. The high spatial structure/diversity risk rating for the Lemhi River population is driven by a substantial loss of access to tributary spawning and rearing habitats and the associated reduction in life history diversity. High spatial structure/diversity ratings for the Pahsimeroi River, East Fork Salmon River, and Yankee Fork Salmon River populations reflect a combination of habitat loss and diversity concerns. Four of the seven populations in the MPG with sufficient information to directly estimate hatchery contributions had very low hatchery proportions (Lemhi River, East Fork Salmon River, Valley Creek and Upper Salmon River Lower Mainstem). The most recent 5-year mean for the Pahsimeroi River population was also relatively low (NWFSC 2015). Hatchery contributions to the Yankee Fork Salmon River population have increased substantially in recent years, reflecting returns from a large-scale supplementation effort.

Table 5.4-2. Viable Salmonid Population (VSP) risk matrix for independent populations in the Upper Salmon River spring/summer Chinook salmon MPG with *current status*, as determined from ICTRT population viability assessments (ICTRT 2010).

		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	HR
	High (>25%)	HR	North Fork Salmon, U. Salmon L. Main HR	Valley Creek, L. Salmon Mainstem HR	Lemhi, Pahsimeroi, East Fork, Yankee Fork HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years.

5.4.3 MPG Limiting Factors and Threats

Many limiting factors and threats affect the viability of Idaho's Snake River spring/summer Chinook salmon during their complex, wide-ranging life cycle. This section summarizes the impacts on Upper Salmon River spring/summer Chinook salmon populations from natal habitat alteration and hatchery programs. Chapter 4 summarizes the regional-level factors that impact all Idaho Snake River spring/summer Chinook salmon and steelhead populations. Limiting factors and threats specific to individual Upper Salmon spring/summer Chinook salmon populations are discussed in the Population Summaries in Sections 5.4.5 through 5.4.13.

5.4.3.1 Natal Habitat Alteration

Federal lands managed by the U.S. Forest Service and BLM cover much of the upper elevation areas of the Upper Salmon River MPG, with areas included within the Sawtooth National Recreation Area, Sawtooth Wilderness Area, roadless areas, and the Boulder-White Clouds Wilderness Area, established on August 7, 2015. Lower elevation lands, including valley bottoms in many areas, are in private ownership. Land uses influencing habitat quality in the MPG include livestock grazing, timber harvest, agricultural practices, recreation, and mining. In some areas, these land uses have reduced riparian function and vegetation, decreased recruitment of large woody debris, accelerated sediment loading, and increased summer water temperatures to critical levels. Irrigation diversions reduce summer flows in most populations areas, with tributaries in some reaches disconnected from main rivers. Passage barriers also restrict spring/summer Chinook salmon assess to historical spawning and rearing habitat in most population areas. Presently, some degraded areas are on an improving trend due to ongoing habitat restoration efforts. Table 5.4-3 identifies the habitat-related limiting factors in the MPG.

Table 5.4-3. Habitat-related limiting factors in the Upper Salmon River spring/summer Chinook salmon MPG.

Population	Habitat-related Limiting Factors							
	Riparian Condition	Excess Sediment	Passage Barriers	Summer Flow	Floodplain Connectivity	Instream Complexity	High Water Temperatures	Toxics
North Fork Salmon R.	√		√	√	√	√		
Lemhi River	√	√	√	√	√	√	√	
Up Salmon R. L Main	√	√	√	√	√	√	√	
Pahsimeroi River	√	√	√	√	√	√	√	
East Fork Salmon R.	√	√	√	√		√	√	
Yankee Fork Salmon R	√				√	√		
Valley Creek	√	√	√	√	√	√	√	
Up Salmon R. U Main	√	√	√	√	√	√	√	
Panther Creek *(functionally extirpated)*			√	√		√		√

5.4.3.2 Hatchery Programs

Hatchery production is a prominent feature of the Upper Salmon River spring/summer Chinook salmon MPG. There are currently three populations within this MPG that receive hatchery releases; Pahsimeroi River, Yankee Fork Salmon River, and the Upper Salmon River Upper Mainstem. Hatchery releases in these population areas vary in size. Large hatchery programs exist for the Pahsimeroi River and Upper Salmon River Upper Mainstem populations, with releases of more than one million juveniles in the Pahsimeroi River and up to two million juveniles in the Upper Salmon River Mainstem (Table 5.4-4). Hatchery releases in the Yankee Fork Salmon River population area vary yearly.

The Upper Salmon hatchery program is associated with the LSRCP and Idaho Power Company and provides releases to help achieve LSRCP mitigation goals. The Pahsimeroi hatchery program is mitigation for the Idaho Power Company's Hells Canyon Complex of dams. Hatchery and Genetics Management Plans for the hatchery programs describe program operations and actions taken to support

recovery and minimize ecological or genetic impacts, such as straying and other forms of competition with naturally produced fish. The FCRPS biological opinion (NMFS 2008a) requires the hatchery operators and the action agencies to submit to NMFS updated HGMPs describing site-specific applications of the "best management practices" for the hatchery programs as described in Appendices C and D of the Supplemental Comprehensive Analysis of the FCRPS (NMFS 2008c) for those mitigation hatchery programs funded by the FCRPS action agencies. The HGMPs are the basis for NMFS' biological opinions on hatchery programs under sections 7 and 10 and the 4(d) rule, which all relate to incidental and direct take of listed species.

There are currently no hatchery releases in the North Fork Salmon River, Lemhi River, Upper Salmon River Lower Mainstem, East Fork Salmon River and Valley Creek populations. However, hatchery releases occurred in the Lemhi River and East Fork Salmon River populations under previous programs. Panther Creek is considered a functionally extirpated population. The Shoshone-Bannock Tribes are currently developing a program to reestablish a summer Chinook salmon population in Panther Creek.

The Shoshone-Bannock Tribes have developed the Crystal Springs Hatchery Program aimed at increasing abundance of Chinook salmon in the Yankee Fork and Panther Creek watersheds. NMFS is currently reviewing an HGMP for this hatchery program. The Shoshone-Bannock Tribes are proposing to release Chinook salmon from the Crystal Springs hatchery into both the Yankee Fork and Panther Creek watersheds, with goals of providing opportunities for harvest of hatchery fish and restoring locally-adapted hatchery stocks.

Limiting Factors and Threats

The current hatchery programs can pose some risk to the populations they influence. The Sawtooth Hatchery releases occur at the lower end of the hatchery and the fish outmigrate with smolts from other Upper Salmon River MPG populations. The Pahsimeroi River population received releases from the Pahsimeroi Hatchery. The large hatchery releases from these programs pose risks to the two populations that are targeted to support MPG-level recovery, with proposed status levels of highly viable status for the Upper Salmon River Upper Mainstem population and viable status for the Pahsimeroi River population. Adult from the hatchery programs periodically stray into populations without weirs for control.

The hatchery programs in the Upper Salmon River Upper Mainstem and Pahsimeroi River are transitioning to integrated broodstock programs using the Hatchery Scientific Review Group recommended stepping stone program. These hatchery programs were sourced primarily from within-population broodstock and have used local broodstock since the 1990s. Both populations were treatment sites for the Idaho Supplementation Studies project, which was designed to test the impacts of supplementation on population fitness (Venditti et al. 2015). The research project included three phases, or periods. The pre-treatment period allowed no hatchery-origin adults above the weirs from 1992 to 1995. The treatment period released hatchery- and natural-origin fish above the weirs from 1996 to 2007. The post-treatment period allowed few or no hatchery fish above the weirs from 2008 to 2012. The transition to the integrated broodstock program began in 2013 after the completion of the Idaho Supplementation Studies (ISS) project's post-treatment period.

The Yankee Fork population has had extremely low abundances of adult Chinook salmon, with a mean abundance of 28 adults from 1980 to 2007. A primary concern for this population was continued low spawner abundance. The low spawner abundance, combined with the desire by the Shoshone-Bannock Tribes to re-initiate harvest fisheries in this traditional fishing area, resulted in a supplementation program which was initiated in 2008. Mean spawner abundance since initiation of supplementation in 2008 has been 1,000 adults. The Upper Salmon River MPG has a high degree of similarity and the 2005 Yankee Fork samples were genetically most closely aligned with Sawtooth Hatchery Chinook salmon, and wild Chinook salmon from Decker Flat (upstream of the Sawtooth Weir), and Valley Creek wild Chinook salmon (Ackerman et al. 2014). The program will phase to a localized broodstock as abundance increases in Phase 1. The initial goal is to outplant up to 1,500 hatchery-origin adults and release a minimum of 200,000 smolts from Sawtooth Hatchery (up to 400,000). The broodstock source during this period is expected to transition from Sawtooth Hatchery adults to an increasing percentage of adults collected from Yankee Fork returns. Once the Crystal Springs Hatchery is operational, production would be scaled up to 1,000,000 smolts.

The Lemhi River has been identified as a possible supplementation site through the *U.S. v. Oregon* process, but program details have not been proposed. Table 5.4-4 summarizes the historical and current limiting factors and threats from hatchery programs on the natural populations within this MPG.

Table 5.4-4. Upper Salmon River Spring/Summer Chinook Salmon MPG hatchery programs, limiting factors and threats, and recovery strategies.

Population	Summary Description	Current		Hatchery Influence		Hatchery Effects on Population Viability (+ denotes a Beneficial Effect and – Denotes a Risk or Threat to Viability)	Recovery Strategy
		Limiting factors	Threats	Current	Historical		
North Fork Salmon River	Currently no hatchery program.	None	None	None	one release, 1977	- Periodic straying from within-MPG hatchery programs.	Manage for natural production; Monitor for strays.
Panther Creek	Considered functionally extirpated. Currently no hatchery program.	None	None	Pahsimeroi	one release, 1977; one release, 2001 of adults from South Fork Salmon River program	- Periodic straying from within-MPG hatchery programs.	Develop criteria for reintroduction plans.
Lemhi River	Currently no hatchery program, but hatchery activity in recent past.	Reduced genetic adaptiveness	None	None	Use of Rapid River stock, which may have reduced genetic adaptiveness. 1967-1977, 1979, and 1991. Captive brood: 1994-2003	- Periodic straying from within-MPG hatchery program.	Manage for natural production; Monitor for strays.
Upper Salmon Lower mainstem River	Currently no hatchery program.	Reduced genetic adaptiveness	Hatchery strays from out-of-population programs	None	None	- Periodic straying from within-MPG hatchery programs	Manage for natural production; Monitor for strays.
Pahsimeroi River	Hatchery program in place.	Reduced genetic adaptiveness	Operation of weir; Incidental catch of natural-origin fish in mark-	Smolt releases	Legacy effect of high pHOS and use of out-of-basin broodstock.	- If population abundance remains low, there is increased risk of negative effects from hatchery program.	Develop gene flow standards through HGMP process.

Population	Summary Description	Current		Hatchery Influence		Hatchery Effects on Population Viability (+ denotes a Beneficial Effect and – Denotes a Risk or Threat to Viability)	Recovery Strategy
		Limiting factors	Threats	Current	Historical		
			selective fisheries for hatchery-origin fish				
East Fork Salmon River	Currently no hatchery program, but considerable hatchery activity in recent past.	None	None	None	Potential legacy effects from hatchery program	- Periodic straying from within-MPG hatchery programs.	Manage for natural production; Monitor for strays.
Yankee Fork Salmon River	The Yankee Fork has had various levels of hatchery influence since 1966 (SBT HGMP).	Reduced genetic adaptiveness	Incidental catch of natural-origin fish in mark-selective fisheries for hatchery-origin fish; Continued use of out-of-basin broodstock; High pHOS; Low pNOB*	Juvenile and adult releases; Shoshone-Bannock Tribes likely to develop integrated program in future	Since 1966	- reduced genetic adaptiveness from sustained use of out-or-population broodstock. High proportion of hatchery-origin spawners and reduced proportion of natural-origin broodstock. - Periodic straying from within-MPG hatchery programs.	Develop local broodstock; Develop gene flow standards through HGMP process.
Valley Creek	Currently no hatchery program.	Reduced genetic adaptiveness	Hatchery strays from out-of-population programs	None	None	- Periodic straying from within-MPG hatchery programs.	Manage for natural production; Monitor for strays.
Upper Salmon River Upper Mainstem	Large hatchery program in place (Sawtooth).	Reduced genetic adaptiveness Weir design	Incidental catch of natural-origin fish in mark-selective fisheries for hatchery-origin fish.	Smolt releases	Since 1966	- Lower than desired PNI at low natural-origin abundances.	Develop gene flow standards through HGMP process; evaluate weir design.

*Proportion of hatchery-origin spawners (pHOS); proportion of natural-origin broodstock (pNOB); proportionate natural influence (PNI).

5.4.3.3 Fisheries Management

Snake River spring/summer Chinook salmon from the Upper Salmon River MPG's nine populations pass through fisheries in the estuary, mainstem Columbia, Snake, and Salmon Rivers during their migration from the ocean back to the Upper Salmon River. These fisheries continue to pose a threat to the MPG's abundance, productivity, and diversity; however, negotiations and agreements between fishery managers have reduced mortality rates on the natural-origin spring/summer Chinook salmon.

Mainstem Columbia and Snake River Fisheries

Most fishery-related mortality for spring/summer Chinook salmon returning to natal streams in the Upper Salmon River MPG occurs on the mainstem Columbia River. Incidental take of Snake River spring/summer Chinook salmon occurs in spring and summer season fisheries in the mainstem Columbia River that target harvestable hatchery and natural-origin stocks migrating through Zones 1-6. State and tribal fisheries in Zones 1-6 are regulated under the *U.S. v. Oregon* Management Agreement and associated biological opinion to ensure that fishery-related mortality of ESA-listed Snake River spring/summer Chinook salmon does not exceed a rate of from 5.5 to 17 percent of the Columbia River mouth run size. The fishery-related mortality rate for the Snake River spring/summer Chinook salmon ESU varies annually based on abundance. Overall, fishery-related mortality rates on natural-origin Snake River spring/summer Chinook salmon have remained relatively low, generally below 10 percent for the entire ESU. The *U.S. v. Oregon* Management Agreement allocated the majority of ESA impacts to treaty tribal fisheries (NMFS 2008b).

Tributary Fisheries

Fishery-related mortality of natural-origin spring and summer Chinook salmon returning to natal areas in the Upper Salmon River MPG and Salmon River occurs in state tributary fisheries targeting hatchery-origin fish in the lower and upper Salmon River. Lower and upper Salmon River fisheries target hatchery-origin spring/summer Chinook salmon returning to the Pahsimeroi River, Yankee Fork, and other upriver areas. IDFG conducts a fishery in many years along the Upper Salmon River to the Pahsimeroi River that targets Chinook salmon returning to Pahsimeroi Hatchery. State fisheries on spring/summer Chinook salmon do not currently occur within the North Fork, Panther Creek, Lemhi, East Fork, Yankee Fork, and Valley Creek population areas (Table 5.4-5).

Tribal fisheries also affect the abundance, productivity and diversity of natural-origin spring/summer Chinook salmon returning to the Upper Salmon River MPG. Returning natural-origin spring/summer Chinook salmon are exposed to tribal fisheries on the Salmon River and in the Upper Salmon River MPG where the tribes continue traditional fishing practices. Tribal fisheries could potentially occur in all Upper Salmon River MPG populations depending on expected population-specific abundance. While the tribal harvests are generally nonselective for hatchery or natural-origin fish, the tribes limit fishery-related mortality of natural-origin populations by implementing an abundance-based management framework that has been authorized under the ESA. Under the framework, the allowable fishery-related mortality rate on populations in the Upper Salmon River MPG generally ranges from 1 – 8 percent of the expected return; however, when abundance of the natural-origin run is low, allowable harvest rates are also very low. The tribes conduct monitoring and evaluation to assess the abundance of spring Chinook salmon and to determine fishery effort and catch.

Table 5.4-5. Fisheries on spring/summer Chinook salmon populations in the Upper Salmon River MPG.

Population	State Fisheries	Tribal Fisheries	Discussion
North Fork Salmon R.		X	No hatchery-origin fish releases in area.
Panther Creek		X	No hatchery-origin fish releases in area.
Lemhi River		X	No hatchery-origin fish releases in area.
Lower Salmon River	X	X	State fisheries target hatchery-origin fish returning to upriver areas.
Pahsimeroi River		X	State fisheries on Salmon River target hatchery fish returning to Pahsimeroi Hatchery.
East Fork Salmon R.		X	No hatchery-origin fish releases in area.
Yankee Fork Salmon R.		X	Artificial production in Yankee Fork will primarily support non-selective terminal tribal fisheries.
Valley Creek		X	No hatchery-origin fish releases in area.
Upper Salmon River	X	X	State fisheries target hatchery-origin fish returning to Sawtooth Hatchery.

Summary of Fishery-related Limiting Factors and Threats

Historical and Current Limiting Factors

- Direct mortality associated with fisheries that target specific stocks.
- Indirect mortality of fish harvested incidentally to targeted species or stock.
- Delayed mortality of fish that encounter gear but not landed, or that die after being caught and released.
- Selective effects on timing, size, age (including larger, older fish) and/or distribution due to type of gear or fishing technique and/or location.
- Reduced marine-based nutrient supply and carrying capacity.

Historical Threats

- Past Columbia and Snake River mainstem fisheries.
- Past Salmon River and tributary fisheries. While harvest would have occurred in the Salmon River and tributaries, few, if any, published catch data are available for these fisheries.

Current Threats

- Fisheries targeting harvestable hatchery stocks or other species.
- Targeted fisheries.
- Harvest methods and timing.
- Illegal harvest (poaching).

Other Threats and Limiting Factors

Upper Salmon River spring and summer Chinook salmon populations are also affected by threats posed by the Columbia and Snake River hydropower system, predation and competition, estuarine habitat alterations and climate change. Chapter 4 and Section 5.1 summarize the factors that affect all Idaho Snake River spring/summer Chinook salmon populations. The recovery plan modules provide more detailed discussions on these threats and related limiting factors.

5.4.4 MPG Recovery Strategy

5.4.4.1 Proposed Population Status

The recovery strategy for this major population group includes achieving a proposed status for each population within the MPG. There are multiple viable MPG scenarios for the Upper Salmon River Spring/Summer Chinook salmon MPG, as described above in section 5.4.1. To provide focus for this recovery plan, NMFS and the State of Idaho have selected a proposed status for each population, matching one of the viable MPG scenarios. The selections are described below and shown in Table 5.4-6; however, the recovery scenario remains flexible and will be updated depending on how the populations respond to changes over time. Any viable MPG scenario satisfying the criterion in 5.4.1 is acceptable for achieving the recovery goal.

Table 5.4-6. Viable Salmonid Population (VSP) risk matrix for independent salmonid populations in the Upper Salmon River spring/summer Chinook salmon MPG. This scenario illustrates one way to achieve a viable MPG.

		Spatial Structure/Diversity Risk			
		Very Low	Low	Moderate	High
Abundance/ Productivity Risk	Very Low (<1%)	HV	U. Salmon Mainstem HV	V	M
	Low (1-5%)	V	V	Valley Creek, Lemhi, Pahsimeroi, East Fork V	M
	Moderate (6 – 25%)	M	North Fork Salmon, L. Salmon Mainstem M	Yankee Fork M	HR
	High (>25%)	HR	HR	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction.

Upper Salmon River Upper Mainstem (above Redfish Lake Creek)

This population provides a large amount of suitable spring/summer Chinook salmon habitat, and many conservation projects have already been completed to address the impacts of human land uses. The current natural-origin abundance remains the highest among populations within the Upper Salmon River MPG, and its productivity (return-per-spawner ratio at low to moderate abundance) is among the highest for populations in the MPG. This population occupies the most upstream location including some of the highest elevation spawning/rearing habitats in the MPG, providing geographic diversity. It is also one of five large and very large-size populations, four of which must achieve at least low risk status. The population does have hatchery programs that in the long term introduce diversity risk. The desired status for this population is ***Highly Viable***, with a very low (<1%) risk of extinction over 100 years. Targeting this population to attain Highly Viable status at this time does not eliminate future flexibility to demonstrate MPG viability with a hatchery program present in this important population, nor does it preclude considering other populations in the MPG that may attain Highly Viable status before this population.

The existing hatchery management includes a weir and three major spawning areas providing flexibility to manage population diversity risk. The proportion of hatchery fish spawning above the weir is intensively managed. Based on new genetic testing tools that are available, NMFS believes that attaining highly viable status with an integrated hatchery program present in this population is possible, but will require intensive management of the hatchery influence and monitoring of the population above the weir to assure genetic diversity is not disrupted.

A segregated hatchery program is also maintained at the Sawtooth Fish Hatchery. This program does not release adult hatchery fish upstream of the weir and smolt releases can be managed to minimize

interaction with the wild population. The segregated hatchery program provides fish for harvest by states and tribes under the Lower Snake River Compensation Plan.

Pahsimeroi River

The Pahsimeroi River population has the only extant summer-run life history strategy in the MPG, so under any viable MPG scenario this Large-size population must achieve at least ***Viable*** status, with a low (1-5%) risk of extinction over 100 years.

Lemhi River

The Lemhi River is one of two Very Large-size populations in the MPG, and its habitat was historically very productive. As a historically Very Large population located in the lower part of the MPG, the population provides connectivity with the Middle Fork and South Fork Salmon MPGs. The population has very little hatchery influence. This population will help meet the requirement of at least four Large or Very Large populations at low risk status. The proposed status for this population is ***Viable***, with low risk of extinction over 100 years.

East Fork Salmon River

This population is one of the five Large and Very Large-size populations, four of which must achieve at least low risk status. The habitat is in better shape than in some of the other population areas in the MPG, but are similar or in worse shape than some others. Habitat improvements will likely be easier to achieve with restoration projects than in the remaining Large/Very Large-size population, the Lower Salmon Mainstem. It will also be easier to manage hatchery impacts to the East Fork Salmon population, as a tributary, than in the mainstem Salmon River. The proposed status for this population is ***Viable***, with low risk of extinction over 100 years.

Valley Creek

This population has the highest estimated productivity of the three Basic-size populations in the MPG. Stream habitat is in better condition than in the other two Basic-size populations or the Lower Salmon River Mainstem. The proposed status for this population is ***Viable***, with low risk of extinction over 100 years.

Upper Salmon River Lower Mainstem (below Redfish Lake Creek)

This population is one of the five Large and Very Large-size populations, four of which must achieve at least viable status. The habitat for this population, however, will be more difficult to improve due to the high percentage of private land and the location of state highways along the river. The proposed status for this population is ***Maintained,*** with only a moderate (25% or less) risk of extinction over 100 years.

North Fork Salmon River

The North Fork Salmon River has the potential to achieve viable status, but this would require a greater amount of habitat improvement than for some of the other populations in the MPG. The proposed status for this Basic-size population is ***Maintained,*** with only moderate risk of extinction over 100 years.

Yankee Fork Salmon River

The Yankee Fork Salmon River population has been heavily influenced by hatchery out-planting from both the Rapid River and Upper Salmon hatcheries. The habitat has also been significantly modified by historic mining operations. The Shoshone-Bannock Tribe would like to operate a hatchery program within population. The proposed status for this Basic-size population is ***Maintained,*** with only moderate risk of extinction over 100 years.

Panther Creek

The ICTRT considers this population to be functionally extirpated. No proposed status is assigned to the population because it is not required for this MPG to attain viability. A reestablished Panther Creek population could, however, contribute to the abundance, productivity, and spatial structure of the Upper Salmon MPG. If this Intermediate-size population successfully achieves viable status, it could possibly be substituted for another population of the same size or smaller within the MPG.

If each population achieves its proposed status, shown in Table 5.4-6, the Upper Salmon River spring/summer Chinook salmon MPG will be viable. Other combinations, however, could also achieve MPG-level viability. Thus, we will continue to monitor the status of the populations and adjust the MPG-level recovery scenario over time based on how the populations respond to recovery efforts.

5.4.4.2 Recovery Strategies and Actions

The recovery strategy for the Upper Salmon River spring/summer Chinook salmon MPG increases abundance and productivity for all populations. The VSP risk matrix (Table 5.4-2 and Table 5.4-6), shows that each population requires a decrease in abundance/productivity risk to reach its proposed status of highly viable (very low risk), viable (low risk), or maintained (moderate risk).

The current spatial structure/diversity risk for the Lemhi River, Pahsimeroi River, East Fork Salmon River, and Yankee Fork Salmon River needs to improve to at least moderate risk for these populations to meet their proposed status. The recovery strategy for improving spatial structure and diversity for the Lemhi River and Pahsimeroi River populations is to reconnect historic spawning areas. The upper spawning areas in each of these populations are currently inaccessible to spring/summer Chinook salmon due to seasonal surface water withdrawals. The spatial structure/diversity risk for the Upper Salmon River Upper Mainstem population needs to improve from a current rating of moderate risk (driven by hatchery-origin fish spawning naturally in the system) to low risk for the population to achieve its proposed status of highly viable. Continued hatchery management to reduce diversity risk is necessary for the Upper Salmon River Upper Mainstem, Pahsimeroi River, East Fork Salmon River, and Yankee Fork populations; although future genetic analyses indicating that the Yankee Fork population is diverging from Rapid River stock could lower this population's genetic risk rating. For the remaining populations, the recovery strategy is to prevent any further impacts to spatial structure or diversity.

Increases in population abundance and productivity will come from the cumulative positive impacts of recovery actions targeting every life stage. Because all of the populations in this MPG are currently at high risk, recovery actions will be needed at each stage to increase survival.

Natal Habitat

Natal habitat for the populations in the Upper Salmon River MPG has been degraded by human land uses, and there are opportunities to increase abundance and productivity through habitat restoration. The overall natural function of the rivers in this MPG must be improved by increasing streamflows, side channel habitat, floodplain connection, and channel-forming flows.

Spawning and rearing habitat recovery actions in this MPG are summarized as follows:

1. Increase streamflows in spawning and rearing areas. This includes reconnecting tributaries that have been disconnected from mainstem rivers by diversions (tributaries with potential for spawning are the highest priorities for reconnection). Mechanisms should be developed to apply leased or purchased water to instream flow with the original priority date for the water right.
2. Improve riparian and aquatic habitat conditions and riverine function in selected areas through the improvement of hydrologic processes. The mainstem Salmon River and many of the major tributaries in this MPG have roads or man-made disturbances located within the riparian zone, substantially reducing or altering riparian function. In the selected areas identified in the population-level recovery plans, projects should be pursued to improve these conditions.
3. Remove artificial fish passage barriers where they are blocking access to high quality spring/summer Chinook salmon habitat.
4. Install and maintain fish screens on diversion ditches in areas occupied by spring/summer Chinook salmon.
5. Improve water quality by implementing TMDLs where they have been developed for streams occupied by Chinook salmon.

These five actions address primary habitat limiting factors in the MPG. Other habitat actions specific to certain populations are identified in the population summaries in sections 5.4.5 through 5.4.13. Additionally, for populations in the Upper Salmon River, more research is needed to determine whether there would be a population-level response (e.g. more returning adults) to nutrient enrichment actions.

Hatchery Programs

The intent of the recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that hatchery programs may present. Key aspects of this strategy are discussed below and shown in Table 5.4-7. They include: (1) Manage populations currently without hatchery production for natural production. (2) Transition the Pahsimeroi and Upper Salmon hatchery programs from supporting Idaho Supplementation Studies to using the programs for harvest and conservation in a manner that reduces ecological and genetic risks of the hatchery programs consistent with achieving the proposed status levels of Highly Viable for the Upper Salmon Upper Mainstem population and Viable for the Pahsimeroi River population. (3) Continue to evaluate influence of hatchery programs on all populations.

Hatchery strategies to support recovery:

- Manage populations in the North Fork Salmon, Lemhi, Upper Salmon Lower Mainstem, East Fork Salmon Rivers, and Valley Creek for natural production.
- Monitor for stray rates and sources; if needed, develop actions to reduce straying.
- In Pahsimeroi and Upper Salmon programs, minimize the ecological and genetic risks of releasing hatchery fish consistent with achieving proposed status levels of Highly Viable for the Upper Salmon Upper Mainstem population and Viable for the Pahsimeroi River population. This may involve the use of weirs where appropriate or other methods agreed to by co-managers and funding agencies.
- Manage for agreed-upon levels of gene flow (determined through the HGMP process) in populations where gene flow can be controlled (e.g. Pahsimeroi, Upper Salmon Mainstem), and investigate alternative methods to manage straying of hatchery-origin adults where there are no weirs or other infrastructure that can be used.
- Transition Yankee Fork program to use of locally adapted stock.
- Evaluate juvenile release strategies for the hatchery programs to identify ecological interactions with naturally produced juveniles sharing the same areas downstream. Develop actions needed to minimize ecological interactions with naturally produced juveniles.

Table 5.4-7. Hatchery programs in Upper Salmon River spring/summer Chinook salmon MPG and recovery strategies.

Population	Recovery Strategy
North Fork Salmon River	Manage for natural production; Monitor for strays
Panther Creek	Monitor to determine if recolonization is occurring naturally. Develop criteria for potential reintroduction plans
Lemhi River	Manage for natural production; Monitor for strays;
Upper Salmon River Lower Mainstem	Manage for natural production; Monitor for strays
Pahsimeroi River	Manage for no hatchery influence on spawning grounds above weir. Develop gene flow standards through HGMP process
East Fork Salmon River	Manage for natural production; Monitor for strays
Yankee Fork Salmon River	Develop local broodstock; Develop gene flow standards through HGMP process;
Valley Creek	Manage for natural production; Monitor for strays
Upper Salmon River Upper Mainstem	Develop gene flow standards through HGMP process

Fishery Management

While past fisheries contributed to the reduced viability of the Upper Salmon River spring/summer Chinook salmon MPG, harvest-related risks to populations in the MPG are now managed through harvest agreements and regulations. Based on the fishery management protocols under *U.S. v. Oregon* agreements, FMEPS and TRMPs, the fishery mortality rates for natural-origin spring Chinook salmon are managed at levels intended to support the recovery of natural-origin populations belonging to this MPG.

Recovery Strategy

The overall harvest strategy for the Upper Salmon River MPG is to continue the abundance-based approach for managing mainstem and tributary fisheries to limit ESA impacts on natural-origin Snake River spring/summer Chinook salmon. Fishery opportunities provided for spring Chinook salmon will continue to be sensitive to annual population abundance and recovery criteria, while remaining consistent with tribal trust responsibilities and formal agreements. Fisheries in the Columbia River mainstem will continue to comply with criteria developed through negotiation in *U.S. v. Oregon*. Tributary fisheries for Snake River spring/summer Chinook salmon will continue to be managed to support natural production and not reduce the likelihood of survival and recovery of the ESU.

The harvest strategy also calls to refine monitoring and research efforts. Genetic tools are available to monitor and manage population-specific impacts on natural-origin returning Chinook salmon and catch and release impacts in recreational fisheries.

Specific elements of the harvest strategy include:

- Continue marking all hatchery-origin juveniles (e.g., fin clips, genetic marking, internal or coded wire tags).
- Conduct genetic marking to assess fishery effects with better population-level resolution and to focus fisheries on targeted stocks.
- Where possible, develop a population-specific sliding scale for harvest management based on natural-origin returns and designed to minimize impacts to natural-origin fish.
- Continue to coordinate harvest among all co-managers to ensure that the collective impacts to each population are consistent with recovery goals.
- Continue to implement and improve creel surveys and other monitoring of fisheries to assess and manage impacts on natural-origin returns. The creel surveys should provide reasonable estimates of total harvest as well as population-specific harvest where possible.
- Conduct genetic stock identification, when available and appropriate, and/or PIT-tag studies to determine population-specific impacts from mainstem Columbia, Snake and Salmon River mixed-stock fisheries.
- Continue implementing fisheries in the mainstem Columbia that comply with management agreements developed under the jurisdiction of *U.S. v. Oregon* and associated biological opinions.

Additional Out-of-MPG Threats

Natal habitat restoration and other actions taken within the MPG will not alone produce the increases in survival needed for the Upper Salmon River spring/summer Chinook salmon MPG to achieve viability. Improvements in survival must also come from recovery actions implemented downstream of the MPG, including from natal habitat through the mainstem Salmon River, and in the Snake and Columbia River migration corridor, Columbia River estuary, and ocean. Actions being taken to improve life-cycle survival in the mainstem migration corridor are particularly important. These issues and strategies are discussed in Chapter 4 and Section 5.1, and in the Estuary, Hydro, Harvest, and Ocean Modules to the recovery plan.

5.4.5 Upper Salmon River Upper Mainstem Spring Chinook Salmon Population

The Upper Salmon River Upper Mainstem population occupies the area above Redfish Lake Creek and supports spring-run Chinook salmon. The population is currently not viable, with high abundance/productivity and moderate spatial structure/diversity risk. Its proposed status is Highly Viable, which requires a minimum of very low abundance/productivity risk and low spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Highly Viable

Population Status

This section compares the Upper Salmon River Upper Mainstem population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review, which identifies population risk in terms of four viability parameters: abundance, productivity, spatial structure, and diversity. This section focuses primarily on population abundance (the total number of adults) and productivity (the ratio of returning adults to the parental spawning adults). It also summarizes spatial structure (the amount and nature of available habitat) and diversity (genetic traits) concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The Upper Salmon River Upper Mainstem spring/summer Chinook salmon population includes the mainstem Salmon River and all tributaries upstream from Redfish Lake Creek (including Redfish Lake Creek) (Figure 5.4-2).

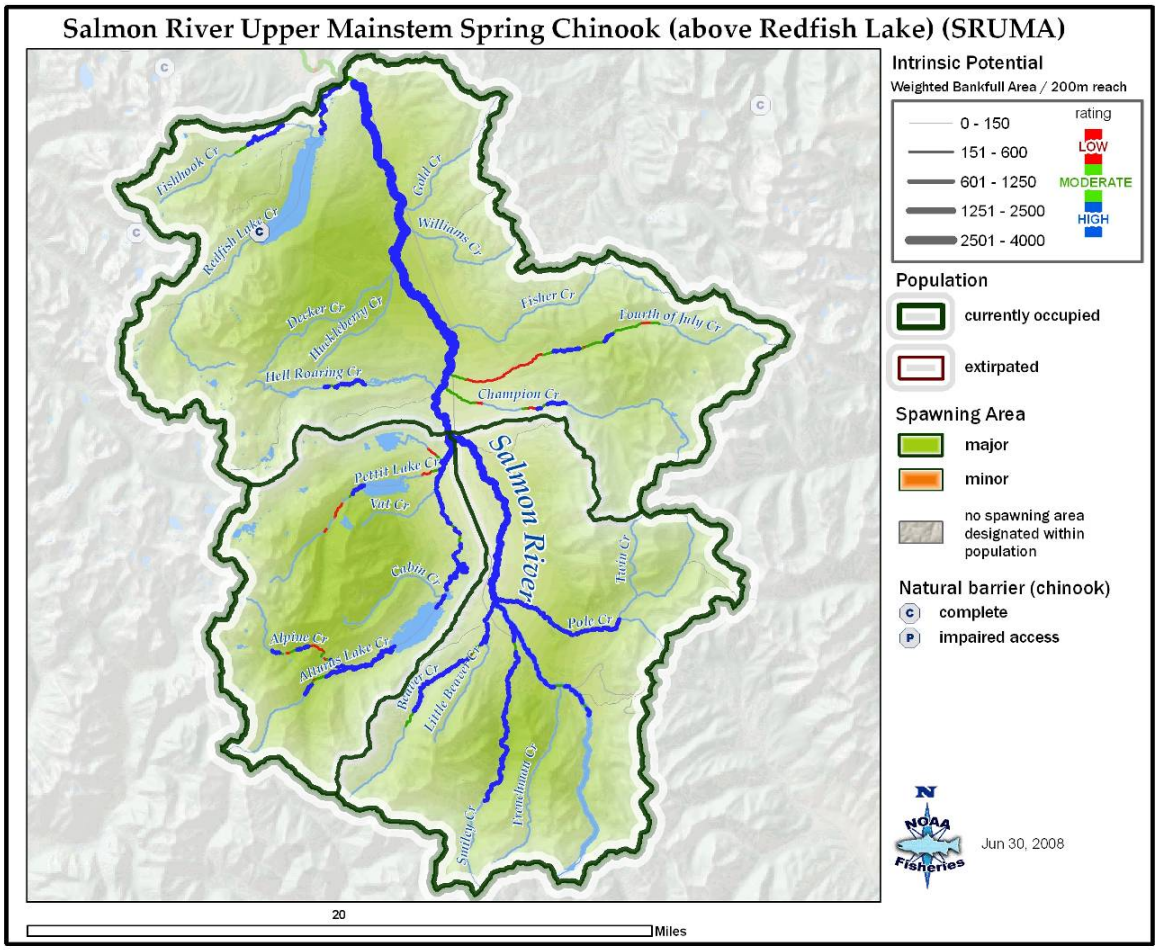

Figure 5.4-2. Upper Salmon River Upper Mainstem spring Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

This area was designated as an independent population based largely on historical estimated run size. Genetic sampling generally supports this designation; however, some evidence suggests that spring/summer Chinook salmon in Alturas Lake Creek may be segregated from the rest of the population. The apparent genetic distinction of Alturas Lake Creek fish could also be the result of genetic drift, since only three redds were counted in Alturas Lake Creek the year before the genetic samples were collected. The ICTRT therefore considers Alturas Lake Creek part of the Upper Salmon River Upper Mainstem population, but recommends that the possible genetic distinctiveness of Alturas Lake Creek spring Chinook salmon be considered when evaluating management actions (ICTRT 2003, p. 25).

The ICTRT classified the Upper Salmon River Upper Mainstem spring Chinook salmon population as Large in size and complexity based on historical habitat potential. This population consists of three major spawning areas (Alturas, Upper Salmon, and Middle Salmon), and the entire population is considered spring run (ICTRT 2010). In addition to the Salmon River mainstem, streams occupied by different life stages of this population include Fishhook, Redfish Lake, Decker, Hell Roaring, Petit Lake, Fisher, Alturas Lake, Beaver, Smiley, Frenchman, Pole, Champion, Fourth of July, Williams,

and Gold Creeks. Most spawning occurs in the mainstem Salmon River downstream from Alturas Lake Creek (ICTRT 2010). Alturas Lake Creek is the only tributary that currently has consistent spring Chinook salmon spawning, but spring Chinook salmon occasionally spawn in Pole Creek and they consistently spawned in Beaver and Frenchman Creeks as late as the early 1970s. Some spawning also consistently occurs in the Salmon River upstream from Alturas Lake Creek, at which point the Salmon River is of similar size to other tributaries in the population. The Sawtooth Fish Hatchery is located five miles south of Stanley, and the facility includes a permanent weir across the Salmon River. Returning wild spring Chinook salmon are passed over the weir to spawn in their natal streams.

Abundance and Productivity

A Chinook salmon population classified as Large has a minimum mean abundance threshold of 1,000 natural-origin spawners with a sufficient intrinsic productivity (≥ 1.58 recruits per spawner at the minimum abundance threshold) to achieve viability, defined as a 5 percent or less risk of extinction over a 100-year timeframe. For the Upper Salmon River Upper Mainstem population to achieve highly viable status, with a 1 percent or less risk of extinction over a 100-year timeframe, productivity would need to be at or greater than 2.30 recruits per spawner at the minimum abundance threshold of 1,000 spawners (ICTRT 2010). In contrast, the 10-year (2005-2014) geometric mean abundance of natural-origin spawners for this population is 419 fish. The geometric mean productivity is 1.22 recruits per spawner, well below the 2.3 recruits per spawner required at the minimum abundance threshold for highly viable status (NWFSC 2015). Figure 5.4-3 shows spring Chinook salmon abundance for the Upper Salmon River Upper Mainstem population between 1960 and 2005.

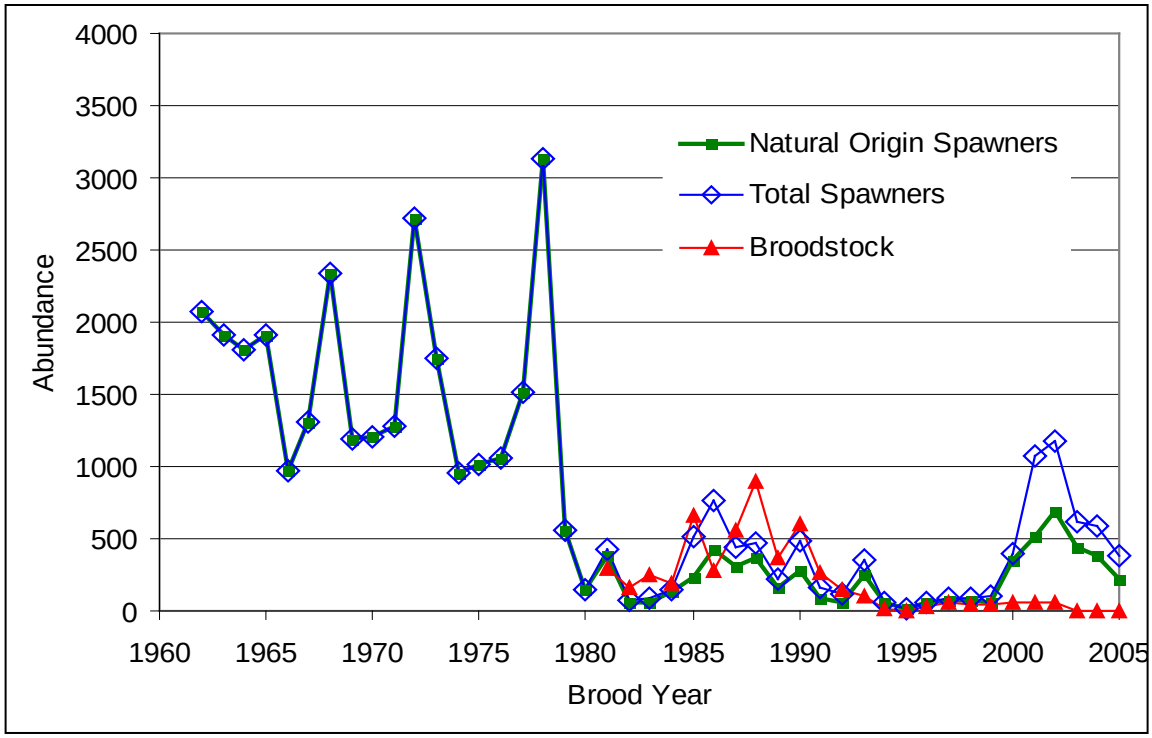

Figure 5.4-3. Upper Salmon River Upper Mainstem spring Chinook salmon population adult spawner abundance. Broodstock refers to returning adults removed at the Sawtooth Fish Hatchery to support the hatchery program. Although adults removed from the river for the broodstock program are natural-origin, they are not included in natural-origin or total spawners in this chart.

As Figure 5.4-3 shows, between 1981 and 2005, the number of natural-origin spawners in the population was extremely variable. During this period, returns of natural-origin fish to the spawning grounds were reduced through broodstock removals to support the ongoing hatchery program operating within the upper Salmon River drainage. Returns increased somewhat in the mid-1980s from extremely low numbers in 1982-1983. After a downward trend through the 1990s, returns to the Upper Salmon River Upper Mainstem population peaked in 2001-2002, and then entered another decline.

ICTRT viability criteria for population abundance and productivity can be expressed as a viability curve – minimum combinations of current natural-origin abundance (measured as spawners) and productivity (measured as brood year spawner-to-spawner ratios) that correspond to a particular risk level. As seen in Figure 5.4-4, a proposed risk level can be achieved with various combinations of abundance and productivity, in addition to the minimum threshold abundance described above. For the Upper Salmon River Upper Mainstem population, viable status can be attained with any combination of abundance and productivity that is above the green line. The proposed highly viable status is not shown graphically in Figure 5.4-4, but would require a combination of abundance and productivity even farther above the green curve. The Upper Salmon River Upper Mainstem population is at high risk based on current abundance and productivity.

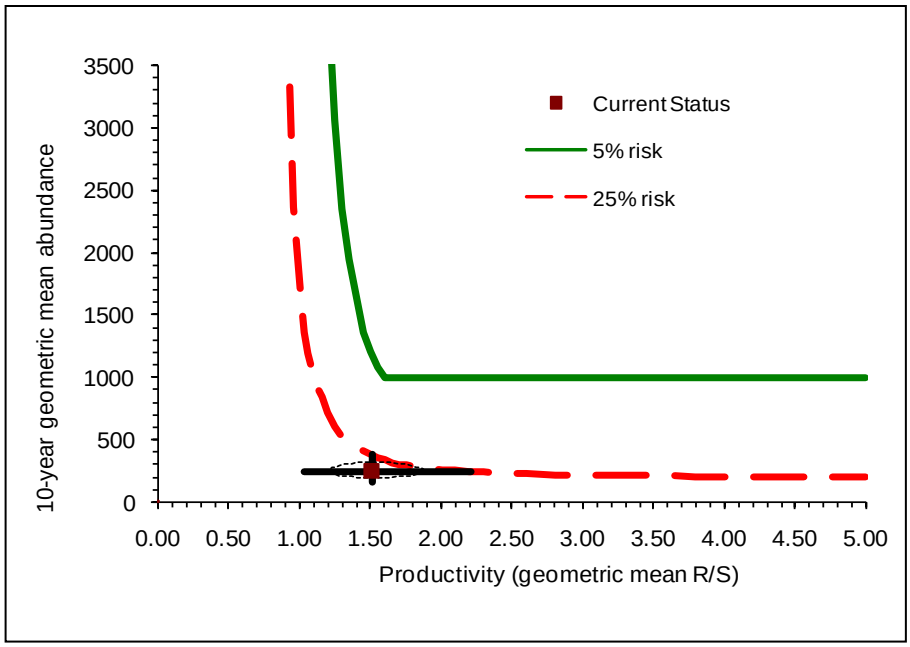

Figure 5.4-4. Upper Salmon River Upper Mainstem spring/summer Chinook salmon population abundance and productivity. [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Spatial Structure

The ICTRT (2010) rated overall spatial structure risk as very low for this population because all historical major spawning areas are occupied, there has been no increase in distance between spawning areas within the population, and there has been no increase in distance between spawning for this population and other populations in the MPG or ESU. Although this rating is applied at a population

scale, within each major spawning area there are tributaries that may be partially or completely blocked, as discussed in the limiting factors section below.

Diversity

The ICTRT (2010) rated genetic diversity risk for this population as moderate. The primary factor leading to the moderate risk diversity rating is potential genetic homogenization, due to Sawtooth Fish Hatchery fish influencing the population. The population has a relatively high proportion of hatchery fish spawning naturally: the proportion of hatchery-origin spawners observed upstream of the hatchery weir has ranged from 0 to 50 percent per year, and averaged 25 percent over the last two generations (ICTRT 2010). The moderate risk rating for diversity reflects this high proportion of hatchery-origin fish spawning naturally.

Summary

The Upper Salmon Upper Mainstem population is currently rated high risk. The current rating is driven by a high risk rating for abundance/productivity. Without survival increases that lead to increases in abundance and productivity, the Upper Salmon River Upper Mainstem population cannot reach viable status. Additionally, without decreases in genetic diversity risk from moderate risk to low risk, the population cannot reach the proposed highly viable status (less than 1% risk of extinction over 100 years).

Table 5.4-8 summarizes the abundance/productivity and spatial structure/diversity risks for the Upper Salmon River Upper Mainstem spring Chinook salmon population. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.4-8. Viable Salmonid Population parameter risk ratings for the Upper Salmon River Upper Mainstem spring Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	U. Salmon Mainstem	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors.

Natal Habitat

Habitat Conditions

This population occupies the headwaters of the Salmon River, including the mainstem river and all tributaries upstream of the Salmon River's confluence with Redfish Lake Creek, including Redfish Lake Creek. The population area is bordered by the Sawtooth Mountains on the west, the White Cloud Mountains on the east, and the Smoky Mountains on the south. Most of the upper reaches of streams in this population occur in inventoried roadless areas of public land, including the Sawtooth Wilderness and the Boulder White-Clouds Wilderness. The Sawtooth National Recreation Area encompasses the entire population. Private lands are located mainly along the more fertile valley bottoms, although some private, patented mining land also exists within the watershed. Elevations within the population range from a low of 6,190 to a high of 10,750 feet (SNF 2006). The Upper Salmon River population area is approximately 348 square miles in size, 93 percent of which is under federal ownership.

A variety of human activities currently take place within the population area, including recreation, grazing, and timber harvest. Recreation, both developed and dispersed, is one of the most common activities. Developed recreation includes constructed campgrounds, interpretive historic and scenic sites, and trails. Dispersed recreation consists of day use and camping activities at undesignated and undeveloped sites. Roads provide access to some of these sites. Road densities within the population boundaries at generally less than one mile per square mile of land and most roads are surfaced with native materials and located where established during settlement 100 or more years ago, often adjacent to streams (SNF 2006). An extensive system of well-maintained trails in the area also provides a variety of motorized and non-motorized opportunities. In addition, float-boating and fishing on the Salmon River are popular forms of recreation, with over 10,000 boaters and anglers using the mainstem Salmon River within the Sawtooth National Recreation Area every summer (SNRA 2014). Angling impacts present a threat to the security of spawning and incubation Chinook salmon.

While most human visitors to the population area have very little impact on habitat quality, recreation-related activities continue to impact habitat conditions in some areas. Undeveloped campsites continue to grow both in size and number. Motorized use to access these undeveloped campsites, and illegal motorized vehicle off-trail travel in some areas, have impacted vegetation and resulted in landscape scarring, compacted soils, channelized flows, and increased rates of erosion (SNF 2003, p. III-106).

Livestock grazing currently occurs on much of the public and private land within this population. On private land, livestock grazing is the exclusive agricultural land use (in contrast to lower elevation watersheds of the Salmon River basin, where irrigated crop agriculture is common). Many of the pastures on private land are irrigated with water diverted from streams located on both private and public land (SNF 2006). The condition of the riparian vegetation varies throughout the area. Several stream reaches do not currently meet U.S. Forest Service Forest Plan Standards and Guidelines for riparian vegetation due to past intensive grazing. Riparian exclosures along the main Salmon River and on tributaries such as lower Pole Creek are slowly improving bank stability (SNF 2013).

Timber harvests within this watershed are generally small operations for post and pole, personal fuelwood, or commercial sawtimber and fuelwood. The infestation of mountain pine beetle throughout

the area during the late 1990s and early 2000s lead to several forest thinning projects intended to protect the wildland/urban interface near development and communities. Nevertheless, these treatments have taken place on a relatively small percentage of the landscape.

Mining activities have occurred throughout headwaters of the population since the latter part of the nineteenth century. However, the legislation that established the Sawtooth National Recreation Area withdrew the area from additional mineral entry under the 1872 Mining Law, and directed validation of existing mining claims. The vast majority of claims present in 1972 have since been invalidated. Valid claims remain, but active mining is not currently occurring (SNF 2006).

A number of noxious weeds and exotic plants occur in the area, particularly along main road and trail corridors. Spotted knapweed and yellow toadflax are the primary species of concern and are currently found in small, scattered populations (SNF 2003, p. III-105). These invasive plants pose a threat to instream sediment levels in the Upper Salmon River and its tributaries.

The Agreement in Principle (AIP) Tech Team identified important stream reaches for Upper Salmon River Upper Mainstem spring Chinook salmon (SNF 2009a). The AIP Tech Team identified these stream reaches based on the ICTRT's intrinsic potential habitat model shown in Figure 5.4-2 (NMFS 2006), documented locations of current spawning and rearing habitat, and the Screening and Habitat Improvement Prioritization for the Upper Salmon Subbasin (SHIPUSS) (USBWP 2012).

The AIP Tech Team concluded that the most important stream reaches for spring Chinook salmon in the population area are in the mainstem Salmon River. The Salmon River mainstem provides 56 percent of current spawning habitat area, 34 percent of current rearing habitat area, and 46 percent of intrinsic potential weighted habitat area within the Upper Salmon River Upper Mainstem population. The AIP Tech Team identified the most important stream segment as the mainstem Salmon River between Redfish Lake Creek and Fourth of July Creek. This stream reach represents 28 percent of the intrinsic potential weighted habitat area in the population. The AIP Tech Team further concluded that Alturas Lake Creek is the most important tributary in the Upper Salmon River, supporting 25 percent of current spawning habitat area, 15 percent of current rearing habitat area, and 12 percent of the intrinsic potential weighted habitat area within the population. Other important tributaries for spring/summer Chinook salmon include Champion Creek, Fourth of July Creek, Cabin Creek, Vat Creek, Yellow Belly Creek, Pole Creek, Williams Creek, Gold Creek, and Redfish Lake Creek. Collectively these streams comprise 9 percent of the current spawning habitat area, 32 percent of the current rearing habitat area, and 15 percent of the intrinsic potential weighted habitat area for the population (SNF 2009a).

Similarly, the SHIPUSS report identified the upper mainstem Salmon River as important for spring/summer Chinook salmon, and classified the Salmon River from Pole Creek to Frenchman Creek as a Priority I stream (USBWP 2012). Smiley Creek, Beaver Creek, Pole Creek, Fourth of July Creek, and Huckleberry Creek were also identified as Priority I streams, while Champion Creek, Fisher Creek, Gold Creek, Williams Creek, and Boundary Creek were identified as Priority II streams. Under SHIPUSS, Priority I streams are those streams that have the potential to realize immediate, tangible benefits to fish if recovery efforts are directed toward them. Priority II streams are those streams that

will also see tangible benefits to fish as a consequence of recovery projects, but where the benefits may be less substantial or may be delayed (USBWP 2012).

Current Habitat Limiting Factors

NMFS determined the habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups.

1. Low streamflows, passage barriers and entrainment due to water diversions.

Many of the pastures on private land in the Upper Salmon River are irrigated with surface water diversions from streams (Figure 5.4-5). Some diversion ditches start on private land, whereas others start on public land and deliver the water to private land. Water diversions may affect fish by reducing instream flow and thereby reducing habitat quality and quantity, by blocking fish passage to upstream or downstream habitat, by entraining fish in unscreened irrigation ditches, and by delaying downstream migration of juveniles that must negotiate fish bypass systems. In this population, surface water diversions primarily impact spring Chinook salmon through diversion structures that block access to suitable habitat in tributaries and through reductions in streamflow.

Many of the diversions shown in Figure 5.4-5 create passage barriers to either adult or juvenile spring Chinook salmon at all or some streamflow conditions. Table 5.4-9 displays results from a Sawtooth National Forest survey of many of the diversion structures.

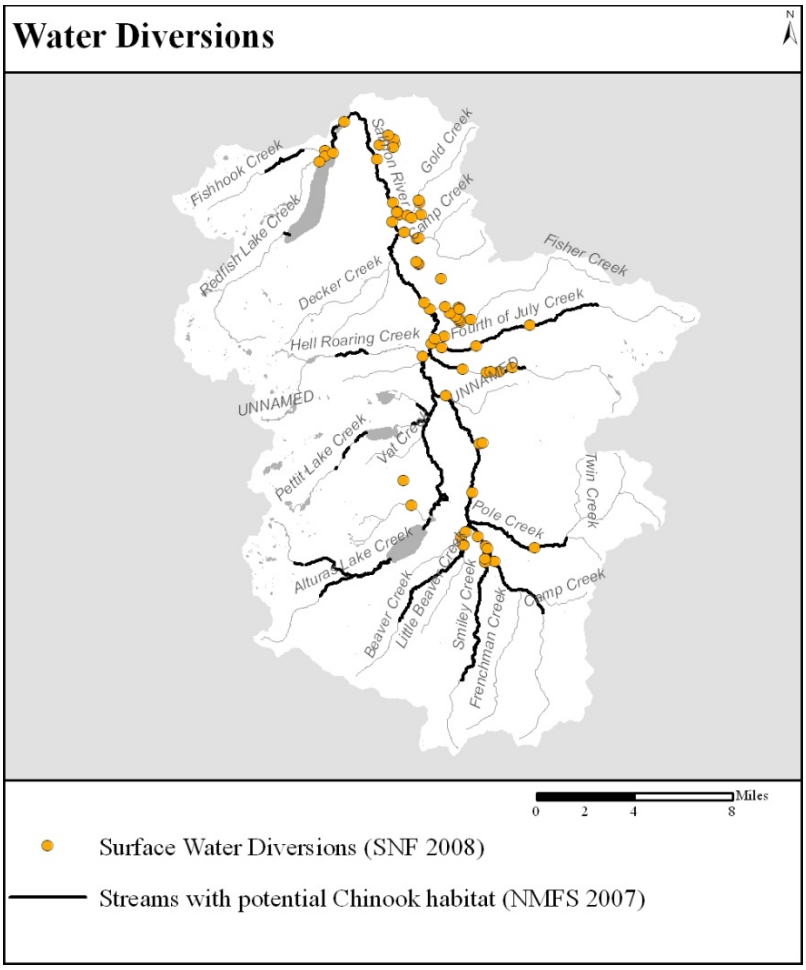

Figure 5.4-5. Surface water diversions in the Upper Salmon River Mainstem (SNF 2008).

The information presented in Table 5.4-9 shows that few of the diversion structures surveyed create complete barriers to fish passage. In most streams with surface water diversions, adult or juvenile spring Chinook salmon have been found upstream from the diversions structures, implying at least seasonal passage. In Pole Creek, a diversion (PC7) stopped upstream distribution of spring Chinook salmon and steelhead prior to 2015 when an irrigation efficiency project restored passage. Diversions on Smiley, Champion, Fourth of July, Fisher, Gold, Williams, Cleveland, and Boundary Creeks result in very low baseflows and likely create seasonal barriers to fish passage. In addition, irrigation diversions on Fisher Creek dewater the last mile of stream during the summer irrigation season in most years (SNF 2009c).

Table 5.4-9. Fish passage at diversion structures within the Upper Salmon River Upper Mainstem spring Chinook salmon population (SNF 2009b).

Stream	# Diversions/ # w/ Barrier Evaluation	Adult Passage at Low Flow	Adult Passage at Mod. Flow		Adult Passage at High Flow	Juvenile Passage at Low Flow	Juvenile Passage at Mod. Flow	Juvenile Passage at High Flow
Salmon River (Pole Creek upstream) [a/b]	5/1	VG	VG		VG	VG	VG	VG
Smiley Creek [a/b]	2/0							
Beaver Creek [a/b]	4/2	1-G, 1-B	1-F, 1-B		1-B, 1-P	2-G	2-F	1-B, 1-F
Pole Creek	1/1	G	G		G	G	G	G
Cabin Creek	1/0							
Vat Creek	1/0							
Warm Creek	1/1	VG	VG		VG	VG	VG	VG
Lost Creek [b]	2/0							
Salmon River (Alturas Lake Ck. to Pole Ck.) [a/b]	1/0		No Diversion Structure (Pump)					
Champion Creek [b]	5/3	1-VG, 2-B	1-G, 2-B		1-G, 2-B	1-VG, 1-P, 1-B	1-G, 1-P, 1-B	1-G, 2-B
Fourth July Creek [b]	3/3	2-G, 1-F	1-G, 2-F		1G, 2-B	1-VG, 2-G	1-VG, 1-G, 1-F	1-VG, 1-G, 1-B
Hell Roaring Creek	1/0							
Salmon River (Fourth July to Alturas Lake Ck.) [a/b]	1/1	1-VG	1-G		1-F	1-VG	1-G	1-F
Fisher Creek [a/b]	10/0							
Gold Creek	4/3	1-B, 1-G, 1-F	1-VG, 1-F, 1-G		1-VG, 1-B, 1-G	1-VG, 1-F, 1-G	1-VG, 2-F	1-B, 1-P, 1-F
Club Canyon Creek	2/0							
Williams Creek	3/2	1-F, 1-VG	1-G, 1-VG		1-F, 1-G	1-G, 1-VG	1-F, 1-G	1-P, 1-G
Salmon River (Redfish Lake to Fourth July Ck.) [a/b]	5/3	2-VG, 1-B	1-VG, 1-B, 1-G		1-VG, 1-B, 1-G	2-VG, 1-B	2-VG, 1-B	2-VG, 1-B
Redfish Lake Ck. [a]	3/0		No Diversion Structure (Pump)					
Fishhook Creek	2/0		No Diversion Structure (Pump)					
Boundary Creek	1/1	P	B		B	B	B	B
Cleveland Creek	2/0							
Niece Creek	2/0							
Totals:	61/21							

Key: a – some diversions have pumps and no diversion structure; b – diversions on private land; B – barrier to fish passage; P – barrier to most fish; F – barrier to some fish; G – passage as good as can be expected; and, VG – passage as good as in the natural stream channel.

Entrainment in irrigation ditches is also a problem for salmonids in the Upper Salmon River. It is estimated that approximately 10 percent or less of diversions in Chinook salmon occupied streams are screened. Fish may enter unscreened irrigation ditches and become stranded in the ditch. Fish may also become stranded by entering irrigation ditches at the start of the irrigation season when ditches are open but fish screens are not yet in place; by entering ditches through wastewater return flows; or by entering through a site where a ditch has breached due to a structural failure or to being undersized relative to the volume of water it conveys. Upon entering the hydrologically unstable irrigation system, fish are subject to dewatering and stranding in fields as well as high temperatures, reduced forage,

increased predation (Ecovista 2004, p. 58). Many diversions on the main Salmon River are screened to NMFS criteria, but diversions on tributary streams frequently lack fish screens.

Water diversions reduce the amount of flow in stream channels, which in turn, reduces water depth, water velocity, and stream width. Depending on stream morphology, habitat condition, and the magnitude of the flow reduction, these changes can reduce access to cover and off-channel habitat and impede upstream and downstream fish passage. Reduction in flow volume can also reduce the amount of drifting invertebrates available for rearing salmonids and can increase summer water temperatures. Although water diverted in this population area is primarily used to irrigate pasture (as opposed to crops), water use has historically been relatively heavy and has caused periodic drying of Fisher, Fourth of July, Champion, Pole, and Beaver Creeks, as well as the mainstem Salmon River just upstream from Alturas Lake Creek. Historically, water use also greatly reduced flow in Alturas Lake Creek and in the Salmon River mainstem downstream from Alturas Lake Creek. Due to restoration actions implemented since the ESA listing of Chinook salmon, the mainstem Salmon River, Pole Creek, Fourth of July Creek, Beaver Creek, and Alturas Lake Creek. No longer experience the acute streamflow impacts that were once commonplace. Despite these restoration projects in some reaches of the population, reduced streamflow continues to adversely affect spring Chinook salmon productivity in the mainstem Salmon River and in Fourth of July, Champion, Pole, Frenchman, and Smiley Creeks (SNF 2013). Recent work on Pole Creek has greatly improved flows in the creek.

2. Excess sediment.

The U.S. Forest Service reports localized areas of accelerated sediment delivery to streams within the population boundaries, primarily from livestock grazing, dispersed recreation, and irrigation use (SNF 2003, p. III-103). The IDEQ lists several tributaries are impaired by sediment/siltation including Camp Creek and Williams Creek. The main Salmon River and its side channels between Decker Creek and Fisher Creek (totally 8 miles) are impaired by sediment/siltation in the 2012 Integrated Report (IDEQ 2014), indicating that elevated instream sediment levels are degrading salmonid habitat in this population. Several other streams may also be experiencing impacts to salmonid habitat from excess sediment (Moulton 2008).

3. Degraded riparian and channel condition.

Riparian areas have been degraded in localized areas due to loss of riparian vegetation, resulting from grazing, stream and floodplain alteration from road building, developed and dispersed recreation, removal of beaver, and irrigation. Dead and down wood levels are low in some riparian areas due to firewood gathering. In addition, native sedge and willow species are being replaced by grass species due to livestock grazing. Fire exclusion and irrigation diversions have had the cumulative effect of reducing wet meadows, willows, and the overall amount of riparian areas (SNF 2003, p. III-105). Channel confinement and development of riparian areas along the mainstem Salmon River has caused a reduction in pools, streambank stability, and shade, and has limited salmonid access to side channel habitat (Ecovista 2004, p. 60).

Riparian conditions have improved substantially in many locations in this population, following changes in land management and particularly in grazing practices. Nevertheless, some areas of

degraded riparian conditions and lack of instream and peripheral habitat complexity persist. In lower Pole Creek, a riparian exclosure constructed in the late 1980s has led to increased bank stability in most reaches. Along the main Salmon River, livestock have been fenced off from some reaches, but other reaches remain exposed and grazing on public and private lands continues to degrade bank stability and riparian vegetation (SNF 2013).

4. Temperature

Although the Upper Salmon River Upper Mainstem population is at high elevation with a relatively cool climate, summer stream temperatures can nonetheless be suboptimal for salmonids. To some degree, water temperatures are naturally elevated as they pass through naturally wide, slow, shrub-dominated, valley reaches; however, irrigation and grazing on public and private lands has likely exacerbated these conditions through reductions in streamflow and riparian vegetation (SNF 2013). In tributaries to the main Salmon River in this population, Rothwell and Moulton (2001) found that reductions in streamflow caused by irrigation diversions led to dramatic increases in stream temperature of greater than 10°C. In the main Salmon River, noticeable increases in summer stream temperatures occurred around the inputs of tributaries affected by diversions (Rothwell and Moulton 2001).

5. Passage barriers at road stream crossings.

Year-round or seasonal barriers exist at many culvert road crossings. Culvert inventories conducted by the Sawtooth National Forest in 2003 and 2007 revealed that passage is impeded in many important tributaries within the population at certain flow conditions (Table 5.4-10; SNF 2009b). Most barriers occur in tributary headwaters (i.e., Smiley Creek, Little Beaver Creek, Twin Creek, and Vat Creek), affecting minor amounts of historic spring/summer Chinook salmon habitat. Culverts on Fisher Creek, Cabin Creek, and Mays Creek, however, block access to most of the potential habitat in those streams. A culvert in Fisher Creek and another in Williams Creek are considered partial barriers to fish passage (SNF 2009b).

Table 5.4-10. Miles of habitat blocked or partially blocked by culverts in the Upper Salmon River Upper Mainstem spring Chinook salmon population (SNF 2009c).

Stream	Miles Completely Blocked	Miles Partially Blocked
Frenchman & Headwaters Salmon River	0.32[a]	-
Smiley Creek	1.43[b]	1.77[a]
Beaver Creek	1.94[c]	-
Cabin Creek	2.55[b]	-
Vat Creek	0.78[a]	-
Mays Creek	1.75[b]	-
Fisher Creek	0.64	4.05[b]
Williams Creek	-	2.63[b]
Boundary Creek	1.36[a]	-
Totals:	11.02	14.32

Key: a – Stream segment not delineated above culvert; b - Miles not taken to the end of the stream; c – Historic habitat for Chinook salmon and steelhead not delineated in Little Beaver Creek.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Upper Salmon River Upper Mainstem watershed.

1. Riparian area degradation from dispersed recreation. Monitoring sites where recreation use is concentrated, and modifying or discontinuing use of these sites if riparian habitat deteriorates, will likely minimize impacts.
2. Excess sediment from OHV use. Assuring that OHV use is restricted to existing U.S. Forest Service roads and trails will likely minimize impacts.
3. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density and result in increased erosion and sediment levels.
4. Beaver removal. Reduction or removal of the North American Beaver (*Castor canadensis*) has a negative effect on aquatic and terrestrial ecosystems. Programs are needed to encourage beaver activity in areas with reduced human conflict, or to create structures that mimic beaver habitat in areas of potential conflict.
5. Angling impacts. Angling pressure can affect the security of spawning and incubation habitats.
6. Aquatic invasive species. These species are a pronounced threat to Chinook salmon in the MPG because of the presence of major boating areas and the headwater location.

Hatchery Programs

The Sawtooth Hatchery is located within the Upper Salmon River Upper Mainstem population and releases fish into the population from below the hatchery. These releases are outside the natal habitat area for the population and may have reduced genetic adaptiveness of the Upper Salmon River Upper Mainstem spring Chinook salmon population; however, hatchery fish releases occur as smolts and outmigration occurs rapidly from release to the Lower Granite Dam, averaging 9 days. Hatchery fish interactions with natural-origin fish are limited to smolt immigration during high flows, with food and space not likely limiting viability. Also, the majority of the spawning (90% of the intrinsic potential)

area within this population is located above the Sawtooth Hatchery weir, which allows management of the composition of hatchery and wild spawners for the majority of the population. Additionally, the Sawtooth Hatchery program was sourced from Chinook salmon from the Upper Salmon River and the hatchery program was integrated prior to the initiation of mass marking. The program is transitioning back to an integrated programs using the HSRG recommended stepping stone methodology.

The Upper Salmon River Upper Mainstem population served as a treatment area for the Idaho Supplementation Studies, designed to test the impacts of supplementation on population fitness (Venditti et al. 2015). During the research project, three phases were conducted. The pre-treatment period allowed no hatchery-origin adults above the weirs from 1992 to 1995. The treatment period released hatchery- and natural-origin fish above the weirs from 1996 to 2007. The post-treatment period allowed few or no hatchery fish above the weirs from 2008 to 2012. The transition to the stepping stone supplementation program began in 2013 after the completion of the Idaho Supplementation Studies project's post-treatment period. From the time the hatchery program began in the mid-1980s to present time, the proportion of wild spawners observed at the population scale has ranged from 100 percent to a low of 35 percent and averaged 75 percent since the beginning of the program (1986 to present). Van Doornik (et al. 2011) evaluated genetic stability of Salmon Basin Chinook salmon populations and found stable levels of allelic richness and heterozygosity over four generations (1992 to 2007) for Sawtooth Hatchery and wild fish in the Upper Salmon River Upper Mainstem population (samples from the Decker Flats upstream of the Sawtooth Weir) and low levels of differentiation between the hatchery and wild components of the population.

Hatchery-related limiting factors and threats for the population are further discussed at the MPG level in Section 5.4.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River pose a threat to Upper Salmon River Upper Mainstem natural-origin spring Chinook salmon. Lower and upper Salmon River fisheries target hatchery-origin spring Chinook salmon returning to the area. Tribal fisheries also occur. States and tribes manage fisheries in the Columbia River estuary, mainstem Columbia River, Snake River and Salmon River to focus on different stocks and populations while adhering to the guidelines and constraints of the Endangered Species Act administered by NMFS, the Columbia River Compact, and management agreements negotiated between the parties to *U.S. v. Oregon*. Consequently, mortality rates on natural-origin Snake River spring/summer Chinook salmon are influenced by a combination of laws, policies, and guidelines. Overall, this management has reduced mortality rates on natural-origin Snake River spring/summer Chinook, with rates generally below 10 percent. The rates have increased in recent years, however, due to the continued large returns of hatchery spring Chinook salmon to the Columbia River basin that have triggered increased allowable harvest rates under the abundance-driven sliding-scale harvest rate strategy guiding annual fishery management.

Fishery-related limiting factors and threats for Upper Salmon River Upper Mainstem spring Chinook salmon and other Upper Salmon River populations are discussed at the MPG level in Section 5.4.3.3.

Predation/Competition

Non-native brook trout are found within virtually every stream system in the Upper Salmon River basin (SNF 2006). At a selection of sites in the Salmon River basin, Levin et al. (2002) found that juvenile spring Chinook salmon survival in streams without brook trout was nearly double the survival in streams with brook trout.

Brook trout may impact spring/summer Chinook salmon through several mechanisms. Brook trout are known to aggressively defend feeding territories and outcompete anadromous salmon (Hutchison and Iwata 1997). In some studies, competition between brook trout and Chinook salmon parr appears related to the larger size of brook trout affecting growth rates and survival of juvenile salmon (Meekan et al. 1998; Einum and Fleming 2000), with brook trout outcompeting juvenile Chinook salmon for limited food and habitat. On the other hand, Macneal et al. (2009) compared feeding behaviors and aggressive encounters between brook trout and juvenile Chinook salmon in a watershed in the South Fork Salmon River basin and found minimal competition for prey. Brook trout may also impact spring/summer Chinook salmon through direct consumption; brook trout are voracious predators, frequently consuming juvenile salmonids (Sigler and Sigler 1987, as cited in Levin et al. (2002); Karas 1997). Brook trout also appear to be an important predator of salmon eggs (Karas 1997). For example, salmon eggs have been found to represent between 38 and 95 percent of the diet of brook trout in a tributary to Lake Ontario (Johnson and Ringler 1979; Johnson 1981). Finally, increasing numbers of brook trout could be in part due to replacement, with brook trout becoming more established in areas historically occupied by native species as the native species' population numbers fall and habitat conditions worsen (Dunham et al. 2002).

Currently, brook trout occupy areas in the mainstem Salmon River and in almost every one of its tributaries. Therefore, removal of brook trout may be key to long-term improvements in spring/summer Chinook salmon abundance and productivity in the Upper Salmon River Upper Mainstem population. However, as reported by Dunham et al. (2002), options for controlling brook trout invasions are limited and typically focus on direct removal (e.g., removal by electrofishing, selective angling, trapping, or toxicants). The authors caution that brook trout removal efforts can have mixed success, often resulting in injury or mortality to native fish species (Dunham et al. 2002).

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions target limiting factors and are intended to increase the capacity for natural smolt production in the watershed and improve Chinook salmon productivity rates.

1. For all surface water diversions, pursue adequate bypass flows to support all spring/summer Chinook salmon life stages that would likely be present, provide for upstream and downstream fish passage, and are equipped with fish screens and juvenile bypass systems that meet NMFS criteria.
    a. Improve streamflows in the mainstem Salmon River and improve streamflows and connectivity of tributaries that are currently disconnected from the mainstem Salmon River due to water diversions. Strategies include:

(1) Construct bypass structures, siphons, ditch consolidations, or other infrastructure that is designed to convey adequate tributary streamflow to the mainstem Salmon River and to provide fish access to tributary habitat.

(2) Improve efficiency of water conveyance systems for diverted water such that some water can be put back into the stream channel in flow-impaired reaches.

(3) Permanently secure water through water transactions such as conservation agreements, water leases, or water purchases. Relative to other populations in the MPG, the opportunity to implement this action is high.

(4) Stagger the timing of diversion operations to minimize impacts on flow.

(5) Develop and implement hydrologic modeling tools, such as MIKE BASIN, to accurately characterize impacts and help develop solutions to streamflow issues. MIKE BASIN is an integrated water resource management and planning computer model that integrates GIS with water resource modeling.

b. Reduce stranding or harm to fish that enter diversion ditches. Strategies include:

(1) Improve structural integrity of diversion ditches or pipes.

(2) Improve instream habitat conditions so that fish are less likely to seek refuge in irrigation ditches.

(3) Encourage annual irrigation district meetings to develop and refine management strategies for diversion structures in order to reduce harm to fish. Implement a program where water managers meet with irrigators to ensure that ditches are managed to minimize impacts on fish.

2. Reduce sediment delivery to streams. Reduce road-related sediment delivery in southern and eastern drainages of the population, including Fisher Creek, upper Salmon River, Fourth of July Creek, Pole Creek, Frenchmen Creek, Smiley Creek, and Beaver Creek; Fisher Creek and the upper Salmon River headwaters are the priorities. Also reduce sediment delivery associated with livestock grazing, dispersed recreation, and irrigation use.

3. Restore degraded riparian, peripheral, and floodplain area processes and functions through the following actions:

a. Reduce grazing impacts to streams and riparian habitat. Control livestock access to encourage re-establishment of native riparian vegetation.

b. Plant or provide for regrowth of natural riparian woody and hydric vegetation composition, age classes, structure, and pattern in order to restore and maintain streambank stability and reduce width-to-depth channel ratios.

c. Conduct land acquisitions and riparian conservation easements.

d. Improve floodplain connectivity and habitat complexity for side channel rearing habitat.

e. Improve instream, peripheral, and floodplain habitat complexity and riverine function to impacted areas upstream to the headwaters of the Salmon River.

f. Encourage beaver activity and beaver analog structures where appropriate.

4. Remove human-caused migration barriers at stream road crossings that are blocking access to potential spring/summer Chinook salmon habitat.

Implementation of Habitat Actions

Implementation for the habitat section of the recovery plan for this population will occur primarily through efforts of Upper Salmon Basin Watershed Program partners, which include staff from state, federal, and local natural resource management agencies, more than 75 ranchers in the upper Salmon River basin, private interest groups, and others. On federal lands, following the U.S. Forest Service Land and Resource Management Plan should largely provide the protection needed for this population. For example, the Sawtooth National Forest has planned barrier replacements as part of their long-range plan, and some of these projects may occur in the next 10 years. In addition, in the Sawtooth National Recreation Area, the U.S. Forest Service places restrictions on float-boating on the Salmon River each summer in August and September, downstream from the Sawtooth Fish Hatchery, to minimize disturbance of spawning spring/summer Chinook (SNRA 2014).

Active restoration to implement this recovery plan will also likely occur through the U.S. Forest Service and Upper Salmon Basin Watershed Program partners. Together, these groups provide an excellent representation of private, state, and federal entities that manage land and other resources within the watershed. These entities have created an effective process for working together, providing technical reviews of proposed projects, and working with interested parties to accomplish these conservation projects. The groups have a strong record of implementing water quality and salmon conservation and recovery projects, including removal and screening of water diversions, reducing water diversions and increasing irrigation efficiency, fencing riparian areas, and increasing stream structure and complexity.

Table 5.4-11 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not represent a full list of projects. Specific projects are planned continuously based on available funding and established priorities. During plan implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.4-11. Habitat Recovery Actions Identified for the Upper Salmon River Upper Mainstem Spring/Summer Chinook salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Streamflow	Protect 14 cfs flow	BPA Contract # 1994-015-00: Idaho Fish Screening Project Restoration-Lemhi BPA Contract # 2002-013-01: Water Entity- Water Transaction Program BPA Contract # 2007-268-00: Idaho Watershed Habitat Restoration-Custer District BPA Contract # 2007-399-00: Upper Salmon Screen Tributary Passage	N/A
Barriers	Address 5 barriers		
Riparian Conditions, Sediment, and Temperature	Improve 2 riparian miles Improve 6.4 riparian acres Improve 2 road miles	BPA Contract # 2008-602-00: Upper Lemhi River-Restoration BPA Contract # 2008-608-00: Idaho MOA/Fish Accord Water Transactions	N/A

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 4.2-11 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined (TBD).

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs may present. For the Upper Salmon River Upper Mainstem population, the strategy aims to transition the hatchery program to provide for harvest and conservation in a manner that reduces ecological and genetic risks. The strategy includes developing gene flow standards through the HGMP process. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon and catch and release impacts in recreational fisheries. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Predation Recovery Strategy and Actions

The following action is intended to improve productivity rates for Upper Salmon River Upper Mainstem spring/summer Chinook salmon by addressing impacts from brook trout.

1. Manage brook trout populations to reduce brook trout abundance and distribution.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.4.6 Pahsimeroi River Spring/Summer Chinook Salmon Population

The Pahsimeroi River spring/summer Chinook salmon population is currently not viable, with a high abundance/productivity and moderate spatial structure/diversity risk status. The population primarily supports a summer-run timing, but may have once included spring-run fish. Its proposed status is Viable, which requires a minimum of low abundance/productivity risk and moderate spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Viable

Population Status

This section compares the Pahsimeroi River population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The ICTRT (2003) distinguished Pahsimeroi River spring/summer-run Chinook salmon as an independent population based on geographic isolation from other populations, genetic differentiation, the substantial drainage area of the basin, and a historical estimate of 2,500 spawners. The major adult life history strategy is summer-run timing, although the population may have once included spring-run fish.

Current spring/summer Chinook salmon distribution within the watershed is limited to the lower Pahsimeroi River mainstem and to lower Patterson Creek, which runs parallel to the lower Pahsimeroi and is locally known as Big Springs Creek. In both the Pahsimeroi River and Patterson Creek, spring and summer Chinook salmon distribution ends at Hooper Lane downstream from Meadow Creek. Streamflows in the Pahsimeroi River directly above Hooper Lane are insufficient to support spring/summer Chinook salmon spawning and rearing and create an upstream migration barrier (Trapani 2002).

Historic distribution of Chinook salmon may have included several tributaries to the Pahsimeroi. A NMFS model of potential spring/summer Chinook salmon habitat for the Interior Columbia Basin, based on stream characteristics such as gradient and width, suggests that upper Patterson, Big, Goldberg, Burnt, and Doublespring Creeks, and the upper reaches of the Pahsimeroi River, could support spring/summer Chinook salmon (Cooney and Holzer 2006)[4] (see Figure 5.4-6). However, this habitat model may not adequately account for the unusually deep alluvial slopes of the Pahsimeroi

[4] For a detailed description of model methods and assumptions, see http://www.nwfsc.noaa.gov/trt/trt_documents/appendix_c_viability_3_15_2007.pdf. Also available from NMFS Boise Habitat Office upon request.

River basin. Due to the geology of the Pahsimeroi basin, many tributaries have high levels of subsurface flow and may have been intermittent historically, with insufficient natural streamflow to support salmon. For example, Meinzer (1924) reported that Doublesprings Creek had very little surface flow for its size and no distinct stream channel at the mouth, apparently due to underlying geology. Doublesprings Creek therefore likely did not support Chinook salmon historically. For the other tributaries, all the water is currently withdrawn for irrigation of fields, making it difficult to assess whether or not the streams would have connected to the mainstem Pahsimeroi River historically and been accessible to Chinook salmon.

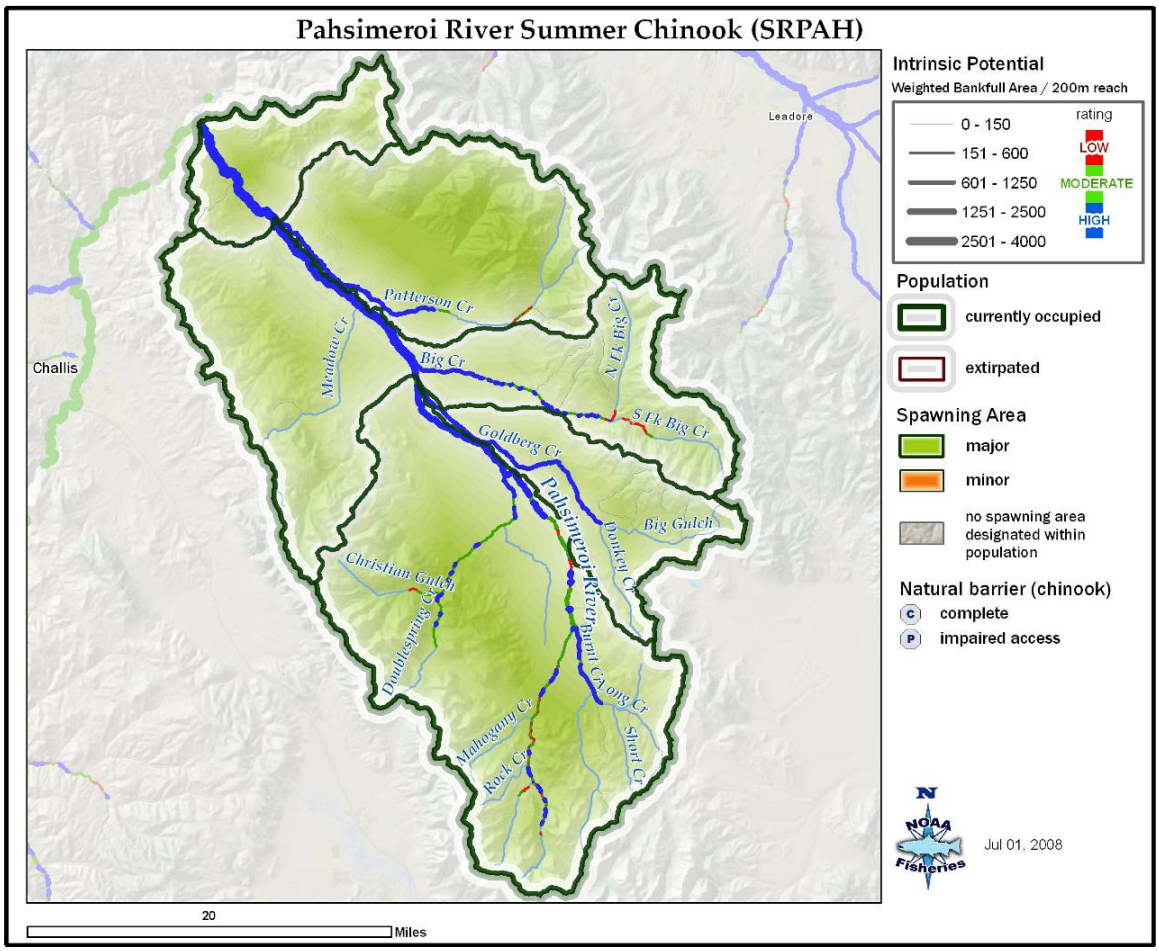

Figure 5.4-6. Pahsimeroi River Summer Chinook Salmon Population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

IDFG operates a hatchery program in the Pahsimeroi River, with hatchery facilities and a permanent weir less than a mile from the confluence with the Salmon River. The hatchery is funded by Idaho Power Company as mitigation for fishery losses related to construction of hydroelectric dams on the Snake River in Hells Canyon. The hatchery's Chinook salmon stock was established with fish indigenous to the Pahsimeroi River. Hatchery Chinook salmon smolts are released into the lower Pahsimeroi River annually, and until recently a portion of the hatchery-origin adults returning to the Pahsimeroi were allowed to spawn in the river upstream from the hatchery. The Pahsimeroi River is part of the Idaho Supplementation Studies. In 2006, the ISS entered its third phase during which only

natural-origin fish are allowed to spawn in river. No hatchery-origin adults have been released in the Pahsimeroi River to spawn upstream from the weir since 2005.

Abundance and Productivity

The Pahsimeroi River population is classified as a Large-size population. To achieve viable status, it needs to attain a mean minimum abundance of 1,000 natural-origin spawners at a productivity of 1.58 recruits per spawner. In contrast, the recent (2005-2014) 10-year geometric mean adult spawner abundance for the Pahsimeroi River spring/summer Chinook salmon population is 286 natural-origin fish. The recruit-per-spawner geometric mean productivity estimate is 1.37, less than the 1.58 productivity required at the minimum abundance threshold (NWFSC 2015).

The ICTRT developed a viability curve for population that shows minimum combinations of current natural-origin abundance and productivity that correspond to a particular risk level. As seen in Figure 5.4-7, a proposed risk level can be achieved with various combinations of abundance and productivity. For the Pahsimeroi River population, the proposed viable status can be attained with any combination of abundance and productivity that is above the green line. The current abundance/productivity risk for the population is high.

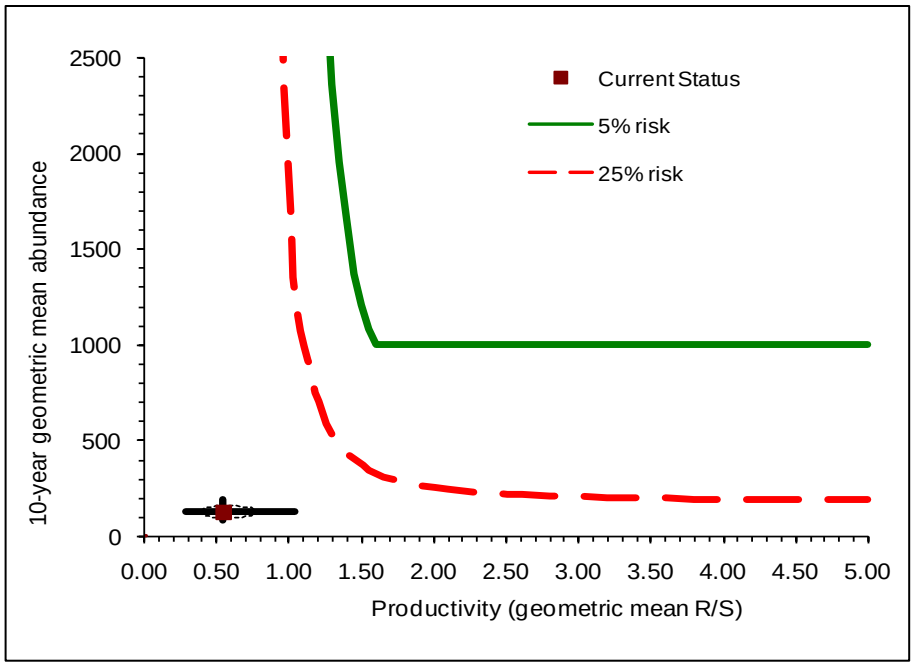

Figure 5.4-7. Pahsimeroi River summer Chinook salmon population current abundance and productivity compared to the ICTRT viability curve for Large-size populations. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Spatial Structure

The population consists of five major spawning areas: Lower Pahsimeroi, Middle Pahsimeroi, Upper Pahsimeroi, Patterson Creek, and Goldberg Creek. The ICTRT delineated major spawning areas based on the NMFS (2006) intrinsic potential habitat model, described above, which may overestimate the extent of historical tributary habitat. The number and proximity of spawning areas in the Pahsimeroi

drainage would result in a low risk rating for spatial structure if all were currently occupied. However, the Upper Pahsimeroi and Goldberg Creek major spawning areas are unoccupied and only a small part of the Middle Pahsimeroi major spawning area is accessible to spawning and rearing spring/summer Chinook salmon. Streamflow in the Pahsimeroi River mainstem is insufficient to support anadromous fish upstream above Hooper Lane (Trapani 2002), blocking access to the Upper Pahsimeroi River and Goldberg Creek. This substantially reduces the population's spatial structure and resilience to environmental variability and results in a moderate risk rating for spatial structure. A moderate spatial structure risk rating is adequate for the population to attain the proposed overall status; however, access to more habitats may be necessary to lower abundance and productivity risk.

Diversity

The diversity risk rating is high for this population based on: (1) lack of genetic variation from hatchery fish, (2) the high proportion of naturally spawning hatchery-origin fish, and (3) selective changes in juvenile migration timing caused by the hydropower system (ICTRT 2010). Lack of genetic variation from hatchery fish is due to the history of the Pahsimeroi River hatchery. All Pahsimeroi River returning adults were captured at the weir over two periods (1975-1976 and 1981-1985) to establish the broodstock for the hatchery. Beginning with the 1986 return year, a portion of the total hatchery return was released upstream of the weir into natural spawning areas. Given the fact that the entire run was taken into the hatchery program in the brood years contributing to returns in 1985-1989, returns of Chinook salmon to the Pahsimeroi River are assumed to be 100 percent hatchery-origin for that period. Hatchery-origin spawners averaged 51 percent of the total from 2001-2005, but starting in 2006 no marked hatchery-origin adults have been released past the weir (ICTRT 2010).

Selective pressures on juvenile migration timing are also creating diversity risk. Studies conducted by the IDFG indicate that the Pahsimeroi River spring/summer Chinook salmon population includes yearling and subyearling out-migration components. Copland and Venditti (2009) found that Pahsimeroi River subyearling migrants may be the more productive juvenile life history strategy. However, there are no records of tagged subyearling smolts returning from the Pacific Ocean, suggesting that this juvenile life history strategy is being eliminated in the mainstem river migration corridor.

A diversity risk of at least moderate is necessary for the population to achieve its overall proposed status. At present, the primary factor leading to a high diversity risk for the Pahsimeroi River spring/summer Chinook salmon population is genetic structure. This is most likely the result of the use of out-of-basin stocks in the 1980s and of all the returning spawners being taken by the hatchery for one complete brood cycle of four or more years while the hatchery program established a broodstock for a long-term program. Under the current hatchery management approach, the Pahsimeroi River population could move to a moderate diversity risk rating if genetic sampling indicates a trend towards natural levels of within-population variability.

Summary

The cumulative risk rating for the Pahsimeroi River population is currently high risk. A reduction in the levels of risk related to abundance/productivity and to diversity needs to occur before the population can attain its proposed status of viable. The spatial structure risk is currently moderate and does not preclude attainment of the viability criteria for the population, but additional habitat may need to be made available for the population to improve abundance and productivity.

Table 5.4-12 summarizes the abundance/productivity and spatial structure/diversity risks for the Pahsimeroi population. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.4-12. Viable Salmonid Population parameter risk ratings for the Pahsimeroi River spring/summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	HR	Pahsimeroi River

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors.

Natal Habitat

Habitat Conditions

The Pahsimeroi River, a tributary of the Salmon River, drains an area of approximately 840 square miles. The drainage is semiarid, with most of the precipitation falling as snow in the higher elevations. The higher elevations may receive up to 30 inches (water content) per year, while lower elevations receive as little as 8 inches annually (Young and Harenberg 1973). Peak streamflows historically occurred during late May and early June with rapid snowmelt, but are now much smaller than historic peak flows because of irrigation withdrawals. The surface and groundwater system throughout the basin is highly connected (Meinzer 1924; Young and Harenberg 1973), such that streamflow can be affected by both surface and groundwater withdrawals. While most of the watershed is managed by the BLM, U.S. Forest Service or State of Idaho, the valley bottom is occupied by privately owned ranches,

so private land management has a large influence on spring/summer Chinook salmon habitat. Irrigated agriculture and cattle grazing are prominent land uses along the valley bottom.

Most tributaries are disconnected from the mainstem Pahsimeroi River by irrigation diversions, and the flow is often intermittent in the upper parts of the basin. Diverted water returns to the river via large springs near the center of the valley, so the lower Pahsimeroi River has flow year-round and high connectivity to the Salmon River. Within this lower reach, the river is a low gradient stream dominated by groundwater flow, which moderates temperature. The channel is sinuous and well developed, and has a large proportion of pool habitat. During the summer, submergent plants grow in the main channel, indicating a relatively high level of aquatic productivity, which sets the Pahsimeroi River apart from other tributaries in the Salmon River basin (Copland and Venditti 2009).

Current Habitat Limiting Factors

NMFS determined the habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups.

1. Low streamflows.

The Northwest Power and Conservation Council identified dewatering and reduced flows as one of the primary impacts on aquatic habitat quality in the Pahsimeroi River basin (NPCC 2004 p. 3-18). There are approximately 38,000 acres of irrigated agriculture in the Pahsimeroi River basin (IDWR 2011), which results in the consumptive use of approximately 57,000 acre feet of water per year. This suggests that approximately 25 percent of the total annual flow of the Pahsimeroi River is removed from the system each year. An estimated 84 percent of the farmland is irrigated with surface water diversions that directly reduce streamflow, and the remaining 16 percent of farmland is irrigated with groundwater. Groundwater pumping may lower groundwater levels and thus indirectly impact streamflow. The Idaho Power Company also holds water rights and permits for surface and ground water for operation of the Pahsimeroi Fish Hatchery (IDWR 2011).

Irrigation in the Pahsimeroi River valley started in 1870 and amount of land irrigated has increased over time (Table 5.4-13). Between 1971 and 2003, groundwater levels dropped by as much as 39 feet, possibly due to an increase in groundwater pumping. Surface water and groundwater in the Pahsimeroi River drainage appear to be closely linked (Meinzer 1924; Young and Harenberg 1973), so the Pahsimeroi River and its tributaries may be experiencing a long-term decline in streamflow due to dropping groundwater levels.

Table 5.4-13. Amount of land irrigated from surface water and ground water sources in the Pahsimeroi River drainage.

Decade	Total land (acres) irrigated from surface water sources at the end of the decade	Total land (acres) irrigated from ground water sources at the end of the decade
1870-1879	851	0
1880-1889	4,561	0
1890-1899	7,554	0
1900-1909	15,634	0
1910-1919	22,944	0
1920-1929	27,540	0
1930-1939	27,741	0
1940-1949	28,163	4
1950-1959	30,579	832
1960-1969	31,442	3,615
1970-1979	32,357	5,196
1980-1989	32,513	5,239
1990-1999	32,514	5,680

Although the lower Pahsimeroi River never completely dries, its flows are severely altered by water use. Streams in central Idaho that are not impacted by irrigation experience high flow from mid-April through mid-July and baseflow conditions for the rest of the year. Streams that are moderately impacted by irrigation experience high flow from mid-April through mid-July, very low flow in August and September, and normal baseflow conditions from October through March (Arthaud et al. 2010). In contrast, the lower Pahsimeroi River experiences lower than normal base flow from May through September and normal base flow for the rest of the year, indicating a highly modified hydrograph (Arthaud et al. 2010). Water use has essentially eliminated high spring flows (Colvin and Moffitt 2009). In spite of these dramatic impacts to the natural hydrograph, year-to-year variation in precipitation does result in variation in flow levels at the Ellis gage (RM 0.1). Since 1984, mean May flow has ranged from a low of 111 cfs in 1992 to a high of 211 cfs in 1999, allowing for an examination of juvenile spring/summer Chinook salmon survival at different streamflows.

Population productivity and abundance of Pahsimeroi River spring/summer Chinook salmon has been reduced by extensive development of water resources, which has reduced access to tributary and mainstem habitat (described above) and has reduced the amount of currently accessible mainstem habitat. In the adjacent Lemhi River, population productivity has been found to relate to streamflow experienced by rearing juveniles (Arthaud et al. 2010). Irrigation levels in the Pahsimeroi River drainage are similar to the Lemhi River drainage (48 irrigated acres per square mile in the Pahsimeroi watershed versus 55 acres per square mile in the Lemhi watershed). The lower Pahsimeroi River hydrograph is also similar to the lower Lemhi River hydrograph: the hydrograph in the Pahsimeroi River at Ellis is highly modified, with baseflow conditions prevailing throughout the irrigation season (April-September), similar to the Lemhi River at McFarland Campground. The similarities between the Lemhi River and Pahsimeroi River drainages in water use, and in flow conditions in the currently accessible spawning and rearing areas, suggest that effects of water use on spring/summer Chinook salmon are similar in the Lemhi and Pahsimeroi drainages. Furthermore, a similar relationship has

been found in the Pahsimeroi River and Lemhi River drainages for juvenile survival rates (from egg to juvenile screw trap, or "egg-trap" survival[5]) versus streamflow (Figure 5.4-8). As mean May flow increases, egg-trap survival increases, suggesting that flow in currently accessible habitat affects productivity of the Pahsimeroi River spring/summer Chinook salmon population. For spring/summer Chinook salmon populations in semi-arid systems with highly modified hydrographs, such as the Lemhi and Pahsimeroi drainages, population abundance and productivity would likely be improved by increasing streamflow for rearing juveniles (Arthaud et al. 2010). In the Pahsimeroi River drainage, the relationship of egg-trap survival rate to streamflow suggests that increasing rearing flow in the currently accessible lower mainstem river will increase population productivity.

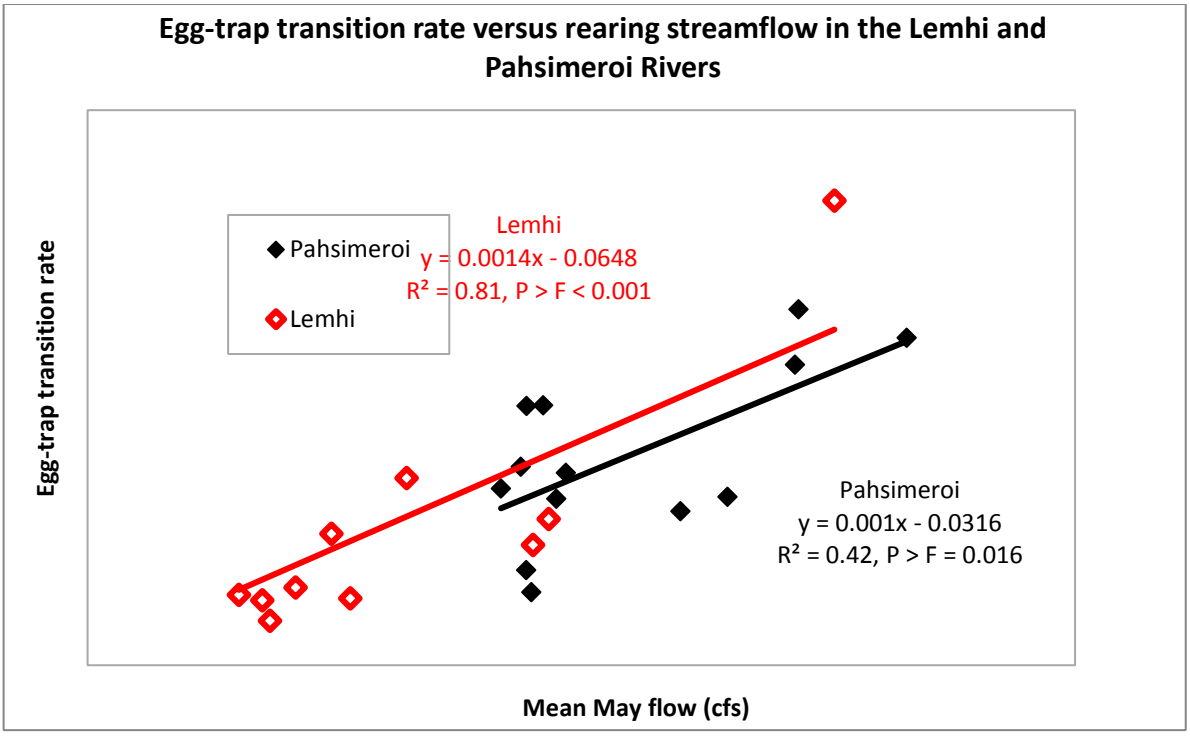

Figure 5.4-8. Egg-trap transition rate versus early rearing streamflow in the currently occupied spawning and rearing areas of the mainstem Lemhi and Pahsimerio Rivers. Egg-trap transition rate is based on the estimated number of juveniles migrating past the Lemhi weir juvenile trap in the Lemhi River, and the juvenile trap at the Pahsimeroi hatchery weir in the Pahsimeroi River. Flow was measured at the McFarland Campground gage in the Lemhi River and at the Ellis gage in the Pahsimeroi River.

The relationship between streamflow and juvenile survival in the Pahsimeroi River could be driven by a variety of factors. Growth and survival of juvenile salmonids is related to streamflow (Nislow et al. 2004), and reducing streamflow by diverting water reduces food availability and growth of juveniles (Harvey et al. 2006). Juvenile salmonids also require access to cover and are rarely found more than a meter from escape cover (Hardy et al. 2006; Holecek et al. 2009). As flows decrease, availability of

[5] Juvenile Chinook salmon are captured at the Lemhi River and Pahsimeroi River screw traps as subyearling smolts, summer parr, fall parr, and yearling smolts, as described by Copeland and Venditti (2009). These life history types were combined to estimate cohort abundance. Because the time period used to estimate juvenile abundance extended over most of a year, egg-trap survival is actually a combination of survival and migration timing, and might best be described as egg-trap *transition rate*. However, egg-trap survival rate in the Lemhi River was a good predictor of egg-smolt and egg-adult survival rates (Arthaud et al. 2010).

escape cover decreases, reducing the amount of habitat that can be used by juvenile salmonids (Hardy et al. 2006). The relationship between lower Pahsimeroi River flow and population productivity is therefore likely driven by food availability and access to escape cover for juveniles rearing in the stream channel. However, the lower Pahsimeroi River also has an abundance of off-channel habitat that could be accessed by juvenile salmonids in wet years, so the relationship might be partly driven by increased lateral connectivity with increased flow. Regardless of the mechanisms driving the flow-survival relationship, increased productivity in the currently accessible spawning and rearing habitat will be needed to achieve the population's minimum productivity and abundance.

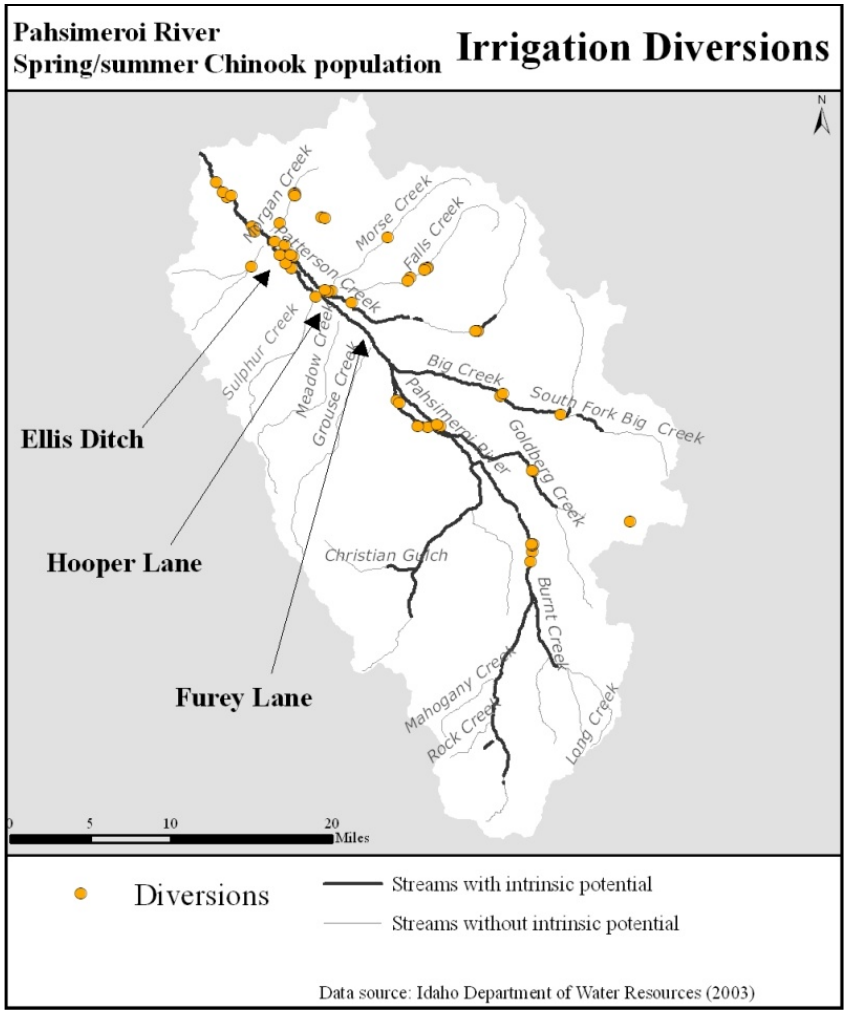

Figure 5.4-9. Surface water diversions, with local landmarks.

2. Passage Barriers and Connectivity.

All tributaries besides Sulphur Creek are disconnected from the mainstem Pahsimeroi River, and streamflow is often intermittent in the upper Pahsimeroi River. Irrigation diversions remove all surface flow from most tributaries. If the diversions were not in place, some tributaries might still be disconnected from the mainstem Pahsimeroi River in late summer due to streamflow moving subsurface across the deep alluvial slopes of the valley. Figure 5.4-9 shows surface water diversions in the watershed, along with local landmarks.

Migration barriers are caused by water diversion structures and by low streamflow or dry channels. These barriers preclude spring and summer Chinook salmon from using spawning and rearing habitat in the middle and upper Pahsimeroi River, Big Creek, Goldberg Creek, and many smaller tributaries. Morgan Creek, for example, has the potential to provide Chinook salmon rearing habitat if reconnected to the mainstem. The reduction in accessible habitat caused by migration barriers has reduced the productivity and abundance of the Pahsimeroi spring/summer Chinook salmon population. Migration barriers also adversely affect the population's spatial structure.

There is some uncertainty in the Pahsimeroi River watershed over where surface flow could feasibly be restored to allow fish access to more habitat. Currently, the mainstem Pahsimeroi River dries below Furey Lane (RM 17.8) in summer due to surface water diversions and flows going subsurface. This reach below Furey Lane, where flow goes subsurface, has been described as a "natural" sink. However, as late as the mid-1920s the Pahsimeroi River had perennial flow through this reach and up to Goldberg Creek (RM 26.4), in spite of approximately 25,000 acres being irrigated at that time (Meinzer 1924). Reconnection of the mainstem Pahsimeroi River through this reach may therefore be possible.

Most of the tributaries upstream from Goldberg Creek are currently connected to the mainstem Pahsimeroi River and have surface flow year round (although Chinook salmon are blocked from accessing these tributaries due to the dry reach in the mainstem Pahsimeroi River). Most tributaries downstream from Goldberg Creek are dry in their lower reaches for most of the irrigation season, and many have been completely disconnected from the mainstem Pahsimeroi River for many years. In the mid-1920s, almost no surface water from tributaries reached the lower stretches of the Pahsimeroi River after spring flooding (Meinzer 1924). Colvin and Moffit (2009) use an analysis of ditch locations to suggest that, at the time of ditch construction, some tributaries were likely already disconnected from the mainstem Pahsimeroi River during summer low flows, due to natural sinks in the water table. Due to the geology of the Pahsimeroi River valley, many of the smaller tributaries were likely intermittent historically. The lower reaches of larger tributaries may have had low flows, without being completely disconnected from the mainstem, or may have been connected in early summer, allowing Chinook salmon access to tributary habitat before the streams became disconnected during low flow periods.

Tributaries with potential for reconnection include the upper Pahsimeroi River mainstem (and its tributaries), Big Creek, Patterson Creek, Falls Creek, Morse Creek, and Morgan Creek. Most of the streams on the west side of the valley quickly infiltrate into the substrates and do not even reach the valley floor. Sulphur Creek is an exception on the west side of the valley in that it currently has intermittent connection to the mainstem and may be a good candidate for complete perennial reconnection.

3. Degraded riparian conditions, channel form, and water quality.

Water quality and channel form in the Pahsimeroi River watershed have been impaired, largely due to poor riparian conditions. Streambank erosion has contributed to high levels of instream sediment, and lack of riparian vegetation and shade has increased stream temperatures. More than half of the drainages in the Pahsimeroi River basin have less than satisfactory riparian vegetation conditions,

based on stream functionality and plant community-type assessments. Most of these altered riparian communities are in the lower portions of the watershed (NPCC 2004, p. 3-18). Degradation of riparian conditions is due both to livestock grazing and to reduced streamflows from irrigation withdrawals.

Extensive collaboration efforts in recent years have resulted in on-the-ground restoration projects targeting degraded riparian processes and function. Most of the efforts have occurred on privately owned stream reaches downstream of Hooper Lane. These actions have likely improved conditions at site scales, but restoring riparian vegetative communities and functional processes can take decades and information is still needed regarding the larger habitat improvements due to these efforts. The broad level of historical impairment and general consensus of area experts suggests that extensive impairment remains in the Pahsimeroi River basin and continued efforts are needed.

Excess sediment. As indicated in IDEQ's 2012 Integrated Report (IDEQ 2014), many stream reaches in the Pahsimeroi watershed have high levels of fine sediment. Fine sediment can harm Chinook salmon and their habitat by smothering redds and spawning gravels, filling in pools used by juveniles for cover, or reducing the availability of aquatic insects. Increased stream bank erosion from overgrazing within the riparian vegetation zone is the largest source of sediment into the Pahsimeroi River (IDEQ 2001a). The primary sources of sediment from stream bank erosion are above Hooper Lane, affecting the reaches below this point that are occupied by spring/summer Chinook salmon. Other sources of sediment in the Pahsimeroi River basin are from roads, legacy mining, and legacy forestry (IDEQ 2001a).

IDEQ's TMDL for sediment in the Pahsimeroi River prescribes a reduction in streambank erosion and anticipates that this reduction will result from an improvement in riparian vegetation density and structure (IDEQ 2001a). Instream sediment targets for the Pahsimeroi River remain at 80 percent streambank stability and less than 28 percent of the total streambed particle volume for subsurface fine sediment (IDEQ 2013). An increase in riparian vegetation should help armor stream banks, reduce lateral recession, trap sediment, and reduce the erosive energy of the stream, which should reduce sediment loading. In reaches that are down-cut, or that have vertical erosive banks, continued erosion may be necessary to re-establish a functional floodplain that would subsequently be colonized with stabilizing riparian vegetation. This process could take many years. The TMDL to cover the tributaries will be developed in the future.

Elevated water temperatures. Water temperatures for some stream reaches in the Pahsimeroi River exceed State standards for spring/summer Chinook salmon (IDEQ 2001a; 2013). IDEQ (2001a) reports stream temperatures five degrees Celsius greater than the State standard during the spawning season in 1999. Elevated temperatures in the Pahsimeroi are likely caused by lack of riparian vegetation and reduced streamflows. Improvement of riparian vegetation density, vigor, and structure would reduce the width of stream banks and increase stream shading, which would reduce stream heat loading. Irrigation diversions can cause increased temperatures in two ways: by reducing streamflow volume and thus reducing the temperature buffering capacity of the streams, and by delivery of heat loading from irrigation return water. It is expected that improvement of riparian vegetation density and structure will help reduce temperatures in the future (IDEQ 2001a).

Heavy metals contamination. A third potential water quality concern is heavy metals contamination from historic mining. The Ima Mill on Patterson Creek processed tungsten ore from area mines from the early 1900s until 1957. The waste materials from this refining process include concentrated metals, such as lead and zinc, which could pose a threat to humans and wildlife, but are relatively minor in extent (BLM 2004a). Through its Abandoned Mine Lands program, the BLM has taken steps to stabilize tailings and minimize the transport of sand-sized tailings to Patterson Creek (BLM 2004a). In 2012, BLM conducted core sampling of tailings to determine if heavy metals were migrating through the tailings and therefore might pose a threat to water quality (BLM 2012). Following the 2012 tailings investigation, additional surface and groundwater sampling efforts were completed by BLM in 2013. These efforts concluded that although groundwater discharges coming from the mine workings had anomalously high metals concentrations, sampling of Patterson Creek downstream of the point where those groundwater sources discharge to the creek demonstrated that Idaho Surface Water Quality Standards for aquatic life were not being exceeded in Patterson Creek.

The Patterson Creek drainage is one of the estimated five historical major spawning areas for the population. However, a combination of irrigation withdrawals and natural infiltration across the alluvial fan have disconnected upper Patterson Creek from its lower reaches. The mill site is just upstream from the alluvial fan, such that Chinook salmon cannot currently access this area. High levels of dissolved metals in the surface water could limit spring/summer Chinook salmon spawning and rearing in the historical Patterson Creek major spawning area; however, the 2013 BLM water quality results suggest that the risk of surface water contamination may be low.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Pahsimeroi River watershed.

1. New water diversions and wells. Instream flows are already low due to irrigation withdrawals and new surface or groundwater development could further threaten spring/summer Chinook salmon habitat.
2. Floodplain development. Residential development in floodplains and riparian zones can lead to bank instability, loss of riparian vegetation, and loss of floodplain function.
3. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density. Annual grasses, such as cheat grass, can alter the fire regime allowing for more frequent and larger fires.
4. Loss of beaver. Reduction or removal of beaver has negatively affected aquatic and terrestrial ecosystems. Programs are needed to encourage beaver activity in areas with reduced human conflict, or the building of structures that mimic beaver activity in areas where potential conflict exists.

Hatchery Programs

The Pahsimeroi River spring/summer Chinook salmon population area below the hatchery receives large releases from the Pahsimeroi Hatchery. The Pahsimeroi River program was part of the Idaho Supplementation Studies. As part of this program, no hatchery-origin adults have been released in the

Pahsimeroi River to spawn upstream from the weir since 2005. The hatchery fish may compete with natural-origin fish for food and space. Hatchery-related limiting factors and threats for the population are further discussed at the MPG level in Section 5.4.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River pose a threat to natural-origin Pahsimeroi River spring/summer Chinook salmon, and to other Upper Salmon River populations. State fisheries on the Salmon River targeting hatchery-origin fish returning to the Pahsimeroi Hatchery. Tribal fisheries also occur. Overall, however, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook salmon and other ESA-listed species. Fishery-related limiting factors and threats for Upper Salmon River populations are discussed at the MPG level in Section 5.4.3.3.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

NMFS reviewed all of the information summarized above on habitat limiting factors and stream conditions and prioritized the habitat limiting factors to be addressed as part of the recovery strategy for the Pahsimeroi River population. The priority habitat limiting factors are ranked as follows:

1. Low flows reduce the amount of available habitat in the lower mainstem Pahsimeroi River and contribute to habitat connectivity problems throughout the watershed.
2. Habitat issues such as sediment, temperature and degraded riparian conditions are also problematic. As flow is restored and barriers removed, actions to implement the Pahsimeroi River TMDL and improve riparian conditions should be taken.
3. Physical barriers on the mainstem river, between the mainstem river and its tributaries, and on the tributaries themselves limit access to habitat. Barriers include irrigation diversion structures and culverts.
4. Entrainment in irrigation diversions may become an issue as more habitat becomes accessible to the fish. Fish screens may need to be installed on diversions on newly accessible habitat.

NMFS identified priority streams for habitat restoration actions in the Pahsimeroi watershed (Figure 5.4-10) starting with the information compiled by the Upper Salmon Basin Watershed Program Technical Team in 2005 in the report titled *Screening and Habitat Prioritization for the Upper Salmon Subbasin (SHIPUSS)* (USBWP 2005), which was updated in 2012. The SHIPUSS report prioritized stream reaches based on a scoring system that considered stream connectivity, stream size, and habitat and fisheries information on a weighted basis.

Under SHIPUSS, Priority I streams are those streams that have the potential to realize immediate, tangible benefits to fish if recovery efforts are directed toward them. Priority II streams are those streams that will also see tangible benefits to fish as a consequence of recovery projects, but where the benefits may be less substantial or may be delayed for quite some time (USBWP 2012). Because this report considered salmonid species other than spring/summer Chinook salmon, NMFS adjusted the SHIPUSS scores to reflect only Chinook salmon and steelhead. NMFS then cross-checked this

adjusted list of priority streams for the Pahsimeroi drainage with the NMFS (2006) model of potential Chinook salmon habitat ("intrinsic potential"). Streams with low intrinsic potential that are currently unoccupied were removed from the priority list, such as Falls Creek and the upper reaches of Big Creek. The 2012 report with an updated list of priority streams is available at: http://modelwatershed.org/resources/library/.

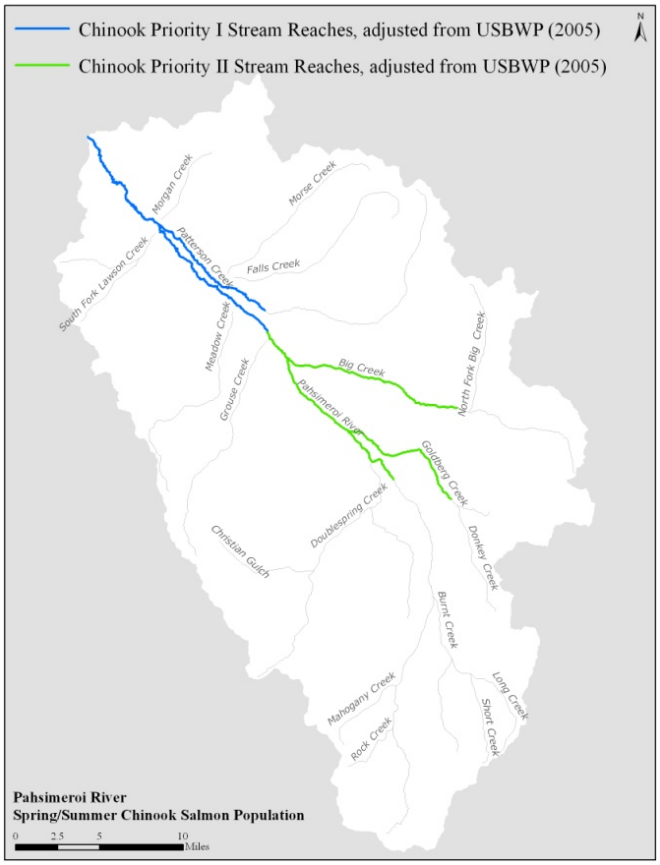

Figure 5.4-10. Priority streams for spring/summer Chinook salmon habitat restoration projects (USBWP 2005).An updated list of priority streams is available at: http://modelwatershed.org/resources/library/.

Habitat projects aimed at spring/summer Chinook salmon recovery should first be implemented on Priority I streams in Figure 5.4-10, with a secondary focus on Priority II streams. The Priority I streams are currently accessible to spring/summer Chinook salmon, meaning that habitat projects addressing limiting factors would produce immediate benefits to the population. Addressing limiting factors in streams not identified as priorities will benefit other species of salmonids and their habitat. However, except for possible flow enhancement projects in these streams that would also benefit the spring/summer Chinook salmon priority areas, NMFS does not recommend that such projects be paid for with funding sources primarily oriented to spring/summer Chinook salmon recovery.

The following strategies address the priority limiting factors described above and should be implemented on the priority streams identified by the USBWP Technical Team in 2012. These habitat actions are intended to improve productivity rates and increase the effective capacity for natural smolt production in the watershed and contribute to maintaining and restoring the VSP parameters to move the population towards its proposed viable status.

1. Increase streamflows in the mainstem Pahsimeroi River below Hooper Lane. Currently, this area supports spring/summer Chinook salmon spawning, and increasing flow will result in increased productivity in this section of the river. Increasing streamflows above Hooper Lane could create access to historic spawning areas in the middle and upper Pahsimeroi and Goldberg Creek. Studies should be completed to help identify the best locations and feasibility for additional flow augmentation and reconnection activities in the upper sections of the river.
2. Modify existing barriers caused by either culverts or irrigation diversion structures. Barrier removal should be scheduled to make the best use of additional water added to the system to reconnect mainstem Pahsimeroi River reaches and tributaries.
3. Improve riparian habitat conditions, thus improving instream conditions. This work can be done through implementation of the Pahsimeroi River TMDL, which is designed to improve riparian conditions, reduce temperature, reduce nutrients and reduce sediment (IDEQ 2001a, IDEQ 2013). The IDEQ prepared a TMDL for this basin in 2001 that concluded that poor riparian habitat conditions and water quality issues are directly linked and that improving riparian conditions will likely reduce sediment, nutrients, and stream temperatures (IDEQ 2001a, p. 41). This work should start in the lower reaches of the mainstem Pahsimeroi River, or in additional stream reaches occupied by spring/summer Chinook salmon or steelhead. Riparian vegetation should be restored to the historical range of natural variability.
4. Screen diversions so as not to entrain fish in ditches. This work should be scheduled in conjunction with the higher priority actions described above and in the context of the priorities set in the Screening and Habitat Improvement Prioritization for the Upper Salmon Subbasin report (USBWP 2012) for the upper Salmon River basin.

Implementation of Habitat Actions

Implementation of habitat actions for this population will occur primarily through the work of the Upper Salmon Basin Watershed Program partners. These groups work with private, state, and federal entities that manage land and other resources within the watershed. The groups have created an effective process for working together, providing technical reviews of proposed projects and working with interested parties to accomplish conservation on the ground.

These groups have a strong record of implementing water quality and salmon conservation projects in the past, and have made important contributions to salmon recovery projects. There projects include riparian area fencing, improving streamflow and reducing water diversions, fish screen and passage projects, and improving stream structure and connectivity. In addition, conservation easements with willing landowners have enabled specific on-the-ground projects that have reconnected tributaries to the mainstem rivers, conserved stream flows, and restored streambanks and riparian vegetation. Future efforts will build on these accomplishments.

Table 5.4-14 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not represent a full list of projects. Specific projects are planned continuously based on available funding and established priorities. During Plan

implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.4-14. Habitat Recovery Actions Identified for the Pahsimeroi River Spring/Summer Chinook salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Streamflow	Protect 14 cfs flow	BPA Contract # 1994-015-00: Idaho Fish Screening Project Restoration-Lemhi BPA Contract # 2002-013-01: Water Entity- Water Transaction Program BPA Contract # 2007-268-00: Idaho Watershed Habitat Restoration-Custer District BPA Contract # 2007-399-00: Upper Salmon Screen Tributary Passage BPA Contract # 2008-603-00: Pahsimeroi River Habitat BPA Contract # 2008-608-00: Idaho MOA/Fish Accord Water Transactions	N/A
Entrainment	5 fish screens		
Barriers	Address 17 barriers (diversions)		
Riparian Conditions	Improve 17.8 instream miles		

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 5.4-14 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined (TBD).

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs may present. For the Pahsimeroi River population, the strategy aims to transition the Pahsimeroi River hatchery program to minimize the ecological and genetic risks. The strategy includes developing gene flow standards through the HGMP process. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts and catch and release impacts in recreational fisheries. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.4.7 Lemhi River Spring Chinook Salmon Population

The Lemhi River spring Chinook salmon population is currently not viable, with a high abundance/productivity and spatial structure/diversity risk status. Lemhi River Chinook salmon are primarily spring-run fish. The population's targeted proposed status is Viable, which requires a minimum of low abundance/productivity risk and moderate spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Viable

Population Status

This section compares the Lemhi River population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The ICTRT (2003) distinguished spring Chinook salmon in the Lemhi River watershed, including its major tributary Hayden Creek, as an independent population. This determination was based largely on the geographic isolation of Lemhi River spring Chinook salmon from other Chinook salmon in the Upper Salmon River. Genetic sampling showed that Lemhi River spring Chinook salmon are highly distinct from Chinook salmon in the East Fork Salmon River, Herd Creek, Alturas Lake, and Frenchman Creek, but less distinct from Chinook salmon samples in Valley Creek, the Upper Salmon River, the Sawtooth Hatchery, or the Pahsimeroi River. The genetic similarity between Chinook salmon in the Lemhi River and the nearby Pahsimeroi River is offset, however, by the fact that Lemhi River Chinook salmon are primarily spring-run fish and Pahsimeroi Chinook salmon are primarily summer-run fish, such that these two watersheds have significantly different adult migration timing.

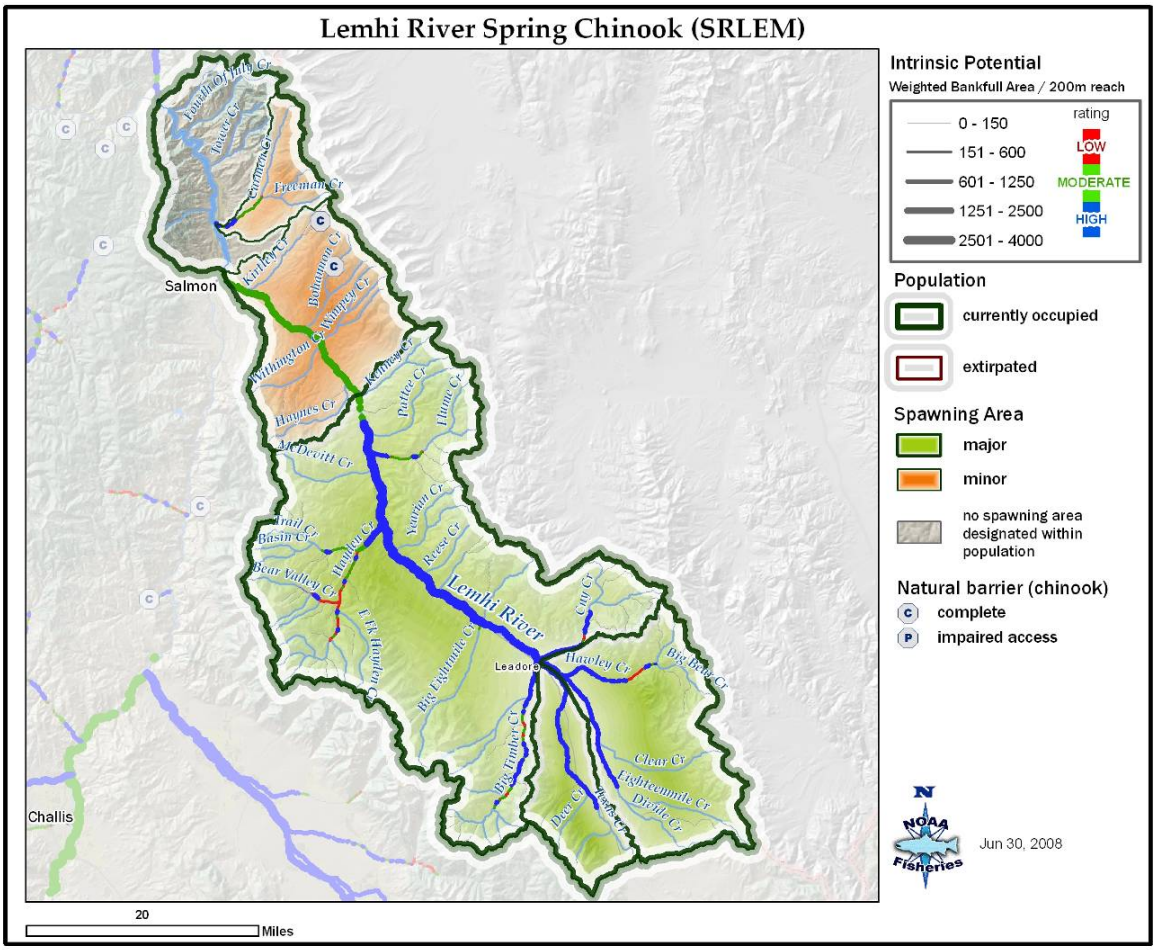

Figure 5.4-11. Lemhi River Spring/Summer Chinook salmon Population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Historically the Lemhi River population supported large runs of spring/summer Chinook salmon (ICTRT 2003, p.24). The ICTRT classified the Lemhi River population as "Very Large" in size and complexity based on historical habitat potential (ICTRT 2007). This population includes three major spawning areas (Upper Lemhi, Texas Creek, and Eighteenmile Creek) and two minor spawning areas (Carmen Creek and Lower Lemhi), as shown in Figure 5.4-11. The Carmen Creek spawning area is outside of the Lemhi River watershed on a short section of the main Salmon River that the ICTRT included within the Lemhi River population. Much of the spawning currently occurs in the mainstem Lemhi River upstream from Hayden Creek to the town of Leadore and in Hayden Creek (IDFG 2015). Very limited spawning may also occur in the mainstem Lemhi River downstream from Hayden Creek (ICTRT 2003) and in Big Springs Creek.

Abundance and Productivity

As a Very Large-size population with a proposed status of viable, the abundance and productivity targets for Lemhi River spring Chinook salmon are a mean minimum abundance threshold of 2,000 natural-origin spawners, with a productivity greater than 1.34 recruits per spawner. This would achieve a 5 percent or less risk of extinction over a 100-year timeframe (viable status). Since the late 1960s,

abundance has been variable and far below the minimum low-risk threshold. The recent (2005-2014) 10-year geometric mean abundance of natural-origin spawners was 143 natural-origin fish. The geometric mean productivity was 1.30 recruits per spawner (NWFSC 2015). This estimated productivity essentially is at replacement, and is less than the 1.34 required at the minimum threshold abundance.

The ICTRT's viability curve shows the minimum combinations of current natural-origin abundance and productivity that correspond to a particular risk level. As seen in Figure 5.4-12, a proposed risk level can be achieved with various combinations of abundance and productivity. For the Lemhi River population, the proposed viable (low-risk) status can be attained with any combination of abundance and productivity that is above the green line.

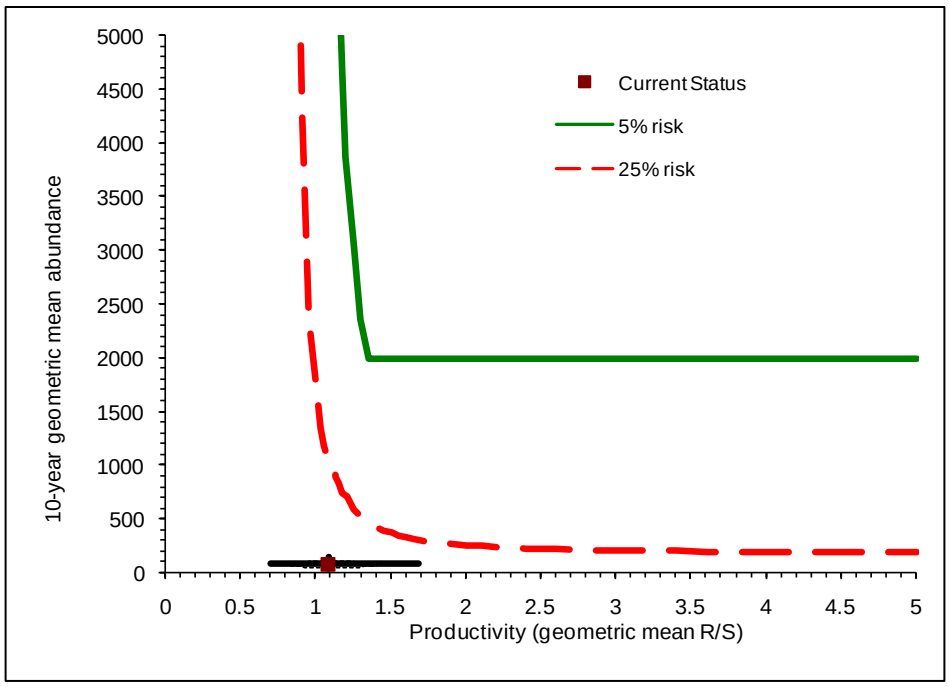

Figure 5.4-12. Lemhi River spring Chinook salmon population current abundance and productivity compared to the ICTRT's viability curve for a Very Large-size population. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

The Lemhi River population abundance and productivity risk is currently high and must be reduced to achieve the proposed status for the population.

Spatial Structure

The risk rating for a population's spatial structure is a function of multiple metrics that assess the number and spatial arrangement of spawning areas and the difference in extent of historic versus current spawning. The Lemhi River population has three major spawning areas and two minor spawning areas in a non-linear configuration, which provides inherent protection against extinction. However, two of the population's three major spawning areas ─ Texas Creek and Eighteenmile Creek ─ are currently unoccupied. Fish have been precluded from reaching these areas because of passage

barriers and instream flow reductions caused by irrigation, although recent restoration projects have been aimed at reconnecting these tributaries to the Lemhi River. The third major spawning area, the Upper Lemhi River including Hayden Creek, is where the majority of current spawning occurs. The ICTRT's delineation of major spawning areas is based on historical habitat patch size estimated with the GIS-based intrinsic potential model (Cooney and Holzer 2006; and see Figure 5.4-11). Given current stream and landscape conditions, it may not be possible for Texas and Eighteenmile Creek to provide spawning areas even with increases in instream flow. However, these areas could provide important rearing habitat.

The two minor spawning areas are Carmen Creek and the Lower Lemhi River. Spring Chinook salmon historically spawned in the lower Lemhi River and some spawning still occurs. However, results from recent radiotelemetry studies of adult Chinook salmon tagged at Lower Granite Dam suggest that adults enter the lower Lemhi, migrate quickly upstream, and stage (holding with no movement) either just downstream or adjacent to their eventual spawning location (Personal Communication, J. Diluccia 2017). Most tagged fish staged in Hayden Creek or the upper Lemhi River from mid-July to mid-August. A few fish staged below Hayden Creek, but none did so below McDevitt Creek. Staging fish rapidly moved short distances at the onset of spawning.

The unoccupied spawning areas and the resulting increased gaps between spawning areas create spatial structure risk for the population. The cumulative spatial structure score is moderate risk based on these parameters. Until recently, most tributaries were disconnected from the Lemhi River at some point during the irrigation season, also contributing to spatial structure risk. Recent tributary reconnections through 2010 have reconnected some of these tributaries for all or part of the irrigation season with varying fractions of historical flows.

Achieving the proposed overall status for this population requires a spatial structure risk rating of moderate or better. Therefore, the Lemhi River's current spatial structure risk rating is adequate to attain the population's proposed overall status.

Diversity

A population's diversity risk rating is a function of multiple metrics that assess the population's major life history strategies, phenotypic variation, genetic variation, spawner status including hatchery and stray influences, and distribution across different habitat types. The metrics driving the cumulative diversity risk rating for Lemhi River spring/summer Chinook salmon are the loss of the summer-run adult migration life history strategy and selective pressures on out-migrating smolts in the existing spring-run life history. Currently, the major adult life history strategy is spring-run migration timing, but historically a summer-run adult migration component to the population also existed. Summer-run fish primarily spawned in the lower mainstem Lemhi River downstream of Hayden Creek. This section of the river has been significantly modified by water diversions, and the summer-run life history strategy has been lost from the population, resulting in a high-risk rating for the major life history strategies metric.

Selective pressures on out-migrating smolts create a second diversity risk. Juveniles migrating later in the spring face higher mortality rates than early juvenile migrants for two reasons: (1) low flows

caused by irrigation water withdrawals hinder out-migration from tributaries to the mainstem rivers, and (2) migration conditions in the Snake and Columbia River worsen in the late spring. Currently both yearling and subyearling out-migrants occur in this population. The effects of the habitat modifications on migration, combined with the high mortality of subyearling out-migrants in the hydropower system, are likely causing some selective pressures within the existing spring-run fish. This also increases the diversity risk of the population.

The proposed overall status of viable for this population requires a diversity risk rating of moderate or better. The cumulative diversity risk for the population is rated as high for the Lemhi River population. This risk rating must be improved to attain the proposed status for the population.

Summary

The cumulative risk ratings for the Lemhi River population for both abundance/productivity and spatial structure/diversity are currently rated as high, leading to an overall high risk rating for the population. The cumulative high risk rating for spatial structure/diversity is driven by a high risk rating for diversity. Reduction of the risk level will need to occur in both the natal habitat in the Lemhi River and in the migration corridor in the Snake and Columbia Rivers. Without survival increases and a reduction in the diversity risk, the Lemhi River population cannot reach its proposed status of viable.

Table 5.4-15 summarizes the abundance/productivity and spatial structure/diversity risks for the Lemhi population. A complete version of the ICTRT draft population viability assessment is available at: http://www..noaa.gov/trt/columbia.cfm

Table 5.4-15. Viable Salmonid Population parameter risk ratings for the Lemhi spring Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	HR	HR Lemhi River

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors.

Natal Habitat

Habitat Conditions

The Lemhi River and its surrounding drainage area encompass over 800,000 acres, and 80 percent of this land is publically owned and is managed by either the BLM or the U.S. Forest Service. The federal land is primarily in the higher elevations, whereas private land is located at lower elevations along valley bottoms. The majority of the occupied salmon habitat in this watershed is on private lands at lower elevations.

Much of the Lemhi River has been substantially modified (Welsh et al. 1965; Gebhards 1958, 1959). These modifications have resulted from channelization and diking associated with transportation routes, diking to protect floodplain developments, and channel straightening and downcutting undertaken in response to historic floods (Gebhards 1958). The Lemhi River valley was settled in the 1860s when gold was discovered in the region (ISCC 1995). The human population density has remained relatively low although future development and growth in the valley is possible. Most land use activities on private lands are associated with agriculture and the livestock industry, focused on hay production and grazing.

The environmental effects from this agricultural development have been pronounced. Impacts to stream habitat include diversion of natural flows from the mainstem Lemhi River, diversion of tributary flow and disconnection of most tributaries from the mainstem Lemhi River, channelization and riprapping of the mainstem, modification of riparian vegetation, increasing sedimentation, and water temperatures, and entrainment of juvenile and adult fish in irrigation facilities.

Further, following a major flood in 1957, Gebhards (1958) quantified the channel modifications that local residents and the State Department of Highways made with the intention to reduce future flood impacts on private lands and to construct Highway 28. He found that the single event had led to: (1) alteration of 20.9 percent (>13 miles) of total spawning habitat; (2) removal of 11.9 percent of the spawning habitat used by 90 percent of the population's spawning fish; (3) increased gradient and eliminated cover, resting pools, and large woody debris, degrading rearing and migratory conditions; (4) decreased potential spawning capacity of the core area by an estimated 483 females, or about 2.2 million eggs; and (5) the direct kill of approximately 500,000 Chinook salmon eggs from the 1957 brood. Effects of this event and others like it remain evident today.

The Lemhi River basin was one of the first waterbodies in the state to receive a TMDL under the Clean Water Act. In 2000, IDEQ issued a TMDL for sediment and fecal coliform bacteria in the Lemhi River basin, covering roughly 259 miles of the river and its tributaries (IDEQ 1999). Implementation of the TMDL is ongoing. The Lemhi River TMDL Implementation Plan calls for restoring riparian

vegetation and stabilizing eroding streambanks in order to reduce sediment delivery to streams (IDEQ 1999). The implementation plan further directs that grazing and livestock concerns be addressed by providing off-site watering for pasture and feeding operations.

Numerous invasive exotic weeds with potential impacts to aquatic habitat have invaded the Lemhi River watershed, although the watershed has relatively fewer known weed infestations than other watersheds in the Upper Salmon River basin. Leafy spurge, rush skeletonweed, spotted knapweed, and thistle are the species currently posing the greatest threat (NPCC 2004, p. 3-24). These invasive plants pose a threat to instream sediment levels in the Lemhi River and its tributaries.

Past Habitat Assessments and Improvement Projects in the Lemhi River Basin

Landowners in the watershed have recognized the impacts of water withdrawals and other land uses on salmonid habitat and have a history of working to reduce the effects, in conjunction with local watersheds groups, government agencies, and other stakeholders. The Lemhi River Habitat Improvement Study (Dorratcaque 1986) or "Ott Report," was funded by Bonneville Power Administration to assess habitat improvements that would benefit fish in the Lemhi River basin. The Ott Report found that the primary limiting factors to salmonid productivity in the Lemhi River were blockages to upstream migration of spawners caused by irrigation structures, low flows caused by irrigation withdrawals, especially on the lower Lemhi River, and excessive mortality of downstream migrating juveniles as a result of inadequate fish screens or bypass facilities at irrigation diversions.

Based on the findings of the Ott Report, local water users developed a plan to improve salmonid habitat, called the Irrigators Plan to Improve Fish Passage, or "Irrigators Plan" (Lemhi Irrigation District and Water District 74 1992). The plan recommended improving fish screens, replacing existing irrigation headgates that did not adequately control flow, consolidating diversions where possible to achieve greater water use efficiencies, and transferring water rights to an alternate source (e.g., the Salmon River) to improve flow in the Lemhi River.

In 1991, the U.S. Bureau of Reclamation selected the Lemhi River basin as one of four pilot irrigation water conservation projects in the Columbia River basin for the purpose of demonstrating actions that could be undertaken to improve stream flows, fish passage, and fish habitat for salmon in critical river reaches. The primary purpose of the Lemhi Water Conservation Demonstration Project was to address passage barriers caused by irrigation diversions in the lower Lemhi River, previously identified in the Ott Report and the "Irrigators Plan". One of the project components was to eliminate five push-up dams on the lower Lemhi River to improve adult upstream migration. Of the five push-up dams, three were eliminated by consolidation with other diversions, and two were upgraded to permanent variable crest dams with adjustable headgates, fish ladders, water flow measuring devices, and improved fish screens. These projects were completed between 1995 and 1997 and partially improved adult migration conditions (IDFG 2015). Other components of the demonstration project included bank stabilization efforts at the new diversion structures and at Baker Bridge on St. Hwy. 28, conversion from a flood to sprinkler irrigation system on 385 acres of the Fisher Ranch and development of a conservation easement on another 280 acres.

In 1992, another demonstration project for habitat restoration began in the Lemhi River drainage, called the Model Watershed Plan, and was conducted by the Idaho Soil and Water Conservation Commission. The goal of the Model Watershed Plan was to improve spring/summer Chinook salmon and steelhead habitat in the Lemhi River, Pahsimeroi River, and East Fork of the Salmon River watersheds. The Model Watershed Project was then formally changed to the Upper Salmon Basin Watershed Program in 2000 to include the North Fork and Yankee Fork Salmon Rivers, as well as the mainstem of the Salmon River from the mouth of the Middle Fork upstream to its headwaters. Prior to 2000, restoration efforts focused on improving diversion structures and fish screens, fencing livestock away from stream channels, and better management of livestock grazing near stream channels. These efforts resulted in a substantial improvement in riparian conditions along the upper mainstem Lemhi River and on Big Springs Creek (which flows parallel to the upper Lemhi River).

Since 2000, the Upper Salmon Basin Watershed Program has directed more effort toward reconnecting tributaries and improving mainstem flow. Recent projects include reconnections and partial reconnections of Big Timber Creek, Canyon Creek, Hawley Creek, Bohannon Creek, Little Springs Creek, Wimpey Creek, lower Lee Creek, and Kenney Creek to the mainstem Lemhi River, increasing the amount of habitat available for listed salmon and steelhead. Other projects implemented in the basin include floodplain reconnection and enhancement, channel restoration, land purchases, conservation easements, and fish passage restoration. The Upper Salmon Basin Watershed Program continues to work with Soil Conservation Districts, IDFG and its screen shop, IDEQ, Idaho Water Resources Board, Lemhi and Custer Counties, Shoshone-Bannock Tribes, NMFS, the Nature Conservancy, BLM, Lemhi Regional Land Trust, Trout Unlimited, U.S. Bureau of Reclamation, U.S. Forest Service, Natural Resource Conservation Service and, most importantly, many private landowners to protect and restore aquatic habitat. These projects have had a positive effect on habitat conditions and processes, but additional habitat improvement is needed to increase abundance, productivity, spatial structure, and diversity of this population.

The IDFG has also been active since the mid-1960s, working with landowners to screen water diversions on the upper Salmon River and its major tributaries, including the Lemhi River. The Lemhi River watershed has been a primary focus for installing screens on diversion ditches through IDFG's Fish Screen Program. Approximately 100 irrigation diversions in the Lemhi basin have been equipped with fish screens, including all of the diversions on the mainstem Lemhi River and most on Big Springs and Hayden Creeks.

Current Habitat Limiting Factors

NMFS determined the habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups.

1. Low flows during critical periods.

Numerous water diversions exist in the Lemhi watershed (Figure 5.4-13). These diversions reduce the amount of flow in stream channels, which in turn, reduces water depth, water velocity, and stream width. Depending on stream morphology, habitat condition, and magnitude of flow reduction, these changes can affect access to functional and escape cover and off-channel habitat, and can impede

upstream and downstream fish passage. Reduction in flow volume can also reduce the amount of drifting invertebrates available for rearing salmonids and can increase summer water temperatures.

Water diversions have reduced flow volume in essentially all the spring/summer Chinook salmon habitat (current and historic) in the Lemhi River drainage. Until recently, all Lemhi River tributaries except Hayden Creek and Big Springs Creek were dewatered to the extent that they were no longer occupied by spring/summer Chinook salmon. Flow reductions have regularly dewatered the mainstem Lemhi River near the mouth and in its upper reaches near Leadore. Agreements with water users and restoration actions implemented since 2000 have improved streamflow in the mainstem Lemhi River and in Big Timber Creek, Canyon Creek, Bohannon Creek, lower Lee Creek, Carmen Creek, Hawley Creek, Little Springs Creek, and several smaller tributaries. After streamflow restoration projects were implemented, IDFG found juvenile Chinook salmon in Big Timber Creek, Canyon Creek, Little Springs Creek, and Kenney Creek.

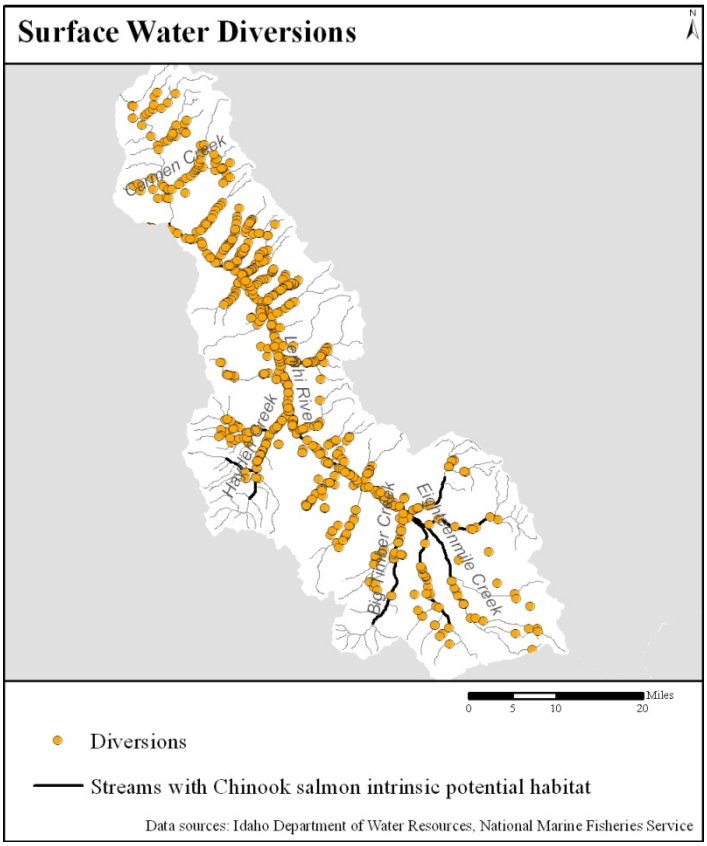

Figure 5.4-13. Surface water diversions in the Lemhi River spring/summer Chinook salmon population.

Water use in the Lemhi River watershed also has impacts on stream reaches that maintain perennial flow and have high quality riparian and instream habitat. For example, in normal to dry years, the mainstem Lemhi River upstream from Hayden Creek has a “reversed” hydrograph, in which base flow conditions occur in April and early May when unimpaired streams are nearing peak flow conditions. This reduction in early rearing flow adversely affects rearing conditions. Egg-to-smolt survival in the Lemhi River is two and a half times lower than in a reference stream in the Middle Fork Salmon River with unimpaired flow (Arthaud et al. 2010). In fact, the productivity of Lemhi River spring/summer

Chinook salmon, measured as either number of juveniles migrating downstream in the Lemhi River, number of smolts arriving at Lower Granite Dam on the Snake River, or number of adults returning to the Lemhi River, is strongly related to early rearing streamflow (May) and only slightly less strongly related to late rearing streamflow (August) (Arthaud et al. 2010). This indicates that low streamflow during juvenile rearing is limiting the Lemhi spring/summer Chinook salmon population. Increasing streamflow during the irrigation season should increase egg-to-smolt survival and year class strength (Arthaud et al. 2010).

Streamflow conditions in three reaches of the mainstem Lemhi River and tributaries to the Lemhi River are described below.

Lemhi River from the Salmon River to Agency Creek. Habitat conditions for this river reach have been significantly altered. In the past, dewatering of a one-mile segment below the L6 diversion occurred during dry years, due to irrigation withdrawals both in late April through mid-May, with the beginning of spring run-off, and then often again in late July through September during summer low flows (Trapani 2002). This dewatering blocked returning adults from accessing upstream spawning habitat and juveniles from migrating downstream. Since actions by water users have increased flows in this reach during some parts of the irrigation season, such that dewatering is avoided and flows are maintained annually. An additional flow agreement with the water district ensures that flows from the March 15 start of the irrigation season through June 30 are maintained at 35 cfs, and at 25 cfs from July 1 to November 15. These actions have improved upstream and downstream migration conditions during low flow periods; however, more flow may be needed for adequate adult upstream passage and to increase rearing habitat in this river reach.

Lemhi River from Agency Creek to Hayden Creek. This section of the river is less affected by irrigation diversions and stream channelization than the reach below Agency Creek, but impacts from surface water diversions are still evident. Together flow depletions and simplified channels cause this reach to currently provide only a limited amount of suitable habitat for spring/summer Chinook salmon spawning and rearing. Flows are closer to the natural hydrograph than other sections of the Lemhi River, due to the large input of flow from Hayden Creek. Hayden Creek is less impaired by irrigation diversions than the upper Lemhi River. This reach is never dewatered, even in the driest years. However, flows during the irrigation season are much lower than they would be without water use.

Lemhi River from Hayden Creek to Leadore, ID. This reach provides the best spawning and rearing fish habitat currently available in the Lemhi River (Trapani 2002) because of its low gradient and because it has not been channelized as much as lower sections of the river. Nonetheless, habitat quality and quantity in this segment is limited by reduced flows. The entire reach has an “inversed” hydrograph, wherein the lowest flows occur in early spring. During dry years, flows are actually higher in summer than early spring, likely caused by calls for water from senior water users downstream. This reach is the focus of several current projects to improve flow. Additional flow in this reach during spring and summer are needed to increase spring/summer Chinook salmon egg-to-smolt survival and juvenile growth, which should increase population productivity.

Tributaries to the Lemhi River. All tributaries to the Lemhi River, except Big Springs Creek and Hayden Creek, have been disconnected from the mainstem for most or all of the irrigation season over the past few decades. A major focus of the Upper Salmon Basin Watershed Program partners has been to reconnect tributaries to the mainstem Lemhi River. Recent projects have reconnected Little Springs Creek, Bohannon Creek (partially), Canyon Creek, Hawley Creek (partially), Kenney Creek, lower Lee Creek, Wimpey Creek, and Big Timber Creek (partially) to the mainstem Lemhi River. Ongoing projects are aimed at reconnecting Eighteenmile Creek and Pratt Creek. Reconnecting tributaries gives spring/summer Chinook salmon access to rearing habitat and to cold-water refugia, and in the case of larger tributaries, like Big Timber Creek, may provide additional spring/summer Chinook salmon spawning habitat. Still, most tributaries remain disconnected from the mainstem Lemhi River at some point during the irrigation season.

Hayden Creek has a relatively intact meander pattern, unaltered streambanks (only 3.2% riprapped), and contains spawning and rearing habitat for spring/summer Chinook salmon. Hayden Creek was once thought to contain only a relatively small number of Chinook salmon (Trapani 2002); but recent redd surveys show extensive Chinook salmon spawning in Hayden Creek, and screw trap data collected since 2006 indicate that the Hayden Creek drainage produces one-third to one-half the number of juvenile spring/summer Chinook salmon as the mainstem Lemhi River. Although generally less flow-impaired than the mainstem Lemhi River, flows can get very low in lower Hayden Creek. East Fork Hayden Creek is essentially dewatered by one large diversion in years when the diversion is in operation (DEA 2002), and Basin Creek, another major tributary, is also dewatered by irrigation diversions.

Big Timber Creek was reconnected to the Lemhi River in 2009 by moving the point of diversion for a senior water right holder that was lowest in the Big Timber Creek system to a new point of diversion on the Lemhi River. This provided a minimum flow of 4.56 cfs in the lower reaches of Big Timber Creek, which reconnected the stream to the Lemhi River, providing access for spring/summer Chinook salmon to habitat in the lower reaches of Big Timber Creek. Another water user has since joined this project to bring the total projected flow in lower Big Timber Creek to 6.0 cfs. However, barriers to fish passage exist farther upstream in Big Timber Creek caused by other diversions, few of which currently have fish screens. These barriers will need to be fixed for spring/summer Chinook salmon to access all potential habitat in Big Timber Creek.

2. Passage barriers.

Dams or weirs placed across a river or stream to divert water into irrigation ditches can constitute physical blockages to fish passage. Many such structural passage barriers in the Lemhi drainage have been replaced with structures designed to allow fish passage, but some diversion-related barriers remain on tributaries. As tributaries are reconnecting to the Lemhi River mainstem with water conservation projects, the removal of such barriers would increase access to rearing habitat. Currently, 16 diversion structures on the Lemhi River mainstem have been eliminated: 13 through consolidation with other diversions (e.g., as in the U.S. Bureau of Reclamation Water Conservation Demonstration Project from the early 1990s), one by abandonment, one by purchase of the water rights, and one by use of alternative water sources. Three diversion structures have been eliminated on Hayden Creek. In addition, eight diversion structures on the Lemhi mainstem and four on Hayden

Creek have been modified so they allow fish passage in the stream. Culverts at road stream crossings in tributaries to the Lemhi River have also created fish passage barriers. Between 2010-2015, the Upper Salmon Basin Watershed Program partners replaced culverts on Canyon, Hawley, Little Springs, Wimpey, Carmen, Bohannon, Pratt, Carmen, and Agency Creeks, in order to allow fish passage.

3. Fish entrainment.

Without fish screens on water diversions, fish enter ditches and can become entrained and die. Installation of fish screens in the Lemhi River basin began in the late 1950s to mitigate for the effects of BPA's Columbia River hydroelectric facilities. The program accelerated rapidly beginning in the late 1980s prior to the listing of Snake River spring/summer Chinook salmon as a threatened species under the ESA. Currently, the installation of fish screens is done in accordance with screening standards established by NMFS (NMFS 2011). Approximately 100 irrigation diversions in the Lemhi basin have been equipped with fish screens, primarily through the IDFG's Fish Screen Program. On the Lemhi River mainstem, 70 existing diversions have been screened. An additional 32 diversions have been screened in the river's tributaries, including 12 on Hayden Creek, 7 in Big Springs Creek, 5 in Wimpey Creek, 6 in Bohannon Creek, 2 in Kenney Creek, and 1 in Hawley Creek. As priority tributaries are being reconnected, screening is being addressed when reasonable and with landowner cooperation. However, to date some of the diversions in connected tributary remain unscreened and most of the diversions in the disconnected tributaries remain unscreened. It is important for the IDFG screen shop to continue screening tributary diversion in a prioritized manner that will achieve the greatest benefit. Screening a diversion at the top of a tributary should be lower in priority if multiple unscreened diversions exist below.

Fish screens reduce mortality due to entrainment of fish into water diversions. However, juvenile fishes still have to find their way through the bypass systems, delaying their downstream migrations, even with state-of-the-art screens and bypass systems. Juvenile fish migrating downstream are at greatest risk of entrainment, although upstream-migrating adults can occasionally become entrained, and most bypass systems are not sized to accommodate adults. Fish screens are typically placed within the irrigation canal immediately downstream of the diversion headgate. They prevent entrainment by blocking passage down the canal and routing fish into a bypass pipe that connects with the river.

Procedures for irrigation ditch turn-on in the spring and ditch turn-off and ramp-down at the end of the irrigation season are being implemented in the Lemhi River basin by the irrigators to reduce entrainment and subsequent fish mortality. Ditch turn-on procedures include (1) contacting the Idaho Department of Water Resources water master to assure that minimum instream flows are available for fish before diverting water, and (2) contacting the IDFG Screen Shop to install removable screen parts prior to diverting water. At the end of the irrigation season the water users gradually stop diversion to provide sufficient opportunity for fish in the irrigation canals upstream from the screens to find their way out through the bypass system prior to final closure of headgates at the end of the irrigation season.

4. Degraded riparian and instream habitat conditions and channelization.

Riparian and instream habitat conditions are degraded along much of the Lemhi River, impacting natural riparian area processes and functions. As in the discussion of streamflow above, the discussion for riparian and instream habitat in this population is divided into four sections: three distinct reaches of the mainstem Lemhi River, plus tributaries to the Lemhi River. Habitat problems include high sediment levels, elevated water temperatures, and simplified stream channels lacking structure.

Lemhi River from the Salmon River to Agency Creek. The lower Lemhi River from its mouth to Agency Creek has been affected by numerous bank stabilization and channelization activities over the years. This reach has been constrained by State Highway 28 and the Lemhi County road, has been diked and channelized for flood control, and has lost much of the historic meander pattern (Trapani 2002). While streambanks along the lower Lemhi River are 75 percent stable, 19 percent of the reach has been riprapped, natural riparian vegetation occurs along only 37.5 percent, and only 9.6 percent is characterized as pool habitat. These conditions, together with high sediment levels in river substrates and low flows, have resulted in the virtual elimination of spawning and rearing habitat for Chinook salmon within this river reach (Trapani 2002). In the section of this reach upstream of the L6 diversion, stream habitat and riparian conditions improve slightly.

Lemhi River from Agency Creek to Hayden Creek. Although still very impaired, habitat conditions are substantially better in the Agency Creek to Hayden Creek reach of the Lemhi River relative to the lower reach. This river reach has significantly more natural riparian vegetation (covering 67 percent of the reach compared to 37.5 percent natural riparian vegetation on the lower reach); only 13 percent is riprapped (compared to 19 percent of the lower reach); and banks are 85 percent stable (compared to 75 percent of the lower reach) (Trapani 2002). Spawning habitat is limited by cobble embeddedness (45 percent embedded) and high sediment levels. Rearing habitat is limited by a lack of slow water (only 8 percent of the habitat) and pools (Trapani 2002). This section of the river has been less channelized than the lower reach, but impacts of human land use are still evident. Although there is little spawning in this reach, it is likely important rearing habitat for subyearlings migrating downstream from the upper Lemhi and Hayden Creek.

Lemhi River from Hayden Creek to Leadore, ID. This reach represents the best spawning and rearing fish habitat currently available in the Lemhi River (Trapani 2002). The river gradient in this reach is naturally low and suitable for spring/summer Chinook salmon spawning and rearing. Unlike the lower sections of the river, which have been channelized, most of the natural river channel in this reach remains intact, with a high degree of channel sinuosity. Almost 60 percent of the reach is bordered by natural riparian vegetation (characterized as in good to excellent condition) and only 1.4 percent has been riprapped. There is more slow water habitat compared to the lower and middle reaches, with 25 percent of the reach characterized as pool habitat, with some pools up to seven feet deep (Trapani 2002). However, substantial habitat degradation is still evident. Streambanks in the reach are only 61 percent stable, and sediments levels in spawning gravels are high. Water temperatures in the reach fluctuate widely and periodically exceed recommended levels for salmonids in summer (Resseguie 2004). Appropriate land management has the potential to improve habitat conditions, and the Upper Salmon Basin Watershed Program partners have been conducting projects to improve riparian

conditions since the 1990s. For example, most of this reach has been fenced to prevent livestock from damaging streambanks.

Tributaries to the Lemhi River. Within all tributary watersheds to the Lemhi River, habitat conditions consistently vary from the headwaters to the mouth. Typically, headwater areas receive less human land use and salmonid habitat conditions are generally classified as good to excellent. Thus, healthy populations of resident fish have been documented in the upper reaches of many tributaries, upstream from potential spring/summer Chinook salmon habitat (Murphy and Horsmon 2004; Warren and Anderson 2005, as cited in IDFG 2015). Proceeding downstream, most tributary watersheds are more heavily affected by land use activities. Some of these effects include loss or degradation of riparian habitats, sedimentation resulting from erosion, high water temperatures, and loss or reduction of instream habitat features such as pools, large woody debris, and undercut banks. On many tributaries, the net result is that potential spawning and rearing habitat for spring/summer Chinook salmon is severely degraded or lost completely.

Riparian conditions in Hayden Creek at the upper end of the watershed are functioning appropriately to provide high quality salmonid habitat, but these areas are generally upstream from potential spring/summer Chinook salmon habitat. The lower reaches of Hayden Creek are more degraded. Riparian vegetation is limited (33.5 percent of the areas surveyed), streambanks are only 65 percent stable, pool habitat is limited (15.2 percent by stream length), and water temperatures in the creek's lower 3 miles are high during low flows (Trapani 2002).

Big Springs Creek also provides important fish habitat in the basin. Big Springs Creek runs parallel to the upper mainstem Lemhi River, and the stream channel retains much of its natural meander pattern. Riparian vegetation is lacking along 46 percent of its length, livestock impacts to streambanks are evident, and streambanks are only 54 percent stable. Summer water temperatures are high (Waterbury 2003; Resseguie 2004), as are fine sediment levels in spawning gravels. However, grazing effects on Big Springs Creek are being reduced through various measures such as livestock fencing, and habitat conditions are improving. In 2007, Chinook salmon redds were documented in Big Springs Creek for the first time in many years (Morrow 2011). Extensive restoration work has recently been completed on Little Springs Creek, including elimination of irrigation diversions, restoration of riparian vegetation, channel restoration, increases in channel complexity with woody vegetation, fencing, and culvert replacements. In 2013, biologists found high densities of juvenile Chinook salmon in Little Springs Creek, likely because the improved habitat provided a more reliable source of cool water and refuge from predators.

The Big Timber Creek watershed has the potential to provide more than 50 miles of high quality spring/summer Chinook salmon rearing habitat. The lower and middle reaches of Big Timber Creek contain an intact floodplain and a functional riparian zone with healthy cottonwood, willow and conifer stands. Lower Big Timber Creek has a fairly narrow riparian corridor that is vegetated with black cottonwoods and willows. The previously dewatered section of the stream has limited riparian vegetation, but is currently ungrazed and riparian vegetation conditions should improve now that year-round flow is provided in the stream channel.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Lemhi River watershed.

1. Reduced flows from new water development. Because instream flows are already low due to irrigation withdrawals, new water development for agriculture or other purposes would further threaten spring/summer Chinook salmon habitat.
2. Floodplain and riparian degradation, and associated reduced processes and functions. Residential development in floodplains and riparian zones is likely to lead to bank instability, loss of riparian vegetation, and loss of floodplain function. Upper Salmon Basin Watershed Program partners are working with private landowners to educate them on riparian setbacks and retaining vegetation along streams and to develop conservation easement agreements.
3. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density. Annual grasses such as cheat grass are also expanding throughout the lower elevations of the Lemhi River. Cheat grass introduction has the potential to alter the fire regime resulting in larger fires more frequently and subsequently increasing sediment inputs.
4. Loss of beaver. Reduction or removal of beaver has negatively affected aquatic and terrestrial ecosystems. Programs are needed to encourage beaver activity in areas with reduced human conflict, or the building of structures that mimic beaver activity in areas where potential conflict exists.

Hatchery Programs

There are currently no hatchery releases in the Lemhi River population; however, hatchery releases occurred in the population area under prior hatchery programs. Hatchery-related limiting factors and threats for the population are further discussed at the MPG level in Section 5.4.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River and Salmon River pose a threat to returning Lemhi River spring Chinook salmon, and to other Upper Salmon River populations. State fisheries on spring Chinook salmon do not exist in the Lemhi River population area. Tribal fisheries may occur in some years. Overall, however, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for this and other Upper Salmon River populations are discussed at the MPG level in Section 5.4.3.3.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

To accomplish their habitat restoration goals, the Upper Salmon Basin Watershed Program Technical Team created a list of priority stream segments for salmonid habitat improvement projects in 2005 and updated the list in 2012 (USBWP 2012). This prioritization report, called Screening and Habitat Improvement Prioritization for the Upper Salmon Subbasin (SHIPUSS), considered all of the native

Oncorhynchus and *Salvelinus* species. Despite covering four species with differing habitat needs, the SHIPUSS prioritization overlaps considerably with habitat that has a high intrinsic potential for spring/summer Chinook salmon, and it is therefore useful in recovery planning.

The SHIPUSS priority stream reaches identified in 2005 are shown in Figure 5.4-14. Under SHIPUSS, Priority I streams are those streams that have the potential to realize immediate, tangible benefits to fish if recovery efforts are directed toward them. Priority II streams are those streams that will also see tangible benefits to fish as a consequence of recovery projects, but where the benefits may be less substantial or may be delayed for quite some time (USBWP 2012). The 2012 report with an updated list of priority streams is available at: http://modelwatershed.org/resources/library/.

Figure 5.4-14. SHIPUSS priority streams (USBWP 2005) overlaid on modeled Chinook salmon intrinsic potential habitat (NMFS 2007). Intrinsic potential indicated the relative suitability of a stream reach to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Because the SHIPUSS prioritization included cutthroat trout and bull trout, it gave high priority to many headwater streams and small tributaries that likely have very limited potential as spring/summer Chinook salmon habitat. Restoration actions for spring/summer Chinook salmon should occur in SHIPUSS Priority I and II streams that have Chinook salmon intrinsic potential (Figure 5.4-14).

Intrinsic potential refers to the relative suitability of stream reaches to support Chinook salmon spawning and rearing under historical unimpaired conditions, inferred from stream characteristics such as channel size, gradient and valley width (Cooney and Holzer 2006). The highest priority reaches for Chinook salmon habitat restoration are the mainstem Lemhi River and its tributaries that provide improved water quantity/quality to spawning grounds and rearing habitats.

The following habitat actions are intended to improve productivity rates and increase the capacity for natural smolt production in the population, thus maintaining and restoring the VSP parameters that will move the population towards viable status.

The following actions are shown in priority order.

1. Increase flows in the mainstem Lemhi River. The upper mainstem Lemhi River currently supports spring Chinook salmon spawning and increasing flow in this reach will result in an increase in productivity. Increasing streamflows is the highest priority action to increase abundance and productivity for the population. Increasing instream flows in the mainstem Lemhi can be accomplished through water transactions such as permanent subordination agreements, long-term leases, and water right acquisitions.
2. Reconnect priority tributaries to the mainstem Lemhi River to allow spring/summer Chinook salmon to reach currently inaccessible tributary habitat and to increase flows to the mainstem Lemhi River. Reconnections may be necessary due to dewatering or manmade barriers. Priorities for full reconnection to the Lemhi River are Eighteenmile Creek, Hawley Creek, Texas Creek, Big Timber Creek, and Canyon Creek.
3. Maintain the network of fish screens on diversions to continue to minimize effects of entrainment in water diversions. Continue to screen additional diversions in conjunction with the higher priority actions described above and in the context of the priorities set in the Screening and Habitat Improvement Prioritization for the Upper Salmon Subbasin report (USBWP 2012) for all of the populations in the upper Salmon River basin.
4. Improve riparian habitat conditions, thus restoring natural riparian area processes and functions and improving instream conditions.

Implementation of Habitat Actions

Implementation of habitat actions for this population will occur primarily through the work of the Upper Salmon Basin Watershed Program partners, which are an excellent representation of private, state, and federal entities that manage land and other resources within the watershed. These entities have created an effective process for working together, providing technical reviews of proposed projects, and working with interested parties to accomplish conservation projects. The groups have a strong record of implementing water quality and salmon conservation projects in the past and have made very important contributions to salmon recovery projects. Their projects have included consolidating water diversions to improve efficiency and streamflow, screening and fish passage improvements, tributary reconnection, riparian area fencing and restoration, streambank stabilization, improving pool habitat and stream complexity, and restoring floodplain connectivity. In addition, conservation easements with willing landowners have enabled specific on-the-ground projects that

have reconnected tributaries to the mainstem rivers, conserved stream flows, and restored streambanks and riparian vegetation.

Completed or ongoing projects are aimed at reconnecting most of the upper Lemhi River tributaries for all or a substantial part of year, including Big Timber, Hawley, Eighteenmile, and Canyon Creeks. Kenny Creek and Little Springs Creek in the lower Lemhi River drainage have also been reconnected. With these reconnects, lateral diversions have been breached, diversion points moved, irrigation efficiency increased, and lateral bypass routes eliminated. These actions have resulted in increased flows in tributaries and in the Lemhi River for short reaches until the water is reallocated.

These projects have improved habitat conditions and increased spring Chinook salmon production in the Lemhi River system, but further habitat restoration is needed for this population to reach viability. Table 5.4-17 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not represent a full list of projects. Specific projects are planned continuously based on available funding and established priorities. During Plan implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.4-17. Habitat Recovery Actions Identified for the Lemhi River Spring/Summer Chinook salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Streamflow	Protect 36.8 cfs flow, plus periodic 100 cfs 3-day channel maintenance flow (mainstem Lemhi)	BPA Contract # 1994-015-00: Idaho Fish Screening Project BPA Contract # 2007-394-00: Idaho Watershed Habitat Restoration-Lemhi BPA Contract # 2007-399-00: Upper Salmon Screen Tributary Passage	N/A
Entrainment	26 screens		
Barriers	Address 34 barriers (diversions and culverts)		
Instream Habitat Structure	Improve 11.7 instream miles	BPA Contract # 2008-601-00: Upper Lemhi River-Acquisition BPA Contract # 2008-602-00: Upper Lemhi River-Restoration BPA Contract # 2008-605-00: Lower Lemhi Habitat-Easements BPA Contract # 2008-606-00: Lower Lemhi Habitat-Restorations BPA Contract # 2008-608-00: Idaho MOA/Fish Accord Water Transactions	
Riparian and Floodplain Condition	Improve 11.8 riparian miles Protect 11.5 riparian miles Improve 15 riparian acres		

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 5.4-17 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined (TBD).

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs may present. For the Lemhi River population, the strategy is to manage for natural production. The strategy includes monitoring the population for strays. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon, including catch and release impacts in recreational fisheries. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.4.8 East Fork Salmon River Spring/Summer Chinook Salmon Population

The East Fork Salmon River spring/summer Chinook salmon population is currently not viable, with a high abundance/productivity and spatial structure/diversity risk status. Its targeted proposed status is Viable, which requires a minimum of low abundance/productivity risk and moderate spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Viable

Population Status

This section compares the East Fork Salmon River population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The East Fork Salmon River Chinook salmon population includes all spring/summer Chinook salmon in the East Fork Salmon River drainage (ICTRT 2003). The East Fork Salmon River Chinook salmon population is classified as Large, based on historical habitat potential, with a Branched Discontinuous C type spawning complexity (ICTRT 2010). This population contains both spring- and summer-run fish, including one major spawning area (East Fork) and no minor spawning areas (Figure 5.4-15). Summer-run fish occur in the East Fork from the mouth upstream approximately 15 miles. Spring run fish occur in the East Fork starting from approximately 3.5 miles below Big Boulder Creek upstream to the headwaters. Spawning typically occurs in the mainstem East Fork Salmon River and in the largest tributary, Herd Creek. However, local agencies have also reported spawning activity occurring in other tributary streams, such as Big Boulder Creek, Germania Creek, and Lake Creek (BLM 2012).

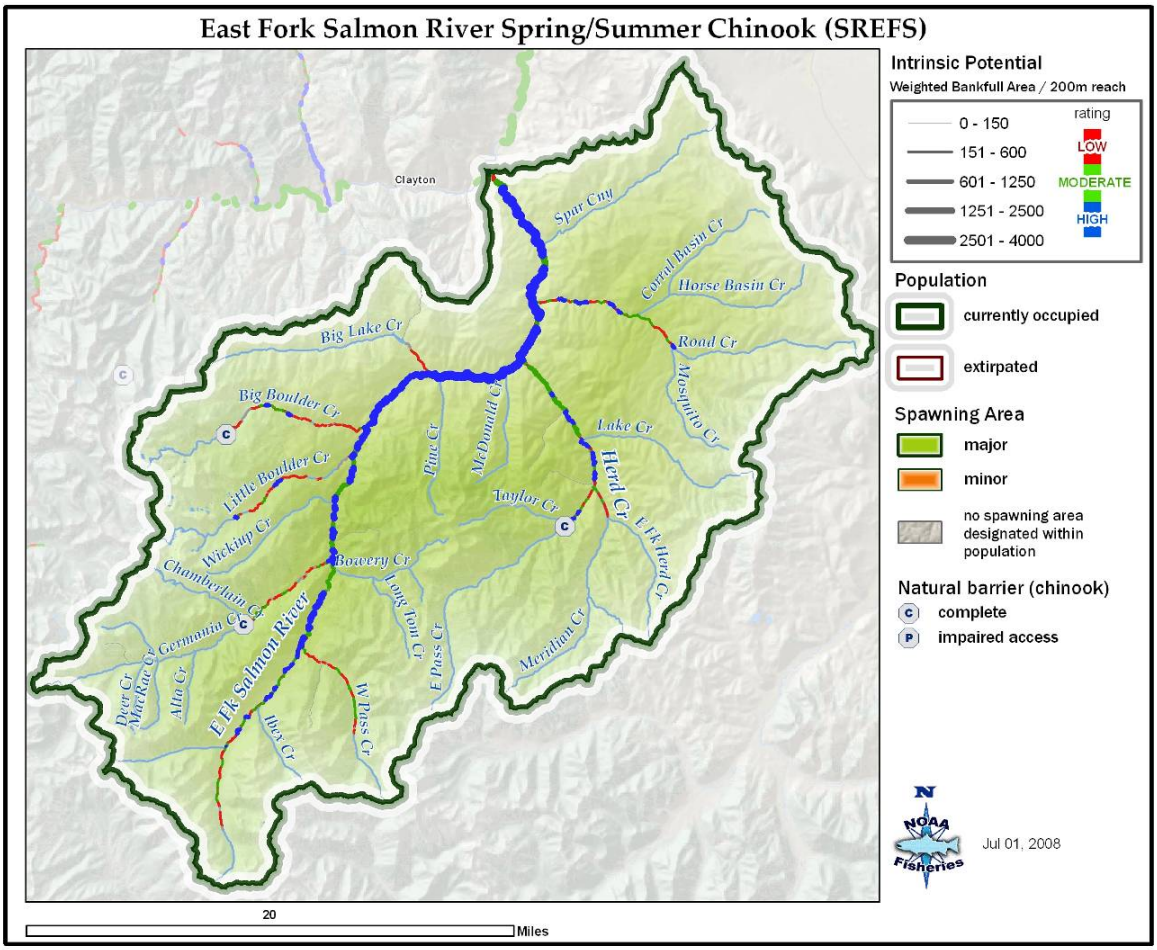

Figure 5.4-15. East Fork Salmon River Spring/Summer Chinook salmon Population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

The ICTRT (2003) suggested that spring/summer Chinook salmon spawning in Herd Creek and upper East Fork Salmon River may be genetically distinct from one another, but limited data is available to confirm this. The ICTRT (2003) described differences in juvenile run timing, with Herd Creek juveniles arriving at Lower Granite Dam earlier than other East Fork fish, suggesting a potential population subdivision.

Juvenile fish generally rear near spawning areas initially, migrating upstream or downstream as habitat conditions, food availability, and competition dictate. Because the East Fork Salmon River population exhibits a stream-type life history (one or more years of freshwater residence), juveniles are likely to be found across the majority of the currently accessible habitat in the watershed. A within-population hatchery program was operational from 1984-1993 (brood years), but since 1998 generally only natural-origin fish have been allowed to spawn in the East Fork (ICTRT 2010).

Abundance and Productivity

The viability target abundance and productivity for this population is to achieve a mean abundance threshold of 1,000 naturally produced spawners with a productivity of 1.58 recruits per spawner. In

contrast, the recent 10-year (2005-2014) geometric mean adult spawner abundance was 347 fish, which is significantly less than the minimum threshold of 1,000 spawners. The geometric mean productivity was 1.08 recruits per spawner (NWFSC 2015).

The ICTRT viability shows the minimum combinations of current natural-origin abundance and productivity that correspond to a particular risk level. As seen in Figure 5.4-16, a proposed risk level can be achieved with various combinations of abundance and productivity. For the East Fork Salmon River population, the proposed status of viable (low risk) can be attained with any combination of abundance and productivity that is above the green line. The abundance/productivity point estimate for this population is below the 25 percent risk curve. The abundance/productive risk for this population is high and must be improved to meet the proposed status.

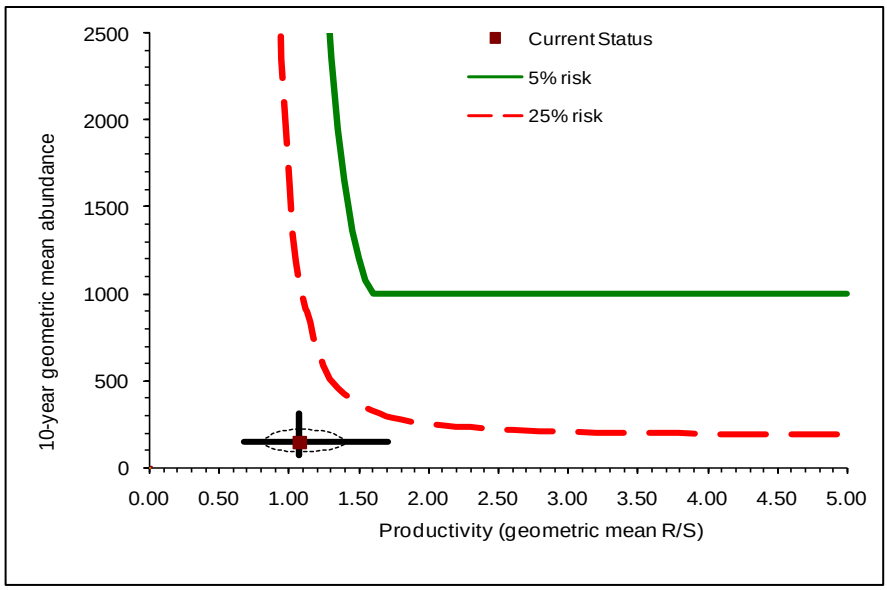

Figure 5.4-16. East Fork Salmon River spring/summer Chinook salmon current abundance and productivity compared to the viability curve. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Spatial Structure

Spatial structure risk is calculated using the results of three metrics: (1) spawning range, (2) spawner distribution, and (3) gap distance between spawning areas. The spawning range metric of the population is moderate risk because the population consists of just one major spawning area. Based on recent spawner surveys, spawning distribution in the East Fork Salmon River is likely similar to the historical range. For the spawner distribution metric, the East Fork Salmon River population was given a very low risk rating. There has been no change in gaps when comparing current to historical spawning distribution, so the gap distance between spawning areas metric received a low risk rating. When these three metrics were factored together, spatial structure received an overall low risk rating. This is suitable for the population to meet its proposed status.

Diversity

Diversity risk is calculated using the results of four metrics: (1) major life history/phenotypic/ genotypic variation, (2) spawner composition, (3) distribution of population across habitat types, and (4) selective change in natural processes or selective impacts. The rating for the genotypic variation metric was based on ICTRT analysis of allozyme data presented in Waples et al. (1993). This analysis showed that Herd Creek spring/summer Chinook salmon samples were not significantly different from Sawtooth Fish Hatchery samples, and that East Fork Salmon River samples were not significantly different from other hatchery samples. This resulted in a high diversity risk rating that is driven by genetic diversity and the legacy effects of hatchery fish. The diversity risk could be reduced in future years if the recent practice of allowing only natural-origin fish to spawn in the East Fork is continued. Over time, this practice should allow local adaptation to occur and lower the diversity risk rating to an acceptable level. The diversity risk must be reduced for the population to meet its proposed status.

Summary

The East Fork Salmon River population does not currently meet the proposed status because its risk rating for both abundance/productivity and spatial structure/diversity risk is high. Although spatial structure risk is low, the combined spatial structure/diversity risk for the population is high due to the high diversity risk. A reduction in the level of risk related to abundance/productivity and to diversity needs to occur before the population can reach its proposed status of viable.

Table 5.4-18 summarizes the abundance/productivity and spatial structure/diversity risks for the East Fork Salmon population. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.4-18. Viable Salmonid Population parameter risk ratings for the East Fork Salmon River spring/summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	HR	East Fork Salmon River

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow indicates proposed minimum improvement required for this population.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors.

Natal Habitat

Habitat Conditions

The East Fork Salmon River spring/summer Chinook salmon population is entirely contained within the East Fork Salmon River watershed, a 560 square mile tributary to the Salmon River. Elevations range from approximately 5,500 feet to almost 12,000 feet at the highest peaks. Precipitation is influenced by these topographic extremes with approximately 10 inches falling at the lower elevations to as much as 50 inches at higher sites. The majority of precipitation falls as winter snow, with dry summers and occasional spring and fall rains. Peak streamflows are associated with winter snowmelt and occur in late spring and early summer. Due to variability in precipitation and air temperature, mean daily streamflow values are also highly variable. Annual minimum flows usually occur in September.

The highest elevations in the watershed have been subject to intense glaciation with cirque basins and rugged ridgelines. Mid-elevations consist of broad ridges and wide U-shaped glacial troughs. Low elevations within the watershed are typically narrow confined canyon bottoms derived from erosional processes where water, rather than ice, has been the mechanism.

The mainstem East Fork Salmon River stretches 33 miles from the confluence of the South Fork East Fork and the West Fork East Fork downstream to the main Salmon River. The lower portions of the East Fork Salmon River have gradients less than 1 percent with an average channel width between 40 and 60 feet. Headwater streams are typically small, steep, and confined A-type channels (as defined by Rosgen (1996)) with limited anadromous habitat. Within the lower reaches of the East Fork Salmon River and its tributaries, channels become larger and less confined, and have reduced gradient (C-type channels). These lower reaches provide the majority of spring/summer Chinook salmon habitat, as suggested by the greater amounts of intrinsic potential habitat shown in Figure 5.4-15.

Most of the watershed is publicly managed (344,500 acres), with a large percentage of the public land falling within the Boulder-White Clouds Wilderness Area. The remaining 6,400 acres are privately owned and generally located along the mainstem East Fork and lower tributaries (Herd and Road Creeks). Because of this concentration of private land along streams, approximately 53 percent of the population’s cumulative intrinsic habitat potential is contained within private land. Therefore, private land management will have a large influence on spring/summer Chinook salmon habitat in the East Fork Salmon River.

The East Fork Salmon River watershed has been degraded from its historic condition, although the aquatic habitat in the watershed is now improving. The predominant land use has been ranching and cattle grazing, which have led to degraded riparian conditions, sedimentation, reduced streamflow, and disconnection of tributaries from the mainstem. Habitat restoration work in the East Fork has focused

on addressing flow and migrations barriers, and reducing impacts of private land activities along critical spawning and rearing habitat with fencing and grazing management (BLM 2012 *draft*).

Mineral exploration and mining was prevalent in most drainages following the discovery of gold in 1860. Mining activity declined at the beginning of the 20th century with a small resurgence in the 1930s. Big Boulder Creek supported the most intensive mining, and stream habitat has been influenced greatly in that drainage through channelization and sedimentation. Mine and tailing reclamation in Big Boulder Creek was completed in 2008 in an effort to reduce these legacy effects. Since 1972, new mineral entry has been prohibited with the Sawtooth National Recreation Area (PL92-400). There are approximately 10 public land grazing allotments in the watershed and grazing occurs on the majority of lands. Within the East Fork Salmon River, road densities are low and generally do not exceed one mile of road per square mile, although roads encroach on stream channels and riparian areas at local sites, contributing to channel instability and sedimentation. Water diversions, predominantly for hay pastures, are shown in Figure 5.4-17.

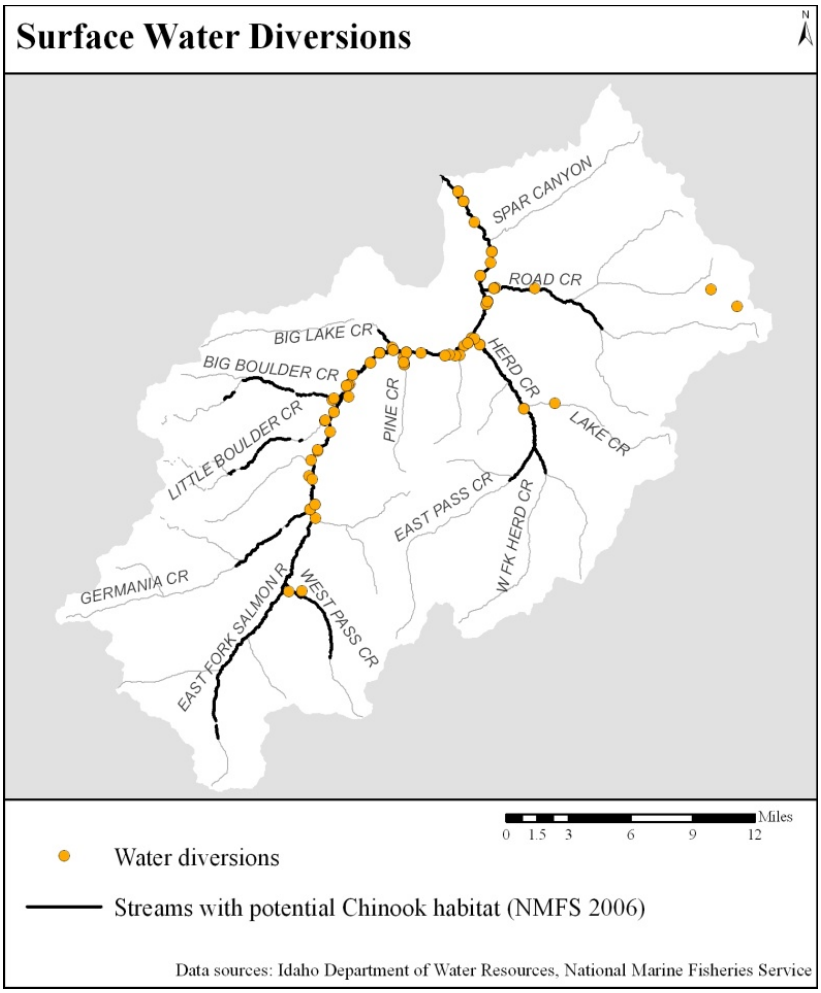

Figure 5.4-17. Surface water diversions in the East Fork Salmon River watershed.

Soils in this watershed are highly erosive. The parent sedimentary and basalt materials produce more productive soils than the granites that are common to the west of the East Fork watershed. These parent materials provide fine–textured soil, which holds moisture and traps organic material well,

encouraging relatively rapid vegetation growth and potentially providing more productive aquatic habitat conditions. However, if disturbed, these soils can produce fine sediments that can result in severe effects to spawning habitat. Volcanic soils in Road Creek and Spar Canyon, lower in the watershed, are also highly erodible.

Bedrock controls and tributary alluvial fans have created many broad, flat, and moist depositional areas along the mainstem East Fork and its major tributaries. These depositional areas were historically controlled by riparian vegetation that allowed incremental migration of the channel across the valley floor over time. These flats have proven attractive to human use and development in the watershed, as evidenced by the majority of the mainstem valley bottom being privately owned. Both historically and currently, private lands in the watershed have been used primarily for cattle grazing and hay production. More than 30 private diversions are located within the watershed (IDWR 2009), shown in Figure 5.4-17. Many of the diversions have fish screens but some remain unscreened. Water withdrawal likely reduces seasonal low flows in the watershed from historic conditions.

Intrinsic habitat potential modeling completed by NMFS provides a means to identify streams with the largest potential production in the East Fork Salmon River population (Figure 5.4-15). Based only on the quantity of intrinsic habitat available, the most important streams for spring/summer Chinook salmon in the East Fork Salmon River population are the mainstem East Fork Salmon River (including South Fork East Fork and West Pass Creek), Herd Creek (including East Pass Creek), Road Creek, Germania Creek, and Big Boulder Creek.

Current Habitat Limiting Factors

NMFS determined the habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups. Based on this review, NMFS concluded that the habitat limiting factors for the East Fork Salmon River spring/summer Chinook salmon population are degraded riparian function, altered hydrology, high water temperatures, sedimentation, and fish passage barriers. The following discussion reviews the available data supporting these determinations.

East Fork Salmon River - mouth to Herd Creek.

The East Fork Salmon River is a B-channel type from its mouth to Herd Creek. This river reach is approximately 13 miles long. The lower section of this reach (approximately 4 miles) is a high gradient channel that flows through an entrenched canyon with large rock substrate and little channel meandering. The upper 10 miles is slightly more sinuous and riparian vegetation plays a larger role in stream geomorphology.

1. Riparian habitat alteration.

Altered riparian habitats in this reach contribute to increased water temperature, elevated sediment levels, and reduced habitat complexity. Pool habitat in this reach may be below natural conditions because of the loss of historic cottonwood galleries within the East Fork Salmon River riparian area. Trapani (2002) supported this assumption, indicating that pool habitat represented just 6.4 percent of the reach's length. Trapani (2002) also identified the reach as having poor bank stability (49% stable) due to the large rock substrate along stream margins and riparian modifications. Cobble embeddedness

is also high for this reach at 41 percent (Trapani 2002) and is believed to be related to bank instability within and upstream of the reach.

Some spring/summer Chinook salmon spawning currently occurs in this reach but at lower densities than in the reach above Herd Creek. The relatively high stream gradient and relatively large average cobble size (6-9 inches) likely contribute to lower utilization of this reach for spring/summer Chinook salmon spawning. However, the low percentage of pool habitat, which often provides suitable spawning gravels, and high cobble embeddedness may have also contributed to reduced spawning opportunities in this reach. Reductions in riparian shading combined with irrigation return flows contribute to increased water temperatures (Ecovista 2004, p. 62). Unpublished BLM data indicates that temperatures at the mouth of the East Fork Salmon River had an average 7-day maximum of 65.9 ˚F for 2001-2006 observations (Tipton 2007). Water temperatures exceeding 60 ˚F are considered functioning at unacceptable risk.

Some migration barriers may also exist in this reach (NPCC 2004, p. 3-14). We recommend an assessment of potential passage blockages in the watershed with subsequent replacement or elimination of identified barriers.

East Fork Salmon River - Herd Creek to Germania Creek.
This reach is approximately 16 miles long and is a C-channel type, and supports the majority of Chinook salmon spawning in the population. Nearly the entire reach is under private ownership.

1. *Reduced habitat quality due to riparian habitat alteration.*

According to the NPCC and the U.S. Forest Service, past grazing and agriculture in this portion of the East Fork has greatly influenced habitat quantity and quality, particularly with respect to increased water temperatures, reduced levels of shade, and degraded streambank stability (NPCC 2004, SNF 2003). Trapani (2002) provided data supporting these claims identifying approximately 34 percent of the banks as unstable (approximately 5 percent of the stable banks consist of riprap) and 26 percent cobble embeddedness. Additionally, Trapani (2002) states, “watershed conditions are considered unstable and substrate imbalances can be seen in this reach” as there are “areas of large cobble/gravel deposits from upstream... causing bank instability and erosion.” However, because the majority of the watershed upstream of this reach is roadless, the large cobble deposits likely originate, at least in part, within the reach. Tributaries to this reach are listed on the Idaho’s Clean Water Act 303(d) list as impaired for failing the combined biota/habitat bioassessment (IDEQ 2008a), possibly due to altered riparian conditions.

2. Low flows and high water temperatures due to water diversions.

Hay production and pasture development in this reach relies heavily on irrigation water from the East Fork Salmon River. There are numerous water diversions in this reach with water rights capable of diverting at least 50 cfs (IDWR 2009). Most irrigation ditches are screened, but according to IDFG staff, the EF-16 diversion screen is ineffective and the EF-13 and EF-6a ditches are unscreened. All these diversions continue to entrain fish when in operation (Murphy 2008).

Water diversions and irrigation return flows within this reach likely exacerbate stream temperature problems while simultaneously reducing available habitat during seasonal low flow periods, through reduced depth and width of available habitat. Additionally, because this reach supports the majority of spring/summer Chinook salmon spawning in the population, fish entrainment in improperly screened or unscreened diversions may affect a significant proportion of the population.

For the reasons discussed above, the limiting factors for this reach are low flows, high water temperatures and high bank instability. Both temperature and bank instability are influenced by riparian modifications that appear to have disrupted the normal sediment transport and storage processes in this reach. Water temperature problems are likely exacerbated by irrigation practices in the reach. Although migration barriers, fish entrainment in irrigation diversions, and channel structure issues are of secondary concern, these factors all may affect productivity of the East Fork Salmon River population. Because this reach supports much of the current spawning, habitat restoration actions in this reach may provide the most immediate survival increases for the population.

Herd Creek.

Herd Creek is the largest East Fork Salmon River tributary and the only one with known spring/summer Chinook salmon spawning occurring in most return years. Herd Creek juveniles arrive at Lower Granite Dam earlier than other fish in the population, representing a potentially important life history within the population. Herd Creek contains approximately 10 miles of potential spring/summer Chinook salmon habitat. Herd Creek is predominately a C-channel type with portions of B channel where the valley narrows and gradient increases in the higher elevations. Spawning occurs throughout the mainstem of Herd Creek (Beatty 2012).

1. Riparian habitat alteration.

The Salmon River subbasin plan identified increased sedimentation and increased stream temperatures from altered riparian habitat as limiting factors in the Herd Creek watershed (NPCC 2004, p. 3-16). Migration barriers were historically present at several irrigation points of diversion, but barriers have since been eliminated by local watershed groups and IDFG. Increased temperatures and sedimentation have been attributed to conversion of riparian habitat to irrigated hay fields and cattle grazing. These uses have reduced historic riparian vegetation resulting in lost shade, higher bank instability levels, and simplified habitats due to stream widening. Fences on federal land and some reaches of private land now largely exclude cattle from accessing Herd Creek (BLM 2012 *draft*). Recent BLM monitoring data on vegetation seral status, percent hydric species, and bank stability, collected on Herd Creek, suggest a distinct improvement in riparian habitat. For example, bank stability has increased to similar levels to reference conditions (BLM 2012 *draft*). Bank instability issues may be more prevalent on the 2.6 miles of privately owned stream bottoms where land use has been most intensive (Trapani 2002). BLM also reports that recent stream temperatures are near or below Chinook salmon and steelhead spawning threshold temperatures and appear to be functioning appropriately (BLM 2012 *draft*).

2. Low flows and high water temperatures due to water diversions.

Water diversions in Herd Creek are limited to four points of diversion associated with 5 water rights with a cumulative maximum diversion rate of 7.57 cfs for irrigation. The diversions on Herd and Lake

Creeks are screened and do not dewater the streams to the point of preventing fish passage (BLM 2012 *draft*). However, water diversions may reduce available habitat quantity and quality, and likely contribute to elevated stream temperatures in the lower reaches of the watershed.

Other East Fork Tributaries and East Fork Headwaters.
Streams in this area make up 14.6 percent of the population's modeled intrinsic habitat potential (Figure 5.4-15). Low flows caused by water diversions, altered riparian areas, increased water temperatures, and fish passage barriers were identified as potential limiting factors in this assessment unit by the NPCC (2004, p. 3-14). However, these factors were considered "areas of secondary concern" for salmonids within the East Fork Salmon River as a whole. The headwaters and some lower tributaries provide potential spring/summer Chinook salmon habitat, but there is no known current spawning in this assessment unit. Germania Creek in particular has potential Chinook salmon habitat. This stream has few contemporary land use impacts and does not have the steep gradients of Big and Little Boulder Creeks.

The major headwater tributaries are Germania Creek, West Pass Creek and South Fork East Fork Salmon River. The majority of the headwaters are within either the White Cloud or Hemingway Boulder Wilderness Areas. With the exception of West Pass Creek, these streams have very limited anthropogenic impacts. West Pass Creek has three unscreened irrigation diversions near its mouth (WP-1, WP-2, and WP-3), reducing streamflow and possibly entraining fish in ditches. West Pass Creek was rated as having low to moderate intrinsic potential habitat, shown in Figure 5.4-15, due to its high stream gradients, and spring/summer Chinook salmon spawning was last documented in West Pass Creek in 1972 (Moulton 2008). The lack of current spawning and relatively low intrinsic potential values in this tributary suggest that the West Pass Creek diversions are probably not limiting population productivity at this time. However, if population abundance increases, spring/summer Chinook salmon may reoccupy West Pass Creek and the diversions may then affect abundance and productivity. One unscreened diversion also occurs in the upper East Fork Salmon River (EF-30), and one screened diversion occurs in Germania Creek, near its mouth. The unscreened diversion in the upper East Fork Salmon River is located in the channel margins where it is unlikely to capture migrating fish, and diverts a small quantity of water. Juvenile entrainment risk is considered low at this diversion site.

The lower East Fork tributaries with modeled habitat for spring/summer Chinook salmon are Big Lake, Little Boulder, Big Boulder, and Road Creeks, making up 8.8 percent of the population's intrinsic potential habitat. The majority of the habitat in these streams is rated as having low potential for spring/summer Chinook salmon (Figure 5.4-15). These streams are all relatively confined small channels with high gradients. Road Creek is the only stream in this group containing high intrinsic potential habitat relatively close to the mouth. No known spring/summer Chinook salmon spawning currently occurs in any of these streams. Juvenile rearing likely occurs in the lower reaches of some of these streams, where cooler tributary water provides refugia from the warmer East Fork water temperatures. Passage barriers block access to some potential tributary habitat.

A dam built on Big Boulder Creek in the 1930s for power generation blocked fish migration into this tributary for many decades until it was removed in 1991. However, a lengthy high gradient reach just

above the stream mouth may constitute an effective barrier to Chinook salmon. Currently Big Boulder Creek near its mouth is limited by lack of spawning gravels and instead is dominated by larger-sized substrate (Beatty 2012).

Road Creek has the most intrinsic potential habitat of the lower tributaries, but the habitat is degraded and seasonally inaccessible to spring/summer Chinook salmon. Road Creek is completely dewatered by irrigation withdrawals near the mouth during summer months. A road within the floodplain parallels Road Creek for most of its length. The volcanic geology in the watershed is highly erosive and contributes to high levels of surface fines throughout the drainage; in 2010, 49 percent surface fines and 89 percent surface fines were measured at two different Road Creek locations, well above criteria for Chinook salmon habitat (BLM 2012 *draft*). Unpublished BLM data indicates Road Creek had an average 7-day maximum temperature of 68.4 ˚F for 1999-2006 observations (as recorded below Horse Basin Creek, upstream of irrigation diversions) (Tipton 2007). Elevated water temperatures may be related to historic cattle grazing on public and private lands and exacerbated by irrigation withdrawals in the lower section of the drainage.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the East Fork Salmon River watershed.

1. Degraded water quality due to new mineral exploration and development. Without sufficient water quality conservation measures, new mining operations could release sediment and toxic chemicals into surface waters.
2. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.
3. Habitat degradation from off-highway vehicle use. Assuring that OHV use is restricted to existing U.S. Forest Service and BLM roads and trails will likely minimize impacts.
4. Riparian and floodplain degradation from floodplain development. Development in the floodplain and along riparian areas in the East Fork remains a threat, as evidenced by Idaho Department of Water Resources data identifying 20 new groundwater well applications from 1996 to 2005 within the 100-year floodplain. We recommend Custer County and private parties work with resource specialists to ensure future developments maintain existing floodplain and riparian processes where they are properly functioning and allow for the long-term recovery of these processes where they are currently impaired.

Hatchery Programs

There are currently no hatchery fish released in the East Fork Salmon River population area but hatchery releases have occurred in the past. Potential legacy effects from the past hatchery program continue to exist. Hatchery-related limiting factors and threats for the population are further discussed at the MPG level in Section 5.4.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River and Salmon River continue to pose a threat to spring/summer Chinook salmon returning to the East Fork Salmon River and to other populations in the MPG. State fisheries do not target spring/summer Chinook salmon within the East Fork Salmon River population area; however, tribal fisheries may occur. Overall, however, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for spring/summer Chinook salmon in the Upper Salmon River are discussed at the MPG level in Section 5.4.3.3.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The description of limiting factors above identified the long history of converting riparian habitat to agricultural uses across the basin. This conversion has resulted in degraded spawning and rearing habitat through elevated sediment and temperature levels. Because so much spawning and rearing habitat occurs on private lands (53% of cumulative intrinsic potential habitat area), maintaining and improving stream habitat on private land should be forefront in the recovery effort.

The following actions, shown in priority order, for habitat improvements within the East Fork Salmon River watershed are intended to improve abundance and productivity by reducing mortality and increasing the effective capacity for natural smolt production in the watershed. Increased production will contribute to maintaining and restoring the VSP parameters while moving the population towards the proposed status.

1. Improve riparian processes and conditions in the mainstem East Fork Salmon River upstream of Herd Creek and in Herd Creek. Improving riparian conditions would help reduce elevated water temperatures and sediment levels that currently reduce spawning and rearing success in this reach. This area currently has the majority of spring/summer Chinook salmon spawning and rearing within the population and increased bank stabilization is likely to result in increased salmonid productivity. Secondary treatment areas include the lower reach of the East Fork Salmon River (below the Herd Creek confluence), and tertiary areas include tributaries that are unoccupied or have very low intrinsic potential (e.g. Lake Creek, Road Creek, and Big Boulder Creek).

   Historic land use in the East Fork has disrupted the processes that form and sustain fish habitats, including sediment supply, woody debris recruitment, shading, and water delivery and storage. Thus, the improvement of fish habitat will require restoration of the watershed processes that have been disrupted. In the East Fork Salmon River, this will require both active and passive restoration to recover riparian areas and thus stabilize banks and increase shade. Passive restoration opportunities may include modifying grazing strategies (e.g., adjusting the duration, intensity, and/or location of grazing) in order to facilitate recovery of riparian vegetation and associated channel forming processes. Passive restoration may also include riparian fencing and securing conservation easements to protect currently undeveloped riparian habitats and allow natural riparian processes to persist or recover as appropriate. Active

restoration of riparian processes may include riparian vegetation planting; constructing bank stabilization structures where natural revegetation is not feasible; construction of riparian fences; and removal or relocation of roads, dikes, or other structures that currently impair stream and riparian function.

In addition to improving sediment and temperature conditions, restored riparian areas (including stable banks) would lead to reduced channel widths and corresponding increases in water depth and improved habitat complexity. These improvements are likely to increase productivity within the East Fork Salmon River spring/summer Chinook salmon population and contribute to increased abundance over time.

2. Directly improve flow and water temperature in the mainstem East Fork Salmon River and Herd Creek. Approximately 33 irrigation diversions exist in the watershed and reduce stream volume during the warmest months. Extensive flood irrigation practices in the basin result in warm return flows that further increase water temperatures. Reestablishment of riparian processes as discussed above will aid in water temperature reductions over the long-term as stream shading and channel depth increases and channel widths decrease. However, local watershed groups, landowners, Irrigation District 72, and the State of Idaho also need to continue to secure increased flows. Increasing base flows will have a direct effect of reducing stream temperatures.

   Increases in flow should be focused first on locations currently supporting spawning and rearing spring/summer Chinook salmon, with emphasis on areas supporting both salmon and steelhead. The mainstem East Fork Salmon River from Herd Creek to Germania Creek and Herd Creek currently meet these criteria and initial efforts should focus in these locations. Efforts to improve temperatures and streamflows in currently unoccupied historic habitat should receive secondary attention except where immediate opportunities can be capitalized on, or where improvements would substantially benefit occupied habitat downstream.

3. Screen all irrigation diversions so that fish do not become entrained in ditches, and eliminate passage barriers associated with diversions. Existing entrainment issues should be addressed first, followed by passage barriers blocking access to stream reaches with the greatest potential for spring/summer Chinook salmon recolonization. Projects should be scheduled within the context of the priorities set by the IDFG Screen Shop for the entire upper Salmon River basin.

   Although spring/summer Chinook salmon spawn in the mainstem East Fork and juveniles likely rear throughout the watershed, partial and complete passage barriers block access to some habitat. Increased spatial distribution could increase the population's abundance. Therefore, we recommend an assessment of potential passage blockages in the basin and subsequent replacement or elimination of identified barriers to spring/summer Chinook salmon. Both structural barriers and irrigation related dewatering barriers are thought to be present. The mainstem East Fork Salmon River should be the primary focus for this effort. West Pass Creek, Big Boulder Creek, Road Creek, and Lake Creek are the second priority. These tributaries have intrinsic potential habitat that may be inaccessible to spring/summer Chinook salmon due to migration barriers. Streams with high gradients that naturally block spring/summer Chinook salmon should not be targeted under this recovery plan for removal of man-made fish passage barriers.

4. Address degraded riparian conditions along tributaries. Where natural revegetation is feasible, recovery plan strategies include the installation of riparian fencing and modification of current grazing practices. Where natural revegetation is not feasible due to physical or management constraints such as structures or roads, structural stabilization of eroding banks should occur. Focus areas, in priority order, for this action include: West Pass Creek, West Fork Herd Creek, Lake Creek, Road Creek, Horse Basin Creek, and Corral Basin Creek. Modifying grazing practices in these riparian areas will reduce sediment delivery to downstream habitats and encourage riparian recovery, resulting in improved water quality conditions and improved fish habitat.

Implementation of Habitat Actions

Implementation of habitat actions for this population will likely occur through the work of the Upper Salmon Basin Watershed Program partners. Between these groups there is an excellent representation of private, state and federal entities that manage land and other resources within the watershed. These entities have created an effective process for working together, providing technical reviews of proposed projects and working with interested parties to accomplish conservation on the ground. These groups have a strong record of implementing water quality and salmon conservation projects in the past and have made very important contributions to salmon recovery projects. Projects have improving fish passage at diversions by screening and structure modification, riparian area fencing and restoration, streambank restoration, and improving irrigation efficiency. Future actions will build on these accomplishments.

Table 5.4-19 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not represent a full list of projects. Specific projects are planned continuously based on available funding and established priorities. During Plan implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.4-19. Habitat Recovery Actions Identified for the East Fork Salmon River Spring/Summer Chinook salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Streamflow	Protect 6 cfs flow	BPA Contract # 1994-015-00: Idaho Fish Screening Project BPA Contract # 2007-268-00: Idaho Watershed Habitat Restoration-Custer District BPA Contract # 2007-399-00: Upper Salmon Screen Tributary Passage	N/A
Entrainment	7 screens		
Barriers	Address 5 barriers (diversions)		

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 5.4-19 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined (TBD).

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs may present. For the East Fork Salmon River population, the strategy is to manage for natural production. This includes monitoring for strays and taking necessary actions to address straying. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.4.9 Valley Creek Spring Chinook Salmon Population

The Valley Creek spring Chinook salmon population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its targeted proposed status is Viable, which requires a minimum of low abundance/productivity risk and moderate spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Viable

Population Status

This section compares the Valley Creek population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The ICTRT designated spring Chinook salmon in the Valley Creek watershed as an independent population (ICTRT 2003). Although genetic samples from Valley Creek cluster closely with those from the upper Salmon River, this clustering is likely due to the influence of the Sawtooth Hatchery. The hatchery is on the Salmon River upstream of the mouth of Valley Creek, and hatchery genetic samples cluster with samples from both the Valley Creek and Upper Salmon River populations. The bulk of spring Chinook salmon spawning in Valley Creek occurs in upstream reaches, sufficiently separated from upper Salmon River spawning areas to warrant independent population status for Valley Creek spring Chinook salmon. A substantial estimated historical run size of 2,500 spawners for the Valley Creek watershed also supports designation as an independent population (ICTRT 2003, p. 25). This population consists of one major spawning area (Figure 5.4-18).

In addition to Valley Creek itself, streams occupied by this population include the tributaries Elk Creek, Stanley Lake Creek, Stanley Creek, Thompson Creek, Crooked Creek, Iron Creek, and Meadow Creek. The ICTRT classified the Valley Creek population as Basic in size and complexity based on historical habitat potential. Valley Creek and its tributaries support both spring-run and summer-run Chinook salmon. IDFG considers adult spawners upstream of Stanley Lake Creek to be spring-run and those downstream of Stanley Lake Creek to be summer-run ICTRT 2010).

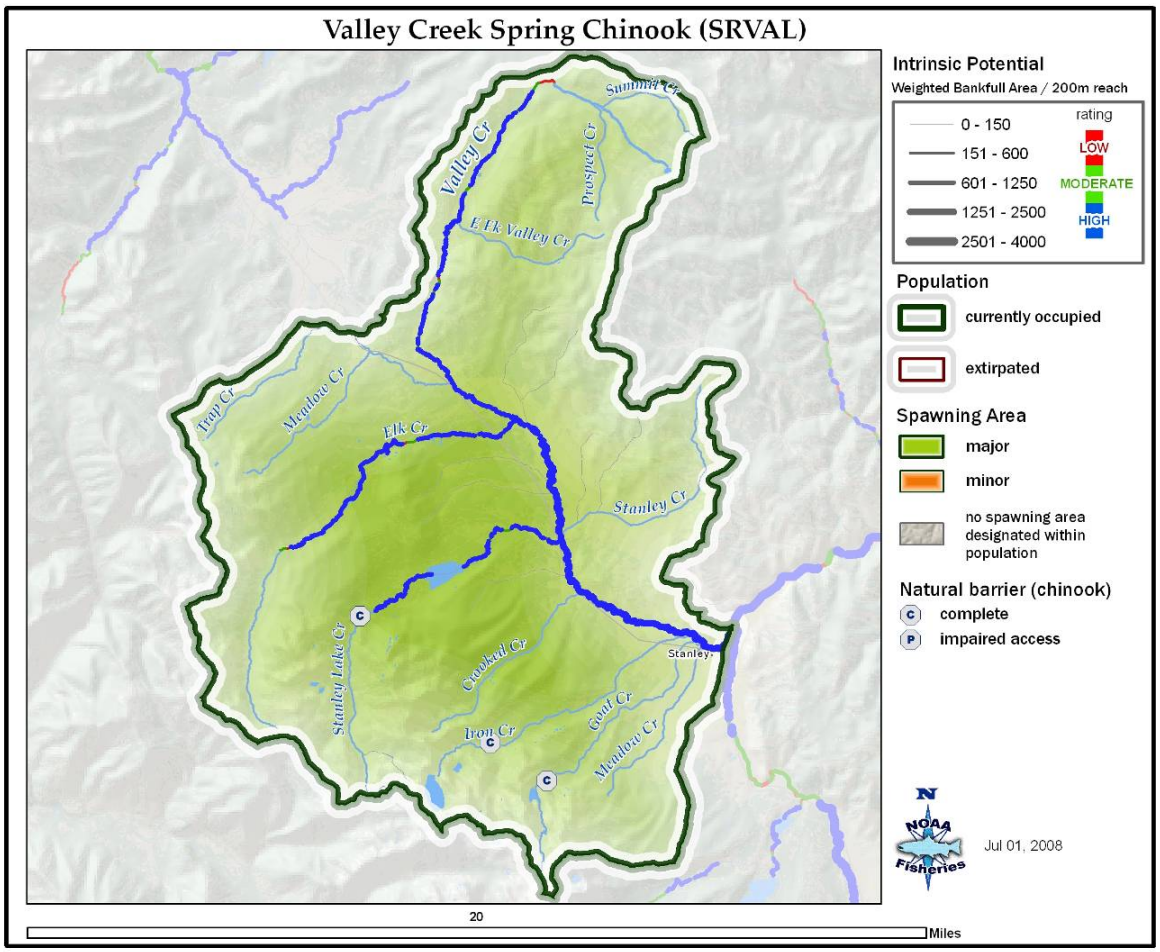

Figure 5.4-18. Valley Creek spring/summer Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

As a Basic-size population, the abundance and productivity targets for Valley Creek spring/summer Chinook salmon to achieve a low risk level are a mean minimum abundance threshold of 500 natural-origin spawners with a productivity of greater than 2.21 recruits per spawner. This would achieve a 5 percent or less risk of extinction over a 100-year timeframe. In contrast, the recent 10-year geometric mean (2005-2014) abundance of natural-origin spawners in Valley Creek is 121 fish. The geometric mean productivity is 1.45 recruit per spawner, significantly less than the 2.21 recruits per spawner required at the minimum abundance threshold of 500 spawners (NWFSC 2015).

In addition to the mean abundance threshold of 500 spawners, the ICTRT viability curve shows the minimum combinations of current natural-origin abundance and productivity that correspond to a particular risk level. As seen in Figure 5.4-19, a proposed risk level can be achieved with various combinations of abundance and productivity. For the Valley Creek population, the proposed viable (low risk) status can be attained with any combination of abundance and productivity that is above the green line in Figure 5.4-19. The current abundance/productivity point estimate for this population resides below the 25 percent risk curve, such that improvement in abundance/productivity status will need to occur before the population can be considered viable.

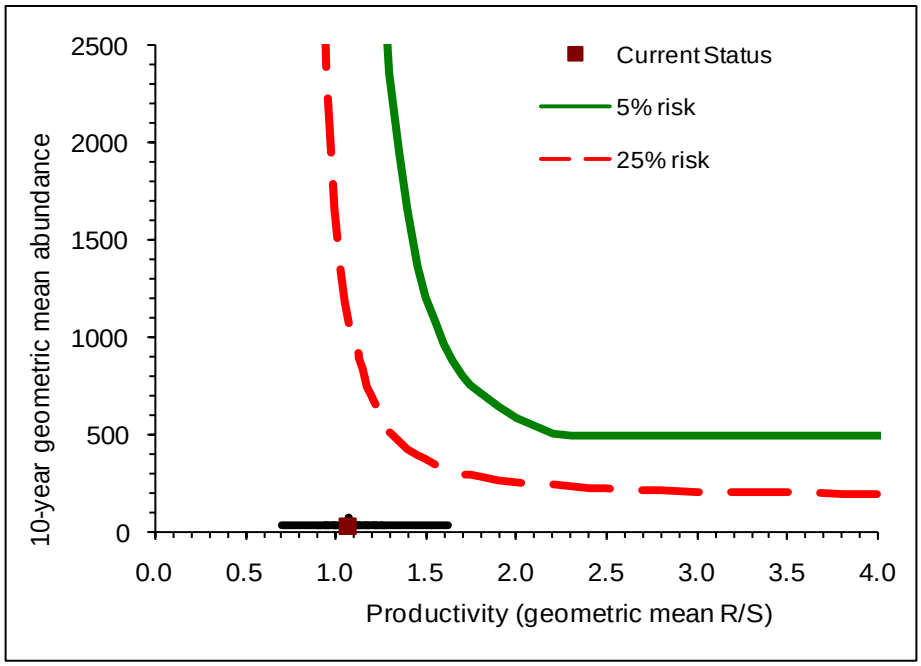

Figure 5-4.19. Valley Creek spring/summer Chinook salmon population current estimate of abundance and productivity compared to the viability curve for the population. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Spatial Structure

The ICTRT (2010) rated overall spatial structure risk as low for the Valley Creek population, based on a moderate risk rating for the number and spatial arrangement of spawning areas, low risk rating for spatial extent or range of the population, and a low risk rating for a change in gaps between spawning areas. The Valley Creek population consists of just one major spawning area, with no minor spawning areas. This limited number and spatial arrangement of spawning areas creates some inherent extinction risk. However, spawning is broadly distributed throughout the population, ranging from the mouth of Valley Creek, to the broad valley in the upper portion of the watershed and the tributary Elk Creek. Furthermore, the ICTRT found that the extent of current spawning mirrors the extent of historical spawning, such that historical range has not been reduced (ICTRT 2010).

Findings by an interagency workgroup in the Upper Salmon River basin, however, estimate that the distribution of Chinook salmon spawning and rearing has been reduced in a number of Valley Creek tributaries compared to the extent of historically available habitat. The Agreement in Principle (AIP) Tech Team analyzes water diversion-related issues in streams in the Sawtooth National Recreation Area (SNRA), which encompasses most of the Valley Creek watershed. The AIP Tech Team argues that the ICTRT assessment of spatial structure risk for this population does not adequately take into account tributaries that historically supported spring/summer Chinook salmon (SNF 2009b). The team determined that currently spring/summer Chinook salmon are rarely observed in Valley Creek tributaries upstream of the low-gradient reaches near tributary mouths, despite suitable habitat for Chinook salmon in many of the larger tributaries, such as Iron Creek, Goat Creek, Trap Creek, Stanley Lake Creek, and Stanley Creek. Access to this historical habitat has been lost in some tributaries and

restricted in others depending upon flow conditions. Iron Creek, Goat Creek, lower Meadow Creek, and Stanley Lake Creek have the most passage issues, limiting the ability of spring/summer Chinook salmon to fully utilize historical habitat. The AIP Tech Team believes that although spawning distribution in mainstem Valley Creek itself is relatively unchanged from historical conditions, the spatial arrangement of current spawning and rearing throughout the population has been simplified, making this population more vulnerable to natural and anthropogenic disturbance (SNF 2009b).

Diversity

The ICTRT (2010) rated genetic diversity risk for this population as moderate. At present, the primary factor leading to a moderate risk diversity rating for the Valley Creek population is genetic structure. Within-population variation in genetic samples showed potential homogenization with other proximate populations and similarity to Sawtooth Fish Hatchery samples.

Summary

The Valley Creek population is rated at high risk of extinction. The current rating is driven by a high risk rating for abundance and productivity. Without survival increases that lead to increases in abundance and productivity, the Valley Creek population cannot reach its proposed status of viable. The Valley Creek spring/summer Chinook salmon population is currently rated at moderate risk for spatial structure and diversity, which is adequate for the population to reach overall viable status.

Table 5.4-20 summarizes the abundance/productivity and spatial structure/diversity risks for the Valley Creek population. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.4-20. Viable Salmonid Population parameter risk ratings for the Valley Creek spring Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	Valley Creek	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors.

Natal Habitat

Habitat Conditions

Valley Creek is a tributary to the upper Salmon River, entering the Salmon River at the town of Stanley, Idaho. The watershed is bordered by the Sawtooth Mountains to the south, and the Middle Fork Salmon River to the north. Elevations range from a high of 10,750 feet, to a low of 6,190 feet at Valley Creek's confluence with the Salmon River. Large wet meadows, created as glaciers receded, are a dominant feature of the watershed. The majority of lands to the west side of Valley Creek are inventoried roadless areas, with the upper portions of Elk Creek and Stanley Lake Creek classified by the U.S. Forest Service as recommended wilderness. Most of the Valley Creek watershed falls within the Sawtooth National Recreation Area. The Valley Creek watershed is approximately 145 square miles in size, 91 percent of which is under federal ownership. Private lands are located mainly along the more fertile valley bottoms, although some private, patented mining land also exists within the watershed.

Primary land uses in the watershed include livestock grazing and dispersed recreation (SNF 2003, p. III-101), with rural development also occurring in the lower reaches of Valley Creek. Grazing occurs on the majority of public and private lands within this watershed. Five grazing allotments are located within the watershed, as is a sheep driveway, which extends from the Valley Creek headwaters south to the Redfish Lake watershed. Grazing is the exclusive agricultural use of private lands within the watershed (in contrast to lower elevation watersheds of the Salmon River basin, where irrigated crop agriculture is extensive). Nonetheless, many of the pastures on private land are irrigated via surface water diversions from streams on both private and public land (SNF 2006). The amount of water use is relatively light compared to other upper Salmon River tributaries, but water diversions for irrigation periodically dewater Iron and Goat Creeks, and greatly reduce flows in Meadow Creek and in Valley Creek upstream from Elk Creek. Water diversion structures impair upstream fish passage, and juveniles are entrained and killed in unscreened diversions on tributaries and the upper mainstem Valley Creek.

Dispersed recreation occurs throughout the watershed. There is an extensive system of well-maintained trails in Valley Creek, providing a variety of motorized and non-motorized recreation opportunities. Illegal off-trail use by motorized vehicles in some areas has resulted in landscape scarring, impacts to vegetation, channeling flow, and increasing rates of erosion (SNF 2003, p. III-106). On the other hand, road densities are relatively low at less than 1 mile of road per square mile, with no new roads constructed in the watershed since the Sawtooth National Recreation Area was established in 1972 (SNF 2010). Likewise, there is very little timber harvest with no clearcuts greater than 10 acres since 1972.

Land uses in the Valley Creek drainage have increased levels of instream sediment, increased water temperatures, degraded floodplain function, decreased pool to riffle ratios, created fish passage barriers, cause periodic dewatering of Iron and Goat Creeks, and reduced flow in several tributaries and the mainstem (NPCC 2004). IDEQ listed 30 miles of Valley Creek in the 2012 Integrated Report (IDEQ 2014): all due to their combined biota/habitat bioassessment scores, which indicated low numbers of macroinvertebrates and low habitat ratings (IDEQ 2014).

The AIP Tech Team has identified the most important stream reaches for Valley Creek spring/summer Chinook salmon (SNF 2009c). The AIP Tech Team identified these stream reaches by synthesizing existing information on habitat, such as the ICTRT's intrinsic potential habitat model shown in Figure 5.4-18 (NMFS 2006), documented locations of current spawning and rearing habitat, and the Screening and Habitat Improvement Prioritization for the Upper Salmon Subbasin (SHIPUSS; USBWP 2012).

The AIP Tech Team concluded that the most important stream reaches for spring/summer Chinook salmon in the population are in Valley Creek. Of all habitat within the Valley Creek watershed, the Valley Creek mainstem provides 68.8 percent of current spawning habitat area, 41.9 percent of miles of current rearing habitat area, and 57 percent of intrinsic potential weighted habitat area. The AIP Tech Team identified the most important stream segments as the mainstem Valley Creek reaches between Iron Creek and Crooked Creek and between Trap Creek and Summit Creek. These two stream reaches represent 8.8 percent and 18.1 percent of the weighted intrinsic potential habitat area in the population, respectively. The AIP Tech Team further reported that Elk Creek is the most important tributary to Valley Creek for spring/summer Chinook salmon, supporting 31.2 percent of current spawning habitat area, 17 percent of current rearing habitat area, and 15.3 percent of the weighted intrinsic potential habitat area within the population. Other important tributaries for spring/summer Chinook salmon include Iron Creek, Goat Creek, and Trap Creek. Although these three streams do not currently support spawning habitat, they collectively comprise 23.4 percent of current rearing habitat area and 10.2 percent of the weighted intrinsic potential habitat area for the population (SNF 2009c). The AIP also determined that some small tributaries, such as Meadow Creek, provide quality rearing habitat and are important to the population.

Similarly, the SHIPUSS report identified the upper mainstem Valley Creek as important for spring/summer Chinook salmon, classifying Valley Creek upstream from Elk Creek as a Priority I stream (USBWP 2012). Elk Creek was also identified as a Priority I stream, while Meadow Creek[6], Goat Creek, and Iron Creek were identified as Priority II streams. Under SHIPUSS, Priority I streams are those streams that have the potential to realize immediate, tangible benefits to fish if recovery efforts are directed toward them. Priority II streams are those streams that will also see tangible benefits to fish as a consequence of recovery projects, but where the benefits may be less substantial or may be delayed for quite some time (USBWP 2012).

Current Habitat Limiting Factors

NMFS determined the habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups.

1. Low streamflows due to water diversions.

Many of the pastures on private land in Valley Creek are irrigated with surface water diversions from streams (Figure 5.4-20). Some diversion ditches start on private land, whereas others start on public

[6] A lower tributary entering Valley Creek near the town of Stanley. Another Meadow Creek is tributary to Trapp Creek in the upper watershed.

land and deliver the water to private land. Water diversions can affect fish by reducing instream flow and thereby reducing habitat availability, by blocking fish passage to upstream or downstream habitat, by entraining fishes in unscreened irrigation systems, and by delaying fishes in bypass systems of screened diversions.

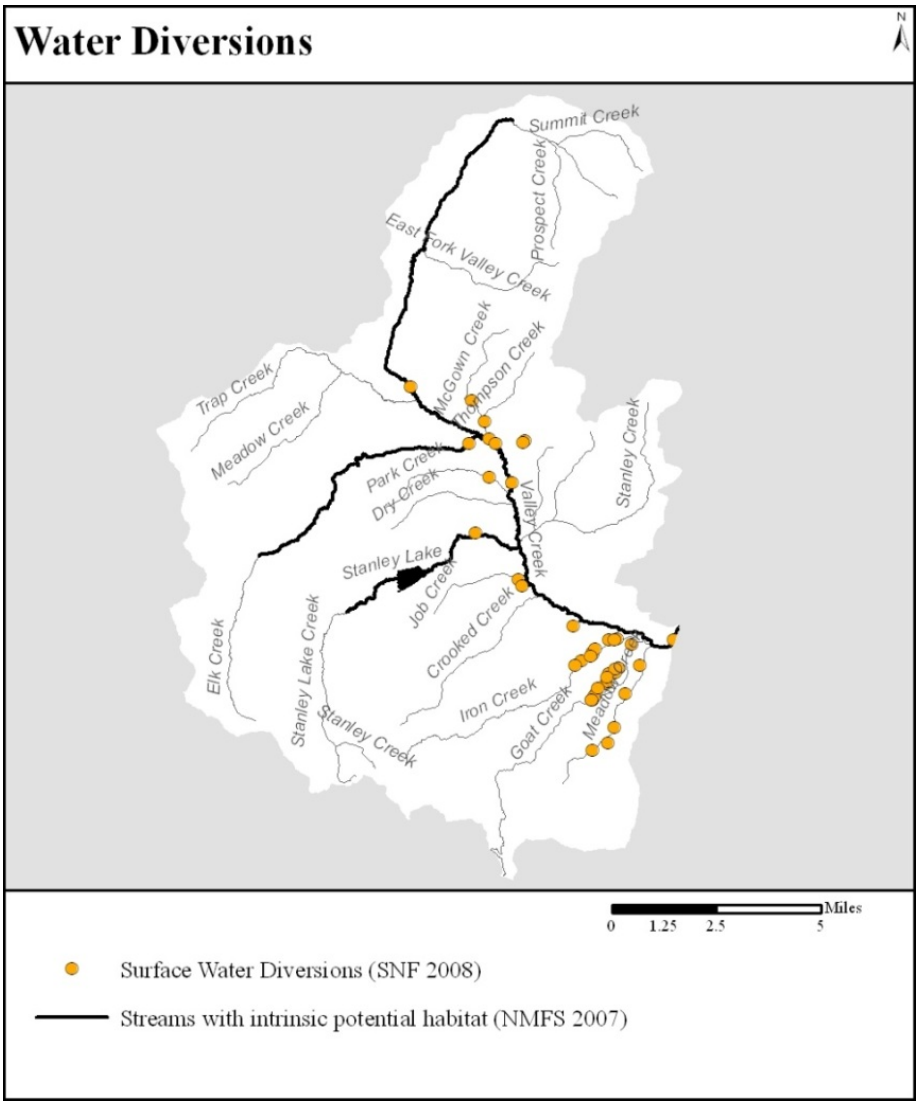

Figure 5.4-20. Surface water diversions in Valley Creek (SNF 2008).

Irrigation diversions affect salmonid habitat throughout the watershed (SNF 2010). Several of the smaller tributaries, such as McGown, Thompson, and Park Creeks, are completely diverted into ditches and no longer flow in their historic channels. Some larger tributaries, such as Iron and Goat Creeks, are periodically dewatered during the irrigation season. Diversions also reduce flows in mainstem Valley Creek, with reductions in upper Valley Creek (below the VC5/6 diversion) possibly enough to impair upstream Chinook salmon migration.

Actions have been taken to reduce adverse effects of water use. All diversions from mainstem Valley Creek have been screened and some have been upgraded to improve upstream fish passage. One diversion on Elk Creek and two on Crooked Creek have been decommissioned (SNF 2010). However,

much work remains. Many diversions on tributary streams are not screened or are not adequately screened, several tributary streams are completely dewatered, and reduced flow in tributary streams and the mainstem adversely affects spring/summer Chinook salmon and their habitat. Table 5.4-21 lists streams in which surface water diversion structures are creating fish passage barriers on U.S. Forest Service land (SNF 2009c).

Table 5.4-21. Fish passage at selected diversion structures in the Valley Creek drainage (SNF 2009c). This assessment did not evaluate the approximately 21 diversions on private land on Iron Creek, Goat Creek, Tennell Creek, and mainstem Valley Creek.

Stream	# Diversions/ # w/ Barrier Evaluation	Adult Passage at Low Flow	Adult Passage at Mod. Flow	Adult Passage at High Flow	Juvenile Passage at Low Flow	Juvenile Passage at Mod. Flow	Juvenile Passage at High Flow
Meadow Creek (lower) [b]	5/0						
Goat Creek [a, b]	14/2	1-B, 1-P	2-F	2-F	1-B, 1-P	1-P, 1-F	2-F
Iron Creek [b]	9/5	2-B, 2-P, 1-F	1-P, 4-G	1-P, 4-G	2-B, 2-F, 1-P	2-B, 2-G, 1-F	3-G, 2-F
Job Creek	1/0						
Tennell Creek [b]	2/0						
Valley Creek (lower mainstem) [b]	3/2	1-P, 1-VG	1-P, 1-VG	1-G, 1-VG	1-F, 1-VG	1-G, 1-VG	1-G, 1-VG
Stanley Lake Creek	1/1	VG	VG	VG	VG	VG	VG
Elk Creek	2/2	2-P	2-F	1-F, 1-G	1-B, 1-F	1-B, 1-P	1-B, 1-G
McGown Creek [b]	2/0						
Park Creek	1/0						
Valley Creek (upper mainstem)	1/1	G	VG	VG	G	VG	VG
Totals:	41	13					

Key: a – some diversions have pumps and no diversion structure; b – diversions on private land; B – barrier to fish passage; P – barrier to most fish; F – barrier to some fish; G – passage as good as can be expected; and, VG – passage as good as in the natural stream channel.

2. Other fish passage barriers.

In addition to diversion structures, year-round or seasonal barriers also exist at many culvert road crossings and at one “rough fish” barrier. Culvert inventories conducted by the Sawtooth National Forest in 2003 and 2007 identified passage barriers on many important tributary streams (SNF 2009c). Table 5.4-22 shows miles of potential habitat that are currently inaccessible to spring/summer Chinook salmon due to passage barriers at stream road crossings and at the rough fish barrier. Culverts on Highway 21 that create partial passage barriers on Iron Creek and Goat Creek were replaced in 2011. The Sawtooth National Forest also includes barrier removals as part of its long-range plan.

Table 5.4-22. Miles of habitat blocked or partially blocked by culverts in the Valley Creek spring/summer Chinook salmon population (SNF 2009c).

Stream	Miles Completely Blocked	Miles Partially Blocked
Meadow Creek (lower)	-	3.3
Iron Creek	-	5.7
Job Creek	2.75	-
Stanley Creek	2.60	2.5
Stanley Lake Creek	3.39	-
Elk Creek	-	11.0
Trap Creek	-	5.5
Hanna Creek	1.66	-
Totals:	10.40	34.5

The Stanley Lake rough fish barrier is on Stanley Lake Creek approximately 0.25 miles downstream from the lake. This barrier was constructed in 1954 to restrict movement of "rough fish" (species that were not popular for recreational fishing) into Stanley Lake, but the barrier actually created a complete barrier to upstream passage for all fish species. Removing the barrier, or establishing fish passage through or around the barrier, would restore access to 3.4 miles of historic high quality spring/summer Chinook salmon spawning and rearing habitat and access to 179 acres of lake habitat that could be used by rearing Chinook salmon.

Establishing upstream fish passage through the Stanley Lake rough fish barrier is feasible, but there are concerns about the spread of non-native lake trout, which are present in Stanley Lake. In 1975, IDFG stocked lake trout in Stanley Lake to reduce density of a population of stunted kokanee (Jeppsen and Ball 1979). By the early 1990s, the lake trout population was established and reproducing, and Stanley Lake has since become known as a trophy lake trout fishery (Schoby and Curet 2007). Reestablishing upstream fish migration into Stanley Lake might alter trophic dynamics, which could lead to increased recruitment of lake trout, with subsequent spreading of the lake trout population to other Sawtooth Valley lakes (Curet 2010).

3. Degraded riparian and floodplain habitat.

Various human land uses have degraded riparian and floodplain habitat in Valley Creek. Livestock grazing, dispersed recreation, and irrigation practices have led to soil instability, soil compaction, accelerated sediment delivery to streams, and stream channel and structure modification (SNF 2003, p. III-103). Riparian areas have been degraded in localized areas due to loss of riparian vegetation. Floodplains have been altered by roads, developed and dispersed recreation, water withdrawals, and grazing. Large woody debris levels are low in some riparian areas due to firewood gathering, and native sedge and willow species are being replaced by grass species due to livestock grazing. Fire exclusion and irrigation diversions have had the cumulative effect of reducing wet meadows, reducing willows, and reducing overall amount of riparian habitat (SNF 2003, p. III-103).

Considerable floodplain modification has occurred in the lower section of the Valley Creek watershed. Near the city of Stanley, numerous floodplain fills, levees, and other similar modifications have

occurred. Past mining and grazing have significantly altered and entrenched some reaches of Stanley Creek, Job Creek, and Little Job Creek.

Elsewhere, some minor localized modification has occurred at road fills, bridges, and surface water diversions. A notable improvement to floodplain function in lower Valley Creek was realized in 2001 when the former city at Stanley sewer lagoon cells, covering 11 acres of floodplain adjacent to Valley Creek, were removed and the former natural topography reestablished.

4. Temperature

Although the Valley Creek population is at high elevation with a relatively cool climate, summer stream temperatures can be suboptimal for salmonids, with August daily maximum temperatures rising above 21 °C in Valley Creek mainstem Chinook salmon spawning reaches (RMRS 2013). Irrigation diversions may be contributing to increases in stream temperature. In tributaries to the main Salmon River in the neighboring Sawtooth Valley, Rothwell and Moulton (2001) found that reductions in streamflow caused by irrigation diversions led to dramatic increases in stream temperature of greater than 10 °C. In Elk Creek (tributary to Valley Creek), Rothwell and Moulton (2001) found that temperatures were only slightly elevated downstream from irrigation diversions, and USGS (2004a) found no diversion-related stream temperature increases in Elk Creek. However, the lower tributaries Goat Creek, Iron Creek, and Meadow Creek are heavily diverted and may be contributing warmer water to Valley Creek.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Valley Creek watershed.

1. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density. Emphasize prevention, control, and eradication of noxious weed infestations on the Highway 75 road corridor.
2. Riparian degradation due to recreational use. Dispersed recreation can damage vegetation, compact soils, channelize overland water flow, and increase erosion. Monitoring sites where recreation use is concentrated, and modifying or discontinuing use of these sites if riparian habitat deteriorates, will likely minimize impacts. Emphasize restoration activities in Iron Creek, Elk Creek, and Valley Creek.
3. Habitat degradation from off-highway vehicle use. Assuring that OHV use is restricted to existing U.S. Forest Service roads and trails will likely minimize impacts, particularly in Elk Creek, Nip and Tuck Creek, upper Valley Creek, Iron Creek, and Crooked Creek.
4. Loss of beaver. Reduction or removal of beaver has negatively affected aquatic and terrestrial ecosystems. Programs are needed to encourage beaver activity in areas with reduced human conflict, or the building of structures that mimic beaver activity in areas where potential conflict exists.

Hatchery Programs

There are currently no hatchery releases in the Valley Creek population area. Hatchery strays from out-of-population programs (including the Sawtooth Hatchery) continue to pose a threat to the Valley

Creek population and a risk to the population's genetic adaptiveness and viability. Hatchery-related limiting factors and threats for the population are further discussed at the MPG level in Section 5.4.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River and Salmon River continue to pose a threat to Valley Creek spring/summer Chinook salmon, and to other Upper Salmon River populations. State fisheries targeting hatchery-origin spring/summer Chinook salmon do not occur in the Valley Creek population area but tribal fisheries may occur. Overall, however, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Upper Salmon River spring/summer Chinook salmon are discussed at the MPG level in Section 5.4.3.3.

Predation and Competition

Current Predation/Competition Limiting Factors

NMFS identified the following predation/competition limiting factor for this Chinook salmon population.

1. *Reduced survival due to competition/predation by brook trout*.

Non-native brook trout are found within virtually every stream system in the Upper Salmon River basin (SNF 2006). Brook trout may impact Chinook salmon through several mechanisms. Section 4.4.5.1 for the Upper Salmon River Mainstem spring/summer Chinook salmon population describes research findings on how brook trout can impact Chinook salmon abundance and productivity.

Currently, brook trout occupy Valley Creek and almost every one of its tributaries. Therefore, removal of brook trout may be key to long-term improvements in Chinook salmon abundance and productivity in the Valley Creek population. Addressing brook trout in Valley Creek is a high priority for this population (NPCC 2004, p.3-13). However, as reported by Dunham et al. (2002), options for controlling brook trout invasions are limited and typically focus on direct removal (e.g., removal by electrofishing, selective angling, trapping, or toxicants). The authors caution that brook trout removal efforts can have mixed success, often resulting in injury or mortality to native fish species (Dunham et al. 2002).

Potential Predation/Competition Limiting Factors and Threats

NMFS identified the following potential predation/competition limiting factor for this Chinook salmon population.

1. Reduced survival due to competition/predation by lake trout. There is a well-established, non-native lake trout population in Stanley Lake. While no studies have yet documented impacts of introduced lake trout on native anadromous salmonids, introduced lake trout have adversely affected bull trout and kokanee in lakes and reservoirs throughout the western United States (Martenez et al. 2009), and could have similar adverse effects on spring/summer Chinook salmon. A barrier to upstream fish migration on lower Stanley Lake Creek currently prevents

Chinook salmon from occupying Stanley Lake. However, if the barrier was removed and Stanley Lake and upper Stanley Lake Creek reoccupied by spring/summer Chinook salmon, the lake trout population could adversely affect rearing juvenile Chinook salmon, and could expand to other lakes via connecting streams (Martenez et al. 2009), so invasion of other Sawtooth Valley lakes by lake trout is a concern. Stanley Lake is the only suitable lake trout habitat in the Valley Creek population area, so the threat to this population is relatively minor. In the adjacent Upper Salmon River Mainstem population, however, Pettit Lake, Alturas Lake, Yellowbelly Lake, and Redfish Lake all provide habitat for spring/summer Chinook salmon and are vulnerable to lake trout infestation.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions are intended to improve productivity rates and increase the capacity for natural smolt production in the population, thus maintaining and restoring the VSP parameters that will move the population towards viable status. Although much of the Valley Creek watershed is considered to be in relatively good condition, several within-basin restoration actions have been identified that may contribute to improving habitat condition and thus productivity for the population.

1. Evaluate existing irrigation diversions to assure that diversions bypass adequate instream flow, provide for fish passage, and are adequately screened. Priority streams for increasing instream flow and removing migration barriers caused by irrigation ditches include Elk Creek, Iron Creek, Goat Creek, Meadow Creek, and upper mainstem Valley Creek.
2. Remove human-caused migration barriers caused by diversion structures and stream-road crossings. Priority streams for barrier removals are Elk Creek, Iron Creek, Goat Creek, Stanley Creek, lower Meadow Creek, and Trap Creek.
3. Restore degraded riparian and floodplain habitat through the following actions:
    a. Discourage additional development in streamside areas on private lands to avoid degrading fish habitat and floodplain function, particularly on lower Valley Creek, within the communities of Stanley and Lower Stanley, and also on Nip and Tuck Creek, Sunny Creek, Iron Creek, and Goat Creek.
    b. Reduce grazing impacts on streams and riparian habitat.
    c. Plant or provide for regrowth of natural riparian woody and hydric vegetation composition, age classes, structure, and pattern in order to restore and maintain streambank stability. Regrowth of natural riparian vegetation will also lead to lower width-to-depth channel ratios.
    d. Modify localized portions of roads and trails along Nip and Tuck Creek and Iron Creek to reduce accelerated contributions to instream sediment, eliminate impairments to proper floodplain function, and restore water quality and geomorphic integrity.

Implementation of Habitat Actions

Implementation for the habitat section of the recovery plan for this population will occur primarily through the efforts of the Upper Salmon Basin Watershed Program partners. On federal lands,

following the existing U.S. Forest Service Land and Resource Management Plan should provide the protection needed for this population. Between these groups there is an excellent representation of private, state, and federal entities that manage land and other resources within the watershed. These entities have created an effective process for working together, providing technical reviews of proposed projects, and working with interested parties to accomplish these conservation projects. They have a strong record of implementing water quality and salmon conservation and recovery projects. For example, in 2009 a water right on Elk Creek was transferred to ground water and the diversion structure on Elk Creek was decommissioned. Future actions will build on these accomplishments.

Table 5.4-23 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not represent a full list of projects. Specific projects are planned continuously based on available funding and established priorities. During Plan implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.4-23. Habitat Recovery Actions Identified for the Valley Creek Spring/Summer Chinook salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Riparian Conditions	Improve 9 riparian miles	BPA Contract # 1994-015-00: Idaho Fish Screening Project Restoration-Lemhi	N/A
Streamflow	Protect 4 cfs flow	BPA Contract # 2007-399-00: Upper Salmon Screen Tributary Passage	
Entrainment	10 screens	BPA Contract # 2008-608-00: Idaho MOA/Fish Accord Water Transactions	

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 5.4-23 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined (TBD).

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs may present. For the Valley Creek population, the strategy is to manage for natural production. This includes monitoring for strays

and taking necessary actions to address straying. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Predation/Competition Recovery Strategy and Actions

The following actions are intended to improve abundance, productivity and diversity for natural spring/summer Chinook salmon production.

1. Develop and implement a lake trout management strategy for removing non-native lake trout from Stanley Lake to benefit both Chinook salmon and sockeye salmon recovery. After this program has been implemented, reestablish adult spring/summer Chinook salmon passage at the barrier on Stanley Lake Creek downstream of Stanley Lake and take necessary actions to prevent the spread of non-native lake trout to other area lakes and streams. Because lake trout are free to move downstream over the barrier at any time, the lake trout control program should be implemented as soon as possible and should be in place and working before the barrier is removed.
2. Develop and implement programs to reduce brook trout populations.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.4.10 Upper Salmon River Lower Mainstem Spring/Summer Chinook Salmon Population

The Upper Salmon River Lower Mainstem spring/summer Chinook salmon population includes fish spawning in the mainstem Salmon River from the mouth of the Lemhi River upstream to Redfish Lake Creek, as well as potential spawning in the smaller tributaries along this reach. The population is currently not viable, with a high abundance/productivity risk and moderate spatial structure/diversity risk status. Its targeted proposed status is Maintained, which requires no more than moderate abundance/productivity and spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Maintained

Population Status

This section compares the Upper Salmon River Lower Mainstem population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

Spring/summer Chinook salmon in this population spawn in the mainstem Salmon River from the mouth of the Lemhi River upstream to Redfish Lake Creek, and in the smaller tributaries along this reach. The population does not include fish from the larger tributaries to the Salmon River: the Lemhi River, Pahsimeroi River, East Fork Salmon River, Yankee Fork Salmon River, or Valley Creek. Although roughly one-quarter of the estimated historic habitat area for the population is found in the tributaries, almost all current spawning occurs in the mainstem Salmon River, primarily from the East Fork Salmon River upstream to Valley Creek (ICTRT 2010). Tributary drainages with intrinsic potential to support spawning, based on relative habitat suitability under historical unimpaired conditions, are listed from most potential to least potential: Challis, Morgan, Squaw, Basin, Iron, Warm Springs, Garden, Slate, Thompson, Hat, Mill, and Bayhorse Creeks. Other tributaries in the population, such as Kinnickinic, Cow, and McKim Creeks, have potential rearing habitat and may also have supported low numbers of spawners. The IDFG considers the entire population to be summer adult run-timing (ICTRT 2010).

The Upper Salmon River Lower Mainstem population is classified as a Very Large-size population, consisting of nearly contiguous spawning aggregates along the Salmon River. The ICTRT separates these spawning aggregates into three major spawning areas (Basin, Challis, and Lower Salmon) and five minor spawning areas (Ellis, Bradshaw, Bayhorse, Hat, and Iron), shown in Figure 5.4-21, and in Figure 5.4-23 below.

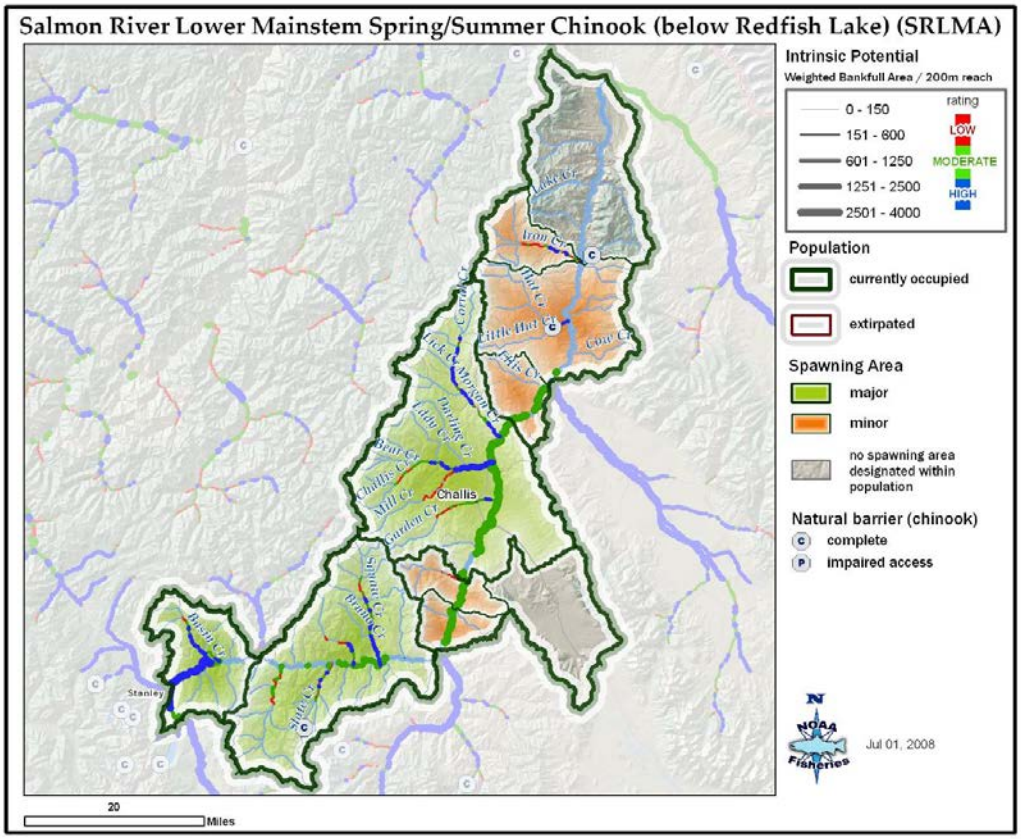

Figure 5.4-21. Upper Salmon River Lower Mainstem spring/summer Chinook salmon population major and minor spawning areas based on relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

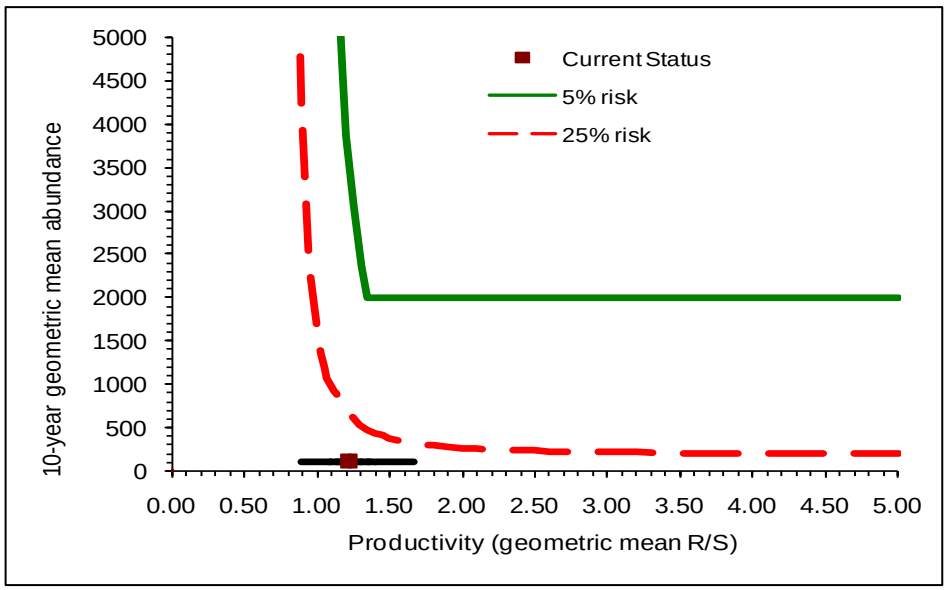

Figure 5.4-22. Upper Salmon River Lower Mainstem spring/summer Chinook salmon population abundance and productivity compared to the low risk and moderate risk viability curves. Error bars = 90% CI. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. For the Final Plan, NMFS will update this figure so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Abundance and Productivity

The ICTRT viability curve shows combinations of minimum abundance and minimum productivity that correspond to a certain level of extinction risk. As shown in Figure 5.4-22, the Upper Salmon River Lower Mainstem, as a Very Large-size population, must reach a minimum threshold of a mean of 2,000 natural-origin spawners at a productivity of 1.34 recruits per spawner or greater to achieve viable status (less than 5 percent risk of extinction over 100 years, represented by the green line). To achieve maintained status, the population must reach a mean minimum abundance of approximately 250 spawners at a productivity of approximately 1.75 recruits per spawner (the red line, showing a 25 percent risk of extinction over 100 years).

This population is at high risk based on current abundance and productivity. The 10-year (2005-2014) geometric mean abundance of natural-origin spawners is 108 fish, well below the low-risk abundance threshold of 2,000 and the moderate-risk abundance threshold of 250. The geometric mean productivity is 1.18 recruits per spawner, also well below the productivity required at the minimum abundance threshold for either viable or maintained status (NWFSC 2015). The most recent abundance trend for this population appears to be lagging behind the rest of the ESU. Increases in abundance and productivity are needed for this population to reach the proposed status.

Spatial Structure

Figure 5.4-23 shows the major and minor spawning areas for this population. The ICTRT (2010) rated overall spatial structure risk as moderate for the Upper Salmon River Lower Mainstem population because recent spawner abundance in the major and minor spawning areas downstream of the East Fork Salmon River has been so low that the ICTRT does not consider these areas to be “occupied”. The population therefore has a limited spatial extent, making it more vulnerable to extinction. These unoccupied spawning areas also create a potentially large disruption in connectivity between the Upper Salmon River Lower Mainstem, East Fork Salmon River, Pahsimeroi River, and Lemhi River populations.

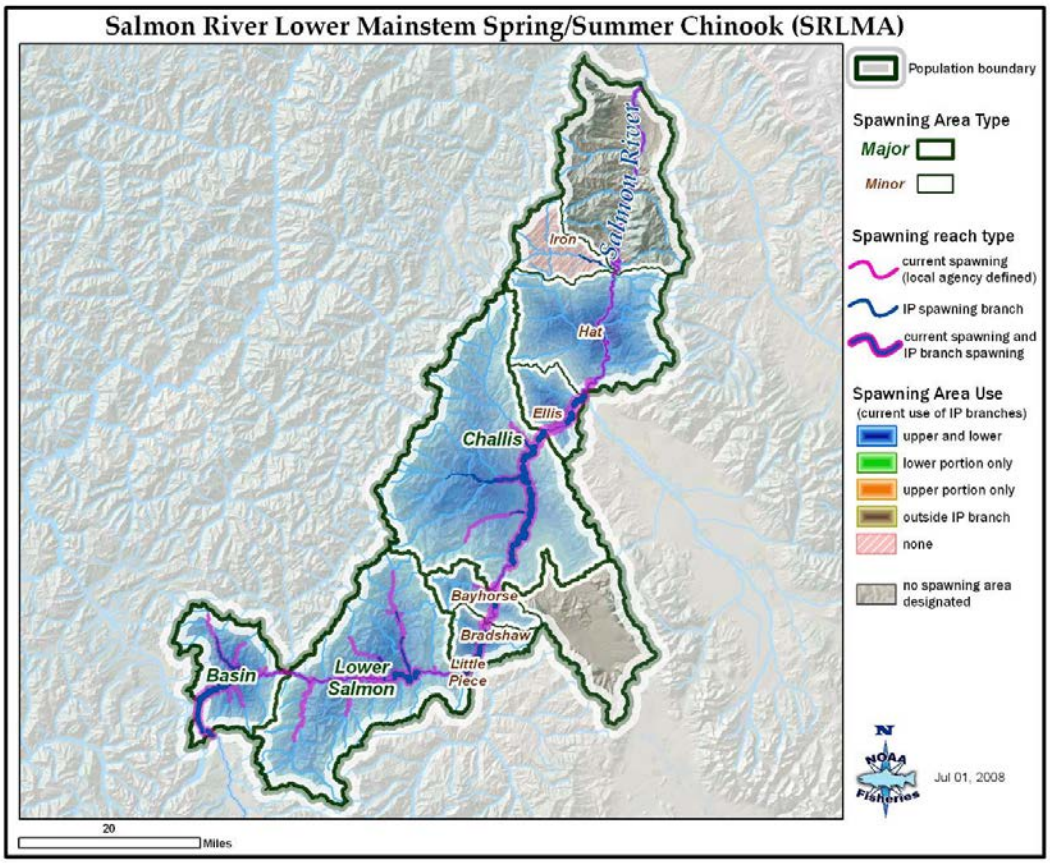

Figure 5.4-23. Upper Salmon River Lower Mainstem spring/summer Chinook salmon population major and minor spawning areas based on relative suitability, or intrinsic potential, of stream reaches to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Diversity

The ICTRT (2010) rated overall diversity risk as moderate based on the possible loss or extreme reduction of a juvenile life-history strategy. The major juvenile life history strategy for this population is suspected to be a spring yearling migrant to the ocean. However, there may have historically also been a subyearling life history strategy, in which subyearlings migrated downstream out of the Salmon River. Fish spawning in the Salmon River downstream from the East Fork Salmon River tended to spawn later in the year because of warmer water temperatures, and the progeny of those spawners may have migrated to the ocean at an earlier age, as subyearlings. Thus, the extremely low numbers of spawners downstream of the East Fork Salmon River may indicate loss of a life history strategy, decreasing the resiliency of the population. The ICTRT assumed that the Salmon River below the East Fork confluence historically produced far more spawners than the current low numbers, based on habitat suitability.

Summary

The Upper Salmon River Lower Mainstem population is currently rated high risk. The current rating is driven by a high risk rating for abundance/productivity. Without survival increases that lead to increases in abundance and productivity, the population cannot reach its proposed status of maintained. Overall, spatial structure and diversity has been rated moderate risk for the population. The current

moderate risk rating is due to the possible loss or extreme reduction in the subyearling life history strategy and the loss of occupancy from a large amount of historically used habitat, particularly in the downstream half of the population. With a substantial increase in abundance, these areas may be reoccupied, which could reestablish the subyearling migrant life history strategy, if not precluded by migratory conditions in the Snake and Columbia Rivers[7]. Even if the combined spatial structure and diversity risk remains at moderate, the population could reach an overall status of maintained or viable if abundance and productivity increase.

Table 5.4-24 summarizes the abundance/productivity and spatial structure/diversity risks for the Upper Salmon River Lower Mainstem population. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.4-24. Viable Salmonid Population parameter risk ratings for the Upper Salmon River Lower Mainstem spring/summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	high (>25%)	HR	HR	Upper Salmon River Lower Mainstem	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors.

Natal Habitat

Habitat Conditions

The Upper Salmon River Lower Mainstem population is located in the central Idaho mountains. The general relief of the area varies from nearly flat on the valley floors of the major drainages, to nearly vertical cliffs on the mountain faces and cirque walls. Within the population boundaries, the Salmon River runs through rocky canyons as well as open valleys, including one section near the city of Challis where the valley is one to three miles wide. River-based recreation in this area is popular, with

[7] Recent PIT-tag data indicate that a high proportion of juvenile Chinook salmon leaving the Pahsimeroi River arrive at Lower Granite Dam in June and July as subyearling migrants rather than yearling migrants. However, no adults have been detected as returning from the subyearling migrants, suggesting undesirable migratory conditions for subyearling migrants (ICTRT 2010).

over 10,000 boaters and anglers every summer on the mainstem Salmon River within the Sawtooth National Recreation Area (which overlaps with upper sections of this population) (SNRA 2014).

The majority of the land within the population boundaries is publically owned, although private land tends to be located along the mainstem Salmon River and along tributary streams: 39 percent of stream miles fall on land managed by the Salmon-Challis National Forest, 39 percent on land managed by the BLM, 2 percent on state land, and 19 percent on private land. Private ownership is generally concentrated around the city of Challis and along the Salmon River, especially near Stanley.

The hydrology of the Upper Salmon River is snowmelt driven. Diverse snowmelt patterns in the Upper Salmon River basin cause significant runoff events in early spring through mid-summer. Snowmelt in the lower elevations begins in early spring while snowmelt in the higher elevations occurs in early to mid-summer. Rain-on-snow events that occur in the spring season also contribute to increased flows. The mainstem Salmon River is a large, powerful river capable of moving large amounts of sediment naturally produced by snowmelt runoff and thunderstorm events in its tributaries (IDEQ 2003).

Numerous invasive non-native weeds have invaded the upper Salmon River and its tributaries, with potential impacts to riparian areas. Leafy spurge, spotted knapweed, and Canada starthistle are species currently posing the greatest threat. These invasive plants may exacerbate instream sediment levels in the Upper Salmon River and its tributaries, particularly in areas with erosive volcanic geology and steep topography.

Activities that have impacted salmonid habitat include grazing, water diversions, residential development, and historic and current mining. Livestock grazing includes sheep, cattle, and horses. Grazing is widespread throughout the area and has been the predominant land use for over a century. The Challis Creek area, for example, has been grazed heavily by sheep, cattle, and horses since the late 1800s. Lowlands are primarily used for grazing and feed production. A few upper rangeland areas are grazed by sheep. On public land numerous grazing allotments are administered by the BLM and the Salmon-Challis National Forest. Grazing has impacted salmonid habitat by degrading riparian vegetation and increasing sediment delivery to streams.

The Salmon River floodplain has been modified considerably by agriculture and residential development. Riverbanks have been altered by the construction of numerous water diversions, by residential development, and by bank stabilization to protect State Highways 75 and 93. Much of the natural sinuosity of the river has been reduced in an effort to protect residential and agricultural lands on either side of the river channel (IDEQ 2003). Although livestock grazing and irrigated agriculture are the dominant activities on private land, residential development is increasing substantially (IDEQ 2003).

Finally, many of the upper Salmon River watersheds have experienced mining activities in the past, with some still ongoing today. Hydraulic mining and placer mining were widely used historically, succeeded by shaft mines and adit mines. The largest active mine of the region is the Thompson Creek Molybdenum Mine located in the Thompson Creek and Squaw Creek watersheds. Potential exists for future mining opportunities in many tributary watersheds to the Salmon River (IDEQ 2003).

The land uses described above have caused substantial habitat degradation. The largest tributaries, Challis and Morgan Creeks, are largely dewatered during the irrigation season and many stream reaches have been listed as impaired on the Clean Water Act 303(d) List. Reasons for listing include sediment, high water temperatures, nutrients, and unknown reasons (IDEQ 2008a). IDEQ has written a TMDL for sediment for Challis Creek, recommending a substantial reduction in streambank erosion. IDEQ has also written a TMDL for phosphorous for Williams Lake on Lake Creek, but neither Lake Creek nor Williams Lake provide habitat for Chinook salmon.

Water quantity, water quality, and riparian habitat conditions are issues of concern for the upper Salmon River and its tributaries. The cumulative effects of grazing, water diversions, historic and current mining, floodplain development, roads, and human-caused stream alterations have combined to limit the production and survival of salmonids in the Upper Salmon River, including spring/summer Chinook salmon. Numerous restoration projects have already been completed or are in the planning stages to offset the impacts of historic and current land uses. Projects completed so far have resulted in dramatic improvement in water quality and fisheries along many miles of streams in the Upper Salmon River (IDEQ 2003).

Current Habitat Limiting Factors

NMFS determined the habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups.

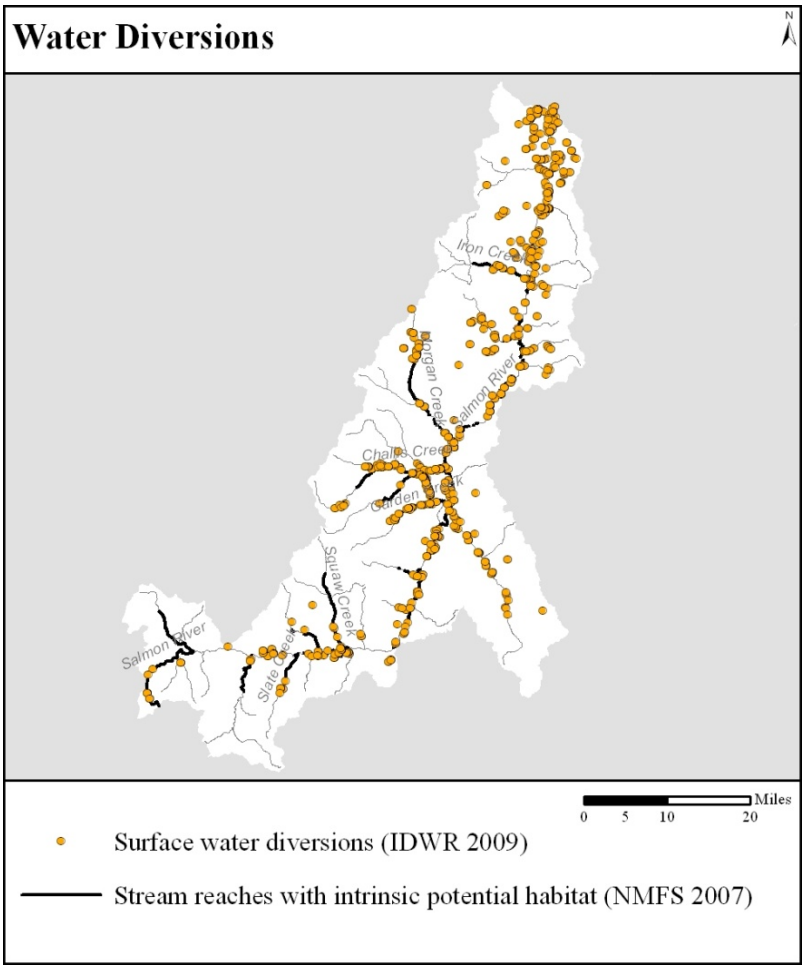

Figure 5.4-24. Surface water diversions in the Upper Salmon River Lower Mainstem population.

1. Low flow during critical periods, fish passage barriers and entrainment.

Pastures and crops along the Salmon River and its tributaries are irrigated with surface water diversions throughout the population (Figure 5.4-24). One of the largest impacts to salmonid habitat in the Upper Salmon River comes from the effects of irrigation diversions (USBWP 2012). Water diversions reduce amount of flow in stream channels, which in turn, reduces water depth, water velocity, and stream width. Depending on stream morphology, habitat condition, and magnitude of flow reduction, these changes can reduce access to cover and off-channel habitat and impede upstream and downstream fish passage. Reduction in flow volume can reduce the amount of drifting invertebrates available for rearing salmonids and can increase summer water temperatures. Water diversions can also entrain juvenile salmonids, which often results in death if the diversion is not adequately screened.

The high number of surface water diversions in the Salmon River basin reduces instream flow in individual tributaries and cumulatively in the Salmon River. So much streamflow is diverted into ditches that several tributaries are disconnected from the mainstem Salmon River during summer baseflows (USBWP 2005), precluding access for rearing juveniles to cold-water refugia in these tributaries, as well as eliminating cold-water refugia in the Salmon River mainstem at the mouths of

tributaries. Many other tributaries in this population are dewatered by irrigation during summer, and flows in almost all tributaries are reduced by water diversions.

Substantial adverse impacts to habitat occur in streams where flow is reduced. In tributaries to the Salmon River upstream of this population, Rothwell and Moulton (2001) found that reductions in flow caused by diversions caused increases in stream temperature. Lack of sufficient flow in late summer precludes spring/summer Chinook salmon spawning in some tributaries, such as Challis Creek and Morgan Creek. Although Challis and Morgan Creeks rank first and second in amount of intrinsic potential habitat among all of the tributaries in this population (as estimated by NMFS (2006)), spawning spring/summer Chinook salmon has not been documented in either stream (IDFG 2003), probably because both have been dewatered by irrigation diversions since before commencement of fish surveys. The dewatering of tributary streams likely exacerbates high temperatures in the mainstem Salmon River and limits cool-water refugia for rearing juveniles.

2. Entrainment in unscreened ditches.

Spring/summer Chinook salmon may enter unscreened irrigation ditches and become stranded in the ditch. Fish may also become stranded by entering irrigation ditches at the start of the irrigation season when ditches are open, but fish screens are not yet in place. They can enter ditches through wastewater return flows, or through a site where a ditch has breeched due to a structural failure or to being undersized relative to the volume of water it conveys. Upon entering the irrigation system, fish are subject to dewatering as well as high temperatures, reduced forage, and increased predation (Ecovista 2004, p. 58). All diversions on the mainstem Salmon River are screened to NMFS standards, but unscreened diversions on tributary streams may number in the hundreds (IDFG 2003). Even when equipped with state-of-the-art fish screens and bypass systems, water diversions delay the migration of juveniles that swim into them.

3. Loss of floodplain connectivity and function.

The Salmon River floodplain has been modified considerably by human land uses. Riverbanks have been altered by the construction of numerous dikes and diversions associated with agriculture, by residential development, and by State Highways 75 and 93. Channel confinement and development of riparian areas has led to a reduction in the pool-to-riffle ratios, a reduction in streambank stability, a reduction in shade, and has limited salmonid access to side channel habitat (Ecovista 2004, p. 60). The stretch of the Salmon River near the town of Challis, known as Round Valley, has seen the most floodplain modification. Construction of dikes and levees, and bank stabilization projects (e.g. riprapping) have been ongoing since the late 1800s and have impeded natural river habitat function. Such human interference in natural geomorphic processes disrupts channel patterns, which otherwise would form and maintain important off-channel habitat. This has caused a long-term reduction in amount, quality, and access to off-channel habitats, which has reduced amount and quality of salmonid rearing habitat in this population.

The Custer Soil and Water Conservation District (CSWCD), U.S. Army Corps of Engineers, and other stakeholders have also worked to restore salmonid habitat and floodplain processes and functions along a reach of the Salmon River, known as the Twelve-mile Reach, that extends approximately 12

miles upstream from the mouth of Morgan Creek (RM 313) and was a core historical spawning and rearing area for this salmon population. The reestablishment of side channel habitat presents significant and cost-effective potential for enhancing salmonid habitat in the Twelve-mile Reach, and the Upper Salmon Basin Watershed Program partners are working with private landowners towards that goal. Restoring side channels will provide high quality rearing habitat, refugia for adults and juveniles (including overwintering fish from upstream populations), and possibly even some suitable spawning habitat. Side channels provide high quality habitat due to their relatively constant water temperatures, fed by springs. The Upper Salmon Basin Watershed Program partners are working with landowners both to reestablish access to side channels and to enhance the habitat by establishing and protecting riparian vegetation and by eliminating grazing along the channel banks.

4. Elevated water temperatures.

In this population, elevated water temperatures have been recorded both in tributaries and in the mainstem Salmon River. In general, tributary water temperatures are much lower than the mainstem Salmon River and provide cold-water refugia for rearing juvenile spring/summer Chinook salmon during summer. IDEQ has listed the Squaw Creek watershed and two sections of the Salmon River as impaired by high temperatures (IDEQ 2008a). In 2003, IDEQ determined that the two listed reaches of the Salmon River did not require temperature TMDLs because they were fully supporting beneficial uses (IDEQ 2003). A temperature TMDL was also not prepared for Squaw Creek, as it was found that the warm temperature in this stream is natural and due to its geothermal sources (IDEQ 2003). The 2012 Integrated report for water quality identified numerous sections of tributaries and the mainstem Salmon River as being impaired by temperature or not fully supporting beneficial uses when evaluated using the combined Biota/Habitat Bioassessment method. TMDLs for these segments have not been developed yet.

The diversion of water for irrigation and subsequent return flows, combined with reductions in riparian shading, are thought to have increased water temperatures in the mainstem Salmon River in the Twelve-mile Reach near Challis (Ecovista 2004). The high water temperature in the late summer and early fall can affect salmon production and suvival. In the Salmon River directly downstream from the population boundaries, below the Lemhi River confluence, daily maximum temperatures exceeded 22 °C on 34 days in the summer of 2003 (one the warmest summers on record) (Resseguie 2004). In July 2007, IDFG recorded temperatures in the sub-lethal range for fish (20.0 to 25.6 °C) at multiple locations along the Salmon River (HSRG 2009). In snorkel surveys in the Salmon River near the mouths of tributaries, IDFG observed that salmonids seemed to be concentrated in the cold-water plume of the tributary and would rarely be observed outside the cold-water plume (HSRG 2009). Tributary confluences thus provide important summer rearing habitat for this population. However, several tributaries in the population are dewatered before reaching the Salmon River, reducing the availability of cold-water refugia at tributary confluences.

5. Excess sediment.

Human land-uses have probably increased sediment delivery to most of the streams in this population. The IDEQ listed parts of the mainstem Salmon River and several tributary streams as impaired by sediment and increased levels of sediment have been reported in the Twelve-mile Reach of the Salmon

River (NPCC 2004, p. 3-14). IDEQ identified Challis Creek as not fully supporting the beneficial uses of salmonid spawning and cold-water biota because of increased sediment. A TMDL for sediment in Challis Creek was prepared for this water body to restore full support of these beneficial uses. IDEQ (2003) identified the primary source of sediment to Challis Creek as streambank and road erosion. Historic overgrazing dramatically changed the character of streambank vegetation, creating the potential for accelerated stream bank erosion. Riparian management has since been implemented in some areas, resulting in improved conditions over limited areas, but increased stream bank erosion from livestock use within the riparian vegetation zone remains a significant source of sediment to Challis Creek (IDEQ 2003). The 2012 Integrated Report (IDEQ 2014) for water quality identifies the segments of the mainstem Salmon River, Garden Creek, and Basin Creek as being impaired by sediment with a TMDL to be developed in the future.

6. Passage Barriers at Road Stream Crossings.

One final limiting factor for the population is the presence of barriers restricting fish movement from the mainstem Salmon River into tributaries. Culverts at road stream crossings can block access to tributaries for juvenile or adult spring/summer Chinook salmon either year-round or at certain flow conditions. Blocking access to habitat is always a concern but especially so in this case because spring/summer Chinook salmon rely on these tributary habitat for thermal refugia (NPCC 2004, p. 3-11). Surveys of passage barriers at road stream crossings are incomplete but suggest that some small tributaries within the population are not fully accessible to anadromous salmonids (StreamNet 2003, BLM 2004b).

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Upper Salmon River Lower Mainstem area.

1. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density. Annual grasses such as cheat grass have the ability to alter the fire regime, allowing larger, more frequent fires.
2. Loss of beaver. Reduction or removal of beaver has negatively affected aquatic and terrestrial ecosystems. Programs are needed to encourage beaver activity in areas with reduced human conflict, or the building of structures that mimic beaver activity in areas where potential conflict exists.

Hatchery Programs

No hatchery releases occur in the Upper Salmon River Lower Mainstem population area and Chinook from production programs upstream (Sawtooth and Pahsimeroi) are not known to spawn within the Lower Salmon River population. The potential for straying by upper Salmon River hatchery fish continues to exist, which could reduce the natural-origin population's genetic adaptiveness. Hatchery-related limiting factors and threats for the population are further discussed at the MPG level in Section 5.4.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River and Salmon River pose a threat to Upper Salmon River Lower Mainstem spring/summer Chinook salmon. This includes state fisheries targeting hatchery-origin spring Chinook salmon in the lower and upper Salmon River. Tribal fisheries also occur. Overall, however, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Upper Salmon River populations are discussed at the MPG level in Section 5.4.3.3.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions, listed in priority order, are intended to improve productivity rates and increase the capacity for natural smolt production in the Upper Salmon River Lower Mainstem population, thus maintaining and restoring the VSP parameters that will move the population towards a maintained or viable status.

1. For all surface water diversions, assure that diversions bypass flows that are adequate for passage of all life stages, provide for fish passage over diversion structures, and screen all diversions to NMFS standards.
    a. Improve connectivity of tributaries that are currently disconnected from the mainstem Salmon River due to water diversions. Strategies include:
        (1) Construct bypass structures, siphons, ditch consolidations, or other infrastructure that is designed to convey adequate tributary flow to the mainstem Salmon River and to provide fish access to upstream tributary habitat.
        (2) Improve efficiency of water conveyance systems for diverted water such that more water can be left in the stream channel in flow-impaired reaches.
        (3) Secure water through water transactions such as conservation agreements, water leases, or water purchases.
    b. Mimic the shape and timing of the natural hydrograph in the mainstem Salmon River and in major tributaries. Strategies include:
        (1) Stagger the timing of diversion operations.
        (2) Develop and implement hydrologic modeling tools, such as MIKE BASIN, in order to accurately estimate the historic hydrograph.
        (3) Permanently secure water through water transactions such as conservation agreements, water leases, or water purchases.
    c. Reduce stranding or harm to fish that enter diversion ditches. Strategies include:
        (1) Improve structural integrity of diversion ditches or pipes.

(2) Where appropriate, investigate the potential to enhance ditch habitat to serve as artificial side-channel juvenile rearing habitat.

(3) Improve instream habitat conditions so that fish are less likely to seek refuge in irrigation ditches.

(4) Encourage annual irrigation district meetings to develop and refine management strategies for diversion control structures in order to reduce harm to fish. Implement a program where water managers meet with irrigators to ensure that ditches are managed to help fish.

(5) Until the appropriate preventative measures are implemented, continue fish salvage operations where warranted to remove stranded fish from irrigation ditches.

2. Improve floodplain connectivity, access to side channel habitat, and quality of side channel habitat. Strategies include:
    a. Ensure continuation of the Salmon River Ecosystem Restoration Project (Twelve-mile Reach), sponsored by the Custer Soil and Water Conservation District and the U.S. Army Corps of Engineers.
    b. Control livestock access to riparian areas to encourage establishment of mature riparian vegetation.
    c. Conduct land acquisitions and riparian conservation easements to protect areas with the highest conservation value.

3. Reduce stream temperatures by limiting the effects of surface water diversions on summer base flows and by increasing shade on tributaries and side channels through the reestablishment of riparian vegetation. Reconnect tributaries to the mainstem Salmon River to provide cool-water refugia during summer high temperatures. Develop and implement temperature TMDLs.

4. Reduce sediment delivery to streams.
    a. Develop and implement sediment TMDLs.
    b. Reestablish riparian vegetation, control livestock access to riparian habitat, decommission unneeded roads, maintain roads with drainage features and other erosion reduction measures, and restrict off-highway vehicle use to existing roads and trails.

5. Establish fish passage at stream road crossings where access to tributary habitat would benefit spring/summer Chinook salmon.

Implementation of Habitat Actions

For this population area, the groups currently working towards salmon and steelhead recovery provide an excellent representation of private, state, and federal entities that manage land and other resources in the Upper Salmon River. These entities have created an effective process for working together, providing technical reviews of proposed projects, and working with interested parties to accomplish conservation projects through the Upper Salmon Basin Watershed Program.

The groups have a strong record of implementing water quality and salmon conservation projects over the past decades. The groups have completed the following types of habitat restoration projects: water diversion screening and removal, stream channel restoration and connectivity to lost historical habitats, development and implementation of agreements to improve stream flow, development and implementation of tributary off-channel stock watering agreements, riparian area restoration, and installation of instream structures to improve habitat complexity. In addition, the Sawtooth National Recreation Area restricts float-boating on the Salmon River each summer in August and September, within the Sawtooth National Recreation Area boundaries. These restrictions minimize disturbance to spawning spring/summer Chinook, with longer restrictions for the most productive spawning areas (e.g. Indian Riffles, Torrey's Hole) (SNRA 2014).

Table 5.4-25 shows habitat projects that have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not represent a full list of projects. Specific projects are planned continuously based on available funding and established priorities. During Plan implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.4-25. Habitat Recovery Actions Identified for the Upper Salmon River Lower Mainstem Spring/Summer Chinook salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Streamflow	Protect 2.5 cfs flow	BPA Contract # 1994-015-00: Idaho Fish Screening Project BPA Contract # 1999-019-00: Restore 12 Mile Reach of Upper Salmon River BPA Contract # 2002-013-01: Water Entity- Water Transaction Program BPA Contract # 2007-268-00: Idaho Watershed Habitat Restoration-Custer District BPA Contract # 2007-394-00: Idaho Watershed Habitat Restoration-Lemhi BPA Contract # 2007-399-00: Upper Salmon Screen Tributary Passage BPA Contract # 2008-602-00: Upper Lemhi River-Restoration	N/A
Entrainment	1 screen		
Barriers	Address 5 barriers (diversions, culverts)		

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. It is possible that some of the actions in Table 5.4-25 will not be funded and that others will be proposed or added. This recovery plan is dynamic and subject to change through

the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined (TBD).

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs may present. For the Upper Salmon River Lower Mainstem population, the strategy is to manage for natural production. This includes monitoring for strays and taking necessary actions to address straying. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.4.11 North Fork Salmon River Spring Chinook Salmon Population

The North Fork Salmon River spring Chinook salmon population is currently not viable, with a high abundance/productivity risk and low spatial structure/diversity risk status. Its proposed status is Maintained, which requires no more than moderate abundance/productivity risk.

Current Status	Proposed Status
High Risk	Maintained

Population Status

This section compares the North Fork Salmon River spring Chinook salmon population's proposed status to its current status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity, and compares the population's current status to the proposed status in terms of both abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

The North Fork Salmon River population is located along the Idaho-Montana border and includes the North Fork watershed as well as Indian Creek and other smaller tributaries to the Salmon River between the North Fork and Panther Creek. The North Fork Salmon River and Indian Creek provide spring/summer Chinook salmon habitat, but most of the smaller tributaries are too small and steep to support the species. North Fork Salmon River spring/summer Chinook salmon were identified as an independent population based on genetic differentiation from other spring/summer Chinook salmon samples in the upper Salmon River, further supported by distance from other spawning areas, basin size, and historical redd counts (ICTRT 2003, p.24). The population is small, or Basic-size, with a branched discontinuous D-type spawning complexity (a core drainage with adjacent but separate small tributaries) (Figure 5.4-25). The population consists of spring-run fish and includes one major spawning area, the North Fork Salmon River watershed, and no minor spawning areas.

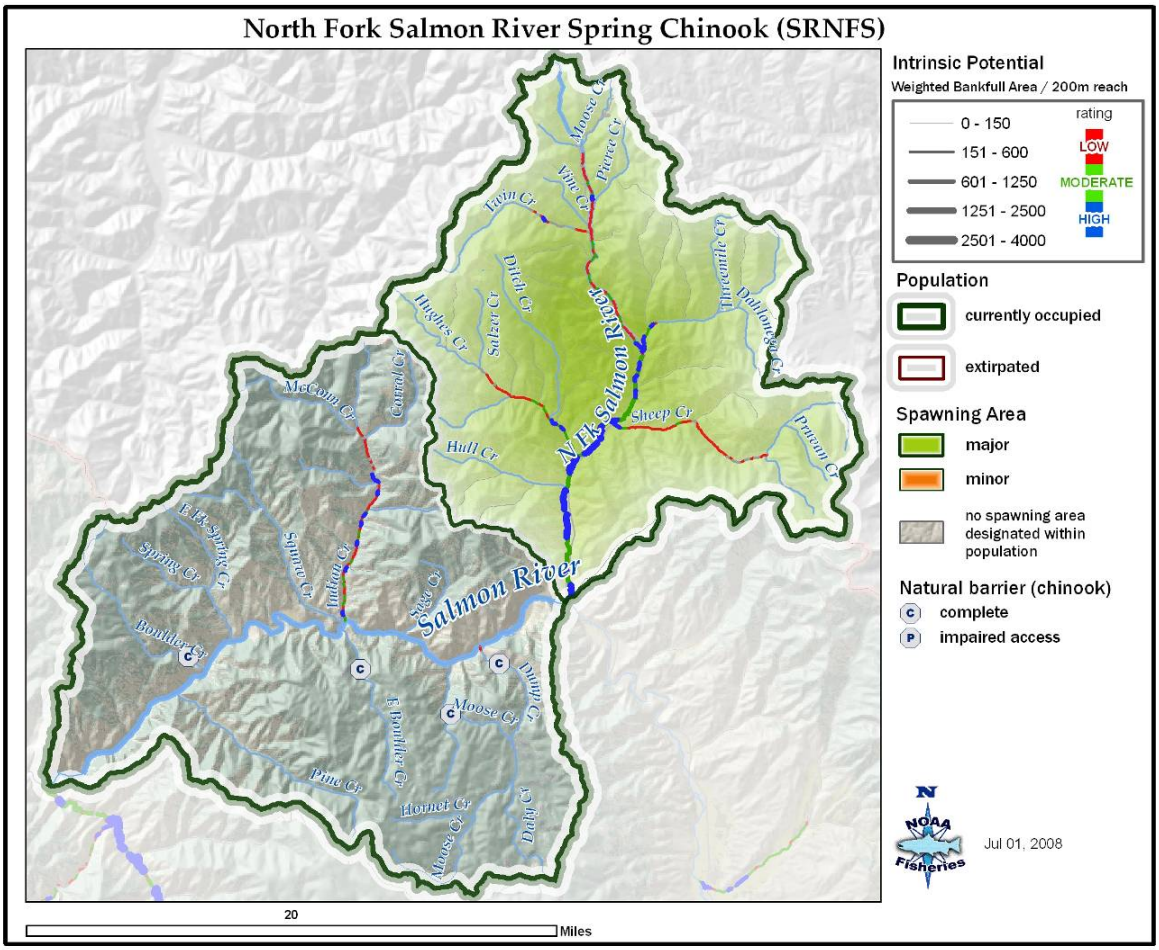

Figure 5.4-25. North Fork Salmon River spring Chinook salmon population boundary and major spawning area based on relative suitability, or intrinsic potential, of stream reaches to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Abundance and Productivity

The ICTRT viability targets for abundance and productivity are expressed as a viability curve: combinations of minimum abundance and minimum productivity that correspond to a certain level of extinction risk. A “low risk” viability curve delineates minimum abundance/productivity combinations necessary for a population to achieve a 5 percent or less risk of extinction over 100 years. Productivity must be substantially greater than replacement rate for a population to persist through swings in abundance, which are natural for the species. Based on the size of the population, in terms of historic habitat capacity, low-risk viability curves also include an absolute minimum abundance threshold: no matter how great the productivity, a population must stay above that minimum threshold for average abundance in order to be at low risk of extinction.

Because the North Fork Salmon River population is small, its abundance viability target is a mean abundance of at least 500 natural-origin spawners. Based on the curves shown in Figure 5.4-26, the ICTRT (2010) determined that a population of 500 spawners needs a productivity of at least 2.21 recruits per spawner to achieve viable (low risk) status. To achieve maintained status, the North Fork needs to attain a minimum average of approximately 250 spawners with productivity roughly 2.21 (ICTRT 2007).

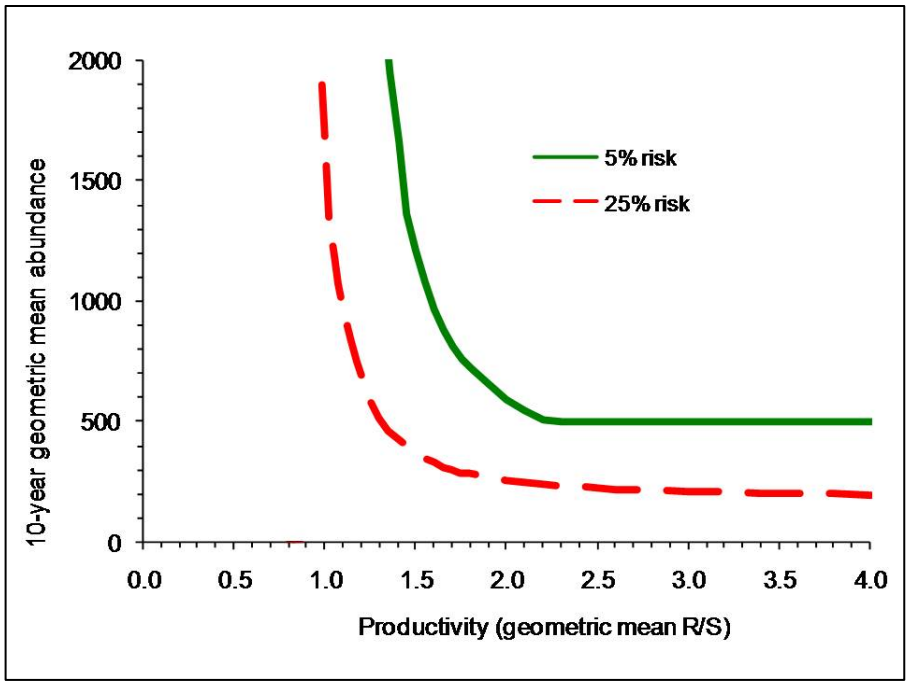

Figure 5.4-26. Viability curves for small spring/summer Chinook salmon populations in the Snake River ESU (ICTRT 2007). [Note: Biologist have been unable to estimate current abundance and productivity for this population because of insufficient data (NWFSC 2015).]

Biologists have been unable to estimate current abundance and productivity for North Fork Salmon River spring Chinook salmon due to insufficient data for the population (NWFSC 2015). Instead, the ICTRT has inferred extinction risk associated with the abundance and productivity viability parameters based on the limited available data and on the abundance and productivity seen in neighboring populations. The available abundance data for the North Fork population come from IDFG redd surveys, conducted on stretches of the mainstem North Fork Salmon River since 1957. The IDFG data indicate that redds per kilometer in these reaches has dropped more than threefold since the 1950s and 60s, with a recent average density of only 1.3 redds per kilometer over 30 kilometers of potential habitat. Given these low densities, the ICTRT tentatively rated the abundance and productivity risks as high for the North Fork Salmon River, consistent with the other seven extant populations in the Upper Salmon River MPG. NMFS assumes that the North Fork Salmon River is currently far below the abundance viability target of 500 spawners and productivity viability target of 2.21 recruits per spawner associated with viable status. NMFS further assumes that the population is below the moderate risk approximate minimum mean abundance of 250 spawners.

Spatial Structure

The historic structure of the North Fork Salmon River population has inherent risk in that the population consists of just one major spawning area. However, spring/summer Chinook salmon are currently distributed throughout the historical range of the population (albeit at assumed depressed numbers), making the overall spatial structure risk low. Figure 5.4-27 compares historical distribution, based on the intrinsic potential habitat model (NMFS 2006), to current distribution. Spatial structure is not precluding the population from reaching maintained or viable status.

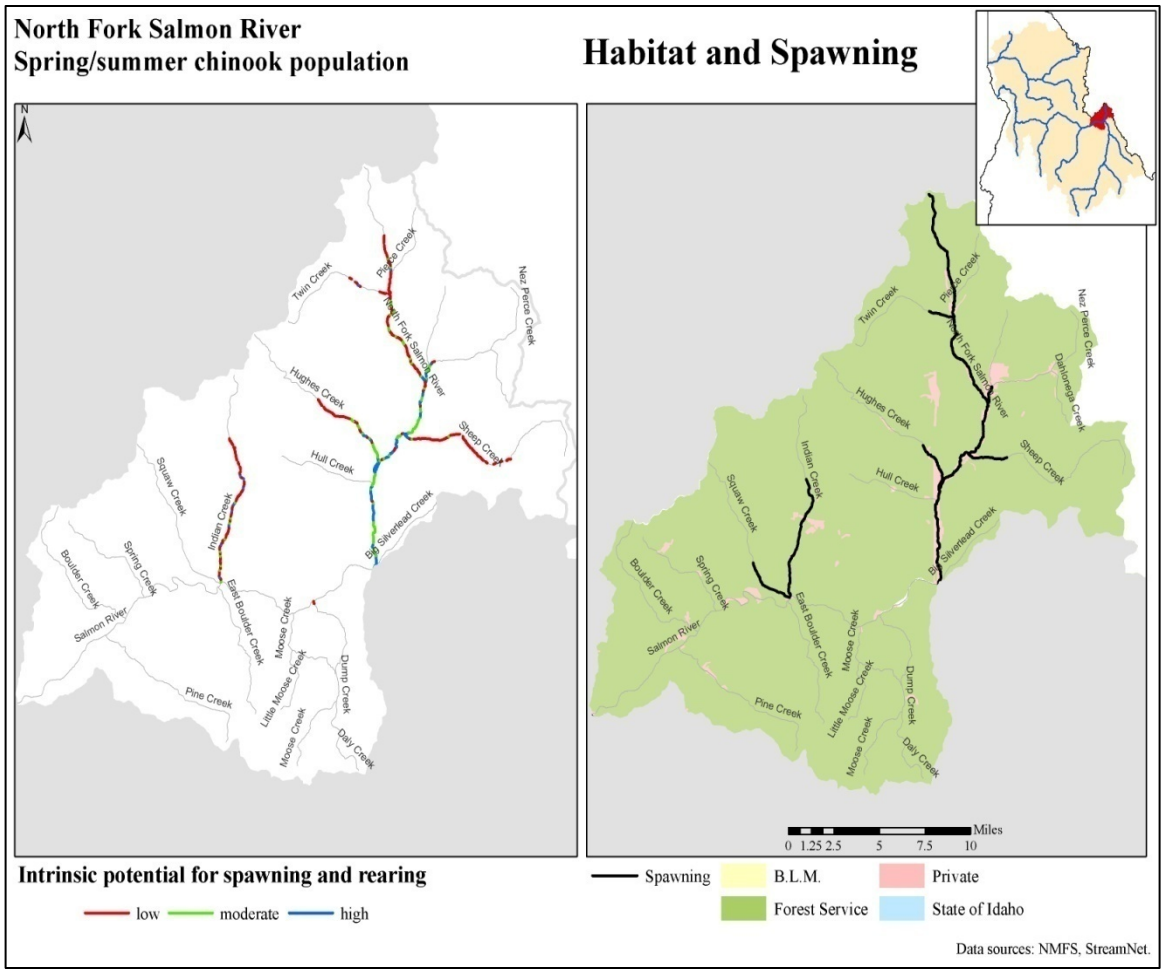

Figure 5.4-27. Historic versus current distribution for North Fork Salmon River spring/summer Chinook salmon. [Note: The Streamnet website contains the latest spring and summer Chinook distribution maps: www.streamnet.org.]

Diversity

The viability target for diversity is to maintain natural patterns of variation such that populations can withstand environmental change in the short and long terms. This includes maintaining life-history strategies and genetic diversity. Diversity risk is categorized using the results of four metrics: (1) Major life history/phenotypic/genotypic variation; (2) Spawner composition; (3) Distribution of population across habitat types; and (4) Selective change in natural processes or selective impacts. It appears that the North Fork Salmon River population has not lost any life history strategies and has been minimally influenced by hatchery fish. Based on these and other criteria, the ICTRT determined that extinction risk caused by loss of diversity is low for this population. Current diversity is not precluding the population from reaching maintained or viable status.

Summary

The North Fork Salmon River population is currently rated high risk. The NWFSC (2015) did not rate this population for abundance/productivity. Without survival increases that lead to increases in abundance and productivity, the North Fork Salmon River population cannot reach its proposed status of maintained. The North Fork Salmon River spring/summer Chinook salmon population combined

spatial structure and diversity is rated as low. The low risk rating for spatial structure/diversity is adequate to attain the proposed status for the population.

Table 5.4-26 summarizes the abundance/productivity and spatial structure/diversity risks for the North Fork Salmon River population. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.4-26. Viable Salmonid Population parameter risk ratings for the North Fork Salmon River spring/summer Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	high (>25%)	HR	North Fork Salmon River	HR	HR

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors.

Natal Habitat

Habitat Conditions

The North Fork Salmon River and other Salmon River tributaries included in the population drain predominantly forested mountains. The Salmon-Challis National Forest administers most of the land within the population boundaries, but private inholdings are located along many streams, primarily those with flat, fertile land which also generally coincides with salmon spawning habitat. Human activities such as mining, timber harvest, livestock grazing, and development have impacted this habitat for at least the last 130 years. Hydraulic gold-mining in the Gibbonsville area caused high levels of turbidity in the North Fork Salmon River and delivered large amounts of fine sediment to stream channels, likely eliminating spring/summer Chinook salmon spawning in the drainage in the 1940s. However, once large-scale mining activities ceased, spring/summer Chinook salmon were again seen spawning by 1957 (USDA Forest Service 1994). Livestock grazing allotments occur within the Hughes Creek and Hull Creek drainages, but impacts from these activities have been declining (IDEQ 2001b). Development of private land along the North Fork Salmon River has markedly increased in recent years, and numerous stream crossings have been installed to access home sites close to the river, potentially affecting stream habitat.

The Upper Salmon Basin Watershed Program partners have ranked many streams in the North Fork population at Priority I (including Hughes Creek, Indian Creek, and Squaw Creek), indicating that these have the potential to realize immediate, tangible benefits to fish from habitat restoration efforts (USBWP 2012). Other streams, such as the mainstem North Fork Salmon River and Dahlonega Creek, are ranked Priority II, indicating that habitat restoration projects will bring tangible benefits, but that the benefits could be less substantial or delayed compared to the potential for restoration on Priority I streams. Stream restoration projects directed at salmon and steelhead to date have included removal of passage barriers and placement of instream structures to increase habitat complexity.

Current Habitat Limiting Factors

NMFS determined the habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups. Based on the information compiled, NMFS concludes that the key habitat limiting factors for the North Fork Salmon River population are as follows: low flows due to water diversions, lack of habitat complexity, and bank instability. Development along the North Fork Salmon River corridor further threatens habitat quality and may lead to limiting factors in the near future. Impassable culverts and elevated fine sediment loads also exist within the population boundaries; however, these factors have limited overlap with potential spring/summer Chinook salmon habitat and are therefore secondary priorities for restoration projects. The habitat limiting factors are described below.

1. Low base flows and entrainment due to water diversion.

Artificially low flows during the summer irrigation season may be a habitat limiting factor for spring/summer Chinook salmon in the North Fork population (NPCC 2004, p. 3-39; USDA Forest Service 2000). Water withdrawals from stream channels reduce the amount of available spawning and rearing habitat, leave un-shaded stream reaches more susceptible to unsuitably high temperatures during summer base flows, and may decrease the connectivity between habitat patches. The numerous water withdrawals in the North Fork population may be limiting this population's abundance and productivity by reducing the availability and quality of juvenile habitat in particular.

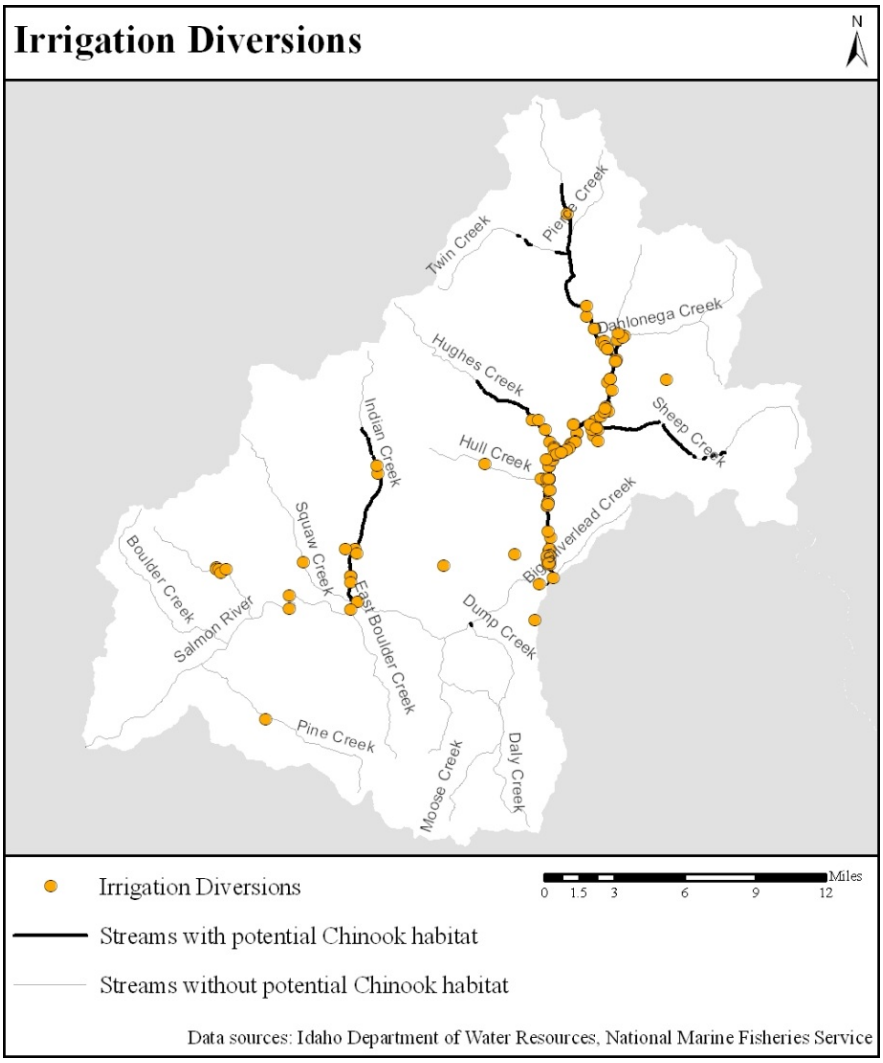

Figure 5.4-28. Irrigation diversions within the North Fork Salmon River population boundaries (IDWR 2008).

Irrigation in the North Fork Salmon River population occurs on strips of private land along narrow stream valleys where ranchers grow alfalfa and hay or maintain pasture. Figure 5.4-28 compares the location of irrigation diversions in the population to the location of streams with historic spring/summer Chinook salmon spawning and rearing habitat (IDWR 2008, NMFS 2006). While irrigation diversion are scattered throughout the population, diversions in the North Fork and Indian Creek drainages have the most potential to affect the population since the other streams in the population do not support spring/summer Chinook salmon. In the North Fork Salmon River drainage, irrigation diversions are known to cause reduced flows in Dahlonega Creek, Hughes Creek, and Hull Creek (USDA Forest Service 2000).

The effects of water withdrawals on North Fork salmonids have not been studied as thoroughly as in neighboring populations like the Lemhi River and Pahsimeroi River, which both have broad valleys with much greater amounts of irrigation. Within the North Fork population, the extent of irrigation is constrained by lack of arable land due to narrower valleys; less than 0.5 percent of the population area is currently in use for pasture or crops (USGS 2004b). Nonetheless, water rights exist for a cumulative 52.5 cfs of water to be diverted from the North Fork Salmon River drainage (IDWR 2008). In contrast,

USGS estimates that in the absence of irrigation diversions, August flow at the mouth of the North Fork Salmon River would exceed 28 cfs only 20 percent of the time (Hortness and Berenbrock 2001), suggesting that irrigation diversions could substantially reduce summer flows within the watershed. On the other hand, the Idaho Power Company reports mean measured August flows of 50.2 cfs, 53.1 cfs, and 39.7 cfs in 2005, 2006, and 2007 (Idaho Power Company 2009); these measured flows during the irrigation season are of the same magnitude as the USGS's modeled unimpaired baseflows, suggesting a smaller impact to flows from irrigation diversions. The apparent conflict between these different sources of information could come from multiple factors, such as the high level of uncertainty associated with the USGS modeled unimpaired flow estimates or the possibility that irrigators may divert less flow than the water right maximums. Lack of long-term data on streamflow or irrigation diversions makes it difficult to quantify the effects of streamflow impairments on salmonids within the North Fork Salmon River watershed.

Water withdrawals may also be limiting spring/summer Chinook salmon habitat in Indian Creek. Water rights exist for a cumulative 2.5 cfs of flow in the watershed, compared to an estimated unimpaired August base flow that exceeds 7.4 cfs only 20 percent of the time (Hortness and Berenbrock 2001), suggesting the potential for substantial streamflow reductions. In 2002, the Lemhi County Soil and Conservation District completed a project to consolidate diversions on Indian Creek in order remove passage barriers created by the old diversions and divert less water overall, enhancing instream flows (USBWP 2009). Again, because of lack of measurements on actual streamflow or water withdrawals, it is difficult to quantify the effects of streamflow impairments on spring/summer Chinook salmon habitat in this drainage.

Watershed reports show that reduced streamflow is limiting spring/summer Chinook salmon habitat in a few specific tributary streams within the North Fork Salmon River population: for instance, Dahlonega Creek and Hughes Creek in the North Fork drainage (USDA Forest Service 2000). The available data are inconclusive on whether reduced flows are also impairing spring/summer Chinook salmon habitat in the North Fork mainstem or in Indian Creek. However, the large number of irrigation water rights relative to summer streamflow levels in both these drainages means that there is potential for habitat impairment. Recent temperature monitoring has not shown elevated stream temperatures, but this remains a possible effect from reduced flows (USDA Forest Service 2007). Reductions in available habitat and barriers to habitat, on the other hand, are likely currently reducing the abundance and productivity of this population. Very few restoration projects have so far addressed this limiting factor within the North Fork population.

Unscreened diversions also pose a threat to rearing spring/summer Chinook salmon in multiple streams in the population, particularly Dahlonega Creek, Hughes Creek, and Hull Creek in the North Fork watershed (USDA Forest Service 2000). Without screens, spring/summer Chinook salmon may enter diversions and become trapped. Many diversions on the mainstem North Fork Salmon River are now screened, but diversions throughout the rest of the population remain unscreened (IDFG 2002). The Upper Salmon Basin Watershed Program partners and IDFG are working with landowners to screen diversions.

2. Lack of pools and habitat complexity.

Past land use has drastically reduced habitat complexity and pool frequency in the North Fork Salmon River population by removing riparian vegetation and altering LWD recruitment processes (USDA Forest Service 2000). Current human activities may be further reducing LWD in stream channels. While surveying the North Fork Salmon River channel in the 1990s, the Salmon-Challis National Forest and IDFG observed a significant reduction in the amount and quality of rearing habitat associated with deep pools and the amount and quality of spawning habitat. The biologists concluded that a major factor in this reduction was loss of LWD (USDA Forest Service 2005). Current highway maintenance and private land practices remove LWD and debris jams from the stream channels, particularly the North Fork mainstem, in order to reduce the risk to the numerous bridges crossing the river. This loss of LWD has led to loss of pool habitat (USDA Forest Service 2007). Furthermore, without LWD to reduce flow velocities, gravel and small cobbles are more likely to be washed downstream during high flows. The Salmon-Challis National Forest has observed a change in substrate from gravel and small cobbles to large cobbles and boulders in the North Fork Salmon River and a simultaneous reduction in suitable spawning habitat (USDA Forest Service 2005).

Stream restoration projects have increased habitat complexity in individual stream reaches in Indian Creek and the North Fork by placing logs and boulders. Many more stream miles in the population are currently limited by lack of habitat complexity and LWD, such that future projects could continue to incrementally increase abundance and productivity for spring/summer Chinook salmon.

3. Stream bank instability.

Grazing, road-building, and hydraulic mining have all removed riparian vegetation and led to widespread bank instability (USDA Forest Service 2000). Bank instability can cause wide, shallow channels that do not provide quality rearing habitat due to lack of cover and the potential for high temperatures.

4. Passage barriers.

The Salmon Subbasin Assessment reports that multiple barriers to fish migration exist on tributaries to the mainstem Salmon River within the North Fork Salmon River population boundaries (NPCC 2004). However, these tributaries are generally more important for steelhead than for spring/summer Chinook salmon, being small and steep, many with natural barriers to anadromous fish. NMFS estimates that potential spring/summer Chinook salmon spawning and rearing habitat within the population exists only in Indian Creek and the North Fork Salmon River drainage (NMFS 2006). Figure 5.4-29 displays known man-made passage barriers in the population, from data gathered by the Salmon-Challis National Forest and StreamNet, primarily culverts (StreamNet 2003). This map shows that known passage barriers are largely upstream of potential spring/summer Chinook salmon habitat, which suggests that passage barriers are not a key limiting factor for this population. While removing passage barriers within these drainages might improve habitat connectivity for other species, and might provide access to small amounts of currently unavailable spring/summer Chinook salmon habitat, these restoration projects would not be likely to substantially increase abundance or productivity for the population.

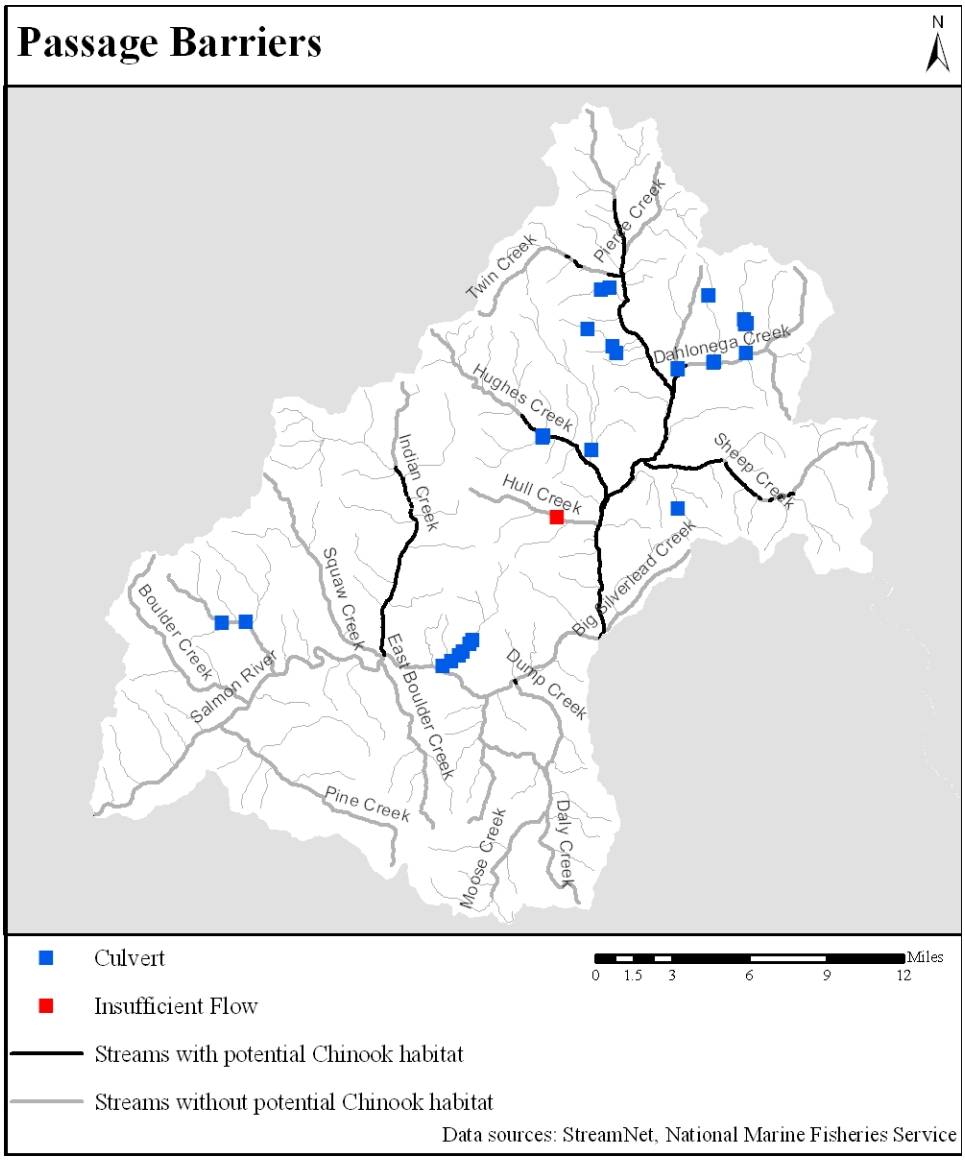

Figure 5.4-29. Passage barriers within the North Fork Salmon River population boundaries.

5. Excess sediment.

Sediment is no longer a primary limiting factor for this population. In past decades, mining, road-building, logging, and grazing delivered elevated levels of fine sediment to streams in the North Fork Salmon River population. Fine sediment and turbidity from hydraulic mining likely eliminated spring/summer Chinook salmon spawning in the 1940s (USDA Forest Service 1994). However, with better land management, fine sediment in stream channels has decreased; for example, the Salmon-Challis National Forest recorded a decrease in percent fines in the North Fork channel from the 1980s to the 1990s (USDA Forest Service 1994), and sediment impacts from livestock grazing in Hughes Creek and Hull Creek are also decreasing (IDEQ 2001b).

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect spring/summer Chinook salmon habitat in the North Fork Salmon River watershed. One concern has been identified for this population.

1. Rural development in riparian areas. Rural development along the mainstem North Fork Salmon River poses a threat to habitat quality for spring/summer Chinook salmon. Development, and particularly bridges crossing the river to reach home sites, can lead to bank instability and loss of riparian vegetation. A study on development in Lemhi County, commissioned by Salmon Valley Stewardship, ranked almost all private land along the North Fork Salmon River as being high priority for development, based on the suitability for housing sites and relatively low agricultural potential of the land (Spatial Dynamics 2006). Housing development along the mainstem North Fork Salmon River is likely to continue, potentially leading to further bank instability and removal of riparian vegetation. These changes to the riparian zone could degrade habitat quality, such as by leading to wider stream channels with less cover for juvenile salmonids and with higher stream temperatures.

Local efforts to reduce this threat to stream habitat are ongoing. Lemhi County is developing a Comprehensive Plan and Growth Management Plan with riparian setbacks. The Nature Conservancy and the Lemhi Regional Land Trust are working with private landowners to educate them and to develop conservation easement agreements. NMFS recommends landowner education programs to encourage landowners to retain vegetation along the river and minimize the effects of bridges.

Hatchery Programs

No hatchery releases currently occur in the North Fork Salmon River population area. The ICTRT reviewed the North Fork Salmon population in June 2007, and rated hatchery impact as low risk because there are no within-population supplementation programs and Chinook from production programs upstream (Sawtooth and Pahsimeroi) are not known to stray into the North Fork Salmon River (ICTRT 2007). Hatchery-related limiting factors and threats for the population are further discussed at the MPG level in Section 5.4.3.2.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River and Salmon River pose a threat to North Fork Salmon River spring/summer Chinook salmon. Currently, no state fisheries target hatchery-origin spring Chinook salmon in the North Fork, but tribal fisheries may occur. Overall, however, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Upper Salmon River populations are discussed at the MPG level in Section 5.4.3.3.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions are intended to improve productivity rates and increase the capacity for natural smolt production in the population, thus maintaining and restoring the VSP parameters that will move the population towards a maintained or viable status.

1. The highest restoration priority in the population is to reduce the impacts to habitat from irrigation diversions. For the North Fork Salmon River, as for much of the Upper Salmon River basin, a key habitat goal is to rehabilitate natural hydrographs in important anadromous fish streams, thus ensuring adequate base flows, channel-maintaining peak flows, and normal flow timing (Ecovista 2004). The Upper Salmon Basin Watershed Program partners will continue to work with private landowners to secure instream flows and improve diversion dams, conveyance systems, and irrigation efficiency. Improving diversion dams includes adding screens to unscreened diversions and thus reducing risk of fish entrainment.
2. A second priority for habitat restoration is to continue to increase habitat complexity, pool frequency, and spawning habitat by adding structures to stream channels. Salmon-Challis National Forest and Trout Unlimited have completed projects in both Indian Creek and the North Fork Salmon River in which they placed multiple log structures. But there are many more miles of stream in which habitat quality is limited by lack of complexity and pools and where placed structures could improve fish habitat by creating pools, stabilizing banks, creating scour, and retaining spawning gravels (U.S. Forest Service 2000). NMFS recommends new projects to increase habitat complexity and monitoring of completed projects to track their effectiveness. Monitoring of log-drop structures placed in Indian Creek has shown steelhead spawning in habitat associated with the structures (U.S. Forest Service 2004).

   Productivity gains could be achieved by reestablishing riparian vegetation and reducing streambank instability. Reestablishing riparian vegetation would provide cover, stabilize streambanks, and reduce stream temperatures (Ecovista 2004). The lower portions of Hughes Creek and Dahlonega Creek have been channelized and altered by mining tailings. Reestablishing a natural channel would improve riparian function.

Implementation of Habitat Actions

Implementation of habitat actions for this population will occur primarily through the efforts of the Upper Salmon Basin Watershed Program partners. On federal lands, following the existing U.S. Forest Service Land and Resource Management Plan should provide the protection needed for this population.

Table 5.4-27 shows habitat projects which have been identified for this population to address limiting factors. This list, however, only identifies projects proposed for implementation through Bonneville Power Administration programs and does not represent a full list of projects. Specific projects are planned continuously based on available funding and established priorities. During Plan implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.4-27. Habitat Recovery Actions Identified for the North Fork Salmon River Spring/Summer Chinook salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Channel structure and habitat diversity	Instream habitat diversity for spawning, rearing, and resting by adding structure: Create log jams and channel spanning weirs. Create pool habitat.	Boyner property restoration project. Turchan property restoration project. McClain property restoration project. Abbott property restoration project. Hutton-Murphy property restoration project. Dedmon-Kozacek property restoration project.	N/A
Floodplain connectivity	Improve floodplain connectivity.		
Riparian Area Stability and Vegetation	Reestablish riparian vegetation and improve streambank stability.		

Habitat Cost Estimate for Recovery

There are many uncertainties involved in predicting the course of recovery and in estimating total costs. Such uncertainties include biological and ecosystem responses to recovery actions as well as long-term and future funding. This recovery plan is dynamic and subject to change through the adaptive management process. Costs estimates for specific projects are provided where known. No cost estimates are provided for (1) baseline actions (programs that are already in existence, such as FCRPS mitigation), which are listed as Not Applicable (N/A); or (2) actions that need costs to be developed, which are listed as To Be Determined (TBD).

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs may present. For the North Fork Salmon River population, the strategy is to manage for natural production. This includes monitoring for strays and taking necessary actions to address straying. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

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The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate

change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.4.12 Yankee Fork Salmon River Spring Chinook Salmon Population

The Yankee Fork Salmon River spring Chinook salmon population is currently not viable, with a high abundance/productivity and spatial structure/diversity risk status. Its proposed status is Maintained, which requires no more than moderate abundance/productivity and spatial structure/diversity risk.

Current Status	Proposed Status
High Risk	Maintained

Population Status

This section compares the Yankee Fork Salmon River population's current status to its proposed status. The population's current status is based on the ICTRT's (2010) population status assessment and NWFSC's (2015) status review. This section focuses primarily on population abundance and productivity. It also summarizes spatial structure and diversity concerns. Diversity concerns are discussed again in the hatchery section. More details on the population status are available in the full status assessment (ICTRT 2010) and status review (NWFSC 2015).

Population Description

Spring Chinook salmon returning to the Yankee Fork and West Fork Yankee Fork Salmon River were designated as one independent population based on habitat capacity in these watersheds and on geographic distance from all other Upper Salmon River spawning aggregations (ICTRT 2003). Spring Chinook salmon in the mainstem Yankee Fork Salmon River are highly differentiated genetically from other adjacent populations, but this difference likely reflects some limited prior out-planting of Rapid River hatchery stock into the mainstem Yankee Fork (ICTRT 2007). West Fork Yankee Fork spring Chinook salmon, on the other hand, are genetically similar to other Upper Salmon River populations. The Yankee Fork Salmon River population is made up of just one major spawning area, which encompasses the whole watershed (Figure 5.4-30). The ICTRT classified the Yankee Fork Salmon River population as Basic in size and complexity based on historical habitat potential. Although abundance is very low, spawning is distributed throughout the population, extending from approximately one mile upstream of the Yankee Fork Salmon River mouth to the headwaters area and up the West Fork Yankee Fork Salmon River. The highest densities of juvenile Chinook salmon are found in the Middle Yankee Fork subwatershed, upstream from Jordan Creek and above the historic dredging in the lower Yankee Fork Salmon River (BOR 2012).

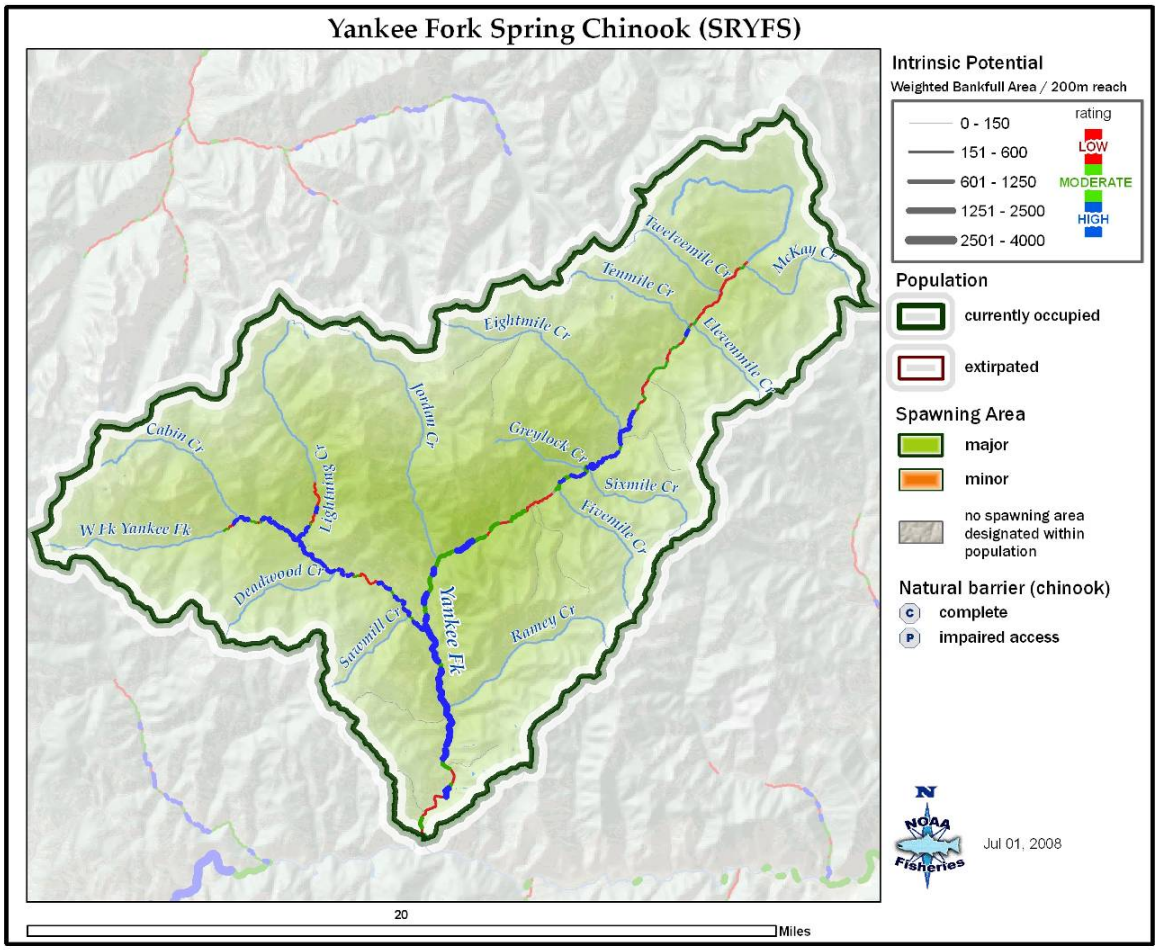

Figure 5.4-30. Yankee Fork Salmon River spring Chinook salmon population. Major and minor spawning areas reflect relative suitability, or intrinsic potential, of stream reaches in this population to support spawning and rearing under historic unimpaired conditions, inferred from stream characteristics such as channel size, gradient, and valley width (Cooney and Holzer 2006).

Yankee Fork Salmon River Chinook salmon are spring-run fish that return as adults to spawn from mid-August to early September, similar to other Upper Salmon River populations. While there is a wide range in size of returning adults, the Yankee Fork population includes a component of large adults measuring up to 94 cm in length (Shoshone-Bannock Tribes 2012). On average 66 percent of Snake River spring/summer Chinook salmon adults are 79 cm or less in length. After spawning, eggs typically hatch in October or early November. Alevins stay in stream gravels until March, when they leave stream gravels as “button-up” fry. These juvenile spring Chinook salmon will feed in the Yankee Fork watershed and reach 8 to 14 cm in length before winter. Starting during fall and throughout the winter some juveniles will migrate from the Yankee Fork to the Salmon River. However, the highest peak of juvenile spring Chinook salmon emigration to the Salmon River occurs in spring. Yankee Fork Chinook salmon spring yearlings then migrate to the ocean where they typically spend two years before returning to the Columbia River as adults (Kiefer et al. 2001).

Recent abundance of natural spawners for this population has been extremely low. The Shoshone-Bannock Tribes are attempting to increase abundance by releasing surplus adults returning to the Sawtooth Fish Hatchery into the mainstem Yankee Fork, as well as smolts reared at the hatchery. In 2008 and 2009, the Tribes released approximately 1,500 surplus hatchery-origin adults and 400,000

smolts; in 2009 the Tribes also released 450,000 eyed eggs (IDFG 2010). The Tribes propose to continue hatchery supplementation for this population.

Abundance and Productivity

To attain moderate risk, this Basic-size population must attain a minimum average threshold of approximately 250 spawners at a productivity of roughly 2.21. In contrast, the most current (2005-2014) 10-year geometric mean abundance of natural-origin spawners is 44 for the population. The geometric mean productivity is only 0.72 recruits per spawner, below replacement and far below the minimum productivity needed for viable or maintained status (NWFSC 2015).

The ICTRT viability curve shows combinations of current natural-origin abundance and productivity that correspond to a particular risk level. As seen in Figure 5.4-31, a proposed risk level can be achieved with various combinations of abundance and productivity. For the Yankee Fork population, the proposed maintained status can be attained with any combination of abundance and productivity that is above the red line in Figure 5.4-31. Because current abundance and productivity are well below the red line, the overall abundance and productivity risk rating is high.

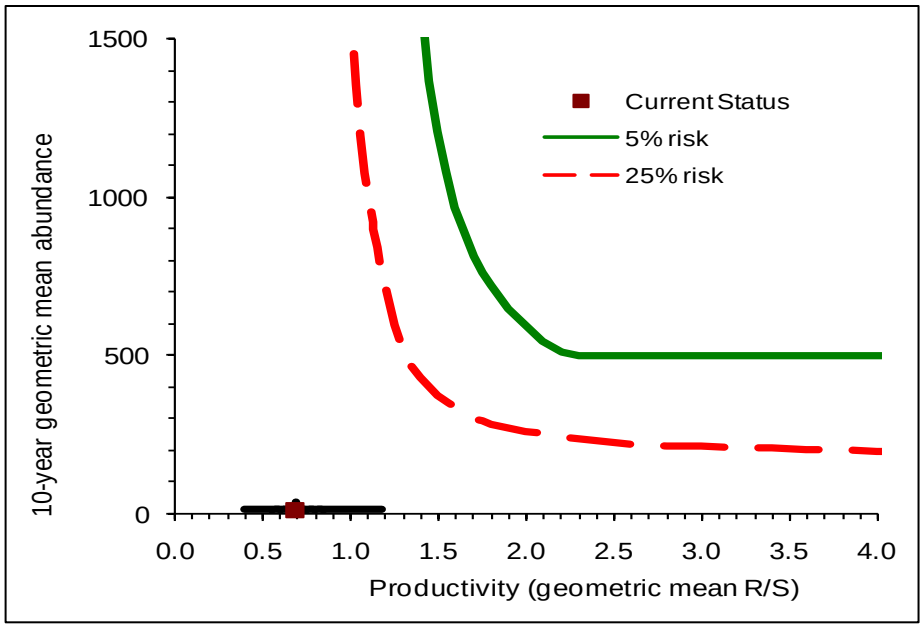

Figure 5.4-31. Yankee Fork spring Chinook salmon current estimate of abundance and productivity compared to the ICTRT viability curve for the population. Abundance is defined as adult spawners and productivity as recruits per spawner (R/S). [Note: The current status shown in this figure is based on abundance and productivity estimates from an earlier species status review. NMFS will update this figure during Plan implementation so that the current status symbol reflects the current population abundance and productivity estimates in NWFSC (2015).]

Spatial Structure

The historic structure of the Yankee Fork Salmon River population has inherent risk in that the population consists of just one major spawning area. However, recent spawner surveys show that spring Chinook salmon spawning in the Yankee Fork Salmon River is distributed throughout the historic range, with no increase in gaps between spawning aggregations, leading to a cumulative

moderate risk rating for spatial structure. This is adequate to achieve the population's overall proposed status.

Diversity

A population's diversity risk rating is a function of multiple metrics that assess the population's major life history strategies, phenotypic variation, genetic variation, spawner status including hatchery and stray influences, and distribution across different habitat types. The metric driving the cumulative diversity risk rating for Yankee Fork spring Chinook salmon is genetic variation. Yankee Fork genetic samples did not group with other Upper Salmon River samples, and instead were not significantly different from hatchery samples from Rapid River Hatchery stock (ICTRT 2010). This similarity to hatchery stock could be due to sporadic past out-planting of Rapid River Hatchery Chinook salmon into this population and may indicate a loss of the population's genetic diversity. Additional diversity risk comes from the fact that Sawtooth Hatchery fish, originating from the Upper Salmon River Mainstem population, are being deliberately released into the Yankee Fork to supplement natural abundance. Out-of-MPG strays and out-of-population spawners also contribute to a diversity risk level of high. The diversity risk must be reduced for the population to achieve the proposed overall status. Future genetic analyses indicating that this population is diverging from Rapid River Hatchery stock could serve to lower the risk rating.

Summary

The Yankee Fork spring Chinook salmon population does not currently meet the viability criteria because the abundance/productivity risk is high and the diversity risk is high. Both of these risk levels will need to be reduced to no greater than moderate to achieve the proposed status for the population.

Table 5.4-28 summarizes the abundance/productivity and spatial structure/diversity risks for the Yankee Fork Salmon River population. A complete version of the ICTRT draft population viability assessment is available at: http://www.nwfsc.noaa.gov/trt/columbia.cfm

Table 5.4-28. Viable Salmonid Population parameter risk ratings for the Yankee Fork Salmon River spring Chinook salmon population. The population does not meet population-level viability criteria.

		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	HR
	High (>25%)	HR	HR	HR	Yankee Fork Salmon River

Viability Key: HV – Highly Viable, V – Viable, M – Maintained, and H – High Risk; shaded cells – do not meet viability criteria, with darkest cells signifying the highest risk of extinction. Percentages refer to risk of extinction over 100 years. Arrow points to proposed risk status.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors.

Natal Habitat

Habitat Conditions

The Yankee Fork Salmon River watershed is located in central Idaho in the Upper Salmon River basin. The watershed is 121,580 acres in size and is located entirely within the Salmon-Challis National Forest, but with several private in-holdings mostly related to mining. The Yankee Fork watershed contains 224 miles of perennial stream. Elevations range from 5,951 feet at the Salmon River confluence to more than 9,843 feet at several high peaks. The watershed receives approximately 30 inches of precipitation annually. Peak flows from snowmelt occur in late May and June, while base flows occur from August through February. Mean annual air temperature averages 33 °F with extremes reaching minus 50 °F in winter and 90 °F in summer. The area's soils are volcanic in origin. Vegetation in the watershed includes montane and subalpine Rocky Mountain flora, with some elements of Intermountain flora near the eastern boundary (USDA Forest Service 1995).

The Yankee Fork mainstem and the West Fork Yankee Fork provide most of the spring/summer Chinook salmon habitat for this population. The upper reaches of the Yankee Fork run through a moderately wide valley with forest interspersed with meadows. Along the lower reaches of the Yankee Fork, the valley remains wide but forest cover becomes sparser, until the last several miles where the river runs through a narrow forested canyon before its confluence with the Salmon River. The upper reaches of the Yankee Fork are 26-43 feet wide, increasing to 43-66 feet in the lower reaches. Stream gradients vary from 0.62 to 1.10 percent, highly suitable for spring/summer Chinook salmon habitat. West Fork Yankee Fork also runs through a moderately wide valley with forest interspersed with meadows. West Fork Yankee Fork is about 6 miles long, 40 feet wide, and has an average gradient of 1.50, which is suitable spring Chinook salmon habitat. Jordan Creek is a major tributary to the Yankee Fork that may provide spring/summer Chinook salmon habitat (StreamNet 2009), although it does not currently support spawning. Jordan Creek is about 6 miles long, 21 feet wide, has a moderate gradient, and runs through a narrow forested valley.

The primary land use impacting stream habitat in the Yankee Fork has been mining. In the late 1800s, gold was discovered within the Yankee Fork basin and a road was built from Challis to Bonanza, bringing miners into the watershed. Mine-related ground disturbance removed hill-slope and riparian vegetation, exposed and compacted soils, and altered drainage patterns. Substantial amounts of timber were cleared from the valley bottoms and margins during the mining boom in the late 1800s and early 1900s to be used in milling operations and building construction. Then in the early 1940s, the substrate of the lower Yankee Fork was mined for gold using a floating dredge, severely impacting the river below Jordan Creek. Before dredging, the river channel was moderately confined with a relatively straight channel pattern, but with small-to-moderate sized patches of floodplain accessible to the river during high flows (BOR 2012). After dredging, the Yankee Fork channel became confined between

unconsolidated, unvegetated dredge tailings. Mining activities in recent decades include the Grouse Creek Mine adjacent to Jordan Creek, a surface gold-silver mine operated in the 1990s. The mine covers approximately 550 acres and created tailings impoundments.

The steep slopes and erosive soils in the watershed are susceptible to mass wasting processes. Summer storm events are common in the watershed, and high-intensity thunderstorms can trigger shallow slides and debris flows, especially in areas where severe fires have burned and in the headwater areas in colluvial hollows. In 1994, 1996, 2001, 2002, and 2003, thunderstorms caused landslides and debris flows in Fivemile Creek, Sixmile Creek, Ninemile Creek, Preachers Cove, Jerrys Creek, and several unnamed tributaries ─ and some of the debris flows reached the Yankee Fork. Some of these sediment inputs contain a high percentage of fine materials that can cause high turbidity and siltation, which generally have short-term negative impacts to fish habitat (on the order of days or weeks). However, these types of events provide gravel and wood inputs to the system, which benefits salmonid habitat over the long-term (months or years) (BOR 2012). IDEQ had previously listed the Yankee Fork from Jordan Creek to Eightmile Creek on the 303(d) list as impaired by siltation, but in 2010 IDEQ delisted this section and the classified the Yankee Fork as fully supporting beneficial uses (IDEQ 2011)

Current Habitat Limiting Factors

NMFS determined the habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups. The U.S. Bureau of Reclamation's "Yankee Fork Tributary Assessment" (BOR 2012) describes current salmonid habitat conditions at the reach-scale and prioritizes reaches for habitat restoration projects.

1. Reduced floodplain connectivity, riparian function, and channel complexity.

In the 1940s and early 1950s, a large floating dredge mined the Yankee Fork stream channel beginning about one mile from the confluence with the Salmon River and continuing upstream to Jordan Creek, covering approximately seven miles. The dredge dug 10-35 feet into the streambed to recover gold by washing and separating rock from dirt. This floating dredge moved massive amounts of channel substrate (mostly gravel to large cobble) into large tailings piles along the east side of the stream bank. A total of 626 acres of land is now covered in tailings with gravel piles that reach heights of 20 feet. These gravel piles disconnected seven miles of the Yankee Fork Salmon River from much of its floodplain by constricting the stream channel.

The tailings piles blocked access for fish to off-channel habitat and covered up riparian vegetation. Further, since the tailings do not contain sufficient soil, riparian vegetation has not regrown. Consequently, the current riparian zone does not provide either large wood recruitment or shade to the Yankee Fork Salmon River stream channel. Tributaries have eroded downward as they adjust to the lowered elevation of the mainstem Yankee Fork, and two perennial tributaries (Jerry's Creek and Silver Creek) are disconnected from the Yankee Fork where flow goes subsurface through dredge tailings. These tributaries likely provided Chinook salmon rearing habitat prior to dredging. The difference between the pre-dredge channel and the present channel is the degree of channel confinement. By increasing channel confinement between dredge piles, the channel has a narrower width that must convey the same peak flows, resulting in increases to water depth, flow velocity, and

sediment transport capacity. Both wood and sediment are transported downstream, such that wood frequency is extremely low at less than one piece of wood per mile and spawning gravel availability is reduced (BOR 2012).

Before dredge mining, the Yankee Fork Salmon River and West Fork confluence area had a broad floodplain in which the two unconfined channels dynamically interacted. The channels migrated across their floodplains, which progressively changed where and how the channels converged. The dynamic interactions resulted in varying hydraulic conditions that created and maintained a mosaic of habitat patches. The dredge-mining process relocated the Yankee Fork Salmon River and West Fork confluence downstream of the broad floodplain to a moderately confined channel segment. The new channel configurations and location of channel convergence are now static and the hydraulic conditions no longer create the mosaic of habitat patches (BOR 2012).

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Yankee Fork Salmon River watershed.

1. Water quality degradation from new mines. New minerals development could introduce chemical contamination to surface waters and increase sediment delivery to streams following extensive ground disturbance.
2. Water quality degradation from historic mining. Legacy mining waste poses a risk of heavy metal contamination (e.g. selenium and mercury) to ground and surface waters - although water quality currently does not negatively impact Chinook salmon in the Yankee Fork Salmon River (BOR 2012). Sediment surveys have shown that while there are areas of concern, risk of chemical contamination of surface waters is generally low (BOR 2012).
3. Noxious weeds. The spread of noxious weeds can increase soil erosion and decrease native plant density.

Hatchery Programs

The Yankee Fork Salmon River population has had various levels of hatchery influence since 1966 (SBT HGMP). In early years, predominantly Rapid River broodstock were used for releases in the Yankee Fork between 1966 and 1989 (Kiefer et al. 1992) but Sawtooth Hatchery broodstock were also used. More recently, both Sawtooth and Pahsimeroi hatchery adults have been used to supplement the Yankee Fork, although currently the Yankee Fork program uses fish from the Upper Salmon program, which are not genetically similar to the Yankee Fork Salmon River population. The hatchery releases have reduced genetic adaptiveness of the Yankee Fork Salmon River population due to the sustained use of out-of-MPG and out-of-population broodstock. They have also resulted in a high proportion of hatchery-origin spawners and reduced proportion of natural-origin broodstock. The hatchery fish compete with natural-origin fish for food and space. Hatchery-related limiting factors and threats for the population are further discussed at the MPG level in Section 5.4.3.2.

The Shoshone-Bannock Tribes have developed the Crystal Springs Hatchery Program aimed at increasing abundance of Chinook salmon in the Yankee Fork and Panther Creek watersheds. NMFS is currently reviewing a Hatchery Genetic Management Plan for this hatchery program. The Shoshone-

Bannock Tribes are proposing to release Chinook salmon from the Crystal Springs hatchery into both the Yankee Fork and Panther Creek watersheds, with goals of providing opportunities for harvest of hatchery fish and restoring locally-adapted hatchery stocks.

Fishery Management

Fisheries in the Columbia River estuary, mainstem Columbia, Snake River, and Salmon River continue to pose a threat to returning Yankee Fork Salmon River spring Chinook salmon. State fisheries targeting hatchery-origin spring Chinook salmon do not currently occur within the Yankee Fork Salmon River but tribal fisheries may occur. Overall, however, negotiations and agreements between fishery managers since the mid-1970s have reduced mortality rates on natural-origin Snake River spring/summer Chinook and other ESA-listed species. Fishery-related limiting factors and threats for Upper Salmon River spring/summer Chinook salmon are discussed at the MPG level in Section 5.4.3.3.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

The following habitat actions are intended to improve productivity rates and increase the capacity for natural smolt production in the population, thus maintaining and restoring the VSP parameters that will move the population towards a maintained or viable status. The Upper Salmon Basin Watershed Program partners ranked all of the streams in the Yankee Fork watershed at Priority 1, indicating that the Yankee Fork and its tributaries have the potential to realize immediate, tangible benefits to fish from habitat restoration efforts (USBWP 2005). The watershed has unimpaired late-summer base flows and cold water temperatures, key elements for successful salmonid habitat restoration (BOR 2012; Gregory and Wood 2012). BOR (2012) ranks the stream reaches with the most potential for restoration projects to improve salmonid habitat as first the formerly-dredged section of the Yankee Fork, followed by the lower reach of Jordan Creek, followed by the middle Yankee Fork upstream of Jordan Creek.

1. Reconnect the lower Yankee Fork Salmon River to its floodplain. Approximately half of the historic spring/summer Chinook salmon spawning and rearing habitat in the Yankee Fork watershed was below the confluence with Jordan Creek, which is the stretch of the river that was dredge-mined. By restoring natural processes to this portion of the river, this river segment could again return to its historical high value as spring/summer Chinook salmon spawning and rearing habitat. The BPA is working with the Shoshone-Bannock Tribes and Simplot, the principle private landowner along the lower Yankee Fork, to begin this long-term project.

   As part of the Yankee Fork Floodplain Restoration Project, the Shoshone-Bannock Tribes have identified two primary categories of actions that could substantially improve fish habitat within the lower Yankee Fork Salmon River: floodplain reconnections and tributary reconnections. These actions are described below in Table 5.4-29 and in more detail in the Yankee Fork Tributary Assessment: Upper Salmon Subbasin (BOR 2012) and the Yankee Fork Fluvial Habitat Rehabilitation Plan, 2013 Working Version (Gregory and Wood 2012). Floodplain reconnections could reduce main channel velocity, shear stress, and sediment transport and

increase the magnitude and duration of flows dispersed across the floodplain. Reductions in shear stress in the main channel could result in deposition of sediment, establishment of riparian vegetation, increases in channel roughness, and narrowing of the main channel width. Tributary reconnections could provide spring/summer Chinook salmon access to additional rearing habitat. Increased access to floodplains could allow spring/summer Chinook salmon juveniles to use off-channel rearing habitat. Increased streamflow could create more off-channel habitat, flush fine sediment and maintain better fish access during low flow conditions (BOR 2012; Gregory and Wood 2012).

2. Maintain a riparian corridor (i.e., about 100-foot buffer zone) along the Yankee Fork Salmon River in the Middle Yankee subwatershed to allow for riparian vegetation regrowth and progress through successional stages towards mature timber.

Implementation of Habitat Actions

Implementation of habitat actions for this population will occur primarily through efforts of the Shoshone-Bannock Tribes, Salmon-Challis National Forest, IDFG, Trout Unlimited, the U.S. Bureau of Reclamation, Bonneville Power Administration, and other local stakeholder groups and landowners. The U.S. Forest Service has lead responsibility for implementation or oversight of most habitat actions occurring on its lands. On private lands, the State of Idaho has responsibility. The Environmental Protection Agency and Idaho Department of Environmental Quality have joint lead rolls to protect water quality from contaminants that can harm Chinook salmon, such as surface water contaminants from mining tailings. The Shoshone-Bannock Tribes traditionally fished for spring Chinook salmon in the Yankee Fork Salmon River and have been developing and implementing habitat improvement actions in the watershed in order to restore the population. The Tribes have been working jointly with BPA, which provides funding, and Simplot Inc., the landowner where floodplain restoration actions will occur.

The projects listed in Table 5.4-29 have been identified by the Shoshone-Bannock Tribes and are aimed at floodplain restoration for the lower Yankee Fork Salmon River. This list does not represent a full list of habitat projects for the population. Specific projects are planned continuously based on available funding and established priorities. During Plan implementation, NMFS will work with partners through the adaptive management process to refine and prioritize habitat actions for each 5-year implementation period.

Table 5.4-29. Recovery Actions identified for the Yankee Fork Spring/Summer Chinook salmon Population.

Limiting Factor	Habitat Actions	Project Name	Cost Estimate
Lack of functioning floodplain	Reconnect main river channel to floodplain through two types of actions[1]: a) In those areas where a low area occurs between the river channel and the gravel piles, create a side channel with dimensions comparable to others within the watershed. b) In those locations where gravel piles are continuous from the Yankee Fork road to the banks of the river, create a floodplain bench by regrading the existing gravel piles to create a floodplain accessible to bankfull and greater flows.	Yankee Fork Floodplain Restoration Project	$10,452,000
Disconnected tributary rearing habitat	Reconnect tributaries to the mainstem river. Restore surface water connections to provide Chinook salmon access to potential rearing habitat and refugia.		
Lack of off-channel rearing habitat	Create new rearing habitat and increase access to existing rearing habitat. Create new side channel rearing habitat in the floodplain and improve habitat for existing ponds. Modify inlets from the river to floodplains to convey more spring runoff and summer base flow and thereby increase available Chinook salmon rearing habitat.		

[1] The Shoshone-Bannock Tribes identified two different types of actions for floodplain reconnections depending upon existing conditions.

Habitat Cost Estimate for Recovery

The total cost estimate for the floodplain restoration actions identified by the Shoshone-Bannock Tribes and listed in Table 5.4-29 is $10,452,000 (CH2M Hill 2008). Removal and redistribution of the gravel piles is the most costly item. Costs to federal and state agencies for oversight and permitting of these actions are the responsibilities of the respective agencies and are not considered ESA recovery plan costs. These costs are, therefore, not included in this total.

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs may present. For the Yankee Fork population, the strategy is to transition the Yankee Fork hatchery program to use locally adapted stock. This includes developing gene flow standards through the HGMP process. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

The fisheries strategy is to continue to control harvest-related risks through the abundance-based approach and existing fishery management programs to support the recovery of natural-origin populations. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

5.4.13 Panther Creek Spring/Summer Chinook Salmon Population

The Panther Creek spring/summer population is defined as functionally extirpated by the ICTRT (ICTRT 2003). The population is not included in the initial recovery strategies for achieving a viable Upper Salmon River MPG or a viable Snake River spring/summer Chinook salmon ESU. Thus, the recovery plan does not designate a proposed status for this population. The primary recovery function of the population will be to contribute to the abundance, productivity, and spatial structure of the Upper Salmon MPG and the Snake River ESU. However, as more information is gathered about the spring/summer Chinook salmon currently spawning in Panther Creek, it is possible that NMFS will select Panther Creek as one of the Upper Salmon River populations to reach low risk status as part of the recovery strategy for the MPG. This determination would then be integrated into the recovery plan.

Although it is not necessary for the Panther Creek population to reach maintained viability for the MPG to attain the minimum requirements for viability, the population represents an important contingency for recovery of the MPG. Extinction risk is highly sensitive to the number of viable populations and decreases rapidly as additional populations are added (ICTRT 2007). If the Panther Creek population reestablishes, it would contribute to increasing the viability of the Upper Salmon River MPG.

Current Status	Proposed Status
Functionally extirpated	None

This population includes the Panther Creek drainage and tributaries to the main Salmon River downstream from Panther Creek. The original stock of spring/summer Chinook salmon in Panther Creek was decimated by the late 1950s, when chemical contamination of surface waters from mining wastes blocked access to habitat in the Panther Creek drainage. Extensive mine site reclamation activities over the past 15 years have partially restored water quality in lower Panther Creek and a few of its tributaries, such that salmonid habitat is improving. Habitat restoration actions are also allowing spring/summer Chinook salmon access into many miles of high quality habitat that are relatively well protected due to the watershed's remote location and predominantly federal ownership.

Spring/summer Chinook salmon redds were observed in Panther Creek in 2001, and subsequent surveys have consistently found evidence of Chinook salmon. There are several possible sources for the Chinook salmon spawning in Panther Creek over the last decade: hatchery adults that were out-planted in Panther Creek; remnants of the historic population, particularly from outside the Panther Creek drainage; or strays from other populations. The reproductive success of these fish is evidence that the watershed will again be able to support a spring/summer Chinook salmon population.

Much of the genetic diversity of the historic Panther Creek spring/summer Chinook salmon population may have been lost, but a reestablished population at least has the potential to provide spatial structure benefits and abundance and productivity benefits to the species at the MPG and ESU scales. Recovery of spring/summer Chinook salmon in the Panther Creek watershed would thus likely be beneficial to the recovery of the species. Funding for reintroduction of spring/summer Chinook salmon in Panther Creek is included in a settlement agreement with Blackbird Mine owners as mitigation for past natural

resource damage. There is also designated critical habitat for spring/summer Chinook salmon within the Panther Creek watershed.

Population Status

This section of the recovery describes the population but does not describe the population's current status in terms of the four viability parameters (abundance, productivity, spatial structure, and diversity). Although spring/summer Chinook salmon have been spawning in Panther Creek in recent years, when the ICTRT completed their status assessments there were inadequate data to complete an assessment for this population.

Population Description

The ICTRT determined that Panther Creek is sufficiently distant from other spawning aggregates and has sufficient available habitat to be considered a separate, independent population, but at this time, it is classified as extirpated (ICTRT 2003). The population area includes the Panther Creek watershed along with the main Salmon River and its tributaries from Panther Creek downstream to the Middle Fork Salmon River (Figure 5.4-32).

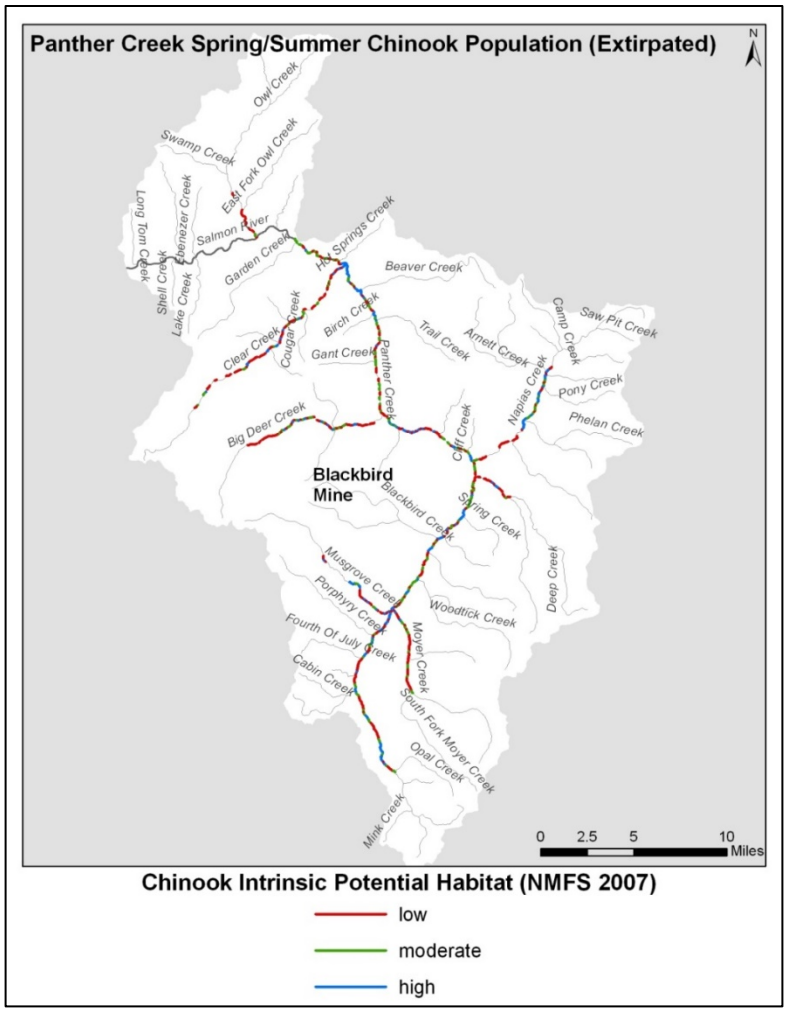

Figure 5.4-32. Panther Creek Spring/Summer Chinook salmon Population.

Stream habitat in Panther Creek was severely degraded by acid and heavy metal drainage from the Blackbird Mine, which operated from 1949-1967. Acid mine drainage resulted in levels of copper in Panther Creek surface water downstream from the mine that eliminated most aquatic life. Spring/ summer Chinook salmon redd counts during the 1950s showed significant declines (e.g. IDFG 1951, Metsker 1955), and were consistently zero by the early 1960s (Corely 1967). Studies conducted in the 1990s observed no fish and a severely depressed aquatic macroinvertebrate community in Panther Creek downstream of the mine.

Since 2001, spring/summer Chinook salmon spawning has again been documented in Panther Creek. There are several possibilities for the origin of Chinook salmon currently inhabiting the Panther Creek drainage. These fish may be descendants of (1) hatchery fish that IDFG has released into Panther Creek several times, most recently in 2001 with surplus adult Chinook salmon from the McCall Hatchery (South Fork Salmon River stock), out-planted into Panther Creek for a tribal and public fishery (ICTRT 2003); (2) individuals from areas of the population where Chinook salmon have persisted, such as Owl Creek, or possibly other Salmon River tributaries or unsurveyed stream reaches in the Panther Creek drainage; or (3) strays from other Salmon River populations.

The Shoshone-Bannock Tribes documented 43 Chinook salmon redds in Panther Creek in the fall of 2001, after IDFG released surplus fish from the McCall Hatchery. Subsequent surveys in September 2002 showed juvenile Chinook salmon distributed throughout Panther Creek. IDFG spawning surveys in 2002, 2003, and 2004 reported 0, 0, and 1 redd, respectively in Panther Creek (IDFG 2007), suggesting that at least one pair of adult Chinook salmon strayed into the watershed in 2004. Monitoring in 2003, 2004, and 2005 found juvenile Chinook salmon in all segments of Panther Creek. During this time, there were also some incidental sightings of Chinook salmon adults, further indication of adults straying into the drainage. Then in 2005 and 2006, IDFG spawning surveys showed 18 and 16 Chinook salmon redds (IDFG 2007). No genetic information was collected on these returning adults, but the return timing four and five years later indicates that these adults were likely offspring of the 2001 hatchery outplants. No outplanting has taken place in recent years, but redds continue to be observed each year. Stiefel et al. (2016) report that an adult carcass survey in Panther Creek in 2015 found 94 Chinook salmon carcasses, none of which were hatchery fish. Between 2010 and 2016, the Shoshone-Bannock Tribes and IDFG found Chinook redds in Panther Creek in the reach from Cabin Creek downstream to Deep Creek, with yearly red counts from 60 to 144 (IDFG 2017).

Status Assessment

The ICTRT and NWFSC (2015) had inadequate data on abundance, productivity, or diversity to complete a status assessment for the Panther Creek population.

Limiting Factors and Threats Specific to Population

This section describes limiting factors and threats that are specific for the population. The population is also affected by limiting factors and threats in the mainstem Columbia/Snake River corridor, estuary, plume and ocean, and by climate change. Chapter 4 discusses these regional-level factors.

Natal Habitat

Habitat Conditions

Panther Creek is a fifth-order stream draining 529 square miles of the Salmon River mountains in east-central Idaho. Stream flow patterns are typical of those driven by snowmelt runoff, with peaks in May or June and lows in fall and winter. Average annual flow at the mouth of Panther Creek is 265 cubic feet per second (cfs) with mean monthly flows ranging from 83 to 136 cfs (IDEQ 2001b).

Mining has been the land use causing the most impact to stream habitat in Panther Creek. Gold and other precious metal mining has occurred in the area since 1893, and cobalt and copper were mined and milled at the Blackbird Mine site from 1917 to 1967. The main period of mineral extraction at the Blackbird Mine followed World War II, from 1949 to 1967 (IDEQ 2001b). By 1955, aerial surveys by IDFG revealed that downstream from Blackbird Creek silt from the Blackbird Mine had turned the Panther Creek stream bottom red with iron deposits (Metsker 1955). Streams draining the Blackbird Mine site delivered toxic levels of copper and other heavy metals to Panther Creek, destroying the stream's ability to support spring/summer Chinook salmon. Major mining activity at the Blackbird site ceased in 1967, but contaminated run-off from the mine site continued to reach Panther Creek in the next decades, particularly during high water flows from thunderstorms and snowmelt (EPA 2010).

In 1983, the State of Idaho filed a natural resources damage suit against the current and previous owners and operators of the Blackbird Mine for alleged damages to surface and groundwater in Panther Creek. The NMFS, U.S. Forest Service, and EPA joined the State of Idaho, and the suit was settled in 1995. The resulting Consent Decree required that the mine owners (the Blackbird Mine Site Group) implement a remedial strategy developed by EPA to restore water quality to levels that would support all life stages of anadromous and resident fishes (*State of Idaho et al. vs. M.A. Hanna Company 1995*). The Consent Decree also required the Blackbird Mine Site Group to implement a Biological Restoration and Compensation Plan for Panther Creek, which includes habitat restoration projects and funding for the eventual reintroduction of spring/summer Chinook salmon into Panther Creek.

The remedial action at the Blackbird Mine site is nearing completion. While the copper water quality criterion identified in the Consent Decree is still occasionally exceeded during high spring flows, Panther Creek is at a point where it will support aquatic life. Aquatic macroinvertebrate populations and fish distribution downstream of the mine are similar to upstream control sites. The habitat restoration portion of the Biological Restoration and Compensation Plan is in its final phases of implementation with projects targeted at reducing suspended sediment from the Blackbird Mine site to further lower delivery of copper-contaminated sediments to Panther Creek. Habitat restoration projects under the Biological Restoration and Compensation Plan have included removing tailings from Blackbird Creek to reduce the risk of downstream transport during high flows and removing contaminated soils from the banks of Panther Creek.

Other land uses in Panther Creek that have affected stream habitat include livestock grazing, surface water withdrawals, and timber harvest (Rieffenberger et al. 2008). Livestock grazing in the watershed occurs on private land and on U.S. Forest Service allotments, and can disturb stream banks and

riparian vegetation. Surface water is diverted for irrigation, domestic use, and mining, but on a much smaller scale than in other watersheds in the Upper Salmon River. Diversions primarily have local impacts to tributary habitat by reducing flow or blocking fish from accessing tributary rearing habitat.

Panther Creek provides the primary spring/summer Chinook salmon spawning habitat in the watershed, particularly from Fourth of July Creek to Napias Creek. Upper Panther Creek also includes the best rearing habitat in the watershed, although tributaries also provide extensive rearing habitat. The tributary habitat with the best intrinsic potential for spring/summer Chinook salmon is largely in Deep Creek, Clear Creek, and Moyer Creek. On the main Salmon River, Owl Creek supports spring/summer Chinook salmon, and stream habitat is currently in excellent condition (Warren and Anderson 2005).

Figure 5.4-32 shows modeled intrinsic potential habitat for Panther Creek spring/summer Chinook salmon, but the model did not take into account natural passage barriers on some tributaries. Big Deer Creek is not considered Chinook salmon spawning habitat due to the steep cascade falls located 0.7 miles upstream from the mouth. Napias Creek also has a natural falls starting one mile upstream from its mouth that may be a spring/summer Chinook salmon passage barrier under some streamflow conditions.

Current Habitat Limiting Factors

NMFS determined the habitat limiting factors for the population by reviewing multiple data sources and reports on stream conditions across Idaho's watersheds, and through discussions with local fisheries experts and watershed groups.

1. *Reduced habitat quality from metals contamination.*

The now inactive Blackbird Mine caused chemical contamination of soils and surface water in the Panther Creek watershed. The mine site is divided by a ridge and drains into two basins: the Big Deer Creek basin to the north, and the Blackbird Creek basin to the south (including Meadow, West Fork Blackbird, and Blackbird Creeks). Disturbance due to historic mining spreads over approximately 830 acres of primarily private patented mining claims along with some unpatented claims on National Forest land. Cobalt, silver and copper ore were extracted from underground and open pit mining operations. Contaminated soil, sediments, and tailings were released from the Blackbird Mine site. Operations at the Blackbird Mine ceased in 1982 and the site is now undergoing cleanup regulated by the EPA. Cleanup actions have included the following: collecting contaminated runoff water in the mine area and treating it for copper and cobalt; stabilizing waste-rock piles at the mine; and removing soils contaminated with arsenic along the banks of Panther Creek (EPA 2010).

While the mine was in operation, high levels of dissolved copper and other metals in Panther Creek below Blackbird and Big Deer Creeks essentially blocked Chinook salmon migration up and down Panther Creek. Dissolved copper is a neurotoxin that damages the sensory capabilities of salmonids and can affect growth, reproduction, and survival (Hecht et al. 2007). The IDEQ listed Blackbird Creek, Big Deer Creek, and sections of the Panther Creek mainstem on the Clean Water Act 303(d) list as impaired by copper. Due to high concentrations of copper and cobalt in the water, IDEQ later removed aquatic life as one of the designated uses of Blackbird Creek (resulting in the stream's

removal from the 303(d) list as impaired by copper). Recent analyses show that metals concentrations have decreased in Blackbird Creek, but remain higher than recommended to attain aquatic life uses (IDEQ 2011b). Panther Creek from Blackbird Creek to Big Deer Creek and Big Deer Creek remain listed as impaired by copper but are being actively remediated (IDEQ 2014).

The improvement in water quality in Blackbird Creek is likely due to mine clean-up actions. Although not included in the modeled potential spring/summer Chinook salmon habitat shown in Figure 5.4-32, the lower two miles of Blackbird Creek have suitable gradients for spring/summer Chinook salmon spawning and rearing. Surveys completed in 2003 found juvenile spring/summer Chinook salmon and bull trout in the lower 100 yards of Blackbird Creek, indicating that habitat conditions are improving (Stantec 2004). Portions of the West Fork of Blackbird Creek, on the other hand, have not yet been assessed for salmonid distribution and habitat quality.

Big Deer Creek is still impaired by copper and remains on the 303(d) list. A natural cascade is located about 0.7 miles upstream from its mouth blocking upstream fish passage, such that Big Deer Creek has very little potential to provide spring/summer Chinook salmon rearing habitat. However, Big Deer Creek continues to deliver pollutants to habitat in mainstem Panther Creek. Waste rock and tailings from the Blackbird Mine site drain into Bucktail Creek, which discharges chemically polluted water into South Fork Big Deer Creek. Historically, copper and iron concentrations in Big Deer Creek below the South Fork have exceeded the lethal limits for most forms of aquatic life (IDEQ 2001b). However, ongoing clean-up efforts and remediation activities, including collection and storage of contaminated water from Bucktail Creek for treatment at the Blackbird Creek drainage collection pond, have significantly improved water quality conditions. Water from an impoundment on Bucktail Creek is pumped back through Blackbird Mountain to a water treatment plant located in the headwaters of Blackbird Creek.

When completed, the Blackbird Mine cleanup will include removal of mill facilities, expansion of a water treatment facility, capping of waste rock, and removal of tailings from along streambanks and impoundments. Cleanup activities are still occurring and agreements between the government agencies and the mining companies are ongoing to meet cleanup goals. Most mine cleanup activities have occurred on patented private lands. Although water quality has improved in Blackbird Creek and Panther Creek, such that spring/summer Chinook salmon now occupy these streams, contaminated soils and tailings piles still have the potential to deliver copper and other metals to streams during high streamflow events.

2. Low streamflows and fish passage barriers due to water diversions.

About 126 cfs of water diversions permitted by IDWR in the Panther Creek drainage are used for domestic use, livestock watering, mining activities, and irrigation (IDWR 2009). The consumptive use from irrigation could reduce summer base flow at the mouth of Panther Creek by up to 30 percent. Most diversions are in upper Panther Creek in relatively low gradient streams that generally have high quality spawning and rearing habitat for spring/summer Chinook salmon. It is unlikely that the approximately 100 diversions in the Panther Creek drainage are screened, and many diversions also cause or contribute to passage barriers in tributary streams and the on upper Panther Creek mainstem.

3. Reduced channel structure.

Although stream habitat is relatively well protected with most lands in federal ownership, many habitat components in the Panther Creek watershed are described as "functioning at unacceptable risk" or "functioning at risk" by land managers. U.S. Forest Service watershed reports have found that sediment, refugia, and peak and base flows are "functioning at risk." Other habitat components are "functioning at unacceptable risk" for the Panther Creek watershed. For example, in tributaries such as Blackbird Creek, streambank conditions and pool frequency are rated as "functioning at unacceptable risk" (Rieffenberger et al. 2008). On the other hand, floodplain connectivity and riparian areas are "functioning appropriately" in the watershed.

Deep Creek has the potential to be an important tributary for spring/summer Chinook salmon rearing in the Panther Creek drainage. Mean annual flow in Deep Creek is 20 cfs, with a mean monthly maximum flow at 80 cfs and a minimum flow at 6 cfs (IDEQ 2001b). No Chinook salmon have been observed in Deep Creek in recent years, but the stream is still considered a potential anadromous fish production tributary of the Panther Creek system, particularly up to the mouth of Little Deep Creek (see Figure 5.4-32). Deep Creek currently supports rainbow trout and possibly steelhead; however, salmonid habitat is generally "functioning at risk" in the Deep Creek watershed, possibly limiting the potential for spring/summer Chinook salmon in this habitat. Pool frequency and quality and habitat connectivity are "functioning at risk" in Deep Creek and sediment is "functioning at unacceptable risk" in Little Deep Creek (Rieffenberger et al. 2008).

Moyer Creek also has the potential to support spring/summer Chinook salmon rearing. The Moyer Creek watershed is 26,637 acres with 20 stream miles. The lower five miles of Moyer Creek have the most potential for Chinook salmon rearing because higher in the drainage the stream becomes steep, with 88 percent of the creek having greater that 10 percent stream gradient. The primary use in the watershed is recreation and habitat is generally in good shape. Past habitat restoration actions been taken to improve fish passage and improve riparian conditions.

Potential Habitat Limiting Factors and Threats

Some potential concerns have not yet risen to the level of a limiting factor, but need to be managed to protect the habitat in the Panther Creek watershed.

1. Water quality degradation due to future mining. The Salmon-Challis National Forest has approved a Mining Plan of Operations submitted by Formation Capital Corporation. This mining plan, called the Idaho Cobalt Project, includes the development of an underground mine, a waste disposal site, and associated facilities on forest lands near the Blackbird Mine site. The mine plans have successfully undergone ESA section 7 consultation for threatened Chinook salmon (NMFS 2008d). NMFS determined that the proposed mining project is not likely to jeopardize the continued existence of the species, in part due to several conservation measures included in the mine proposal: all effluent from the proposed mine will be treated before entering streams, water quality downstream from the mine will be monitored for heavy metals, and fish tissue will also be monitored for potential bioaccumulation of metals. Nonetheless, large-scale mining operations like the proposed Idaho Cobalt Project pose a threat to salmonid habitat if water quality treatment measures are not successful.

2. Noxious weeds. Spread of noxious weeds that can increase soil erosion and decrease native plant density. Annual grasses, such as cheat grass, have the ability to alter the fire regime allowing larger, more frequent fires.
3. Loss of beaver. Reduction or removal of beaver has negatively affected aquatic and terrestrial ecosystems. Programs are needed to encourage beaver activity in areas with reduced human conflict, or the building of structures that mimic beaver activity in areas where potential conflict exists.

Hatchery Programs

Panther Creek is considered a functionally extirpated population. Rapid River stock fingerlings were released into Panther Creek in 1977. Then in 2001, one release of adults from McCall Hatchery (South Fork Salmon River stock occurred. The Shoshone-Bannock Tribes are currently developing a program to reestablish a summer Chinook salmon population in Panther Creek. The tribes have developed the Crystal Springs Hatchery Program aimed at increasing abundance of Chinook salmon in the Yankee Fork and Panther Creek watersheds. NMFS is currently reviewing a Hatchery Genetic Management Plan for this hatchery program. The Shoshone-Bannock Tribes are proposing to release Chinook salmon from the Crystal Springs hatchery into both the Yankee Fork and Panther Creek watersheds, with goals of providing opportunities for harvest of hatchery fish and restoring locally-adapted hatchery stocks. Hatchery-related limiting factors and threats for the population are further discussed at the MPG level in Section 5.4.3.2.

Fishery Management

Currently no state fisheries target hatchery-origin spring/summer Chinook salmon in Panther Creek. Tribal fisheries may occur in some years. Fishery-related limiting factors and threats for Upper Salmon River spring/summer Chinook salmon populations are discussed at the MPG level in Section 5.4.3.3.

Predation/Competition

Predation/Competition limiting factors

NMFS identified the following predation/competition limiting factor for this Chinook salmon population.

Non-native brook trout are present in the Panther Creek drainage and could limit Chinook salmon production through predation and competition. In electrofishing surveys from 2006 to 2010, the Salmon-Challis National Forest has observed brook trout in the Napias Creek watershed (SCNF 2010). Section 4.4.5.1 for the Upper Salmon River Mainstem spring/summer Chinook salmon population describes research findings on how brook trout can affect Chinook salmon abundance and productivity.

Recovery Strategies and Actions

Natal Habitat Recovery Strategy and Actions

Because the extirpated Panther Creek population is not included in the recovery strategy for the Upper Salmon River MPG, this recovery plan does not describe a strategy for dealing with habitat limiting

factors specific to Panther Creek spring/summer Chinook salmon. However, several ongoing efforts in Panther Creek will continue to improve salmonid habitat, and maintain and enhance current levels of spawning. These efforts include the EPA-led Blackbird Mine site reclamation and the Salmon-Challis National Forest's implementation of the existing forest plan to protect and improve habitat within the watershed. For further description of types of habitat projects that could improve salmonid productivity in the watershed, see the Panther Creek Steelhead Population subsection of this recovery plan.

Implementation of Habitat Actions

Although this recovery plan does not include strategies for dealing with habitat limiting factors for spring/summer Chinook salmon in Panther Creek, the above limiting factors section identified metals, water use, and other habitat concerns in the Panther Creek watershed. The EPA is the lead agency for dealing with mine-related issues, and implementation will continue to be done through the CERCLA-related remedial actions for the Blackbird Mine. The majority of other lands not associated with the Blackbird Mine site are managed by the Salmon-Challis National Forest. Additional actions may be planned and implemented by the U.S. Forest Service to protect and improve habitat within the watershed.

Cost Estimate for Recovery

There are no recovery plan costs associated with habitat actions for this population because the population in not included in the recovery strategy for the Snake River spring/summer Chinook salmon ESU.

Hatchery Recovery Strategy and Actions

The intent of the hatchery recovery strategy for the Upper Salmon River MPG is to promote recovery by reducing the fitness and diversity risks that the hatchery programs may present. For the Panther Creek population, the strategy is to develop criteria for potential reintroduction plans to reestablish a summer Chinook salmon population in Panther Creek using a locally adapted stock. This includes developing gene flow standards through the HGMP process. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address concerns related to hatchery programs.

Fishery Management Recovery Strategy and Actions

Harvest impacts on a potential Panther Creek population and other Upper Salmon River populations will continue to be controlled through the abundance-based approach for managing mainstem and tributary fisheries to limit ESA impacts on natural-origin Snake River spring/summer Chinook salmon and support ESU recovery. The fisheries strategy also calls to refine monitoring and research efforts to manage population-specific impacts on natural-origin returning spring/summer Chinook salmon. Section 5.4.4.2 provides more information on the MPG-level recovery strategies and actions to address fishery-related concerns.

Other Recovery Strategies and Actions

Chapter 4 discusses regional-level strategies and actions to address concerns across all Idaho Snake River spring/summer Chinook salmon and steelhead MPGs and populations, including those posed by the mainstem Columbia and Snake Rivers hydropower system, estuarine habitat alterations and climate

change. Section 5.1 summarizes limiting factors and threats, and related recovery strategies and actions for all Idaho Snake River spring/summer Chinook salmon MPGs and populations.

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