Appendix Q
Fish Species Descriptions

Spring Chinook Salmon

Life History, Status, and Watershed Context - Spring chinook salmon are one of three races of chinook salmon (*Onchorhynchus tshwytscha*), along with summer and fall chinook, which are classified by the timing of their return to freshwater. Chinook salmon are also classified as either stream-type or ocean-type chinook depending on whether they rear for a year in freshwater (stream-type) or migrate to the ocean during the first year of their life (ocean-type). Spring chinook salmon in Idaho are stream-type chinook.

Life history strategies of chinook salmon are highly variable, both among and within populations, enabling salmon to adapt to a wide range of physical circumstances (Thorpe, 1994). Spring chinook salmon, including those found in Slate Creek, migrate to the ocean primarily as 1+ juveniles. Adult spring chinook salmon destined for the Snake River and tributaries enter the Columbia River in early spring, pass Bonneville Dam in early or mid April, and reach the Snake River by late April. They arrive at staging areas from late May to early July, and spawn from August through September (IDFG, 1992). Adult ages range from three to six. Fry emerge from February through April, rear through the summer in the natal stream, and then either winter in the natal stream or migrate downstream to a larger stream or river, depending on availability and quality of habitat.

After emergence, fry concentrate in shallow, slow water near stream margins with cover. As fry grow, they occupy deeper pools with submerged cover during the day and shallower inshore habitat at night.

Historically, chinook salmon were widely distributed across the Pacific coast, including the Columbia River basin. Currently, chinook salmon are considered one of the most imperiled of the fish species in the Columbia. Most populations in the central Idaho mountains are considered to be on the brink of extinction. The spring chinook salmon in Slate Creek are considered part of the Snake River spring/summer chinook salmon subpopulation, which is listed as threatened under the ESA.

The Lower Salmon River subbasin has moderate capability for spring chinook salmon, with the unconstrained valley bottoms higher in the Salmon River basin having inherently higher capability for stream-type chinook (spring and summer run). Ocean-type or fall chinook occupy the mainstem rivers within and downstream of the lower Salmon River. In the Lower Salmon, White Bird and Slate Creek are the two watersheds with the highest potential for salmon and that historically supported significant spawning populations.

Slate Creek currently supports a small population of spring chinook salmon. White Bird Creek currently supports juvenile spring chinook, with an occasional spawning adult present in this watershed. Incidental spawning along with juvenile rearing occurs in several of the other tributaries to the lower Salmon. Downstream there are no known self-sustaining spawning populations of spring chinook.

The nearest drainage with a viable population of chinook salmon is Rapid River (located in the Little Salmon subbasin), which occurs upriver from the mouth of Slate Creek. A chinook salmon hatchery is located in lower Rapid River, A weir is located in the lower drainage, below the hatchery, and only wild chinook salmon are allowed upstream passage.

In summary, Slate Creek contains a small but important, unique spring chinook population at the downstream edge of the species' distribution in the Salmon River.

Inherent Habitat Potential - Spring chinook salmon are usually associated with low gradient, meandering, unconstrained stream channels. Habitat requirements include relatively large areas of suitable spawning gravel, cover for staging adults, and slow water juvenile rearing habitat, either along the stream margins or in deeper pools with submerged cover (Quigley et. al. ICRB, 1997).

Mainstem Slate Creek and lower Little Slate provide suitable habitat for spring chinook salmon, given their size and gradient. The breaklands (ALTA 3 and 7) setting of these streams provides less than optimal spring chinook salmon habitat conditions, due to the active nature of this landscape and the confinement of the channel. The narrow alluvial valley bottoms (ALTA 18) along these streams provide increased habitat potential, although still considered to have only moderate potential when compared to the 'classic' broad spawning reaches elsewhere in the Snake River basin. This is based on the patchy distribution of spawning gravels, along with higher gradient and stream energy.

Species Distribution and Population Strength - Historic and current distribution of spring chinook salmon in Slate Creek are thought to be equivalent. Current distribution of spring chinook salmon includes mainstem Slate Creek and lower Little Slate, (see Map 25). Spawning and rearing has been observed throughout these areas (USFS 1999). It is unlikely that historic distribution extended up the North Fork, Upper Main, or further up Little Slate, even though these areas are accessible, given the steeper gradients in these stream reaches.

While the historic runs of chinook salmon in the Columbia were immense (Quigley et. al. ICRB, 1997), given the habitat potential of Slate Creek, particularly the patchy nature of the spawning areas, it is unlikely that it ever supported a really large run of chinook salmon. The reduction in abundance that has occurred in Slate Creek is likely similar in magnitude to the overall reduction for this species in the Snake River in general. The average number of redds currently seen in Slate Creek on an annual basis is three to five.

Map 26 displays the current relative densities, and distribution, of spring chinook salmon within Slate Creek. The higher densities of spring chinook salmon are located within and slightly downstream of the lower gradient, improved spawning habitat, section of the mainstem just upstream of the North Fork. This information is from surveys completed in multiple years. It is likely that the moderate to high densities in mainstem Slate, from a 1990 survey, are an overestimate of the current densities.

Genetic Integrity - There is no record of any stocking of spring chinook salmon in Slate Creek. The small number of remaining fish are likely wild, with the possible addition of naturally straying chinook from other natural and hatchery stocks. The genetic integrity of the spring chinook salmon in Slate Creek is considered high.

Connectivity - The historic connectivity for spring chinook salmon between their spawning and rearing habitat in Slate Creek and the Salmon River is thought to have been high, given that the habitat is immediately adjacent to the Salmon River in the mainstem, and the current connectivity is high. Within Slate Creek, connectivity between the spawning and rearing areas along the mainstem was somewhat restricted. A 1965 inventory mentions numerous obstructions and sections of steeper gradient (Welsh, 1965). A 45' long logjam in lower Little Slate identified in this inventory was recommended for removal.

The current connectivity throughout the mainstem remains somewhat restricted, with some differences. Some of the obstructions, such as logjams, have been removed. However, the deep pools often associated with these logjams have also been lost, resulting in a reduction in functional connectivity.

Habitat Relationships - The relationship of spring chinook salmon to the habitat components discussed earlier will be by adult and juvenile lifestages, focused on how changes in habitat condition have affected this species.

Slate Creek provides spring chinook salmon habitat for adult migration, staging, and spawning. Migration may actually be improved over historic conditions, with the removal of some of the obstructions (logjams) in the channel. This change has resulted in a decrease in the occasional deep pools along the mainstem that would have provided high quality holding and staging areas for the adults prior to spawning. The distribution and amount of spawning gravels for spring chinook salmon, historically and currently, is probably similar. The habitat improvement structures in the mainstem may have increased the amount of spawning area slightly. The condition of the spawning gravels, with respect to fine sediment levels, has been altered. In this active landscape, it is expected that there was a range of conditions resulting from the pulse of natural events. Currently, the change in sediment regime in Little Slate to a more chronic input of fine sediment, and the influence of roads and harvest on the frequency and magnitude of events in the Main Canyon and the North Fork, have resulted in a more evenly degraded fine sediment condition in spawning gravels. This level, however, is not expected to be a significant limiting factor with respect to spawning success.

Slate Creek provides spring chinook salmon juvenile rearing habitat until outmigration as yearlings. Initially they concentrate in shallow, slow water near stream margins (with cover), as they grow moving to deeper pools during the day, and shallower nearshore habitat at night (Quigley et. al. ICRB, 1997). During winter, juveniles conceal themselves beneath cobble or rubble substrate, beneath undercut banks, or migrate downstream. The loss of deep pools and an increase in cobble embeddedness are expected changes that would significantly reduce rearing habitat capability, particularly given the limited amount of slow water habitat in this breaklands setting. It is expected that juvenile survival of spring chinook has been reduced from historic, due to these habitat changes, and that a greater percentage of juveniles may be migrating earlier to the Salmon River than historically.

Population Dynamics - Spring chinook salmon in Slate Creek could be considered a small local population, part of a metapopulation that covered the streams in the lower Salmon and Little Salmon (including Rapid River). Chinook are known for high rates of straying, resulting in constant genetic exchange between the local populations. Historically, Slate Creek, White Bird Creek, and Rapid River would have served as source areas for the metapopulation. Currently, the hatchery based populations of Rapid River probably function in this role for this metapopulation. Given the current spring chinook salmon population numbers in Slate Creek, this local population exists at a high risk of extirpation. The metapopulation, excluding the hatchery component, as a whole is similarly at risk.

Key Factors & Threats - Key factors identified for chinook salmon in the interior Columbia basin include some applicable to Slate Creek and some that involve downstream effects. While these downstream effects influence salmon returning to Slate Creek, they are beyond the scope of this assessment to evaluate. It is recognized that survival and recovery of spring chinook salmon in Slate Creek will require addressing these downstream factors, including; passage mortality at the dams, harvest, and predation and competition by non-native species. Factors affecting spring chinook salmon that are applicable to Slate Creek include; 1) habitat degradation, 2) hatcheries, and 3) harvest (Quigley et. al. ICRB, 1997). These factors are applicable to various degrees in Slate Creek.

The most significant factors of habitat degradation in Slate Creek for spring chinook salmon are the loss of complex pool habitat, for both juvenile and adult rearing, and the loss of juvenile overwintering habitat from the embeddedness of the substrate. With respect to Slate Creek, this is the principal factor affecting spring chinook salmon.

Hatcheries are a factor for the spring chinook salmon in Slate Creek to the extent that hatchery fish stray into the watershed and intermix. This extent is unknown, however, and this is probably not considered a key factor for Slate Creek.

The principle harvest of spring chinook salmon, as adults, occurs outside the Slate Creek watershed. While harvest of non-hatchery salmon is prohibited in Slate Creek, there may be some illegal harvest. Harassment is likely a larger concern. The level of harvest of juvenile spring chinook salmon in Slate Creek is unknown. The streamside road that provides easy access, along with the reduced complexity of the habitat, provides increased opportunity for harvest of both juveniles and adults. Spawning adults are readily visible from the road and from dispersed and developed campsites along the mainstem. They are thus vulnerable to harassment and harvest. Given current low numbers, harvest of one or several adults could be significant.

The factors most influential in the present status, and potential future recovery, of spring chinook salmon in Slate Creek are the downstream factors of passage mortality at the dams, downstream harvest, and predation and competition from non-native species. Reducing the risk of extirpation of spring chinook in Slate Creek will require addressing these factors. Within the Slate Creek watershed, habitat degradation of mainstem Slate Creek and lower Little Slate is the critical factor. Harvest of juveniles and harassment of adults may also be significant.

Steelhead Trout

Life History, Status, and Watershed Context - Steelhead trout (*Oncorhynchus mykiss*), the anadromous form of rainbow/redband trout, are widely distributed across the Pacific coast and are composed of two distinct subspecies, coastal and inland. Fish in the Snake River are considered inland, summer-run steelhead, entering freshwater nine to ten months prior to spawning. Summer-run steelhead are further differentiated into "A" and "B" runs based on the timing of passage over Bonneville dam (Quigley et. al. ICRB, 1997). Steelhead in the lower Salmon are "A" run, inland, summer steelhead. The resident form of steelhead trout is the redband trout, discussed below.

Steelhead are spring-spawning fish, capable of repeated migration and spawning cycles. Juveniles emerge from the gravel in early or mid July, and spend two to three years in freshwater before migrating to the ocean. After spending one to four years in saltwater, generally two, adult steelhead trout appear in the lower Salmon River in September or October. These adults hold in the lower Salmon River throughout the fall and winter, ascending into the smaller rivers and tributaries in March and April for spawning (USFS 1999).

Historically, steelhead were both abundant and widely distributed in the Columbia basin and were present in most accessible streams, both perennial and intermittent. While still the most widely distributed anadromous salmonid, very few healthy populations exist (Quigley et. al. ICRB, 1997). Steelhead in the lower Salmon are considered part of the Snake River subpopulation, listed under the ESA as threatened.

In the lower Salmon, Slate Creek provides important steelhead trout habitat, with a high inherent potential, and supports relatively large numbers of steelhead trout. While many of the tributaries to the Salmon River contain accessible, suitable habitat for steelhead trout, Slate Creek and White Bird Creek contain the most significant, highest potential spawning and rearing habitat for this species (USFS 1999). This is principally due to their relatively larger watershed size, resulting in larger amounts of accessible, diverse habitat. John Day, Skookumchuck, and Race Creeks are other streams in the Lower Salmon subbasin which also provide important steelhead habitat. Currently, Slate Creek and White Bird Creek support relatively high numbers of steelhead (USFS 1999). Historic stocking in Slate Creek probably influenced this current number. The population in Slate Creek is considered a natural, but not a wild, population. While not unique within the lower Salmon, Slate Creek supports an important local population of steelhead trout, with inherently high habitat potential and relatively high current population numbers.

Inherent Habitat Potential - Steelhead trout inhabit a wide range of diverse habitats, ranging from intermittent, low order tributaries to mainstem rivers. Analysis suggests steelhead spawning and rearing is most likely in small to mid-size streams, in erosive landscapes, and in steeper, higher elevation watersheds (ICRB). There are generally found in higher gradient, faster, and sometimes smaller streams than chinook salmon. They generally do not occupy the colder, headwater streams at higher elevations, probably due to thermal requirements of incubation. In cold streams where growth is slow, or above partial barriers, steelhead may residualize to a resident form (see Redband discussion that follows).

The larger breakland (ALTA 3 and 7) streams of Slate Creek provide optimum, very high potential habitat for steelhead trout. These include; mainstem Slate, the lower half of Deadhorse, Little Slate and Upper Main, and the North Fork. The smaller tributary streams of the breaklands also contain suitable, moderate potential habitat for steelhead, although generally only for a short distance in the lower ends, before the gradients become too steep. The low relief landscape (ALTA 9) of Upper Little Slate provides suitable habitat, however the gradient may be too low and the elevation too high for steelhead use. Boulder and Van Buren provide suitable habitat, with higher gradients, although elevation may preclude use except in the lower ends. These last three areas are considered to have moderate steelhead potential.

Species Distribution and Population Strength - The historic distribution of steelhead trout in Slate Creek probably included most accessible streams. Given stronger population numbers, fish probably pushed higher up into the drainage and into more of the smaller streams. The current distribution of steelhead trout (see Map 26) is in all of the larger breakland (ALTA 3 and 7) streams, including mainstem Slate, lower Little Slate, lower Upper Main, lower North Fork, and lower Deadhorse, and a few of the steeper, small tributaries of the breaklands. All the areas considered to have a high inherent habitat potential are currently occupied. The fish in upper Little Slate are considered redband trout, a resident form of steelhead. Currently, steelhead are not believed to migrate into this part of the watershed (see Redband discussion).

Map 26 displays the relative densities of steelhead within portions of the occupied habitat in Slate Creek. This data is from single pass snorkeling sampling and can be used to evaluate relative densities between locations, but it cannot be used to estimate actual population size (see methods, Section 5.1.13). The relative densities of steelhead are moderate to high throughout most of their distribution in Slate Creek. These density classes are calculated from the range of steelhead densities measured from surveys across the Nez Perce Forest (1,147 survey reaches), as quantiles or groups with an equal number of observations. The densities from the 1990 surveys (see Map 17) are influenced by the stocking of steelhead in the late 1980s, and current densities may not be at this high level.

Genetic Integrity - Steelhead populations are considered to be one of four types, based on the history of stocking: wild, natural (non-indigenous progeny spawning naturally), hatchery, and mixes of natural and hatchery fish. Wild populations retain any local adaptation and genetic diversity. Natural populations are self-sustaining, but do not retain any unique local genetic variation or adaptation.

Steelhead were stocked in Slate Creek from 1983 thorough 1989. Consequently, the current population in Slate Creek is considered a natural population. No known genetic testing of either the steelhead or the redband populations in Slate Creek has occurred. It is assumed that the steelhead population in Slate Creek has lost some of its genetic integrity, the extent being unknown. The redband population in Little Slate was likely residualized from the historic wild population.

Connectivity - Steelhead trout appear to function less as metapopulations than other salmon and trout species, with significant interchange between local populations. Consequently, connectivity for individuals within the local population is more relevant than the broader view of connectivity of the local population to other local populations in the metapopulation. Connectivity of the steelhead population within Slate Creek to the sympatric redband population in Little Slate is an important aspect of the watershed.

Historic connectivity within Slate Creek was likely high for steelhead, given their strength and abilities. Debris torrents and logjams within the breaklands environment would have reduced this connectivity for short periods of time. Natural restrictions in Little Slate and Boulder may have created isolated groups of individuals. It appears that in the case of Little Slate, steelhead residualized into a resident life form that is present today. The connection between these two populations remains somewhat restricted because of less preferred steelhead habitat. Currently, the connectivity between mainstem Slate Creek and some of the small tributary streams has been loss or reduced, due to passage restrictions from road culverts.

Habitat Relationships - The habitat occupied by steelhead, both historic and current, is found in the sensitive, active landscapes of the breaklands (ALTA 3 and 7). The streams themselves are relatively resistent, and resilient. Historically, the quality of the habitat, including spawning gravel availability and condition, and pool volume and complexity, would have been highly variable. Frequent disturbance events would have dramatically influenced specific stream reaches with inputs of soil, gravel, boulders, and trees. These events would have been responsible for both the short term degradation of habitat condition and connectivity (from fine sediment, substrate stability, and passage restrictions), along with the longer term rejuvenation of habitat potential (from gravel deposition, and woody debris input). Across the range of occupied habitat, there was likely a heterogeneous mix of habitats in various states of disturbance and recovery. Distribution and reproductive success of steelhead would have been correspondingly influenced.

The current habitat condition in Slate Creek is homogeneously degraded. The alteration of the sediment regime in Little Slate, and the change in nearstream environment along mainstem Slate Creek, have resulted in more consistent inputs of sediment, along with interruption of woody debris and large material inputs into the stream. It is likely that the habitat condition and complexity is much more uniform than historic, missing both the highly degraded and the highly productive reaches.

Population Dynamics - Steelhead trout populations generally exhibit relatively high levels of genetic variation between adjacent drainages, suggesting that there is little interchange among local populations. It has been suggested that the basic breeding unit for steelhead is at the drainage, or subdrainage, scale (Quigley et. al. ICRB, 1997).

The principle influences on the steelhead population in Slate Creek have been those occurring outside the watershed. The Snake River subpopulation has experienced significant losses in population size over the last decades. Watershed conditions influence this general trend through effects on adult spawning, reproduction, and freshwater rearing success of the local population. Slate Creek is somewhere in the middle between watersheds that function the same as they did historically, and those that have been completed altered or degraded. Given the current population size in Slate Creek, the steelhead population in Slate Creek is at moderate risk of extirpation, both from factors outside the watershed and conditions within. This rating, relative to other populations in the Snake River, is based on the relative habitat condition, along with the current population numbers.

Key Factors & Threats - Key factors identified for steelhead trout in the interior Columbia basin include some applicable to Slate Creek and some that involve downstream effects. While these downstream effects influence steelhead returning to Slate Creek, they are beyond the scope of this assessment to evaluate. It is recognized that survival and recovery of steelhead in Slate Creek will require addressing these downstream factors, which include predation and competition by non-native species, blocked access to historical habitat, and passage mortality at dams. Factors affecting steelhead that are applicable to Slate Creek include; 1) habitat degradation, 2) hatcheries, and. 3) harvest (ICRB). These factors are applicable in various degrees to Slate Creek.

Habitat degradation is a factor which affects steelhead trout in Slate Creek. The most significant habitat elements are the loss of complex pool habitat, for both juvenile and adult rearing, and the loss of juvenile overwintering habitat from the embeddedness of the substrate. With respect to Slate Creek, this is the principal factor affecting steelhead trout.

Introduction of hatchery rainbow and steelhead trout smolts in the past has been a factor which has affected steelhead in Slate Creek. Steelhead trout in Slate Creek currently comprise a naturalized, not a wild, population. This change probably does not constitute a significant key threat to the persistence of steelhead in Slate Creek, however.

Harvest of adult steelhead trout occurs outside the Slate Creek watershed. The State of Idaho allows a consumptive sport fishery of hatchery adults in the mainstem Salmon River. Hatchery steelhead are marked by removal of the adipose fin. Harvest of wild fish is not legal. Incidental and illegal take of wild adults undoubtedly occurs, but the level of this take is unknown. Perhaps more significant is the harvest of juvenile steelhead in mainstem Slate Creek. The State of Idaho allows harvest of two "trout" from Slate Creek and does not apply a size restriction. The streamside road that provides easy access, along with the reduced complexity of the habitat, provides increased opportunity for harvest of juveniles. Slate Creek is fished heavily during certain times of the year. The number of large pre-smolts and lack of other harvestable species, such as cutthroat or brook trout makes the area especially popular with anglers. Although the impact of juvenile harvest is unknown, it undoubtedly results in fewer numbers of outmigrating smolts.

Redband Trout

Life History, Status, and Watershed Context - Redband trout in Slate Creek are considered the non-anadromous form of *Oncorhynchus mykiss* and have been termed "residuals" or residualized steelhead trout. Both anadromous and non-anadromous forms exist in sympatry in most populations, and morphologically juveniles of both forms are indistinguishable. Redband trout ranges which overlap with steelhead ranged are referred to as sympatric redbands, as opposed to allopatric redbands which evolved without an anadromous form. There are no known populations of allopatric redband trout in Slate Creek. Populations of residualized steelhead trout are usually found in the upper reaches of watersheds which are separated from the rest of the watershed by barriers, which may or may not be passable during certain flow levels. It appears that steelhead confined above partial barriers often adopt a non-anadromous lifestyle appropriate to the habitats available (Moffit and Bjornn, 1984) but retain the potential for anadromy (Mullan et al., 1992).

Life history strategies for redband trout are variable, and several forms have been described, including adfluvial and fluvial migratory forms, and non-migratory resident or stream-dwelling forms. Redband trout are primarily spring spawners and spawn exclusively in flowing waters. They typically migrate to spawning areas. Migration timing is likely affected by water temperature and stream flow. Redband trout mature at age 3 to 5 years, except in very cold waters, where maturity may be reached later. Growth is variable but likely depends on genetic and environmental conditions.

Redband trout are considered a species of concern, and identified in the Northern Region of the Forest Service as a sensitive species.

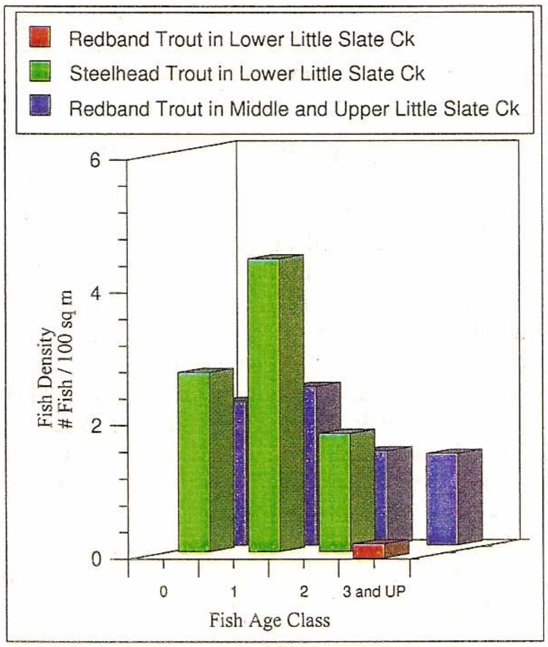
In Slate Creek, size class data suggest that the steelhead/rainbow trout observed throughout the upper reaches of Little Slate Creek and tributaries are resident redband trout (see Figure 5.20). In Lower Slate Creek, where steelhead trout spawning and rearing occurs, large numbers of 0+ juveniles have been documented, suggesting that these fish are the progeny of adults with high fecundity. In the upper reaches of Little Slate Creek, conversely, small numbers of 0+ juveniles have been documented, suggesting parents with low fecundity, i.e. small fish. The size structure beyond 0+ is similar for both populations, however. Redband trout in higher elevation watersheds probably grow slowly and mature at small sizes. Small adult fish, i.e. 200 mm, have been observed spawning in the upper reaches of Little Slate Creek.

In the Lower Salmon subbasin, Slate Creek provides important habitat for redband trout, with very high inherent potential located throughout most of the watershed. While many of the tributaries to the Lower Salmon River support accessible suitable habitat for redband trout, Slate Creek and White Bird Creek probably support the largest blocks of habitat within single watersheds. John Day, Skookumchuck, Race, and Deer Creeks also provide redband habitat and support redband trout. While not unique, Slate Creek supports a large, important local population of redband trout which may be functionally isolated from the other populations in the Lower Salmon subbasin.

Inherent Habitat Potential - Residualized redband trout in Slate Creek exist in sympatry with anadromous steelhead trout throughout the range of steelhead. In this case, they are virtually indistinguishable. In addition, they are found in areas where steelhead currently do not access, including the upper reaches of mainstem Little Slate Creek, Upper Main Slate, and tributaries to both. Analysis suggests that most redband spawning and rearing occurs in small streams in higher elevation watersheds. They do not occur, however, in Boulder Creek or the upper reaches of North Slate Creek. These areas support westslope cutthroat trout.

The moderate to small size streams of the upper Little Slate watershed provide optimum habitat for resident redband trout. Streams are moderate to low gradient, and small particles generally characterize the dominant substrate materials. Streams which are known or suspected to support resident redband trout include upper Little Slate, Miller, Gold Lake, Moon, Ruby, Greek, Victor, and various other tributaries to these streams. All other streams which support steelhead trout also probably support a resident redband component. The middle reaches of Main Slate Creek and lower reaches of North Slate Creek may also support a significant redband component.

Figure 5.20 Redband/Steelhead Comparison



Species Distribution and Population Strength - The historic distribution of redband trout was probably similar to the existing distribution. The resident redband component of the population may have been less due to greater number of returning adult steelhead, which may have pushed up into the middle and upper reaches of Little Slate Creek and the middle reaches of Main Slate Creek. The current distribution of resident redband, where a minor or no anadromous component exists, includes the streams listed above.

Map 27 shows redband trout occurring everywhere steelhead occur, and additionally they occur throughout the upper reaches of Little Slate Creek and tributaries. Densities are moderate to high. All these areas are considered to have high to very high habitat potential smaller resident fish given cool or cold water temperatures, highly complex habitat, and small substrates. Currently, steelhead trout probably do not migrate to these areas, which is probably the primary determinant of adoption of a resident, rather than anadromous, life history strategy. The large number of redband trout identified in mainstem Slate Creek may include some steelhead trout pre-smolts which exceed the size criteria for this species.

Genetic Integrity - No known hatchery supplementation of rainbow or steelhead trout in the upper reaches of Little Slate Creek has occurred. Redband trout in this portion of the watershed may be genetically similar or identical to their ancestors. Supplementation in the lower reaches of Main Slate has occurred, however, both with juvenile steelhead and catchable rainbow trout in the mid to late 1980s. The degree of interbreeding or hybridization of both resident redband and anadromous steelhead trout, if any, is unknown.

Connectivity - Historic connectivity for redband trout within Slate Creek was likely moderate, compromised by steep gradients and other habitat attributes. Debris torrents and logjams within the breaklands environment may have reduced connectivity for short periods of time in these areas. Natural restrictions in the Little Slate watershed may have isolated groups of individuals, but given historic levels of adult steelhead returns, the anadromous and resident component of the population was probably not as neatly segregated as it is currently.

Habitat Relationships - The habitat occupied by redband trout, both historic and current, is found both in the sensitive, active landscapes of the breaklands where resident redband and anadromous steelhead are sympatric, and in the historically more stable uplands (ALTA 9). Historically, habitat where redband trout occurred was highly variable and reflected the opportunistic nature of this species to adapt to a wide range of environmental condition. Adaptations included selection of optimal life history strategies depending on habitat available. Across the range of occupied habitat, there was likely a hetereogeneous mix of habitats in various states of disturbance or recovery.

The current status of habitat condition is homogeneously degraded. The alteration of the sediment regime in Little Slate, and the change in nearstream environments, have resulted in more consistent inputs of sediment, along with changes in channel integrity and the dynamics of large woody debris recruitment and retention. It is likely that the habitat condition and complexity is much more uniform than historic levels, missing both the highly degraded and highly productive reaches.

Key Factors & Threats - Three key factors, or threats, have been identified as having the greatest influence on redband trout in the interior Columbia basin; 1) hybridization and competition, 2) fragmentation and isolation, and 3) habitat disruption (Quigley et. al. ICRB, 1997). All three of these factors may be important in Slate Creek.

Habitat degradation is thought to be a factor which affects redband trout in Slate Creek, particularly the segment of the population located in the upper reaches of Little Slate Creek. These reaches have been degraded by past livestock grazing and mining activities along with the addition of press sediment sources across the landscape. Both factors, combined with low sediment transport capacity, have resulted in high levels of deposited sediment. Increased width-to-depth ratios in some reaches, as well as sediment deposition, probably resulted in higher stream temperatures. Both sediment and temperature factors may have effectively reduced carrying capacity for redband trout.

Fragmentation and isolation may have occurred in Slate Creek, due to less exchange of genetic material from decreased or no infusion of genes from anadromous fish into isolated reaches in Upper Little Slate and Upper Slate Creek. This functional isolation may also have resulted in local adaptations, however.

Although hybridization is probably not a significant factor, competition with introduced brook trout in the upper reaches of Main Slate Creek may have occurred. Although it is unknown if redband trout occupied this part of the watershed, given that their presence elsewhere in similar areas and the presence of brook trout, competition and elimination could have occurred.

Westslope Cutthroat Trout

Life History, Status, and Watershed Context - Westslope cutthroat trout (*Oncorhynchus clarki lewisi)* are an interior subspecies of cutthroat trout located in streams in the Upper Columbia, Missouri, and South Saskatchewan River basins. Populations occur in Washington, Idaho, Montana, British Columbia, and Alberta. While the subspecies remains widely distributed across most of their historical range, there appear to be few remaining healthy populations outside the central Idaho mountains. Rieman and Apperson (1989) estimated that strong westslope cutthroat trout numbers persisted in 11 percent of the historical range in Idaho, and populations that were both numerically strong and genetically pure existed in 4 percent of the historical range. Liknes and Graham (1988) estimated the subspecies still occupied 27 percent of the historical range in Montana but were genetically pure in only 2.5 percent.

Similar to other inland salmonids, westslope cutthroat trout populations are generally migratory or resident, with most populations composed of varying proportions of each life history strategy. Movements of migratory fish vary seasonally, which include spawning migrations in the spring, migrations to and from winter rearing habitat, or simply migrations to other areas of the river which may be related to food availability (Liknes and Graham, 1988). Spawning occurs in the spring or early summer, with initiation of spawning behavior strongly correlated to water temperature. Spawning generally occurs in small tributaries. The subspecies appears to be particularly well-suited to a relatively cold and sterile environment.

In the Lower Salmon subbasin, westslope cutthroat trout distribution is patchy. The subspecies occurs in portions of Slate Creek. It also occurs in Sherwin, Cow, John Day, and Race Creeks. A review of the occurrence of westslope cutthroat in these areas suggests that they are found in relatively small, isolated segments of the watersheds in which they occur. An important consideration is the apparent loss of migratory cutthroat in the mainstem Salmon River. Current known populations probably exist as isolated subpopulations with no connectivity, and as a result, are at increased risk of extinction.

Inherent Habitat Potential - Resident westslope cutthroat populations have been associated with waters which are relatively cold and sterile (Liknes and Graham, 1988; Rieman and Apperson, 1989). In watersheds where anadromous fish are also present, they generally are found where densities of anadromous fish are low or non-existent. The distribution and abundance of cutthroat trout, particularly cutthroat trout >150 mm, has been strongly correlated with the number and quality of pools, which appear to be especially important as wintering areas. Substrate composition is also a factor; highly embedded substrates have been negatively correlated with juvenile abundance (Thurow, 1987), although Magee et al. (1996) found that some populations clearly persist in systems with very high sediment levels.

In Slate Creek, westslope cutthroat trout are associated with Boulder Creek and the upper reaches of North Slate Creek. They are not known to occur anywhere else in the watershed. It is likely that most streams in the watershed support habitat with high to very high capability for cutthroat trout. The subspecies does not occur elsewhere for reasons other than habitat potential, such as competitive displacement by steelhead and redband trout or extirpation through angling. Both Boulder Creek and upper North Fork Slate Creek do not provide access to steelhead. Upper Main Slate also supports habitat for cutthroat with very high potential, but these reaches are currently occupied by brook trout.

Species Distribution and Population Strength - The historic distribution of westslope cutthroat trout in Slate Creek probably differed from the current distribution because of the loss of migratory cutthroat in Main Slate Creek. Although small cutthroat trout are occasionally observed in the lower reaches of Main Slate Creek, no large migratory cutthroat were documented during the 1990 and 1996 stream surveys. The loss of the migratory component of this population combined with the high numbers of steelhead and redband trout probably resulted in loss of the subspecies in all areas of the watershed except where subpopulations were functionally isolated from the rest of the watershed. Also, introduction of brook trout into Little Slate Lake, with subsequent encroachment into the upper reaches of Main Slate Creek, may have resulted in elimination of cutthroat trout, although it is unknown if cutthroat trout historically occurred there. Historically, westslope cutthroat trout were probably distributed more widely than they are currently, with the loss of migratory cutthroat a significant determinant of this change.

Densities of cutthroat trout, where they occur, are moderate to high. In Boulder Creek, the subspecies exists in sympatry with brook trout and outnumber brook trout about 5 to 1. Apparently, habitat conditions in Boulder Creek favor cutthroat trout; loss of cutthroat populations from competition with introduced brook trout is well documented in other areas (Behnke, 1992). In upper North Fork Slate, cutthroat trout exist in allopatry, but habitat degradation and small stream size are the primary limiting factors. Despite habitat impacts, cutthroat trout continue to persist in this area.

Genetic Integrity - Westslope cutthroat trout readily hybridize with hatchery rainbow and other subspecies of cutthroat trout. Cutthroat trout in Boulder Creek may have been supplemented with Yellowstone cutthroat trout, but this information is not included in the state's stocking record. It is possible the genetic integrity of this population has been affected. In other streams where Yellowstone cutthroat trout were stocked in existing westslope cutthroat streams, introgression did not occur. Phenotypically, cutthroat trout in both North Slate and Boulder Creek appear genetically pure. The genetic integrity of westslope cutthroat trout is thought to be high.

Connectivity - Historic connectivity among subpopulations of westslope cutthroat trout both within Slate Creek and within the Lower Salmon subbasin was probably higher than it is currently due to the presence of migratory fish in Main Slate Creek. Westslope cutthroat trout generally function as metapopulations within the context of subbasins the size of the Lower Salmon, with both migratory and resident populations which interact via the migratory component. Within this context, geologic events often resulted in isolation of some subpopulations, which subsequently may have resulted in the development of local adaptations within isolated subpopulations. This phenomenon served both to increase the overall genetic diversity of the population but also put the local subpopulation at higher risk of extinction, given that refounding was unlikely following a stochastic extinction event. Migratory westslope cutthroat trout are rarely, if ever, observed in the mainstem Salmon River within the Lower Salmon subbasin. Populations of cutthroat trout, such as the ones currently found in Slate Creek, are thus functionally isolated from each other. Migratory cutthroat trout in the mainstem Salmon were probably eliminated through a combination of harvest and habitat degradation.

Existing connectivity between the two westslope subpopulations in Slate Creek is also low or non-existent. A significant barrier to upstream migration is located in the lower half mile of Boulder Creek. This barrier (a waterfall) is probably the result of a geologic event which isolated cutthroat trout from the rest of the watershed. This event probably occurred before the advent of anadromous fish evolution in Slate Creek, or the subpopulation would be comprised of redband trout instead. Cutthroat trout have been documented downstream of the mouth of Boulder Creek, and it is likely that these fish emigrated from Boulder Creek. Cutthroat trout observed downstream in main Slate Creek probably emigrated from the North Slate and Boulder subpopulations. Migration back into Boulder Creek probably does not occur because of the barrier, and although migration back into North Slate Creek is possible, the lack of cutthroat trout observed in the lower reaches of North Slate suggests that this rarely, if ever, occurs. Therefore, these two subpopulations are considered functionally isolated.

Habitat Relationships - The habitat currently occupied by westslope cutthroat trout is located across a wide range of ALTAs and does not appear strongly correlated with a specific set of habitat parameters. Perhaps one of the most important determinants of cutthroat distribution in Boulder Creek is gradient, which provides habitat where cutthroat trout have a competitive advantage over introduced brook trout. The upper reaches of Main Slate, conversely, between Rocky Bluff Campground and Little Slate Lake, have significant inclusions of low gradient, meadow habitat in which brook trout compete extraordinarily well (Griffith, 1988). These reaches support allopatric brook trout, and it is possible that westslope cutthroat trout existed there historically but were eliminated by competitive displacement with brook trout. In Boulder Creek, high stream gradient creates plunge pools of varying depths and sizes, and cutthroat trout concentrate in these areas. Addition of large woody debris to pools increases habitat potential, and cutthroat trout are often strongly associated with complex pool habitat created by large wood.

In North Slate Creek, westslope cutthroat trout are found throughout the upper reaches, which are comprised both of moderate gradient, forested reaches and low gradient, meadow reaches. Habitat quality has been affected by livestock grazing adjacent to the streams, input of sediment from press sediment sources, and numerous trail fords, some of which are an additional sediment source. In some areas, bank erosion is a significant contributor of fine sediment, as well as creating a wider, shallower channel. Despite these impacts, cutthroat trout continue to persist in relatively high densities.

Population Dynamics - The local populations present in Slate Creek are functionally isolated. Historically, the degree of this isolation is related to the size of the migratory component. It is unclear how large the migratory component of westslope cutthroat trout was historically. Given the natural passage restrictions to North Fork and Boulder Creeks, this component may have been limited. It is expected that there has been a reduction in number of migratory westslope cutthroat trout, though the extent of this can not be determined.

The current populations of westslope cutthroat trout in Slate Creek are at a moderate risk of extirpation. The isolation of these populations increases the risk of stochastic loss, along with the limited number of populations. The relative high densities of fish and the extent of these two populations moderate the extirpation risk.

Interaction with Other Aquatic Species - The key interaction of westslope cutthroat trout with other aquatic species occurs in Boulder Creek, where brook trout are present in most of the stream reaches with them. The population of westslope cutthroat trout in upper North Fork occurs mostly in isolation of other species.

In Boulder Creek it appears, based on relative densities, that westslope cutthroat trout are dominant. This is not unexpected given the higher gradient of these stream reaches. It is believed that brook trout outcompete westslope in low gradient habitats, particularly those with reduced habitat quality, and that westslope outcompete brook trout in higher gradient streams, particularly those with high habitat quality. It is assumed that the relative population levels are static, and the current relationship is not just a snapshot in a progression of competitive interaction.

While the presence of brook trout increases competition for the westslope cutthroat trout, and is a factor in both population dynamics and extirpation risk, the recommendation is to monitor the interspecies relationship at this point. Brook trout removal in this subwatershed would be a difficult, likely unsuccessful, proposition, and is not recommended as a priority restoration project at this point.

Key Factors & Threats - Three key factors, or threats, have been identified as having the greatest influence on westslope cutthroat trout in the interior Columbia basin; 1) introduced species, 2) angling, and 3) habitat disruption (ICRB). These factors are applicable to various degrees in Slate Creek.

As discussed, the westslope cutthroat trout population in Boulder Creek exists with non-native brook trout. Unlike other non-natives, hybridization between brook trout and westslope cutthroat trout is unlikely. Interspecies competition does result from this combination. While this situation is an important factor in the present status, the level of risk to this westslope population as a future threat is unknown, and complicated by the interaction with other possible threats. There is the possibility that westslope cutthroat trout were historically present in Upper Slate, and were extirpated by the introduction of brook trout.

Angling is believed to be an important factor in the reduction in the number of large migratory westlope cutthroat trout in Slate Creek. The level of threat that angling current poses to the remaining populations of westslope cutthroat trout is unknown, but believed to be small given the location, general lack of human access, and limited fishing pressure on these populations.

Habitat disruption is an important factor in the current status of westslope cutthroat trout in the watershed, particularly with respect to the population in North Fork Slate, and lower Boulder Creek. This factor may also have been important in the reduction in the migratory component in mainstem Slate, through the simplification of habitat that exacerbated the affect of angling pressure. Habitat disruption is the key threat to westslope cutthroat trout in the North Fork, currently and in the near future, and is an important factor in Boulder Creek, particularly as it relates to the interspecies competition.

For westslope cutthroat trout, factors responsible for the current status include angling (particularly related to the reduction in migratory component), introduced species (for the Boulder population, and possibly Upper Main), and habitat disruption. Current and future threats to the existing populations are primarily related to habitat disruption, with the interaction introduced brook trout in Boulder Creek being a possible threat to monitor.

Bull Trout

Life History, Status, and Watershed Context - Bull trout, *Salvelinus confluentus*, are members of the char family of fishes, and closely related to coastal Dolly Varden. Bull trout are widely distributed throughout the Pacific Northwest and Columbia River basin. The species in general is considered a 'species-at-risk', with the Columbia River subpopulation listed under the ESA as threatened. The Central Idaho Mountains contain the core of the remaining bull trout distributions across its range. Because they are the only native char, and usually the only important piscivore (fish eater), they represent a unique contribution to the diversity and ecological function of the aquatic environment.

Bull trout exhibit two distinct life history forms, resident and migratory. Resident populations generally spend their entire lives in small headwater streams. Migratory bull trout rear in tributary streams for several years before migrating into large river systems (fluvial) or lakes (adfluvial) (Idaho, 1996). These divergent life histories are viewed as alternative strategies that contribute to the persistence of populations in variable environments. Both forms are believed to exist together in some areas; migratory fish may dominate populations where corridors and subadult rearing areas are in good condition (Quigley et. al. ICRB, 1997). Migratory fish are believed to be critical for both genetic exchange between local populations and population refounding/rebuilding, due to their much higher fecundity.

The Lower Salmon subbasin is an edge of the environmental gradient that provides suitable habitat for bull trout in the Salmon River basin, based on elevation, climate, and water temperature conditions. Slate Creek contains most of the high elevation lands in the subbasin. John Day Creek contains a good portion of the remainder. Fluvial bull trout have been observed throughout the mainstem Salmon River and in Slate Creek. There have been ancedotal observations of fluvial bull trout in Whitebird Creek. A small resident population of bull trout exists in the headwaters of John Day Creek. Slate Creek supports a vast majority of the bull trout in the Lower Salmon subbasin.

Rapid River occurs in the Little Salmon subbasin, which is approximately 25 miles upriver from the mouth of Slate Creek. Rapid River is a very productive watershed for bull trout (Idaho 1998), with other upstream watersheds supporting lower numbers. Downstream of Slate Creek, there are no known spawning populations of bull trout. Slate Creek and Rapid River are the two highly productive bull trout watersheds in the Lower Salmon, considered the population source areas for species refounding and expansion. Populations at the edge of a species' distribution are recognized as uniquely important, not only in terms of occurrence, but as probable 'edges' of genetic diversity as well.

Inherent Habitat Potential - The Slate Creek watershed has a moderate to high inherent potential to support bull trout, within the context of bull trout habitat across the Columbia basin. Within the context of the lower Salmon, that inherent potential would be considered high. Inherent potential is the habitat capability for a species given the broad geographic, channel morphology, climatic, and disturbance setting of the landscape, independent of the conditions at any one time. The moderate to high potential of Slate Creek for bull trout is based on both the spawning and rearing habitat (early rearing for migratory fish), and the nodal habitat (fluvial rearing habitat), potential within the watershed.

Spawning habitat, and rearing habitat (for resident populations) or early rearing habitat (for fluvial fish), is generally associated with high elevation ALTA's (1, 2, 5 and 21 to a less extent), either within or downstream of these low disturbance frequency, cold water source areas. In Slate Creek these ALTAs are found predominately in Upper Main, Boulder, and Van Buren subwatersheds (see Map 9). The west side of Little Slate and upper Deadhorse subwatersheds also contain significant amounts of these landtype associations. Little Slate contains a large amount of high quality spawning and rearing habitat in the low gradient streams in the low relief hills (ALTA 9) landtype association. The potential of these areas is increased on the west side of Little Slate, where they are downstream from high elevation landtypes.

Subadult and adult rearing and migratory habitat for fluvial bull trout is generally associated with larger, low gradient rivers, often in association with productive anadromous fish populations. Young subadult fish can be found across a wide variety of stream conditions. Larger adult fluvial bull trout are known to migrate large distances, and are generally associated with larger rivers. Mainstem Slate Creek has significant potential as fluvial rearing habitat, as does lower Little Slate Creek. The smaller, low gradient, highly connected network of streams in upper Little Slate provide a large amount of subadult rearing habitat.

Historic Species Distribution & Population Strength - There is no known data, and little anecdotal information, that describes bull trout distribution and population strength under historic conditions. The following discussion is a subjective opinion of what may have occurred during this period based on an understanding of the inherent habitat potential, population dynamics, and disturbance history.

The historic distribution of bull trout most certainly included the areas in which they are currently found; the mainstem of Slate Creek, the lower reaches of most tributaries, the low gradient streams of Little Slate, and Van Buren. While Upper Main and Boulder subwatersheds contain suitable habitat with moderate to high potential for bull trout, it is not known if they ever colonized these areas. While bull trout populations are believed to 'come and go' over long periods of time, this dynamic was primarily in response to dramatic disturbances. The disturbance frequency in upper Boulder and Upper Main subwatersheds is low, and natural extirpation of bull trout from these areas would not be expected. These areas currently support brook trout, which may have been a factor in the extirpation of bull trout if it occurred. The natural restrictions to connectivity that exist in these two subwatersheds would have likely been a factor in either the lack of colonization or the refounding of these areas in response to local population extirpation.

The historic population strength of bull trout is expected to have varied over time and space in response to disturbance events, with these disturbances being responsible for both the short-term negative impacts on populations, and the associated rejuvenation and increased productivity of the environment that resulted in increased population numbers. The local populations across the watershed are expected to have been a changing mosaic in response to the pattern of disturbance. It is expected that there would have been several strong local populations of bull trout at any one time. Based on the presence of much higher numbers of anadromous juveniles, as a prey base for bull trout, the numbers of fluvial fish and the populations strength in these areas is expected to have been much higher. This includes the mainstem Slate Creek, the lower portions of most tributaries, and possibly portions of Little Slate. This prey base is expected to have supported a large fluvial component of bull trout.

Current Species Distribution & Population Strength - The current known distribution and relative densities of bull trout in Slate Creek are shown on Map 28. Based on the extent of the stream surveys in this watershed, this map is thought to represent a fairly accurate picture of the current species distribution, although migratory fish may be found anywhere accessible at a point in time. Densities have not been calculated for all survey reaches, including surveys conducted in 1999, and represent only relative densities and not population estimates.

Fluvial adult and subadult bull trout have been observed in mainstem Slate, lower Deadhorse, lower Upper Main, and lower Little Slate. The numbers and relative densities of these fish is low. Principal use of these areas is for migration and rearing. Juvenile bull trout have been observed in mainstem Slate, near the confluence with Little Slate, which suggests that there may be occasional bull trout spawning in this area. Large prespawning adults are frequently observed throughout the mainstem below the confluence of Main Slate and Little Slate Creeks during the summer months, although densities are low and abundance varies by year.

Bull trout have been observed throughout much of the Little Slate subwatershed, both in Little Slate itself, and tributaries to Little Slate (generally to the west of Little Slate). The numbers of bull trout observed, in general, is low. These fish, mostly in the 4-7 inch size, appear to be rearing subadults and/or resident adult bull trout. It is unclear if several resident populations exist throughout the Little Slate subwatershed, or if the fish observed are part of a fluvial population. No large fluvial fish have been observed in Little Slate. Turnbull and Royal Creeks contain significantly higher numbers of bull trout, and probably support a local resident population.

The Van Buren subwatershed contains relatively high numbers of bull trout, with relative densities in the moderate to high range throughout most of its length, including the North Fork of Van Buren. This local population of bull trout is considered unique and very important both in terms of its extent and its relative strength. The population is thought to be predominately a resident population, although large fluvial fish (up to 21" in length) have been observed in Van Buren. Fish of this size are likely migrating to the Salmon River and back.

Although there are no bull trout currently in Upper Main or Boulder Creeks, these watersheds are thought to contain suitable bull trout habitat. It is unknown if these areas supported bull trout historically and the distribution of this species has shrunk, or that these areas, while suitable, never were colonized.

Genetic Integrity - There has not been any genetic analysis of the bull trout in Slate Creek. Because there has not been any stocking of bull trout, and there is very limited overlap with brook trout, particularly as it relates to spawning areas, the genetic integrity of bull trout in the Slate Creek watershed is considered to be high.

Connectivity - As discussed in the aquatic species habitat section, there are historic physical restrictions between habitats. The natural restrictions in Upper Main and Boulder may have prevented colonization of these areas by bull trout. The natural restriction in Little Slate (just below Boulder Creek) may limit the connection between mainstem Slate Creek and the Little Slate/Van Buren area. However, given the presence of large fluvial fish in Van Buren, this restriction is obviously not complete. The current degraded conditions in mainstem Slate Creek, including the loss of infrequent large pools associated with historic logjams, has reduced the connectivity between Slate Creek and the Salmon River from historic conditions. High stream temperatures may play a role in migration and connectivity for bull trout, both in the mainstem and with respect to access to the Little Slate area.

Population Dynamics - Populations can be considered at various scales. Local populations are the finest scale of population where a species exists in a stream or stream reach. Local adaptation and genetic drift are thought to occur at this scale. Metapopulations are a collection of local populations that have some degree of interaction, usually thought of as operating around the subbasin (4th code HUC) scale. Population refounding and genetic exchange are thought to occur at the metapopulation level. Subpopulations are generally large collections of metapopulations, covering entire river basins such as the Columbia. This description of population interconnection breaks down in the case of isolated local populations. For the purpose of this document, these populations will be referred to as isolated local populations without attempting to reconcile their structure in terms of metapopulations and subpopulations.

The bull trout in Slate Creek can be considered a metapopulation to assist in thinking about the long-term population dynamics of the area. Slate Creek and Rapid River are the strongest sources of species refounding, rebuilding, and genetic exchange between metapopulations in the Lower Salmon area. The reduced connectivity with the Salmon River from changes in mainstem Slate Creek is a factor in this dynamic.

Within Slate Creek, the local population in Van Buren appears strong. It is unclear how many other local populations exist in the watershed, although Turnbull Creek and other streams in Little Slate contain bull trout. The long-term sustainability of aquatic species, in a dynamic environment, is thought to be correlated with the strength and redundancy of the metapopulation. Based on this consideration, the Slate Creek bull trout metapopulation is functioning at some level of risk. Refounding and/or rebuilding of other local populations in Slate Creek would increase the sustainability of the metapopulation.

Interaction with Other Aquatic Species - The reduction in anadromous fish abundance is an important factor in the prey base for bull trout, particularly the larger fluvial fish. At this point, given the lack of overlap in distribution, there is little interaction of bull trout with brook trout, except in mainstem Slate. It is not expected that there has been any significant level of hybridization between these two species, given the natural of the habitat and limited spawning by these species, in this area.

Key Factors & Threats - In general there are thought to be four key factors that are believed to represent the greatest influence on bull trout populations in the Columbia basin; 1) harvest of adults, 2) watershed disruption, 3) introduced species, and 4) isolation and fragmentation of populations (ICRB). These factors are applicable in Slate Creek to various degrees, along with the additional factor of reduction in prey species.

Harvest of adult bull trout may be a factor in Slate Creek, even though State fishing regulations do not allow bull trout caught while fishing to be kept. It is assumed that ease of access is an important consideration in this factor, making the mainstem Slate Creek the area with the highest risk. If the degree of isolation is a consideration in people's likelihood of keeping bull trout, other areas in the watershed would also have risks of this harvest.

Watershed disruption is primarily a factor in mainstem Slate Creek and most of Little Slate. This is also a consideration in lower Van Buren. In mainstem Slate Creek this factor has affected both the fluvial connectivity with the Salmon River and the rearing and spawning habitat condition in the Main Canyon. In Little Slate this factor may have influenced current distribution and population strength, and is the principle factor related to the rebuilding/refounding of bull trout in this part of the watershed. It is not known to what degree the watershed disruption in lower Van Buren has affected this local population.

Introduced species, specifically brook trout, appear to be a minor factor related to bull trout at this point. The overlap in distribution of these two species occurs in lower Little Slate and Mainstem Slate (below the confluence of Upper Main and Little Slate). The degree to which these two species use this area for spawning is the degree to which this factor is a current risk to bull trout. Future changes in species distribution in the watershed could greatly increase the risk from this factor. It appears that the restriction in fish movement up into Little Slate may have a positive effect in this case.

Isolation and fragmentation of populations is a factor at both the local and metapopulation scale for bull trout in Slate Creek. Metapopulation and fluvial connectivity to the Salmon River is an important factor for bull trout, as it relates to both the value of the fluvial component to the Slate Creek metapopulation, and the value of the Slate Creek metapopulation to bull trout in the Lower Salmon. At the local population level, this factor is related to the limited number of strong local populations in the watershed.

The reduction in the abundance of anadromous fish is an important factor for bull trout, due to the loss of this prey base.

Brook Trout

Life History, Status, and Watershed Context

Brook trout (*Salvelinus fontinalis*) are a native coldwater fish species of Northeastern United States, widely introduced to lakes and streams across the West. The habitat requirements and life history of brook trout are similar to the native salmonids where they have been introduced in the West, resulting in potential competition and hybridization with native species. Brook trout also provide important recreational fishing opportunities to people. Consequently, brook trout are assessed in this document, although not to the level of specificity of the native salmonids.

Brook trout are fall spawning fish, that can occupy a wide range of habitat conditions. They can occupy both lakes and streams, with the strongest naturalized populations generally associated with low-gradient streams and some lakes. Brook trout compete with native resident salmonids, including cutthroat, redband, and bull trout. Hybridization is most likely to occur with other fall spawning species, such as bull trout.

Brook trout are not widely distributed in the Lower Salmon subbasin. Besides Slate Creek, they are known to exist in the South Fork of Whitebird Creek, in high numbers. Otherwise, the limited amount of lake and low gradient habitat in the subbasin is thought to have influenced either the amount of stocking of brook trout that occurred or the survival of the stocked populations.

Species Distribution & Population Strength

Brook trout were not present historically in Slate Creek, or other streams in the West.

Map 30 displays the current distribution of brook trout in Slate Creek. They are not found in most parts of the watershed. Populations of brook trout exist in Upper Main Slate and Boulder Creek. Occasional brook trout have been observed in mainstem Slate and Little Slate in the vicinity of these two tributary streams.

The population of brook trout in Upper Main Slate is likely a result of the stocking of Lower Slate Lake, at the headwaters of this subwatershed. The low gradient streams through the middle portion of this subwatershed provide high potential habitat for brook trout. No other fish species are known to exist in these part of the drainage. It is unknown if native fish, either cutthroat or redband, existed in this area prior to the introduction of brook trout. The relative densities of brook trout are moderate throughout most of the streams in this subwatershed. In general, the brook trout in this subwatershed are small, and do not support a large amount of recreational fishing.

The population of brook trout in Boulder Creek co-exists with the westslope cutthroat population in this subwatershed, principally in the lower reaches. There are no lakes in this subwatershed that support brook trout populations. The relative densities of brook trout in Boulder Creek are low to moderate. Given the higher gradient streams in this subwatershed, it is likely that the westslope cutthroat population will outcompete the brook trout. The current densities of westslope cutthroat trout in Boulder Creek are moderate to high.

While brook trout are occasionally observed in mainstem Slate and Little Slate, the relative numbers of fish found are few. It is thought that there is not an established population of brook trout in these larger streams, but that the fish observed are migrating individuals that have moved out of either Upper Slate or Boulder. It is not likely that these fish can return to these streams, given the steep gradient sections present in these subwatersheds.