APPENDIX H

Biology

This page intentionally left blank

Table of Contents

List of Tables

List of Figures

This page intentionally left blank

Overview

The Bureau of Reclamation (Reclamation) and Bonneville Power Administration contribute to the implementation of salmonid habitat improvement projects in the upper Salmon subbasin to help meet commitments contained in the *2010 Supplemental Federal Columbia River Power System* (FCRPS) *Biological Opinion* (BiOp) (NOAA Fisheries 2010). The BiOp includes a Reasonable and Prudent Alternative (RPA), or a suite of actions, to protect listed salmon and steelhead across their life cycle. Habitat improvement projects in various Columbia River tributaries are one aspect of this RPA. Reclamation provides technical assistance to States, Tribes, Federal agencies, and other local partners for identification, design, and construction of stream habitat improvement projects that primarily address streamflow, access, entrainment, and channel complexity limiting factors. Reclamation's contributions to habitat improvement are all meant to be within the framework of the FCRPS RPA or related commitments.

1. Introduction

This report describes historical and existing biological use by ESA-listed species within the assessment area as well as limiting factors by geomorphic reach. A number of fish species inhabiting streams in the Yankee Fork of the Salmon River (Yankee Fork) have been listed under the Endangered Species Act. Those relevant to this Tributary Assessment include a population of spring Chinook salmon, summer steelhead, and bull trout. Spring/summer Chinook salmon that are part of the Snake River Spring/Summer Chinook ESU has five major population groupings (MPG) including: Lower Snake River, Grande Ronde/Imnaha, south Fork Salmon River, middle Fork Salmon River, and the upper Salmon River group. The Yankee Fork population is a spring run and is one of eight remaining populations in the upper Salmon River MPG (ICTRT 2010). The Yankee Fork summer steelhead population is part of the Snake River Basin Steelhead Distinct Population Segment (DPS) that includes all naturally spawned populations of steelhead in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho (CRHRP 2009a), and were federally listed as threatened in 1997 and reaffirmed on January 5, 2006. Bull trout in the Salmon River basin fall under "upper Snake" recovery unit. In 2010, critical habitat for bull trout was designated by the U.S. Fish and Wildlife Service (USFWS) for the Yankee Fork and several of its tributaries.

Historically, the Yankee Fork supported an abundance of salmonids including spring Chinook salmon and summer steelhead. During the past century, numerous factors have led to a substantial reduction in salmonid stocks. Spring Chinook salmon populations in the Yankee Fork as well as other tributaries in the upper Salmon River have declined in size and are substantially depressed from historic levels.

2. Species Overview

2.1 Spring Chinook

Yankee Fork and West Fork Yankee Fork of the Salmon River (West Fork) Chinook salmon were designated as one independent population based on habitat capacity and on their geographic distance from all other upper Salmon spawning aggregations (ICTRT 2010). The mainstem Yankee Fork Chinook salmon are also highly differentiated genetically from other adjacent populations, but this difference likely reflects some limited prior out planting of Rapid River stock into the mainstem Yankee Fork (ICTRT 2010). The Yankee Fork population is small and is made up of just one Major Spawning Area (MSA), which encompasses the whole watershed.

Adult spring/summer Chinook salmon enter and ascend the Columbia River between March and July and reach the upper Salmon River (800 miles upriver) in late July and August. Adult fish hold in deep pools within the main Salmon River and then move into the smaller tributaries (including the Yankee Fork) in late July and August to begin spawning (USFS 2006). Spawning occurs in the Yankee Fork in August and September. Adult Chinook salmon die within a short time after spawning and carcasses can often be observed in close proximity to newly constructed redds. Spring Chinook salmon eggs remain in the gravel with winter and early spring water temperatures determining the actual time of emergence. This typically occurs by mid-March to late April (USFS 2006). Young salmon emerge from redds in the spring and will rear in a variety of environments from small, infertile streams to large rivers. Starting during fall, but also throughout the winter, juveniles will immigrate from the Yankee Fork to the Salmon River. Juveniles spend approximately one year in fresh water before smolting and migrating approximately 900 miles to the Pacific Ocean between April and June (Reiser and Ramey 1987). Yankee Fork Chinook salmon typically spend two years in the ocean before returning to the Columbia River on their return as adults (USFS 2006). Table 1 shows the "phenology" of spring Chinook salmon within the Yankee Fork.

Table 1. Summary of Chinook salmon life stages - Yankee Fork

Species	Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chinook	Adult Staging												
	Peak Spawning												
	Incubation												
	Juvenile Rearing												
	Smoltification (out migration)												

2.2 Steelhead

Steelhead and rainbow trout commonly coexist. Although both the anadromous and non-anadromous forms are classified as the same species taxonomically, the relationship of the two forms in a given area is unclear (USFS 2001). Steelhead/rainbow trout are not present in upper reaches of all tributaries to the Yankee Fork but have been consistently sampled in the lower reaches (USFS 2001).

Adult steelhead migration requirements are generally similar to those described for spring Chinook. Steelhead enter and ascend the Columbia River in June and July, arriving near their spawning grounds several months prior to spawning (USFS 2006). However, adult holding takes place over a much longer period (from fall arrival in the Snake River drainage until spring spawning). Most adult steelhead have moved into tributary streams (such as Yankee Fork) by November. However, some adults hold in the Salmon River until February or March before moving into natal streams to spawn. Unlike other anadromous salmonids that return from the ocean to spawn and subsequently die, steelhead have the ability to migrate back to the ocean after spawning (kelting) and to return and spawn again. Juvenile rearing lasts approximately two to seven years prior to ocean emigration. Table 2 shows the "phenology" of steelhead within the Yankee Fork.

Table 2. Summary of Steelhead life stages - Yankee Fork

Species	Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Steelhead	Adult Staging												
	Peak Spawning												
	Incubation												
	Juvenile Rearing												
	Smoltification (out migration)												

2.3 Bull Trout

Bull trout in the Yankee Fork have both resident and migratory life history patterns. Resident bull trout complete their entire life cycle in a tributary stream. Migratory bull trout spawn in tributary streams where juveniles rear for up to 4 years before migrating to a river or lake. Migrating bull trout return to spawning tributaries from the end of June into October. Spawning occurs between mid-August and early November (Schoby and Curet 2007). Resident and migratory bull trout can be found together in spawning grounds and can spawn together (Ecovista 2004). Offspring can express either life history. Bull trout can live longer than 12 years and prefer the coldest water. All life stages of bull trout are associated with complex forms of cover and pools.

2.4 Westslope Cutthroat Trout

Westslope cutthroat are distributed throughout the Yankee Fork watershed (USFS 2006). Surveys conducted in 2000 indicate the presence of both steelhead and cutthroat in all surveyed reaches of Jordan Creek and Yankee Fork. Fluvial populations of westslope cutthroat have suffered declines throughout the upper Salmon River basin and the rest of their historic range (Schoby and Curet 2007). Numerous factors have contributed to the decline of cutthroat trout including the degradation of spawning and rearing habitats, overfishing, effects of land use management and development, the introduction and expansion of exotic species, and the isolation of habitats by barriers such as dams, diversions, and culverts (Schoby and Curet 2007). The USFS (2006) indicated that "good" populations of cutthroat trout exist within the Yankee Fork and its tributary streams.

2.5 Pacific Lamprey

The Pacific lamprey (*Entosphenus tridentatus*) is an anadromous and parasitic fish widely distributed along the Pacific coast of North American and Asia (USFWS 2010). According to the USFWS (2010), historic runs of Pacific lamprey in the Columbia River Basin numbered in the hundreds of thousands at Bonneville Dam as recently as 1965, but the distribution and abundance of lampreys have been reduced by construction of dams and diversions as well as degradation of spawning and rearing habitat. Pacific lamprey in the Salmon River basin must navigate over eight lower Snake River and Columbia River dams for migration downstream as juveniles to the Pacific Ocean and as adults migrating upstream to their freshwater spawning locations. The Pacific lamprey is a state-listed endangered species in Idaho, designated a tribal trust species, and a species of "special" concern for the USFWS (USFWS 2010) and are a tribal cultural resource for subsistence, ceremonial, and medicinal purposes.

Pacific lamprey likely occurred historically in the Yankee Fork. Sunbeam Dam, constructed on the mainstem Salmon River immediately upstream of the Yankee Fork of the Salmon River in 1910, obstructed Pacific lamprey to an unknown degree until removal in 1934 (Hyatt et al 2006). Today, remnant populations persist in the Salmon River basin but their distribution and abundance are unknown for the most part, making assessment of this species distribution and habitat conditions difficult. According to Cochnauer and Claire (2009), the number of adult Pacific lamprey annually entering the Snake River basin at Ice Harbor Dam has declined from an average of over 18,000 during 1962 to 1969 to fewer than 600 during 1998 to 2006. Following investigations by the Idaho Department of Fish and Game (Hyatt et al 2006), surveys showed Pacific lamprey distribution confined to the mainstem Salmon River downstream of the North Fork Salmon River. Four sites in the Yankee Fork were sampled for lamprey in 2005 with none being observed (IDFG 2006).

3. Historical Occurance/Abundance of ESA Fish Species

3.1 Chinook

Although the historical size of the Snake River Chinook salmon population is difficult to estimate, Chapman (1986) estimated that between 2.3 and 3.0 million adult spring/summer Chinook salmon returned to the Columbia River annually between 1881 and 1895. Declines in Columbia River salmon populations began at the end of the 1800s as a result of overfishing (Chapman 1986). By the early 1900s, environmental degradation from mining, grazing, logging, and agriculture had caused substantial declines (Ecovista 2004). Construction of dams on the mainstem Snake and Columbia rivers further reduced the distribution and abundance of Snake River Chinook salmon and their escapement to the Salmon River (Ecovista 2004). Ecovista (2004) further indicated that an average of 125,000 adults per year entered Snake River tributaries from 1950 through 1960. Returns of spring/summer Chinook salmon continued a steady decline in the 1970s, reaching low points in the mid-1990s before rebounding slightly in 2000 (Ecovista 2004), a result of good river and ocean conditions. According to Ecovista (2004), "all of the Chinook populations in the Salmon subbasin are in significant decline, at low levels of abundance, and at high risk of localized extinction." The 2009 population of wild/natural origin Snake River spring/summer Chinook was estimated to be less than 20,000 (Fish Passage Center).

The Yankee Fork of the Salmon River, a major tributary of the mainstem Salmon River, is a spawning and rearing stream for anadromous salmonids. Past redd counts indicate the Yankee Fork was an important spawning stream for wild spring Chinook salmon (Oncorhynchus tshawytscha) in the Salmon River drainage (Ecovista 2004). Over 6 percent of the Chinook salmon redds historically found in the upper Salmon River were located in the Yankee Fork system (Reiser and Ramey 1987). Buffington (unpublished) estimated that the Yankee Fork historically provided 10 to 15 percent of the available Chinook salmon spawning habitat in the upper Salmon basin. The Yankee Fork was an important fishery for the Bannock Tribe, whose members camped at the mouth of Ramey Creek every summer to harvest spawning salmon (Bellmore and Baxter 2009). Chinook salmon redd counts in the Yankee Fork declined from over 400 per year in the 1960s to less than 40 per year in the 1980s (Bellmore and Baxter 2009) and to as low as 3 in 2006. Studies by Konopacky et al. (in Reiser and Ramey 1987) conducted in the mid-1980s comparing fish densities, species composition, and other habitat variables found the highest fish densities in the Yankee Fork between Jordan Creek and Eightmile Creek (non-dredged reach), and the lowest densities in the dredged portion of the Yankee Fork.

The Yankee Fork Ranger District (USFS 2001) speculated that the salmon, steelhead, westslope cutthroat trout, and bull trout population status was historically strong based on local references made by early settlers of the Yankee Fork watershed, accounts of long-time residents, and research completed for the Upper Columbia River Basin (UCRB) aquatic science report.

3.2 Steelhead

According to Ecovista (2004), the Columbia River Basin has one of the world's largest populations of steelhead. Historical estimates of the pre-European steelhead run in the entire Columbia River Basin was about two million fish (Ecovista 2004). Mallet (in Ecovista 2004) estimated that historically, 25 percent of these fish originated in the Salmon subbasin. Ice Harbor Dam counts indicate that over 100,000 steelhead returned to the Snake River in the early 1960s (CRHRP 2009b). Wild steelhead abundance declined steadily from 1962 to 1976, and abundance was depressed but stable during the late 1970s and 1980s (Ecovista 2004). Wild steelhead abundance in 1993 through 1996 was the lowest ever recorded (Ecovista 2004). Smolt-to-adult return rates decreased from above 4 percent during the 1960s, when only four dams existed, to less than 2 percent on average during the 1970s after eight dams were in place (Tardy 2009a).

Historically, steelhead were widespread in the Salmon subbasin. The Yankee Fork had historically supported productive populations of steelhead trout that represented a significant cultural, social, and subsistence based resource for the Shoshone-Bannock Tribes (Tribes) (Tardy 2009a). Spawning occurred in the mainstem rivers and smaller tributaries. Steelhead initiate spawning just prior to spring runoff in the Salmon River subbasin. This timing makes it difficult to estimate numbers of spawners or redds on the spawning grounds with methods for counting Chinook salmon in the subbasin. Lack of tributary specific adult abundance and distribution information for steelhead severely limits the ability to manage ESA-listed steelhead in the Salmon subbasin (Ecovista 2004).

3.3 Bull Trout

There is limited information on bull trout population productivity and abundance in the Yankee Fork basin. Historically, bull trout were distributed throughout the upper Salmon River basin, and although they were never as abundant as other salmonids, they were more abundant and more widely distributed than they are today (Ecovista 2004). As a result of declines in populations, bull trout were listed under the ESA in 1998 as threatened, primarily due to habitat threats. Bull trout in the Salmon River basin fall into the "upper Snake" recovery unit. In 2010, critical habitat for bull trout was designated by the USFWS for the Yankee Fork and several of its tributaries. Critical habitat receives protection against Federal agencies carrying out, funding, or authorizing the destruction or adverse modification of critical habitat.

4. Present Fish Use in Yankee Fork

4.1 Chinook

The Yankee Fork supports a depressed population of Snake River spring Chinook salmon that is one of eight extant populations in the Upper Salmon Major Population Group (MPG) within the Snake River spring/summer Chinook salmon ESU (ICTRT 2010). This population is currently rated as high risk (ICTRT 2010). Figure 1 delineates the extent of spring Chinook salmon presence and spawning activity within the Yankee Fork. Spawning is distributed broadly throughout the population boundaries, extending from approximately one mile upstream of the Yankee Fork mouth to the headwaters area and the West Fork (USFS 2006). The Idaho Department of Fish and Game (IDFG) has conducted redd counts in the Yankee Fork mainstem (upper and lower watershed) since 1957. The Tribes have also conducted annual redd counts in the mainstem Yankee Fork since 1987. Spawning survey data for Chinook salmon indicate that the Yankee Fork redd counts have ranged from 615 redds (1968) to zero redds (1995). The IDFG data (Table 3) as well as the Shoshone-Bannock data (Table 4) show a declining trend from 1969 through 2007 that has also occurred throughout the rest of the Salmon River drainage (USFS 2006). Similar declining trends in redd counts have occurred for the rest of the Salmon River drainage. Redd counts have increased in recent years as a result of IDFG's captive rearing program and the Tribes Chinook Salmon Supplementation Program. Tardy (2009a) indicated that juvenile Chinook salmon densities remained low in 2008 but increased dramatically in 2009 with adult outplanting activities in 2008.

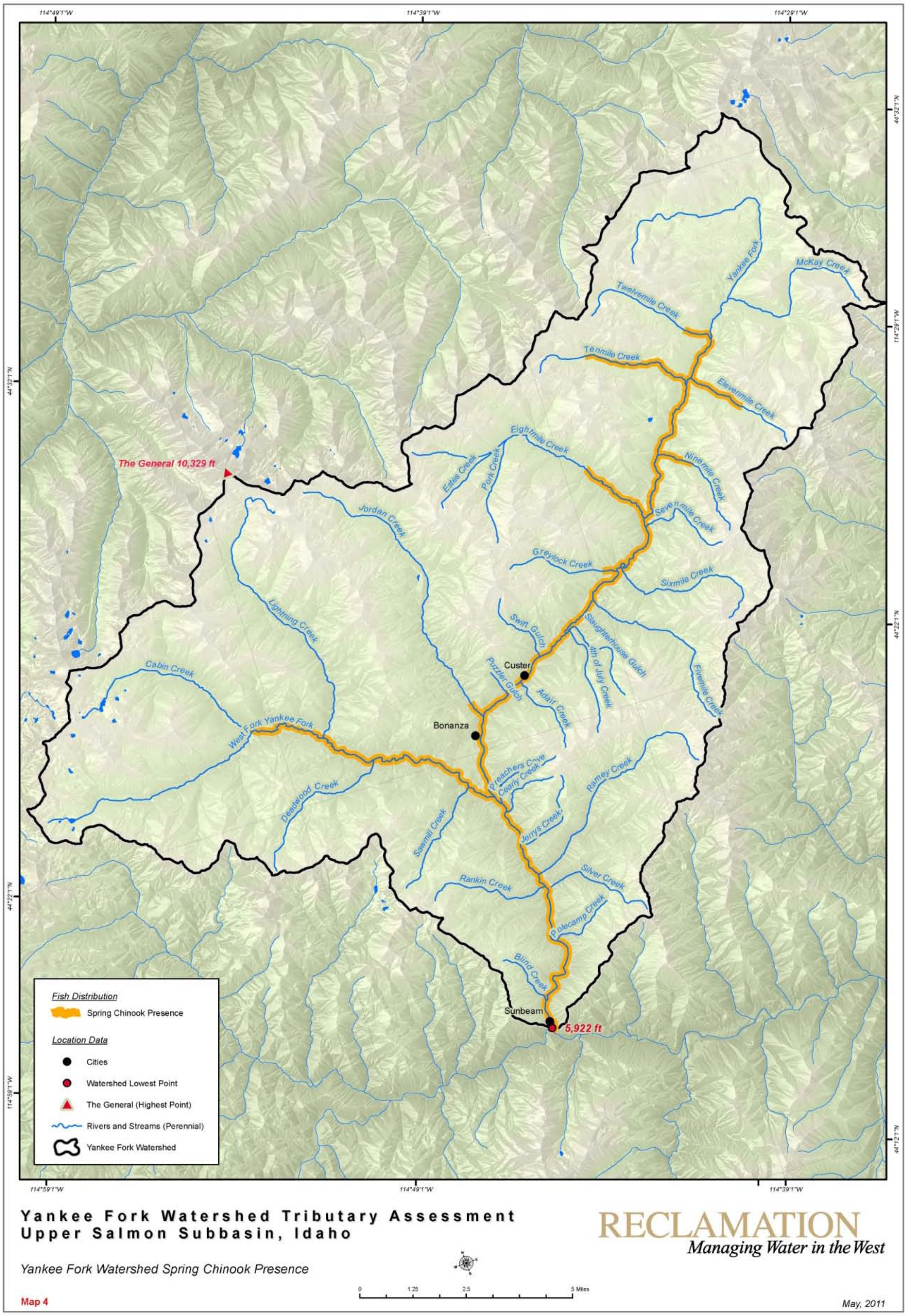

Figure 1. Yankee Fork Watershed Spring Chinook Presence

Table 3. Idaho Department of Fish and Game Aerial Redd Count

Year – Stream Name	Reach	# of Redds
1996 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	1
	Jordan Cr. – Twelvemile Cr.	0
1996 – W. Fork	Mouth – Lightning Creek	1
	Lightning Creek – Cabin Cr.	0
Year – Stream Name	**Reach**	**# of Redds**
1997 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	1
	Jordan Cr. – Twelvemile Cr.	0
1997 – W. Fork	Mouth – Lightning Creek	3
	Lightning Creek – Cabin Cr.	0
Year – Stream Name	**Reach**	**# of Redds**
1998 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	2
	Jordan Cr. – Twelvemile Cr.	4
1998 – W. Fork	Mouth – Lightning Creek	2
	Lightning Creek – Cabin Cr.	2
Year – Stream Name	**Reach**	**# of Redds**
1999 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	1
	Jordan Cr. – Twelvemile Cr.	0
1999 – W. Fork	Mouth – Lightning Creek	0
	Lightning Creek – Cabin Cr.	0
Year – Stream Name	**Reach**	**# of Redds**
2000 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	1
	Jordan Cr. – Twelvemile Cr.	5
2000 – W. Fork	Mouth – Lightning Creek	4
	Lightning Creek – Cabin Cr.	0
Year – Stream Name	**Reach**	**# of Redds**
2001	Upper Yankee Fork	14
Year – Stream Name	**Reach**	**# of Redds**
2002 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	12
	Jordan Cr. – Twelvemile Cr.	22
2002 – W. Fork	Mouth – Lightning Creek	10
	Lightning Creek – Cabin Cr.	1
Year – Stream Name	**Reach**	**# of Redds**
2003 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	20
	Jordan Cr. – Twelvemile Cr.	33
2003 – W. Fork	Mouth – Lightning Creek	18
	Lightning Creek – Cabin Cr.	7

Year – Stream Name	Reach	# of Redds
2004 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	6
	Jordan Cr. – Twelvemile Cr.	2
2004 – W. Fork	Mouth – Lightning Creek	5
	Lightning Creek – Cabin Cr.	0
Year – Stream Name	**Reach**	**# of Redds**
2005 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	0
	Jordan Cr. – Twelvemile Cr.	5
2005 – W. Fork	Mouth – Lightning Creek	1
	Lightning Creek – Cabin Cr.	0
Year – Stream Name	**Reach**	**# of Redds**
2006 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	3
	Jordan Cr. – Twelvemile Cr.	0
2006 – W. Fork	Mouth – Lightning Creek	0
	Lightning Creek – Cabin Cr.	0
Year – Stream Name	**Reach**	**# of Redds**
2007 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	4
	Jordan Cr. – Twelvemile Cr.	2
2007 – W. Fork	Mouth – Lightning Creek	7
	Lightning Creek – Cabin Cr.	0
Year – Stream Name	**Reach**	**# of Redds**
2008 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	1
	Jordan Cr. – Twelvemile Cr.	178*
2008 – W. Fork	Mouth – Lightning Creek	1
	Lightning Creek – Cabin Cr.	0
Year – Stream Name	**Reach**	**# of Redds**
2009 – Main Stem YFk.	Polecamp Cr. – Jordan Cr.	5
	Jordan Cr. – Twelvemile Cr.	341*
2009 – W. Fork	Mouth – Lightning Creek	1
	Lightning Creek – Cabin Cr.	0

Table 4. Shoshone-Bannock Tribe Chinook Salmon Redd Counts

Year	Mainstem Yankee Fork	West Fork Yankee Fork
1987	9	17
1988	6	31
1989	16	6
1990	7	20
1991	12	8
1992	19	6
1993	15	13
1994	0	9
1995	0	0
1996	1	7
1997	12	7
1998	15	12[1]
1999	2	0
2000	11	4
2001	82	36[2]
2002	77	53[3]
2003	86	24
2004	28	15[4]
2005	23	14[5]
2006	15	14[6]
2007	15	10[7]
2008	653*	7
2009	409*	3
2010	21	7

The Yankee Fork spring Chinook salmon population does not meet viability criteria and the overall viability rating is considered high risk (ICTRT 2010). Overall abundance and productivity and spatial structure and diversity are rated at high risk (ICTRT 2010). Reiser and Ramey (1987) stated that based on available rearing habitat, the Yankee Fork drainage had an estimated production capacity of about 90,000 Chinook smolts and 16,000 steelhead smolts. At the time of Reiser and Ramey's report (1987), the Yankee Fork produced less than about 5000 chinook smolts.

[1] Four redds produced from captive rearing program (crp) adult releases
[2] 18 redds from natural production, 18 redds from crp adult releases
[3] 20 redds from natural production, 33 redds from crp adult releases
[4] 4 redds from natural production, 11 redds from crp adult releases
[5] 6 redds from natural production, 8 redds from crp adult releases
[6] 6 redds from natural production, 8 redds from crp adult releases
[7] 3 redds from natural production, 7 redds from crp adult releases

Spring Chinook salmon are considered depressed throughout most of their current range and many stocks are in danger of extinction (Lee et al. 1997). Factors influencing the current depressed status of spring Chinook salmon populations include; low abundance, decreasing trends in abundance, widely dispersed spawning populations, fragmented habitats, degraded habitat, high risks of genetic introgression in most stocks from hatchery fish, low frequency of wild-indigenous stocks, increased competition and predation from nonnative fishes, overharvest and high risk of smolt and adult migration mortality in the mainstem Columbia and Snake rivers due to hydroelectric projects (Ecovista 2004). Anthropogenic activities in the Yankee Fork have eliminated or degraded much of the rearing and spawning habitat in the lower Yankee Fork (Reiser and Ramey, 1987). As a result, the Yankee Fork drainage is substantially underutilized with respect to salmon and steelhead production (Reiser and Ramey, 1987). All remaining populations and habitats are considered to be vital to the continued persistence of spring Chinook salmon in the interior Columbia Basin (Lee et al. 1997). Given the depressed status of the stocks and the critically low returns (no redds observed in 1995) all known spawning areas are considered to be significant.

In Jordan Creek, a tributary to the Yankee Fork, observations of Chinook salmon have been rare (USFS 2006). In 1984, 1985, and 1988, the Tribes observed young-of-year Chinook salmon in the lower reaches of Jordan Creek (USFS 2006). In 1995, the Idaho Department of Environmental Quality (DEQ) observed one juvenile Chinook salmon collected about one-half mile above the confluence with the Yankee Fork. In 1998, juvenile Chinook salmon were observed by the Forest Service in lower Jordan Creek (USFS 2006).

Artificial Production

Adult spring Chinook returns to the Yankee Fork consist of both natural- and hatchery-origin fish (CRHRP 2009a). Currently, the Yankee Fork receives periodic introductions of juvenile and adult Chinook salmon of Sawtooth Hatchery origin. Discussions are underway between the State of Idaho, NOAA Fisheries Service, and the Tribes to initiate an integrated local broodstock program. Since 1977, over 2.9 million spring/summer Chinook fry, smolts, or adults have been stocked in the Yankee Fork (Table 5). The origin of these fish has been from the Rapid River Hatchery (South Fork Salmon River), Sawtooth Hatchery, and Pahsimeroi Hatchery (Tardy and Denny 2010). According to ICTRT (2010), the Rapid River hatchery fish in particular have posed a genetic threat to the Yankee Fork population. The mainstem Yankee Fork Chinook salmon genetics now match more closely with Rapid River stock than with adjacent upper Salmon River populations (ICTRT 2010).

In response to the declining Chinook salmon population in the Yankee Fork, the Tribes developed the Yankee Fork Chinook Salmon Supplementation (YFCSS) Project to increase the number of Chinook salmon returning to the Yankee Fork. The Tribes are working to achieve the long-term goal of returning 2,000 adults for Tribal conservation and harvest management objectives (Tardy and Denny 2010). Until the Chinook salmon population is self-sustaining, the YFCSS Project will supplement the annual return of Chinook salmon to achieve the long-term adult abundance goal.

Table 5. Yankee Fork Chinook salmon artificial propagation history 1977-2009

Brood Year	Run Year	Number	Location	Stock	Size	fish/lb	Hatchery
	1977	56,700	West Fork	Rapid River	fry-fingerling		Mackay
	1978	75,036	Yankee Fork	Rapid River	fry-fingerling		Mackay
	1985	61	Yankee Fork	Sawtooth	adult		Sawtooth
	1985	659	Yankee Fork	Rapid River	adult		Pahsimeroi
	1986	61	Yankee Fork	Sawtooth	adult		Sawtooth
	1986	1,505	Yankee Fork	Rapid River	adult		Pahsimeroi
	1986	386,348	Yankee Fork	Rapid River	fry-fingerling		Pahsimeroi
	1987	157,877	Yankee Fork	Rapid River	fry-fingerling		Sawtooth
	1987	600	Yankee Fork	Rapid River	adult		Pahsimeroi
1986	1987	158,000	Yankee Fork Ponds	Salmon River	pre-smolt	250	Sawtooth
1986	1988	725,500	Yankee Fork Ponds	Pahsimeroi	smolt	20	Sawtooth
1987	1988	50,100	Yankee Fork Ponds	Rapid River	fry-fingerling	120	Sawtooth
1987	1989	198,200	Yankee Fork Ponds	Salmon River	smolt	24	Sawtooth
1988	1989	125,000	Yankee Fork Ponds	Salmon River	fry-fingerling	100	Sawtooth
1988	1990	200,800	Yankee Fork Ponds	Salmon River	smolt	21	Sawtooth
1989	1990	50,000	Yankee Fork Ponds	Rapid River	fry-fingerling	100	Yakima
1989	1990	491,300	Yankee Fork	Salmon River	smolt	45	Sawtooth
1989	1990	50,000	Yankee Fork Ponds	Salmon River	fry-fingerling	111	Sawtooth
1990	1991	50,000	Yankee Fork Ponds	Rapid River	fry-fingerling	120	Sawtooth
	1994	25,025	West Fork	Sawtooth	smolt		Sawtooth
2004	2006	135,934	Yankee Fork	Sawtooth	smolt	21.3	Sawtooth
2008	2008	1,438	Yankee Fork	Upper Salmon	adult		Sawtooth
2009	2009	1,517	Yankee Fork	Upper Salmon	adult		Sawtooth

Chinook salmon smolts for this program were obtained from the Sawtooth Hatchery and subsequently released into the Yankee Fork. Smolt movement in the Yankee Fork is then monitored by screw traps (Tardy and Denny 2010) installed by the Tribes. Picket weirs operated by the Tribes enumerate the natural and hatchery return of adult Chinook salmon and collection of broodstock (Tardy and Denny 2010).

Tardy and Denny (2010) reported 294 adult Chinook salmon being trapped between 2008 and 2010, of which 30.3 percent were of natural origin and 69.7 percent were of hatchery origin. The Tribes obtained about 2,955 adult Chinook salmon from the Sawtooth Fish Hatchery and subsequently outplanted them in the upper Yankee Fork for natural spawning purposes in 2008 and 2009 (Tardy and Denny 2010). Spawning ground surveys were conducted in 2008 to 2010 with a total of 1,101 redds being observed. According to Tardy and Denny (2010), the Tribes estimated a total return of 65 natural-origin adults in 2010.

In 2010, Tribal and IDFG staff released 201,714 smolts in Pond Series One adjacent to the Yankee Fork, and 196,730 smolts at the confluence of Jordan Creek for a total of 398,544 smolts.

The IDFG captive rearing program was initiated in 1995 and developed as a way to increase the number of naturally spawning adult Chinook salmon and maintain genetic population structure in selected populations at high risk of extinction. The goal of the captive rearing program is to evaluate the potential of captive rearing technology for the conservation of Snake River spring/summer Chinook salmon. The strategy of captive rearing is to prevent collapse of the target populations by returning captive-reared adults to natural spawning areas to augment depressed natural escapement (Stark and Gable 2010). This maintains the continuum of generation-to-generation smolt production and provides the opportunity for population maintenance or increase, depending on annual environmental conditions. This program releases maturing adult Chinook salmon (approximately 100 hatchery-reared fish annually) to the West Fork to spawn volitionally. Adults are developed from egg sources from natural redds using hydraulic extraction methods (CRHRP 2009a). The program is currently assessing the contribution to the next generation from captive adult outplants.

The West Fork was one of three streams in the Salmon River basin selected for inclusion in the captive rearing program. Between 2001 and 2009, captive-reared adults were released in the West Fork that resulted in redds being produced by these fish (Stark and Gable 2010).

4.2 Steelhead

The Yankee Fork summer steelhead population is part of the Snake River Basin Steelhead Distinct Population Segment (DPS) that includes all naturally spawned populations of steelhead in streams in the Snake River basin of southeast Washington, northeast Oregon, and Idaho (CRHRP 2009a), and were federally listed as threatened in 1997 and reaffirmed on January 5, 2006. Critical habitat for Snake River basin steelhead, including Yankee Fork, was designated in 2006.

Current abundance (number of adults spawning in natural production areas) is unknown for this population (CRHRP 2009b). The only direct count of natural origin steelhead occurs at the Sawtooth Fish Hatchery weir. The average number of natural-origin returns to the Sawtooth Hatchery weir between 1986 and 2007 was 34 fish (CRHRP 2009b). Steelhead population trends in the Yankee Fork are largely unknown. The capture of juvenile steelhead in Jordan Creek indicates that natural reproduction is occurring somewhere in the Yankee Fork drainage, either in Jordan Creek or some portion of the Yankee Fork (USFS 2006). Figure 2 delineates the extent of steelhead presence within the Yankee Fork.

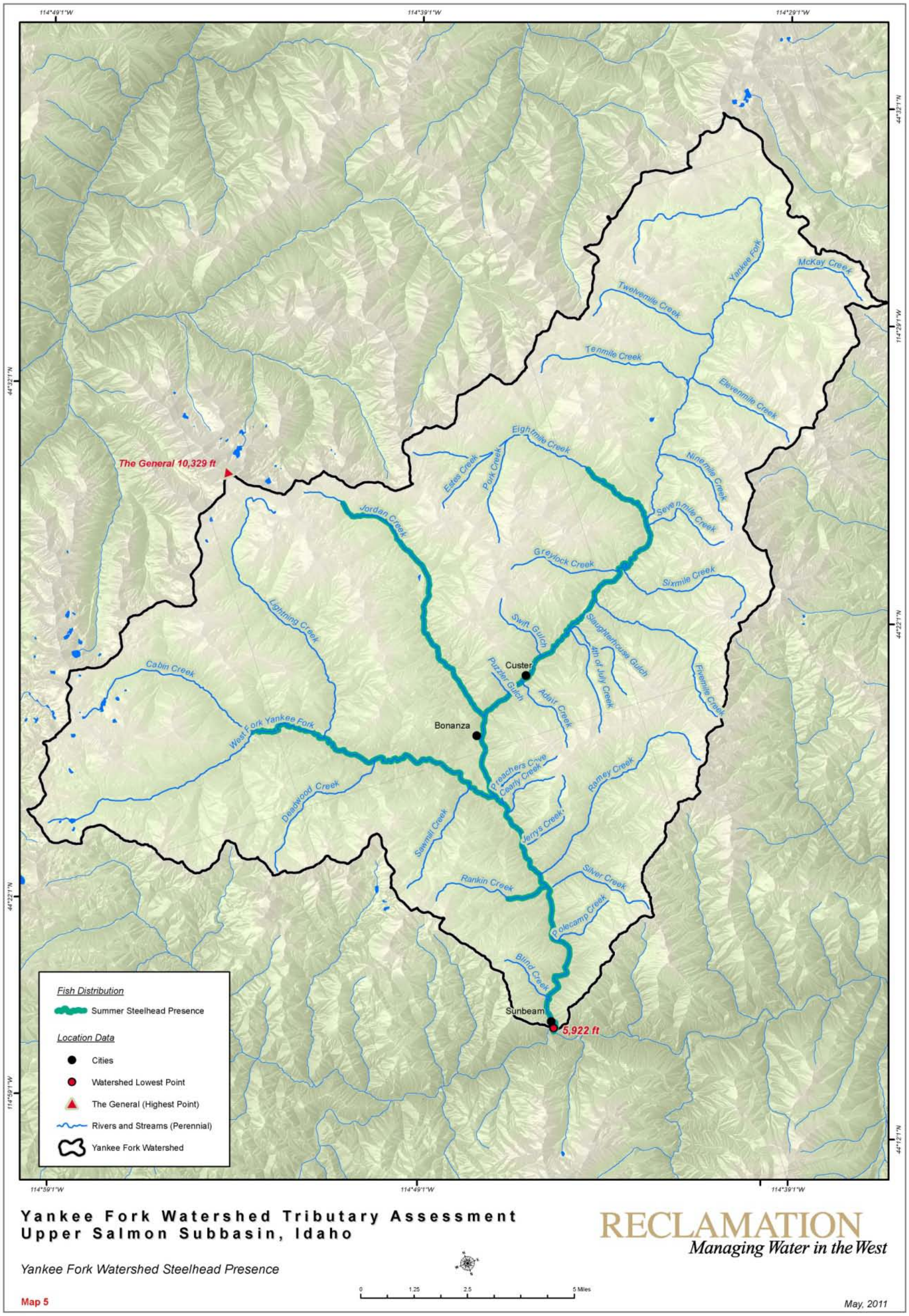

Figure 2. Yankee Fork Watershed Steelhead Presence

Artificial Production

Hatchery steelhead programs in the Snake River basin had their inception in 1966 with the construction of Pahsimeroi Hatchery in the upper Salmon River basin (USFS 2006). Presently, steelhead smolt production in the Snake River basin totals about 10 million fish annually.

Approximately 1.5 million steelhead smolts are released annually from Idaho Power Company-funded hatcheries; release locations include the Little Salmon River, upper Salmon River and Pahsimeroi River (ICTRT 2010). Mitigation for the four lower Snake River dams is provided through the Lower Snake River Compensation Plan (LSRCP), which is administered by USFWS. The annual planned production release in the Salmon River drainage for the LSRCP program is 3.07 million steelhead smolts (Idaho 2006). Those smolts are released in the Little Salmon and upper Salmon rivers (ICTRT 2010).

The Tribes, in an effort to maintain, rehabilitate, and enhance steelhead populations, initiated a steelhead supplementation program in 2007 in the Yankee Fork (Tardy 2009b). The objective of this program is to annually release approximately 330,000 steelhead smolts in the Yankee Fork (Tardy 2009b). The goal of the program is to return greater than 2,000 adults to the Yankee Fork, Valley Creek, and Slate Creek to levels that will help rebuild the populations, collect broodstock, and sustain harvest (Tardy 2009b). The Tribes will monitor adult returns with a weir trap in the Yankee Fork to trap returning adults and to collect genetic information to determine the stream origin of these fish.

Another effort implemented by the Tribes to enhance steelhead production in the Yankee Fork is the Steelhead Streamside Incubation (SSI) program which began in 1995. A component of the SSI program is to determine if targets for hatchery contributions are being achieved and can be improved using DNA parentage analysis (Tardy 2009a). The goal of the program is to release approximately 500,000 steelhead eggs annually into the Yankee Fork. Steelhead eggs from the Sawtooth and Pahsimeroi fish hatcheries are transferred to streamside upwellers where they are incubated on river water to mimic natural hatch timing in the system (CRHRP 2009b). For the October 1, 2008 to September 30, 2009 reporting period, approximately 513,412 total steelhead eggs were planted in the Yankee Fork (Tardy 2009a). Tardy (2009a) reported survival of these eggs at approximately 77.7 percent. Rotary screw trap data estimated a total of 97,504 juvenile steelhead migrating past the screw trap in the Yankee Fork from July 3 through November 13, 2009 (Tardy 2009a). Tardy (2009a) further states that limited information on numbers of returning adult steelhead, redd counts, size of the natural origin population, and migration timing restricts the ability to fully estimate the relative productivity of the SSI program.

According to Idaho (2006), the upper Salmon River steelhead population does not currently meet population level viability criteria because abundance/productivity risk is too high. Without survival rate increases that lead to increases in abundance and productivity the population cannot achieve viable status (Idaho 2006).

4.3 Bull Trout

Bull trout have been documented by the U.S. Forest Service (USFS), IDFG, and the Tribes within the mainstem Yankee Fork, the West Fork, Mackay Creek, and several other tributaries (USFS 2006). Fluvial bull trout distribution occurs in the Salmon River, Yankee Fork and West Fork, and many of the tributary systems of the Yankee Fork. Figure 3 delineates the extent of bull trout presence within the Yankee Fork. Fluvial bull trout use the Yankee Fork and West Fork while smaller tributaries (i.e. Jordan Creek) support only small, if any, resident populations. According to the USFS (USFS 2006), large bull trout have been observed spawning in the lower reaches of small headwater tributaries such as Tenmile Creek.

Populations of bull trout have suffered declines throughout the upper Salmon River basin and the rest of their range (Rieman et al. 1997). Numerous factors have contributed to the decline of fluvial bull trout populations, including the degradation of spawning and rearing habitats (Schoby and Curet 2007). Schoby and Curet (2007) indicated that major concerns for bull trout in the upper Salmon River basin include the disconnection of tributary streams from mainstem rivers, degradation of riparian habitat, dewatering due to irrigation withdrawals, unscreened irrigation ditches, and the introduction of non-native species.

Schoby and Curet (2007) documented that the majority of bull trout spawning migrations made by tagged bull trout in 2003 were into the Yankee Fork. Of the twelve bull trout using the Yankee Fork, nine returned to the Salmon River. Of the nine bull trout that returned to the Salmon River, six migrated upstream, with three each entering Redfish and Little Redfish Lake in early October (Schoby and Curet 2007) where they overwintered. In 2004 and 2005, similar spawning migrations by bull trout into the Yankee Fork occurred (Schoby and Curet 2007).

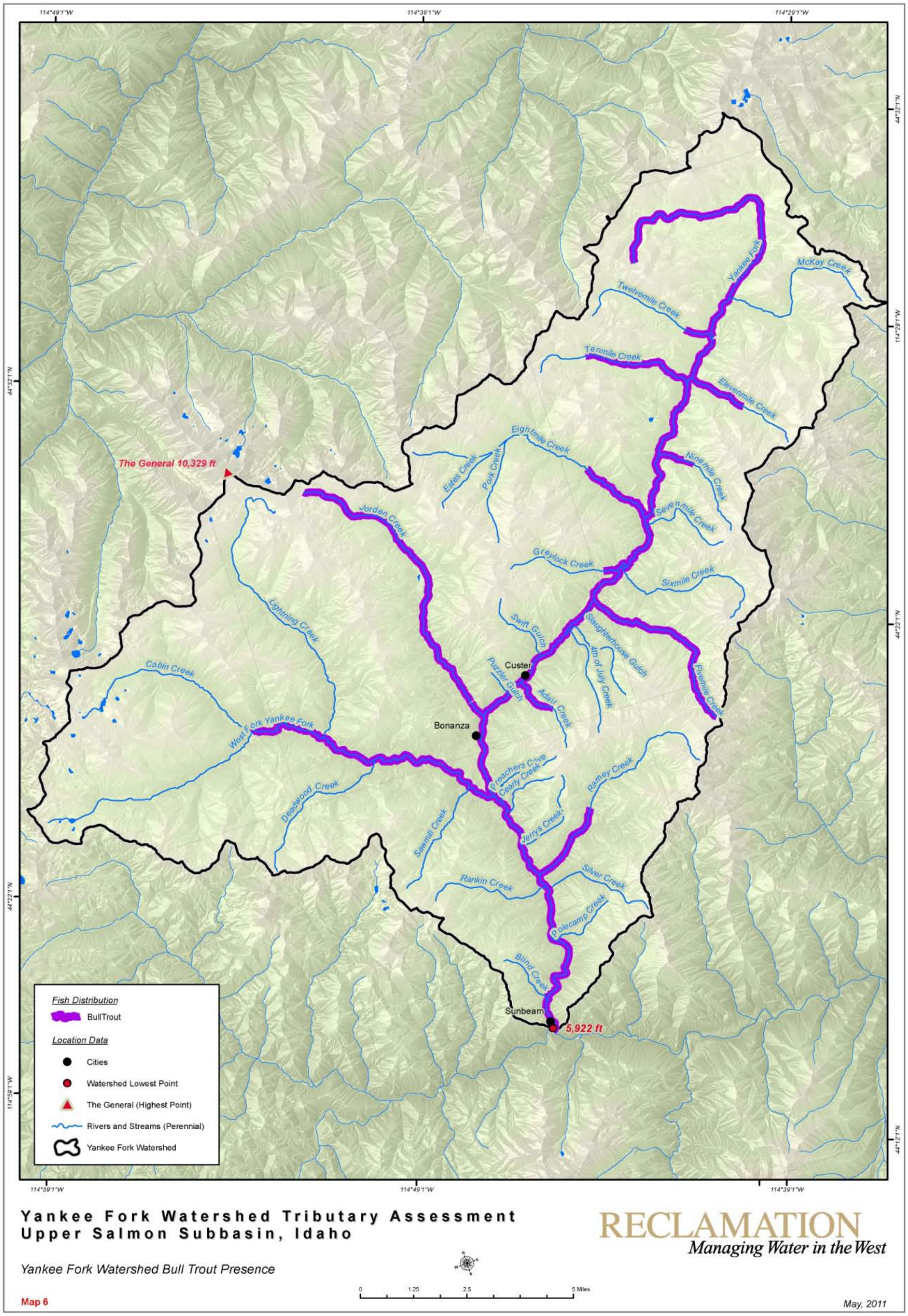

Figure 3. Yankee Fork Watershed Bull Trout Presence

5. Biological Overview by Geomorphic Reach

5.1 Stream Surveys

In 1934, the U.S. Bureau of Fisheries conducted a stream survey of the Yankee Fork (Rodeheffer 1935). Information from this report indicated that the Custer Motor Highway followed the entire length of the Yankee Fork and McKay Creek. Further information from Rodeheffer (1935) indicated that the West Fork, which was roadless at the time, offered better fishing than the mainstem Yankee Fork. Stream temperatures on the Yankee Fork did not exceed 60 degrees F. and flow decreased greatly during the latter part of summer. Rodeheffer (1935) stated that for the lower Yankee Fork, "stream substrate was almost entirely comprised of large stones and boulders". The upper Yankee Fork above Five Mile Creek was comprised largely of gravel where salmon spawning was observed. Rodeheffer (1935) further stated that of the streams they surveyed in the upper Salmon River basin, the Yankee Fork needed improvements more than any other. "Good pools are almost entirely lacking" according to Rodeheffer (1935), however, "spawning areas are excellent". Rodeheffer (1935) also stated that the Yankee Fork streamflow had high velocities, making it difficult for salmonids, and that habitat improvements were recommended to "control" streamflow making it more hospitable for fish.

Dredge mining activities that have occurred within the mainstem of the Yankee Fork and Jordan Creek have severely altered both spawning and rearing habitat by completely re-channeling the stream courses and leaving extensive, unconsolidated dredge piles. In some locations, the channel has been disconnected from the floodplain as the channel elevation was lowered and confined (USFS 2006). USFS R1/R4 stream survey data from 1994 and 2001 shows that width/depth ratios were high, pool frequency was poor, instream cover was poor, and large woody material and riparian vegetation were lacking (USFS 2006). These conditions were likely limiting the growth and survival of Chinook salmon in the Yankee Fork drainage.

Two recent stream surveys have been completed in the Yankee Fork watershed that show some similarities to those of Rodeheffer (1935). In 2001, the USFS conducted a R1/R4 Fish Habitat Inventory on the mainstem of the Yankee Fork (USFS 2006). This survey was completed from the mouth of the Yankee Fork to the confluence with Jordan Creek. Results of the survey indicated a lack of pools and high width/depth ratios. Spawning and rearing habitat in lower reaches of the Yankee Fork were identified as in poor condition due to dredging operations and in fair to good condition in the upper Yankee Fork and West Fork. The 2001 survey also showed that pool frequency, pool quality, large woody debris and instream cover were limiting for juvenile rearing habitat. In 2010, the USFS (USFS 2010) conducted a Level II stream habitat survey on the Yankee Fork and Jordan Creek that was part of the Pacific Northwest Stream Inventory Program. Level II is an extensive stream channel, riparian vegetation, aquatic habitat condition, and biotic inventory on a watershed-wide scale. Level II is used to determine the "pulse" or condition of a system during low flow conditions. The purpose of this inventory was to identify existing stream channel, riparian, and aquatic ecosystem conditions for the Yankee Fork and Jordan Creek.

Results of the USFS Level II stream habitat survey for the Yankee Fork and Jordan Creek indicated that riparian management objectives (RMO's) derived from PACFISH were not met for pool frequency and large woody debris (USFS 2010). Approximately one-half of the reaches surveyed did not meet the RMO for width/depth ratio (USFS 2010). Overall, stream habitat conditions have not changed substantially between the 2001 R1/R4 Fish Habitat Inventory and the 2010 Level II stream habitat survey.

5.2 Geomorphic Reach Analysis

There are multiple physical variables that determine habitat availability and quantity. For example, lack of juvenile rearing habitat can imply insufficient off-channel habitat, in-channel habitat complexity produced by large woody debris, pool-forming elements, protective cover, velocity refugia, or other variables. In general, impacts to juvenile Chinook salmon in the Yankee Fork Tributary Assessment area are attributed to lack of protective cover, lack of pools, and lack of large woody debris. Table 6 and Table 7 provide an outline of the fish usage by lifestage and limiting factors on a reach-by-reach basis for spring Chinook salmon and summer steelhead in the Yankee Fork and Jordan Creek. The limiting factors were determined following a Habitat Work Session meeting conducted on April 12, 2011 in Challis, Idaho.

Table 6. Chinook salmon usage and limiting factors by geomorphic reach

Reach	River Mile	Life Stage Usage	Limiting Factors
1 Yankee Fork	0-3.00	Migration, juvenile rearing	none
2 Yankee Fork	3.00-6.88	Migration, juvenile rearing, spawning	Lack of spawning and rearing habitat; lack of pools; Anchor ice; disconnection to tribs
3 Yankee Fork	6.88-9.12	Migration, juvenile rearing, spawning	Lack of spawning and rearing habitat; lack of pools; lack of LWD
4 Yankee Fork	9.12-11.60	Migration, juvenile rearing, spawning	Lack of spawning and rearing habitat; lack of pools; lack of LWD
5 Yankee Fork	11.60-13.18	Migration, spawning	Lack of LWD
6 Yankee Fork	13.18-16.28	Migration, spawning, juvenile rearing	Lack of juvenile rearing habitat; lack of LWD

Reach	River Mile	Life Stage Usage	Limiting Factors
1 Jordan Creek	0-1.42	Juvenile rearing	Lack of juvenile rearing habitat, lack of pools, lack of LWD
2 Jordan Creek	1.42-4.03	Juvenile rearing	Lack of juvenile rearing habitat; lack of pools; lack of LWD

Table 7. Steelhead usage and limiting factors by geomorphic reach

Reach	River Mile	Life Stage Usage	Limiting Factors
1 Yankee Fork	0-3.00	Migration, juvenile rearing	none
2 Yankee Fork	3.00-6.88	Migration, juvenile rearing, spawning	Lack of spawning and rearing habitat; lack of pools;Anchor ice; disconnection to tribs
3 Yankee Fork	6.88-9.12	Migration, juvenile rearing	Lack of rearing habitat; lack of pools; lack of LWD
4 Yankee Fork	9.12-11.60	Migration, juvenile rearing, spawning	Lack of spawning and rearing habitat; lack of pools; lack of LWD
5 Yankee Fork	11.60-13.18	Migration	Lack of LWD
6 Yankee Fork	13.18-16.28	Migration, spawning, juvenile rearing	Lack of juvenile rearing habitat; lack of LWD
1 Jordan Creek	0-1.42	Juvenile rearing	Lack of juvenile rearing habitat, lack of pools, lack of LWD
2 Jordan Creek	1.42-4.03	Juvenile rearing, spawning	Lack of juvenile rearing and spawning habitat; lack of pools; lack of LWD

6. Limiting Factors and Threats

Mining, road-building, and grazing in the Yankee Fork drainage have degraded habitat from historical conditions (Overton et al. 1999). Habitat limiting factors include:

1) lack of floodplain connectivity and functioning riparian zone and the associated lack of suitable rearing and spawning habitat in the mainstem Yankee Fork

2) risk of heavy metal contamination from historic mining activities

3) excess fine sediment; and 4) bank instability (USFS 2006)

The Yankee Fork has a long history of adverse land use practices which have contributed to the decline of anadromous fish runs. Dredge-mining for gold has severely altered stream conditions for several miles in the lower Yankee Fork and 1.5 miles of lower Jordan Creek. Extensive unconsolidated and unvegetated dredge tailings have increased sedimentation of spawning riffles and rearing pools and reduced riparian cover (USFS 2006). A total of 626 acres of land is now covered in tailings as gravel piles that reach heights of 20 feet (ICTRT 2010). These gravel piles disconnected about 7.5 miles of the Yankee Fork and Jordan Creek from much of its floodplain by constricting the stream channel. Additionally, off-channel habitat was blocked by tailings and riparian vegetation was covered by tailings. Since the tailings do not contain sufficient soil to grow vegetation, the riparian zone lacks both large wood recruitment and shade (ICTRT 2010). There are far fewer pools, especially deep pools, in the lower Yankee Fork than in undisturbed reaches in the watershed (Overton et al. 1999). Dredge mining activities that occurred within the main stem of the Yankee Fork and Jordan Creek have altered both spawning and rearing habitat by completely re-channeling the stream courses and leaving extensive, unconsolidated, barren dredge piles (USFS 2006). In some locations, the stream channel has been disassociated from its floodplain as channel elevation was lowered and confined. As a result, the Yankee Fork drainage is grossly underutilized with respect to salmon and steelhead production.

Water quality, water temperature, sediment levels, and availability of holding water for adults are key factors for spawning habitat (Kondolf et al. 2008). Lower to mid-reaches of the Yankee Fork and Jordan Creek are in poor condition due to dredging, while the upper Yankee Fork and West Fork are in fair to good condition. Land uses including mining, road-building, and grazing have delivered elevated levels of fine sediment to streams in the Yankee Fork, reaching levels detrimental to egg incubation and rearing habitat (Overton et al. 1999, Ecovista 2004). The Yankee Fork from the confluence with the Salmon River to Jordan Creek is currently listed for sedimentation/siltation and physical habitat alterations on the 2008 303(d) list by DEQ (DEQ 2009) and is likely a primary limiting factor to Chinook salmon rearing. Overton et al. (1999) indicated high turbidity levels being often seen in the watershed during spring snowmelt. USFS (USFS 2006) snorkel surveys indicate that pool frequency, pool quality, and instream cover are the limiting factors for Chinook salmon rearing habitat throughout the Yankee Fork.

In summary, the low pool frequency and pool quality, along with the lack of cover, indicate that as a whole, the Yankee Fork has poor rearing habitat for salmonids (see Table 6).

The Yankee Fork bull trout, steelhead trout, and Chinook salmon populations are at risk of extirpation (USFS 2001). They have a depressed population status based on the Upper

Columbia River Basin aquatic science team analysis, have an extreme risk status based on extinction risk table analysis, and both steelhead and Chinook populations have steadily declined based on spawning ground count trends and stream inventory data. Analysis of the data indicates that the two primary factors affecting the Yankee Fork anadromous populations are the lack of adult spawner recruitment resulting from adult and juvenile mortality related to passage at Columbia River Basin hydroelectric facilities and the availability and suitability of spawning and rearing habitat (USFS 2001). The cumulative effects of hydropower operation, habitat degradation, and ocean conditions are evident in the Chinook salmon redd count monitoring data (USFS 2001).

Belmore and Baxter (2009) indicated that to restore more natural characteristics and floodplain function in the dredged segment of the Yankee Fork, several restoration alternatives should be considered. These alternatives (Belmore and Baxter 2009) fall under three main categories: (1) reconnection of tributaries isolated by dredge pilings, (2) connection of isolated dredge ponds to the main channel, and (3) removal of dredge pilings along the main channel, allowing the river to access the floodplain surface at higher flows. Belmore and Baxter also document a recent example of a similar restoration project on the North Fork John Day River where dredge pilings were removed to reestablish natural floodplain connections. Sanchez (2002) summarized that channel form and floodplain elevation were restored at the project site by redistributing over 6000 cubic meters of tailings. Removal of tailings allowed the river, isolated for many decades between tailing piles, to once again access a floodplain surface at flows above bankfull (Sanchez 2002). Chinook salmon were documented using the redistributed substrate to construct redds just weeks after work was completed (Belmore and Baxter 2009). Sanchez (2002) indicated that they did not conduct any pre-project studies to determine the capacity of this reclaimed river segment for re-expression of quality floodplain habitat, or the potential for such restoration to meet the stated goal of enhancing populations of Chinook salmon and steelhead.

The Tribes have worked to increase rearing habitat through the incorporation of old off-channel dredge ponds. Connectivity between ponds was completed in the fall of 1988. In cooperation with the IDFG, the Tribes have out-planted spring Chinook salmon fry and steelhead in these ponds. It is likely that juvenile Chinook salmon hatched or stocked in the Yankee Fork move to tributary streams (lower Jordan Creek and lower West Fork) and off-channel locations (such as the above indicated ponds) to exploit available rearing habitat. This type of activity, combined with additional hatchery programs previously mentioned, are attempting to maintain and improve on the existing low numbers of anadromous fish in the Yankee Fork.

7. Literature Cited

Parenthetical Reference	Bibliographic Citation
Bellmore and Baxter 2009	Bellmore, J.R. and C.V. Baxter. 2009. *Yankee Fork Salmon River Dredge Tailings Restoration Project: A Plan for Monitoring and Evaluation*. Idaho State University. Pocatello, Idaho.
Chapman 1986	Chapman, D. W. 1986. "Salmon and steelhead abundance in the Columbia River in the nineteenth century." *Transaction of the American Fisheries Society* 115:662-670.
Cochnauer and Claire 2009	Cochnauer, T. and C. Claire. 2009. *Evaluate status of Pacific Lamprey in the Clearwater River and Salmon River drainages, Idaho*. Technical Report. BPA Report Project 2000-028-00.
CRHRP 2009a	Columbia River Hatchery Reform Project. 2009. *Hatchery Scientific Review Group. Columbia River Hatchery Reform System-Wide Report*. Salmon-Yankee Fork Spring Chinook Population and Related Hatchery Programs.
CRHRP 2009b	Columbia River Hatchery Reform Project. 2009. Hatchery Scientific Review Group. *Review and Recommendations. Salmon River. Upper Salmon Summer Steelhead A-Run Population and Related Hatchery Programs.*
DEQ 2009	State of Idaho, Department of Environmental Quality. 2009. *Working Principles and Policies for the 2008 Integrated (303[d]/305[b]) Report.* Boise, Idaho. May 22, 2009.
Ecovista 2004	Ecovista. 2004. *Salmon Subbasin Management Plan*. Prepared for the Northwest Power and Conservation Council.
	Fish Passage Center. See web site - http://www.fpc.org
Hyatt et al. 2006	Hyatt, M.W., C. Claire, and T. Cochnauer. 2006. *Evaluate status of Pacific Lamprey in the Clearwater River and Salmon River Drainages, Idaho*. Annual Report. BPA Report Project 2000-028-00
ICTRT 2010	ICTRT (Interior Columbia Technical Recovery Team). 2010. *Part 3: Current Status Review: Interior Columbia Basin Salmon ESU's and Steelhead DPSs*. Part 3: Status summary-Snake River Spring/Summer Chinook Salmon ESU's. NOAA Northwest Fisheries Science Center, Seattle, WA.
Idaho 2006	Idaho. 2006. *Salmon and Steelhead Recovery Planning in the Snake River Basin*. Early Draft Plan Chapters for Public Comment. See web site – http://www.idahosalmonrecovery.net/
Kondolf et al. 2008	Kondolf, G.M., J.G. Williams, T.C. Horner, and D.Milan. 2008. "Assessing Physical Quality of Spawning Habitat." American Fisheries Society Symposium 65:000-000, by the American Fisheries Society.
Lee et al. 1997	Lee, D.C., Sedell, J.R., Rieman, B.E., Thurow, R.F., Williams, J.E. 1997. "Broadscale Assessment of Aquatic Species and Habitats." In T.M. Quigley and S.J. Arbelbide (eds.). *An Assessment of Ecosystem Components in the Interior Columbia River Basin and Portions of the Klamath and Great Basins*. General Technical Report PNW-405. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.
NOAA Fisheries 2010	National Marine Fisheries Service. 2010. *Supplemental Consultation on Remand for Operation of the Federal Columbia River Power System, 11 Bureau of Reclamation Projects in the Columbia Basin and ESA Section 10(a)(1)(A) Permit for Juvenile Fish Transportation Program*. May 20, 2010, F/NWR/2010/0209.

Parenthetical Reference	Bibliographic Citation
Overton et al. 1999	Overton, K.C., M. A. Radko, and S.P. Wollrab. 1999. *Watershed Analysis Approaches for Chinook Salmon, Yankee Fork of the Salmon River, Idaho*: An Example. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Boise, Idaho.
Reiser and Ramey 1987	Reiser, D. W., and M.P. Ramey. 1987. *Feasibility Plan For The Enhancement Of The Yankee Fork Of The Salmon River, Idaho*. Prepared for the Shoshone-Bannock Tribes Fisheries Department. Fort Hall, Idaho. BPA contract No. 83-359.
Rieman et al. 1997	Rieman, B.R., D.C. Lee, and R.F. Thurow. 1997. "Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River Basins." *North American Journal of Fisheries* Management 17:1111-1125.
Rodeheffer 1935	Rodeheffer, I.A. 1935. *A Survey of the Waters of the Challis National Forest, Idaho*. Department of Commerce, Bureau of Fisheries. Washington.
Sanchez 2002	Sanchez, John. 2002. *North Fork John Day Dredge Tailings Restoration Project. Project No. 1996-05300*. Bonneville Power Administration Report DOE/BP-00004994-1. Portland, OR.
Schoby and Curet 2007	Schoby, G.P. and T. Curet. 2007. *Seasonal Migrations of Bull Trout, Westslope Cutthroat Trout, and Rainbow Trout in the Upper Salmon River Basin, Idaho*. Idaho Department of Fish and Game. Boise, ID.
Stark and Gable 2010	Stark, E.J. and J. Gable. 2010. *Captive Rearing Program for Salmon River Chinook Salmon, Project Progress Report*. 2009 Annual Report. Idaho Department of Fish and Game. Boise, Idaho.
Tardy 2009a	Tardy, Kurt A. 2009. Steelhead *Streamside Incubation (SSI) Program. Annual Report, October 1, 2008 – September 30, 2009*. Shoshone-Bannock Tribes. Fort Hall, Idaho.
Tardy 2009b	Tardy, Kurt A. 2009. *Steelhead Smolt Supplementation Program. Annual Report, October 1, 2008- September 30, 2009*. Shoshone-Bannock Tribes. Fort Hall, Idaho.
Tardy and Denny 2010	Tardy, K.A., and L.P. Denny. 2010. 2010 *Yankee Fork Salmon River Chinook Salmon Run Report. Annual Report*. Shoshone-Bannock Tribes, Fish and Wildlife Department. Fort Hall, Idaho.
USFS 2001	United States Department of Agriculture Forest Service Salmon-Challis National Forest. 2001. *Yankee Fork of the Salmon River Watershed Analysis*. Yankee Fork Ranger District. Clayton, Idaho.
USFS 2006	United States Department of Agriculture. 2006. *Biological Assessment for the Potential Effects of Managing the Salmon-Challis National Forest in the Yankee Fork Section 7 Watershed on Snake River Basin Spring/Summer Chinook Salmon, Snake River Steelhead, and Columbia River Bull Trout*. Salmon-Challis National Forest, Yankee Fork Ranger District. Custer County, Idaho.
USFS 2010	United States Department of Agriculture. 2010. *Yankee Fork of the Salmon River. 2010 Stream Survey Report*. Salmon-Challis National Forest, Yankee Fork Ranger District.
USFWS 2010	U.S. Fish and Wildlife Service. 2010. *Best management practices to minimize adverse effects to Pacific Lamprey* (*Entosphenus tridentus*).

This page intentionally left blank