MONITORING STATE RESTORATION OF SALMON HABITAT IN THE COLUMBIA BASIN
IDAHO DEPARTMENT OF FISH AND GAME
Contract No. 12-10

Interim Report for the
National Oceanic and Atmospheric Administration
February 10, 2012

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Task 1: **Monitoring Idaho Restoration of Salmonid Habitat in the Potlatch River Watershed of the Columbia River Basin, Idaho Department of Fish and Game. Phase II.**

Introduction

The Potlatch River Steelhead Monitoring and Evaluation (PRSME) project was initiated in 2005 using Pacific Coastal Salmon Recovery Funds (PCSRF). In 2008, the project was expanded into the upper Potlatch River watershed using National Oceanic and Atmospheric Administration (NOAA) Fisheries Intensively Monitored Watershed (IMW) funds. The additional funds allowed work to occur simultaneously throughout the drainage.

The Potlatch River is the largest tributary to the lower Clearwater River (Figure 1). It likely has the strongest component of wild steelhead present within the Clearwater River Lower Mainstem population (Bowersox et al. 2008). The Interior Columbia River Technical Recovery Team (ICTRT) estimated that the Potlatch River drainage contains one Major Spawning Aggregation (Upper Potlatch River; including Big Bear Creek and East Fork Potlatch River) and two Minor Spawning Aggregations (Middle Potlatch Creek and Little Potlatch Creek)(NOAA Draft Recovery Plan 2006). They estimated that the Potlatch River drainage comprises 25% of the historic intrinsic potential of the Clearwater River Lower Mainstem steelhead population (NOAA Draft Recovery Plan 2006). The lower Clearwater River steelhead population is important to steelhead recovery; however no information was available regarding population production and productivity. This project was designed to establish baseline indices regarding steelhead population dynamics and evaluate the impact of habitat restoration on those baseline indices as work is implemented within intensively monitored watersheds. In addition, the project provides a basin-wide monitoring component for various agencies and projects within the Potlatch River drainage and is intended to direct habitat restoration efforts into priority drainages. The framework needs to be adaptive as well as rigid. It needs to be capable of shifting with monitoring needs as well as being able to detect steelhead production and productivity changes within the Potlatch River.

The Potlatch River is a drainage that has undergone significant amounts of change over the past 150 years. Land practices and manipulation associated with agricultural use and timber harvest have significantly altered the aquatic habitats present within the drainage as well as flow dynamics associated with the hydrograph. These changes have resulted in a variety of limiting factors identified by previous work (Johnson 1985; Bowersox and Brindza 2006) within the drainage. These limiting factors include:

1) Extreme flow variation,
2) High summer water temperatures,
3) Lack of riparian habitat,
4) High sediment loads, and
5) Low densities of in-stream structure.

Despite the significantly altered condition of aquatic habitats within the Potlatch River drainage, it does support an important population of wild steelhead trout. Aside from general distribution and abundance data (Schriever and Nelson 1999; Bowersox and Brindza 2006) limited information was available with regards to levels of productivity, production, and life history strategies for steelhead in the Potlatch River Drainage.

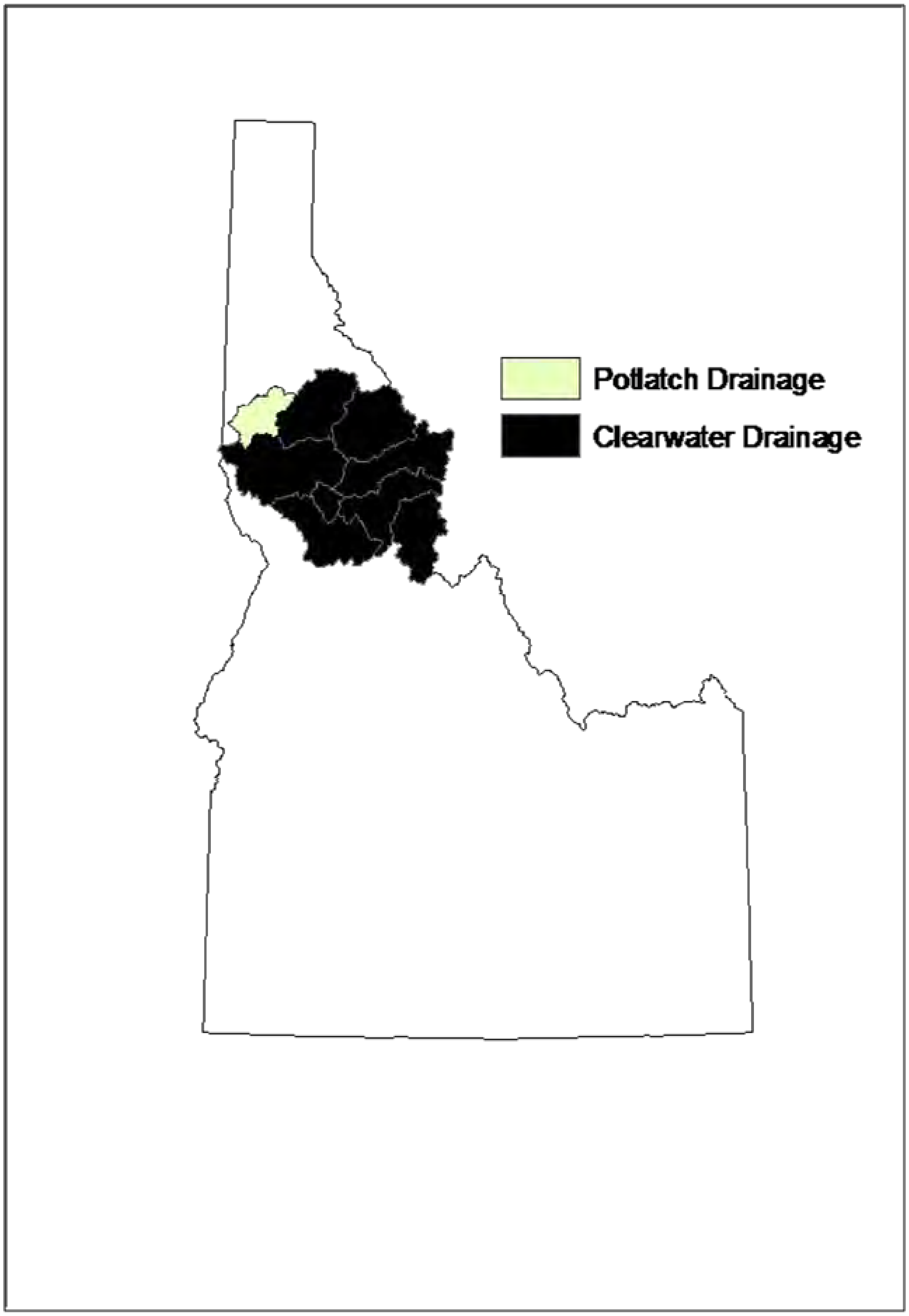

Figure 1. Location of the Potlatch River watershed in Idaho.

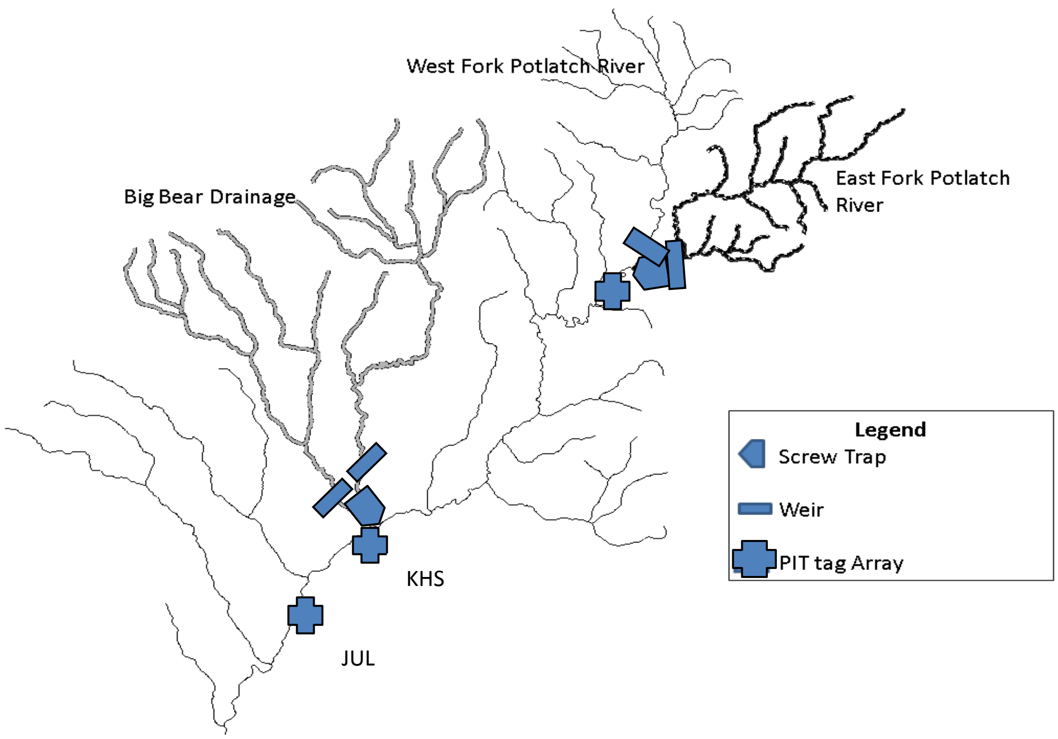

Figure 2. Potlatch River Steelhead Monitoring and Evaluation infrastructure. Including four adult steelhead weirs, two juvenile steelhead screw traps, and three dual in-stream PIT tag arrays.

Field techniques utilized by this project include adult fish weirs, juvenile rotary screw trapping, PIT tag arrays and mark-resight snorkel surveys. Figure 2 shows the location of IMW infrastructure. These methods are providing data needed to estimate adult steelhead escapement, juvenile outmigration estimates, juvenile outmigration timing, juvenile in-stream survival, juvenile survival through the Columbia River hydrosystem, and in-stream juvenile population estimates.

Potlatch River steelhead are genetically distinct from other Clearwater River steelhead groups such as Dworshak hatchery steelhead (Byrne 2005). The geographic location of the drainage and lack of hatchery influence within Potlatch River steelhead make understanding population dynamics of this group extremely important regarding recovery actions for Clearwater River steelhead (ICTRT 2003).

In recent years, the Potlatch River has received additional focus from governmental and non-governmental agencies regarding its restoration potential. The Latah Country Soil and Water Conservation District (LCSWCD), Idaho Department of Fish and Game (IDFG), Natural Resource Conservation Service (NRCS), and the U.S. Forest Service (USFS) have begun significant restoration efforts throughout the drainage. The goal of the ongoing PCSRF project and NOAA IMW project is to determine steelhead population response (production and productivity) to habitat enhancement.

Refer to Appendix A, Potlatch River Steelhead Monitoring and Evaluation Project, Draft 2010 Annual Report for more detailed project description, methodologies, and data analysis.

Requested Information:

<u> Number of years of pre-treatment fish and habitat data collections and the habitat protocols used (i.e. PIBO, AREMP, EMAP, CHAMPS, ODFW, TFW and others).</u>*

Fish and habitat monitoring was initiated in 2005 within the Big Bear Creek drainage using PCSRF funds. The East Fork Potlatch River monitoring was initiated in 2008 after receiving additional funds through the NOAA IMW program. Since that time both index tributaries have been monitored with funds from both sources allowing a Potlatch River drainage-wide monitoring framework.

Habitat reference sites were established within IMW monitored tributaries (Big Bear Drainage and the East Fork Potlatch River) using the Environmental Monitoring and Assessment Program (EMAP) site selection protocols to insure a random habitat index site distribution. In addition, we established habitat index sites within all major steelhead bearing tributaries within the entire Potlatch River drainage using the same protocol. Thirteen habitat index sites were selected within the Big Bear Drainage and 13 index sites within the East Fork Potlatch River drainage. One to five sites were established within other tributaries depending on size of the tributary and estimated level of importance with regards to steelhead production and habitat restoration activity potential. Habitat monitoring protocols used are outlined in Harrelson et al. 1994. This protocol included longitudinal and lateral transects, bankfull and flood prone estimates, Rosgen stream channel classifications, and Wohlman pebble counts. Surveys also incorporated Pfankuch stream stability surveys (Pfankuch 1975), macroinvertebrate counts/species composition, large woody debris (LWD) density survey, and densiometer canopy cover estimates.

Late-summer juvenile steelhead rearing habitat is the limiting factor on steelhead production within the lower Potlatch River drainage. In 2007, IDFG staff developed a Low Water Habitat Availability Protocol (LWHAP) to estimate late summer steelhead rearing habitat present within the lower Potlatch River drainage. Four survey transects were established within all significant steelhead bearing tributaries within the Lower Potlatch River drainage. Since the Big Bear Creek drainage intensively monitored tributary has three major drainages (Big Bear Creek, Little Bear Creek, and the West Fork Little Bear Creek) 12 sites are contained within the drainage (in addition to the 13 habitat index sites). The protocol is designed to measure wetted habitat, pool availability, and pool quality within Lower Potlatch River tributaries during the same time period. Tributaries were stratified into upland and canyon reaches to disperse transects throughout each tributary. Surveys sites were then selected using a site list provided through EMAP protocols. Transects are walked the first week of August each year to provide temporal consistency. Two 500 m transects are walked within each strata and in each tributary resulting in four transects per tributary. The length of wetted habitat and the number of pools is recorded within each transect. The maximum depth, modal depth, pool length, pool width, and whether or not salmonids were present (visual observation) was then recorded for all pools within the transect. LWHAP surveys have provided a valuable tool for quantifying the major limiting factor within the Lower Potlatch River drainage. LWHAP surveys have not been conducted within the East Fork Potlatch River drainage since stream flow is not a limiting factor in that drainage.

It is important to note that these habitat index surveys were established and largely conducted prior to initiation of the IMW project. Surveys within the Big Bear Drainage were completed in 2007 with PCSRF funds and in 2008 in the East Fork Potlatch River using PCSRF and IMW funds. The intent of the habitat index surveys was to establish baseline habitat conditions within intensively monitored tributaries as well as other steelhead bearing tributaries throughout the Potlatch River drainage. Our intent is to re-survey these sites every 5-7 years to examine changes in habitat condition. These sites were established to provide a broad tributary level monitoring tool and were not based on specific habitat restoration activities. Intensively monitored tributaries and the associated infrastructure (outlined later in this report) are designed to provide data on changes to steelhead production and productivity on a tributary level, not a restoration project level. Some high priority projects, discussed later in this report, such as LWD treatments in the East Fork Potlatch River and the Dutch Flat Dam removal on the West Fork of Little Bear Creek are being monitored at a project level.

<u> A description of whether the locations where habitat transects are being measured are also being measured for salmonid densities.</u>*

Yes, fish surveys were also conducted at the habitat reference sites using triple-pass electrofishing or snorkeling methodologies. The fish habitat reference sites and the fish populations at those sites will continue to be monitored in the future. We believe that both habitat condition and fish densities will be highly variable on an annual basis within reference reaches because of the dynamic nature of the Potlatch River drainage. Significant changes in channel morphology regularly occur within reaches during high spring discharge events. Since 2007-2008 we have started to utilize summer PIT-tagging in these tributaries to estimate over-summer / winter survival as another characterization of steelhead production within these tributaries (see below).

<u> Number of years of completed habitat restoration treatments and the percentage of habitat restorations completed compared to the number estimated to be needed to be able to detect changes in fish abundance.</u>*

Significant habitat restoration efforts within the Potlatch River drainage are currently in development. A number of projects are funded and will be implemented in 2012. To date, the majority of habitat restoration efforts have been focused in reaches throughout the drainage that were identified as problem areas prior to the inception of the IMW. Many of these projects were not focused on the Big

Bear Creek and East Fork Potlatch River drainages. IDFG staff are currently working with habitat restoration partners at implementing restoration projects within intensively monitored watersheds as noted by the list of projects below. Detecting changes in steelhead production resulting from individual projects is extremely difficult, if not impossible for some projects. That is why we have adopted a watershed-scale approach to monitoring and evaluating the effectiveness of habitat restoration efforts on fish production and productivity. However, for some large scale projects where a measureable response is expected we have initiated monitoring efforts specifically for that project (i.e. Dutch Flat Dam Removal and East Fork Potlatch River LWD treatments). Other projects (typically small scale) where it is more difficult to estimate a direct impact on steelhead production (i.e. small tributary culvert removal, riparian fencing, tile obliteration, etc) we are generating baseline estimates of steelhead productivity in juvenile recruits / female spawner within intensively monitored tributaries. Future productivity estimates will document changes in steelhead productivity and provide a measure of success for habitat restoration efforts, both large and small scale.

The monitoring program within the Potlatch River drainage has been extremely successful at establishing baseline levels of steelhead production and productivity in the two intensively monitored watersheds. Fish in/fish out monitoring using weirs and screw traps as well as trend monitoring with snorkel surveys is producing a valuable dataset. In addition, to production and productivity measures, we have an extensive understanding of life history characteristics exhibited by steelhead within each intensively monitored tributary. This is extremely important since habitat restoration efforts will likely impact steelhead productivity but may also impact steelhead life history. For instance, if habitat restoration work in the East Fork Potlatch River improves over-winter habitat steelhead may rear an additional year in the East Fork Potlatch River prior to outmigrating. If the age-structure of outmigrating juveniles increases, the measured productivity may decrease, since juveniles will be subject to an additional year of mortality above the screw trap. Fortunately, the IMW monitoring design will be able to detect these differences.

Power Analysis:

Power analysis was run on snorkel survey data from the 2008 field season to determine the number of sample sites needed for reliable precision at a tributary and drainage scale. If the test is treated as one-tailed (i.e. greater or lesser than the target) we estimate 15 snorkel sites needed to determine if the new density is within +/- 50% the previous mean at the drainage wide level (Table 1). We also ran sample sites from Big Bear and East Fork Potlatch drainages and estimated 13 and 11 sites were needed to determine +/- 50% of the previous mean within these streams respectively (Table 1). We also estimated the minimum detectable difference at a drainage wide and tributary level given the current sample design. In 2008 we sampled 56 snorkel sites within the Potlatch River. Repeating this panel of sites in the future will allow us to detect differences of 2.63 fish/100m^2 (Table 2). In 2008 we sampled 10 and 20 sites in the East Fork Potlatch River and Big Bear Creek drainages respectively. This level of effort will allow us to accurately detect a change from the previous mean of 6.48 and 6.71 fish/100m^2 at the East Fork Potlatch and Big Bear Creeks respectively (Table 2). Given the sizable difference in minimum detectable difference between the two tributaries we will sample a minimum of 20 sites to track tributary level changes.

Table 1. Observed steelhead/rainbow trout density from 2008 surveys and survey sites needed to estimate +/- 50% change in the observed density. (Alpha = 0.10, Power = 80%)

	n	Mean Density (#/100m^2)	SD	Log Transformed Mean	Log transformed SD	+/-50% mean
Potlatch Drainage	56	3.44	7.65	-1.3890925	2.83210782	15
Big Bear	20	6.84	11.37	-0.58024941	3.237782384	13
East Fk	10	4.36	5.54	-0.40529703	3.026769741	11

Table 2. Minimum detectable difference in index tributaries and the entire Potlatch River drainage based upon 2008 snorkel data. East Fork Potlatch River minimum detectable change based upon an increase from 10 to 20 sample sites in future years.

	n	Log Transformed SD	Detectable change (Fish/100m^2)
Potlatch Drainage	56	2.832108	2.63
Big Bear	20	3.237782	6.71
East Fk	20	3.02677	6.48

The Northwest Power and Conservation Council produced a document that characterized steelhead smolt densities in a variety of habitat classes (poor, fair, good, and excellent) within the Columbia River Basin (NPCC, 1986). The smolt density described by NPCC was the converted into a juvenile parr density estimate assuming a 50% parr – smolt survival rate by Petrosky and Holubetz 1988. Expected steelhead parr densities in poor, fair, good, and excellent habitat classes are 6, 10, 14, and 20 fish/100m^2 respectively. Given this designation, the Potlatch River, East Fork Potlatch River and Big Bear Creek drainages currently contain poor steelhead habitat, based upon observed parr densities. It is our belief that through habitat restoration efforts (LWD treatment, barrier removal, stream rehabilitation, etc.) we can improve stream habitat condition to a good rating. Initially within the East Fork Potlatch River where a large scale habitat restoration plan is in place and on a longer timeframe on a drainage wide scale. If we are able to improve habitat at that level, we expect a fish density response of approximately 8-10 fish/100m^2 based upon a “good” habitat steelhead density expected level. Power analysis of our current study design shows we will be able to accurately detect these changes at a tributary and drainage scale.

As we continue to refine steelhead/rainbow trout outmigration estimates using juvenile fish screw traps and PIT-tag arrays on index tributaries and the mainstem Potlatch River we will acquire additional power to detect changes in the steelhead population. These tools will be used extensively to build a more robust picture of rainbow/steelhead trout population dynamics within the Potlatch River drainage. Prior to relying on these methodologies it is important to understand life history characteristics of steelhead/rainbow trout within the Potlatch River and how different life history characteristics and strategies might affect production and productivity estimates. This is a very high priority for the project over the next few years.

Big Bear Creek Drainage:

The significant limiting factor within the Big Bear Creek drainage is late summer stream discharge and therefore juvenile steelhead rearing habitat availability. Currently, three habitat restoration projects are planned within the Big Bear Creek drainage that have significant potential to increase steelhead production. All three projects will have positive impacts on the amount of steelhead rearing habitat available on the West Fork Little Bear Creek, which typically contains the highest densities of juvenile steelhead present in the Potlatch River drainage. First, the Dutch Flat Dam removal project on the West Fork of Little Bear Creek is scheduled to be completed in 2012 (LCSWCD). The removal of the dam will open up ~ 5 miles of steelhead habitat that is currently under utilized. Surveys conducted below the dam site in 2011 showed a 100 fold increase in steelhead density compared to sites above the dam. Radio-telemetry work conducted in 2011 also showed the Dutch Flat Dam being the uppermost extent of upstream migration of radio-tagged female steelhead spawners within this drainage. We expect a significant increase in juvenile production upon the completion of this project. Second, the Big Meadow Creek (a tributary to the West Fork Little Bear Creek) is scheduled to be completed in 2012 (Idaho Department of Fish and Game). This project will remove a fish passage barrier that block ~ 5 miles of steelhead habitat. Juvenile steelhead densities located just downstream of the culvert on the West Fork Little Bear Creek exceeded 100 fish /100m^2 in 2011. Third, the University of Idaho has received funding (PCSRF) to explore mid-late summer water releases from a municipal water storage reservoir located on Big Meadow Creek (a tributary to the West Fork Little Bear Creek) to supplement low flow conditions within Big Meadow Creek and the West Fork Little Bear Creek. A lack of water retention and late summer steelhead rearing habitat is the limiting factor in the lower Potlatch River drainage. Finally, we are assessing a potential fish passage barrier on Big Bear Creek that is currently blocking or impeding passage to ~ 20 miles of steelhead habitat upstream. Providing anadromous steelhead passage at Big Bear Creek Falls would quadruple the amount of steelhead spawning and rearing habitat currently available within Big Bear Creek. This action, coupled with projects outlined above could potentially produce measureable changes in steelhead production within the Big Bear Creek drainage. We expect to begin to see results within five years after all these projects are completed.

East Fork Potlatch River:

The major limiting factor in the East Fork Potlatch River is stream channel complexity and over-winter habitat for juvenile rearing steelhead. IDFG has partnered with Potlatch Timber Corporation to address these issues. In 2009 a LWD treatment project was initiated within the East Fork Potlatch River. To date, 1.7 kilometers of steelhead habitat within the East Fork Potlatch River have had LWD treatments put in place. In addition, another 3.2 kilometers of treatments are going to be submitted for funding in 2012 with an anticipated completion date for the summer of 2013. In addition, IDFG is working with a private landowner located downstream of the LWD treatments on a significant meadow restoration/LWD restoration project. This project is funded and scheduled for completion in 2012. The project will enhance ~ 2.2 kilometers of the East Fork Potlatch River within the current distribution of steelhead. All LWD and habitat restoration efforts are located within the core distribution of steelhead in the East Fork Potlatch River. The completion of these projects will enhance 7.1 kilometers of the current distribution of steelhead within the East Fork Potlatch River drainage. We estimate the core steelhead distribution area in the East Fork and tributaries to be 67 kilometers. Completion of these projects will enhance 10% of the distribution. With an additional 4-5 years of project implementation we hope to enhance ~25% of the distribution. This level of enhancement should produce a detectable change in the steelhead production in the years following completion of all these projects.

<u> A summary of fish abundance trends (adult spawners and juvenile migrants) for target species since the project began and whether they correlate with habitat improvements.</u>*

We have been able to establish a juvenile recruits/female spawner estimate of freshwater productivity for the Big Bear Creek drainage, steelhead brood years 2005-2009 (Figure 3). The Big Bear Creek drainage exhibits a strong density dependent relationship indicating that freshwater habitat is limited. The productivity of the drainage greatly decreases with adult female escapements over 60-70 fish (Table 3). Female escapement has greatly exceeded this level on two occasions (2005 and 2010). Juvenile production within the drainage would be increased with improved habitat conditions, such as improved summer base flow, and by opening up new habitat, both high priorities for habitat restoration within the drainage.

We have brood year productivity estimates in the Big Bear Creek drainage which represent baseline levels for the population. This data suggests that the population is habitat limited and restoration efforts will have a positive effect on population production and productivity. Limited habitat restoration efforts have occurred to date within the drainage. However, projects currently funded and being planned in 2012 and beyond will increase the amount of accessible habitat within the drainage and the potential response in fish production should be detectable. We are fortunate to have a robust pre-treatment dataset for making these comparisons.

The dataset for the East Fork Potlatch River is not as robust because we have only been monitoring in that drainage since 2008. However, initial results from brood years 2008 and 2009 suggest freshwater productivity from this drainage is much higher than the Big Bear Creek drainage (Table 3). However, these results are not comparable since the age structure of juvenile steelhead emigrating from the East Fork Potlatch River is much younger. Therefore, the population of fish emigrating past the East Fork Potlatch River screw trap are subject to less freshwater mortality prior to emigration from the natal tributary. These productivity estimates will provide a baseline measure of steelhead freshwater productivity for the East Fork Potlatch River and a measure of change to future productivity as habitat restoration efforts are completed in the drainage.

Freshwater productivity within the East Fork Potlatch River showed a marked increase from brood years 2008 to 2009. However, we don’t attribute this to habitat restoration efforts since the first habitat restoration actions within the drainage did not occur till 2009. If we continue to see increasing trends in steelhead production and productivity within the drainage as more habitat restoration projects come online we will be able to measure their success and impact on the drainage and its steelhead population.

Table 3. Estimate of brood year productivity in juvenile steelhead out-migrants / female spawner in Big Bear Creek and East Fork Potlatch River, Idaho brood years 2005-2011 on Big Bear Creek and brood years 2008-2011 on the East Fork Potlatch River.

Drainage	BY	Adult Escapement Estimate	Proportion Female	# female spawners	Juvenile Outmigration				Total BY Production	Juveniles/ Spawner
					Age -0	Age-1	Age-2	Age-3		
Big Bear	2005	214	0.72	154.08	0	3091	6414	87	9592	62.26
Big Bear	2006	57	0.4	22.8	0	2740	2497	917	6153	269.88
Big Bear	2007	108	0.74	79.92	0	2903	4175	199	7278	91.06
Big Bear	2008	121	0.39	47	0	1256	6171	155	7582	161.32
Big Bear	2009	135	0.45	61.3	0	3583	3367	*		
Big Bear	2010	251	0.6	150.6	0	348	*	*		
Big Bear	2011	124	0.46	57.04	0	*	*	*		
East Fork	2008	140	0.36	50.4	583	9486	7905	80	18054	358.21
East Fork	2009	92	0.46	42.8	0	25776	4097	*	29873	697.97
East Fork	2010	71	0.81	56.7	0	11890	*	*	*	*
East Fork	2011	33*	0.58	N/A	0	*	*	*		

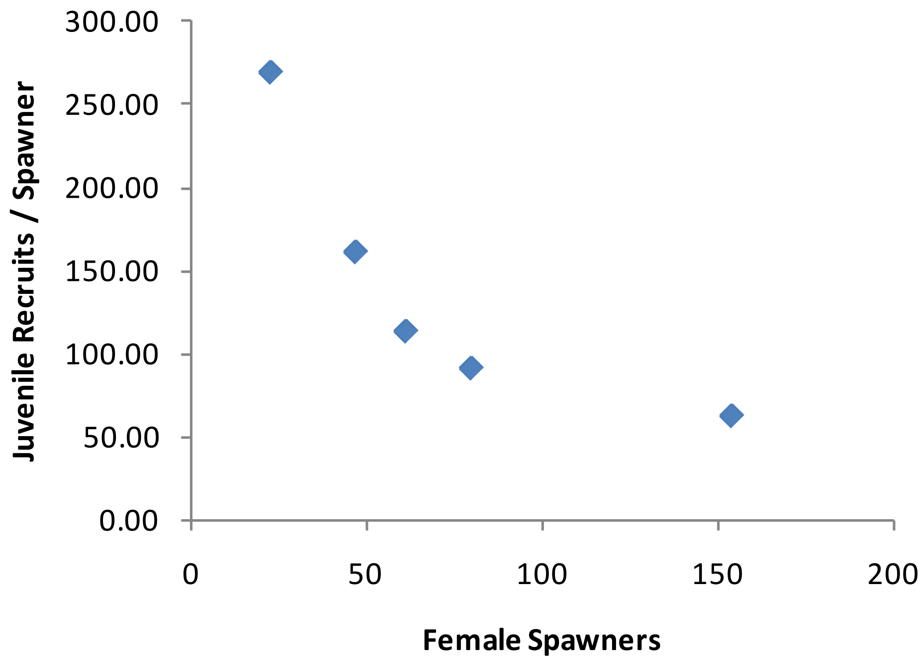

Figure 3. Summary table of juvenile recruits per female spawner in the Big Bear Creek drainage, Idaho for brood years 2005-2009. Brood year 2009 is still incomplete since age-3 juvenile steelhead will outmigrate during the 2012 trapping season.

<u> A summary of the results to date of any PIT tagging, radiotagging, or acoustic tagging underway.</u>*

To date, the PRSME project has deployed 8,272 and 5,039 PIT tags in juvenile steelhead at screw trap locations on Big Bear Drainage and the East Fork Potlatch River respectively (Table 4). The project has also PIT-tagged 539 and 234 adult steelhead at project weir locations in Big Bear Drainage and the East Fork Potlatch River respectively. The associated mark-recapture adult escapement estimates and brood year juvenile outmigration estimates are contained in Table 3.

Table 4. Summary of PIT tags deployed by the PRSME project at weirs and screw traps on intensively monitored tributaries (Big Bear Drainage and the East Fork Potlatch River) since 2005.

		Year							
Intensively Monitored Tributary	**Trap Type**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**Total**
Big Bear Drainage	Screw trap	2278	544	1289	836	926	1827	572	8272
	Weir	0	25	62	61	78	252	61	539
East Fork Potlatch River	Screw Trap	*	*	*	402	1244	2110	1283	5039
	Weir	*	*	*	61	69	71	33	234

The PRSME project has PIT tagged 8,427 juvenile steelhead as part of the roving tagging efforts since 2005 (Table 5).

Table 5. Summary of annual roving PIT tag efforts in Potlatch River, Idaho tributaries 2005-2011.

	Year						
Tributary	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Big Bear Drainage	137	0	150	349	1074	1070	1221
East Fork Potlatch River	*	*	*	293	212	151	430
Pine Creek	0	8	201	285	613	*	410
Cedar Creek	208	10	145	122	535	*	406
Corral Creek	*	*	100	59	238	*	*
Total	**345**	**18**	**596**	**1108**	**2672**	**1221**	**2467**

Over summer/winter survival estimates from summer roving tagging to outmigration to Lower Granite Dam the following year for all sample years has ranged from 0.25 (SE 0.02) and 0.07 (SE 0.01) in the West Fork Little Bear Creek in 2010 and the East Fork Potlatch River in 2008 respectively (Table 6). Even though the West Fork of Little Bear Creek had the overall highest over summer/winter survival for all release groups in 2010, survivals have been low in the previous two years ranging from 0.09 (SE 0.04) and 0.10 (SE 0.03)(Table 6). The grouped Big Bear Creek drainage over summer/winter survival estimate is also much lower, ranging from 0.12 (SE 0.05) – 0.18 (SE 0.01) in 2008-2010 (Table 6). Estimate of over summer/winter survival for the East Fork Potlatch River release groups are low, ranging from 0.07 (SE 0.01) - 0.08 (SE 0.02)(Table 6). This provides insight into the younger age structure of juvenile emigrant leaving the East Fork Potlatch River. Many of these fish emigrate out of their natal tributary during the spring as age-1 and rear in downstream reaches within this mainstem Potlatch River. We believe this is related to habitat condition in the drainage and an overall lack of stream complexity and over-winter rearing habitat that habitat restoration efforts are addressing.

Table 6. Summary of juvenile steelhead over summer/winter survival for roving tagging efforts from year of tagging to subsequent years outmigration to Lower Granite Dam (LRG) in selected Potlatch River, Idaho tributaries. N/A represents release groups with insufficient interrogation data to estimate survival. Big Bear Creek drainage estimates include all fish tagged within the drainage (Big Bear Creek, Little Bear Creek, and the West Fork Little Bear Creek).

Stream	**Tag Year**	**n**	**Arrival to LRG (SE)**
Big Bear Drainage	2008	349	0.14 (0.02)
	2009	1029	0.12 (0.05)
	2010	1076	0.18 (0.01)
Big Bear Creek	2008	123	0.16 (0.04)
	2009	189	N/A
	2010	252	0.09 (0.02)
Little Bear Creek	2008	113	0.17 (0.05
	2009	341	N/A
	2010	298	0.14 (0.02)
WFK Little Bear Creek	2008	113	0.09 (0.04)
	2009	499	0.10 (0.03)

Table 6 continued.

Stream	Tag Year	n	Arrival to LRG (SE)
East Fork Potlatch River	2010	526	0.25 (0.02)
	2008	293	0.08 (0.02)
	2009	212	0.07 (0.01)
Pine Creek	2010	151	N/A
	2008	285	0.20 0.03)
	2009	613	0.15 (0.07)
Cedar Creek	2008	122	0.10 (0.03)
	2009	535	0.11 (0.03)
Corral Creek	2008	59	0.24 (0.16)
	2009	238	N/A

A subsample of upstream pre-spawn female adult steelhead were radio-tagged during the 2010 and 2011 field season at Big Bear Creek drainage weirs (Big Bear Creek and Little Bear Creek) to identify spawning reaches and overall spawner distribution within the drainage. Finalized results from the 2010 field season will be presented in this report. A total of sixteen radio-tags were deployed in the Big Bear Creek drainage. The furthest documented spawning migration of an adult female steelhead was 10.52 km upstream of the Little Bear Creek weir into the West Fork of Little Bear Creek. Seventy-five percent of the detections in Little Bear Creek occurred within 2.0 km of the weir (Figure 4). The furthest documented spawning migration in Big Bear Creek was 9.56 km above the weir and was located at the base of Big Bear Creek Falls, a potential migration barrier. The average number of days fish spent above the weirs before returning as kelts was 23 days (SE = 1.99). There were five steelhead redds documented during the spring of 2010 above adult steelhead weirs (Figure 5). Of the five redds documented in Big Bear Drainage three had active spawning occurring on them, including a single redd at the base of Big Bear Creek Falls.

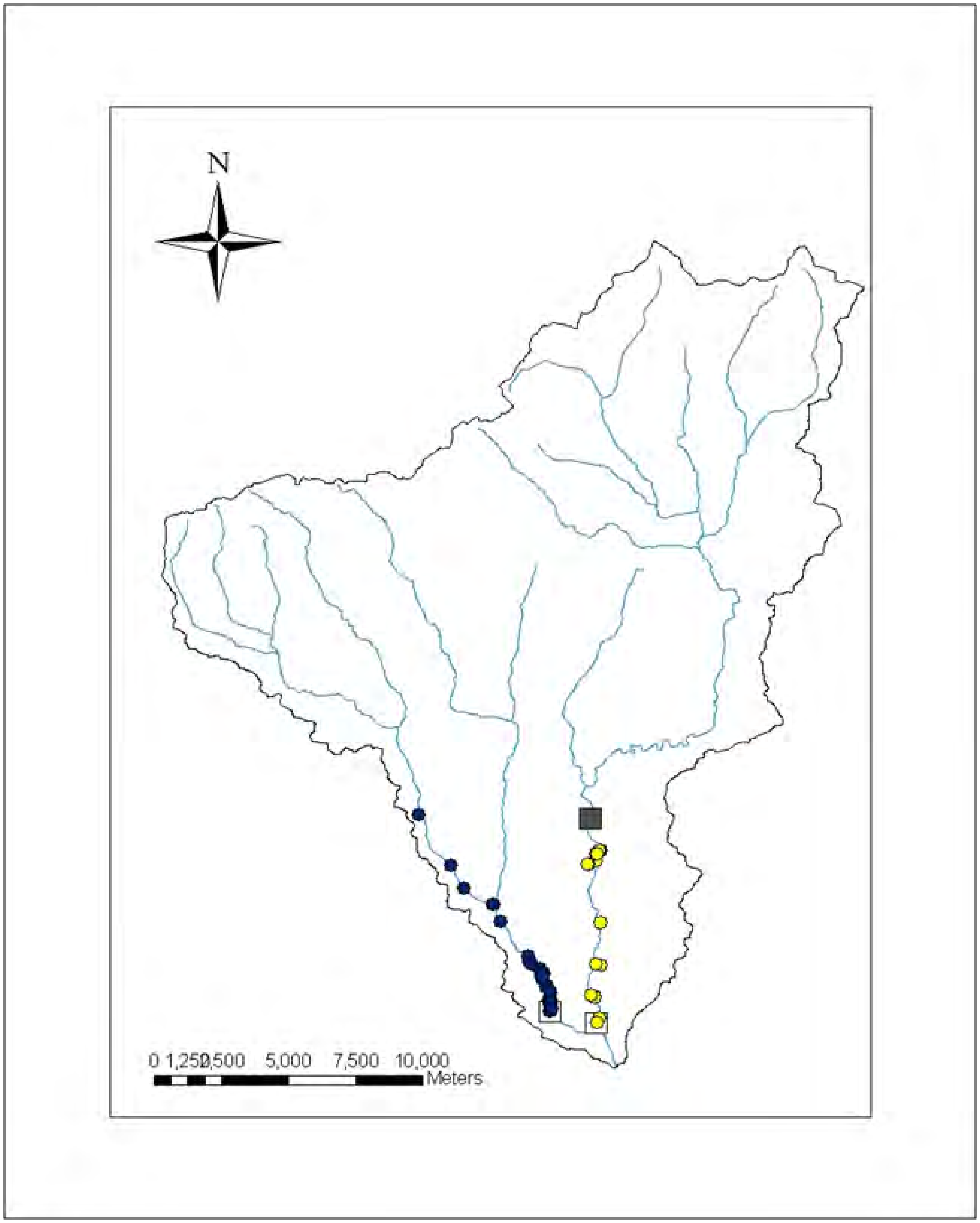

Figure 4. Map of Big Bear Creek Drainage with all detection sites of female spawners during the 2010 spawning migration. Big Bear Creek detections shown in yellow and Little Bear Creek detections shown in blue. White boxes represent the two lower Potlatch River weirs (Little Bear and Big Bear Creeks) and gray box represents Big Bear Creek Falls.

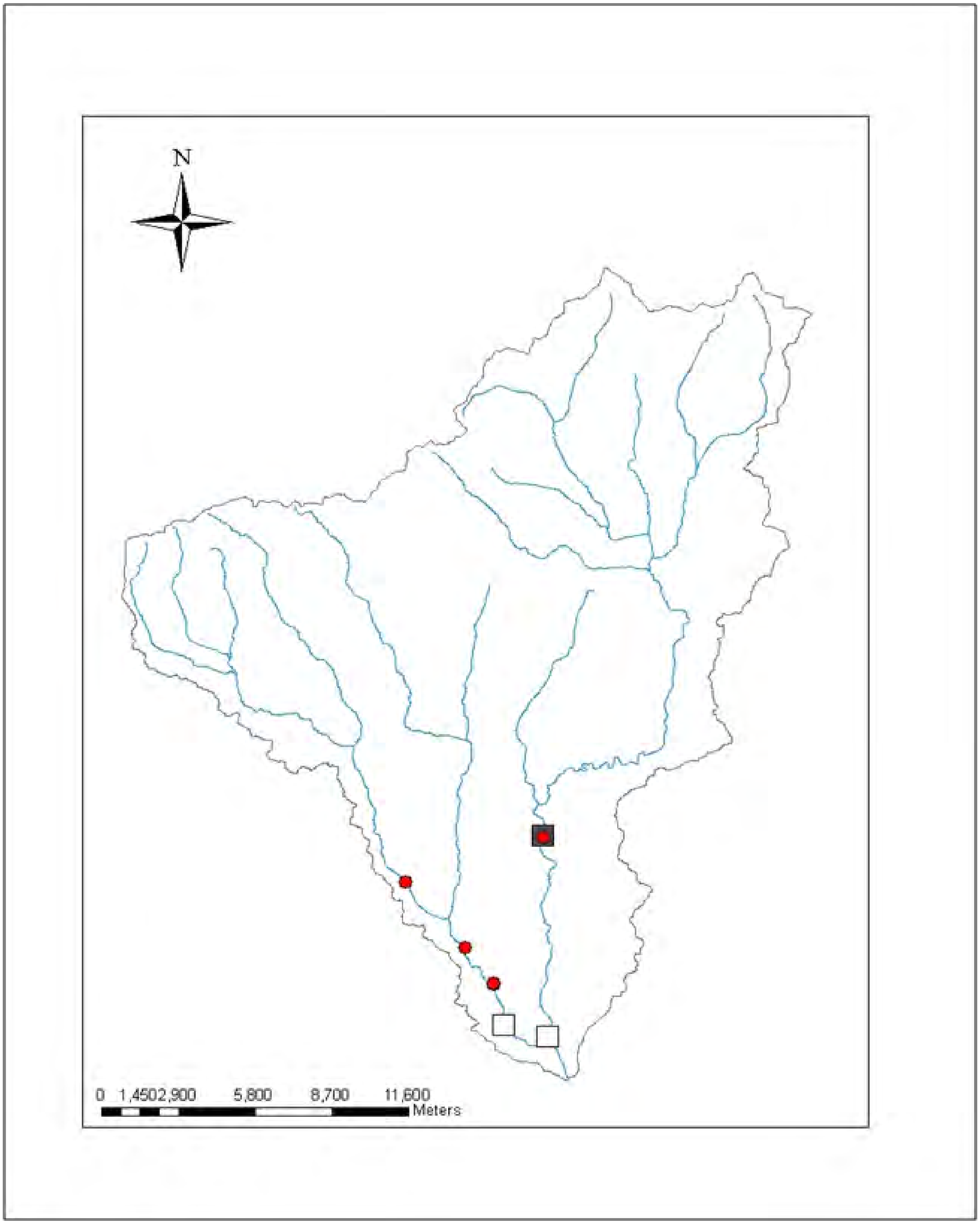

Figure 5. Map of Big Bear Creek Drainage with all documented spawning redds from the 2010 spawning migration. Redds shown with red dots. White boxes represent the two lower Potlatch River weirs (Little Bear and Big Bear creeks) and gray box represents Big Bear Creek Falls.

<u> A summary of other habitat disturbances in the watershed that may be obscuring the IMW results.</u>*

As stated above, the main limiting factor in the Big Bear Creek drainage is water retention and low summer stream flows resulting in a lack of juvenile rearing habitat. This limiting factor has displayed itself clearly with the density dependence exhibited in the freshwater productivity of the drainage (Figure 3). Habitat restoration aimed at recovering base flows in the Big Bear Creek drainage will be a long-term process. Agricultural practices do not include irrigation and instead utilize dryland agriculture techniques. The loss of upland water retention is driving the limiting factor and must be addressed incrementally. There is not irrigation water withdrawals that can be routed back to the streams to provide enhanced base flows such as in the Lemhi River drainage. We have instead taken the approach of opening up new habitat with barrier removals and will initiate plans for restoration of natural flow regimes in agricultural areas in the upcoming years. However, in both intensively monitored watersheds within the Potlatch River drainage we have monitoring infrastructure in place; we have established baseline datasets, and now have habitat restoration projects being implemented. This will allow us to document changes to steelhead production and productivity within the two drainages.

<u> A list of partners who are cooperating to either monitor the IMW for fish or habitat or to place projects in the IMW. A description of their funding source if known.</u>*

Habitat Restoration:

IDFG – PCSRF and BPA
Latah County Soil and Water Conservation District – PCSRF, BPA, and SRBA
NRCS – WHIP and Federal Farm Bill
USFS – Federal funds
Idaho Department of Lands - SRBA

<u> A summary of threats or obstacles, if any, to the successful completion of the IMW.</u>*

Funding for this work is contingent upon annual contracts from both NOAA-IMW and PCSRF funds. IMW funding levels have recently been significantly reduced. Reduced funding and uncertainty regarding long-term funding will compromise our ability to meet IMW project objectives. We have successfully developed and maintained an effective study design and monitoring framework within the Potlatch River drainage since 2005 and 2008 in the lower and upper Potlatch River drainage respectively. Our ability to maintain this monitoring in the future is uncertain due to the funding issues mentioned above.

Currently, there are a limited number of entities implementing projects in the Potlatch drainage. IDFG has one habitat restoration biologist focused on implementing habitat restoration work within the Potlatch River drainage. Projects implemented by this biologist are focused on the two intensively monitored tributaries of Big Bear Drainage and the East Fork Potlatch River. Currently we are able to implement a small number of projects within each of these drainages on an annual basis. We believe that we will begin to see effects within intensively monitored tributaries in a relatively short time period after all the previously mentioned projects have been completed, especially if partners are able to implement projects at a similar rate.

In 2011, we were unable to estimate adult escapement into the East Fork Potlatch River due to extremely high river discharge during the adult trapping season. While we were able to operate a trap at some level for 90% of the season, captures of upstream migrating adults were low (n =31) and we were only able to capture two downstream migrating kelts making a mark-recapture estimate unfeasible for 2011. We were able to estimate adult escapement in the previous three years and believe flow conditions will allow the project to estimate adult escapement in future years. However, if adult trapping remains difficult in 2012 we will reevaluate adult trapping on the East Fork Potlatch River. Annual adult escapement estimates are vital to the success of the juvenile recruits per spawner estimate being used to measure freshwater productivity of the East Fork Potlatch River. Any continued issues with adult escapement estimation may threaten our analysis.

* *Date when the IMW was estimated to be able to provide results.*

Currently, the Potlatch River IMW project has established a robust data set of baseline steelhead population dynamics and life history characteristics within intensively monitored drainages. Limited habitat restoration efforts have been completed; however a number of habitat restoration efforts are currently planned within these drainages. These projects are focused on addressing limiting factors within these high priority watersheds. These projects will be completed in the next two years while new projects are being identified, planned, proposed, and funded. Therefore we expect an increasing number of habitat restoration projects to be completed within intensively monitored watersheds within the next five to ten years. As long as habitat restoration partners are able to initiate high priority projects we believe this level of effort will begin to produce detectable change in the steelhead production found within Big Bear Creek and the East Fork Potlatch River drainages.

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Task 2: Monitoring Restoration of Salmon and Steelhead Habitat in the Lemhi River, Columbia River Basin, Idaho Department of Fish and Game. Phase II.

Introduction

Intensive fish population monitoring in the Lemhi River drainage (Figure 6) began in 2006 using PCSRF and BPA funds. The monitoring grew in 2008 when NOAA IMW funding became available. An experimental design and Statement of Work were prepared with the focus of the monitoring being evaluation of the effectiveness of tributary reconnects on fish production and productivity. Integrated Status and Effectiveness Monitoring Program (ISEMP) funds augmented the monitoring beginning in 2009. ISEMP is focusing on a drainage wide monitoring and evaluation of fish response to habitat restoration efforts and monitoring and evaluating habitat changes throughout the drainage.

This project is monitoring the effectiveness of ongoing habitat conservation actions that are being implemented in Kenney Creek, Big Timber Creek, Canyon Creek, Little Springs Creek, and others to permanently reconnect these tributaries to the Lemhi River.
The objectives of the study are as follows:

1) Monitor the changes in distribution of adult anadromous salmon, steelhead, and fluvial bull trout in Hayden Creek (control) and reconnected tributaries.
2) Estimate rearing densities of juvenile salmonids according to habitat type by land-use categories.
3) Measure changes in productivity (e.g. juvenile survival) of salmon and steelhead in the Lemhi River Basin.
4) Monitor species composition and length and age distribution of anadromous and resident/fluvial salmonids in the tributaries of the Lemhi River.

In Kenney Creek, diversions have been modified and consolidated to remove structures that prevent adult salmon and steelhead from migrating upstream. Water acquisitions have been completed that improve stream flow for spawning and rearing. In Big Timber Creek, a multi-phased plan is being implemented to reconnect nearly 60 miles of stream with the Lemhi River. Multiple barriers have been removed and others are planned. Projects have also been completed that provide a minimum flow of 6 cfs year round through a historically dewatered reach. Habitat improvement projects have also been completed or are planned in Canyon Creek and Lemhi Little Springs Creek.

Phase I (completed) established the infrastructure that will support the tributary monitoring that is required throughout the term of the Lemhi agreement (30 years). Figure 7 shows the location of the PIT tag arrays in the Lemhi River drainage. PIT tag detection arrays were purchased and installed in the lower reaches of Hayden, Big Timber, Bohannon, Canyon, Lemhi Little Springs, and Kenney creeks to document changes in distribution of anadromous and resident fish. Phase I also included limited monitoring activities, including habitat surveys, fish population estimates, redd counts, and PIT tagging juvenile salmonids in Hayden Creek, Big Timber Creek, Kenney Creek and others.
Phase II (ongoing) is full implementation of monitoring activities. Phase II activities include extensive PIT tagging, operating PIT tag arrays, operation of the adult escapement weir, and annual fish population sampling (electro-fishing/snorkeling) within the watershed. Redd counts and visual surveys will document movement and spawning by anadromous and fluvial salmonids. Hayden Creek, one of only two tributaries connected with the Lemhi River year round prior to implementation of tributary reconnect projects, will be used as a control stream for these evaluation points.

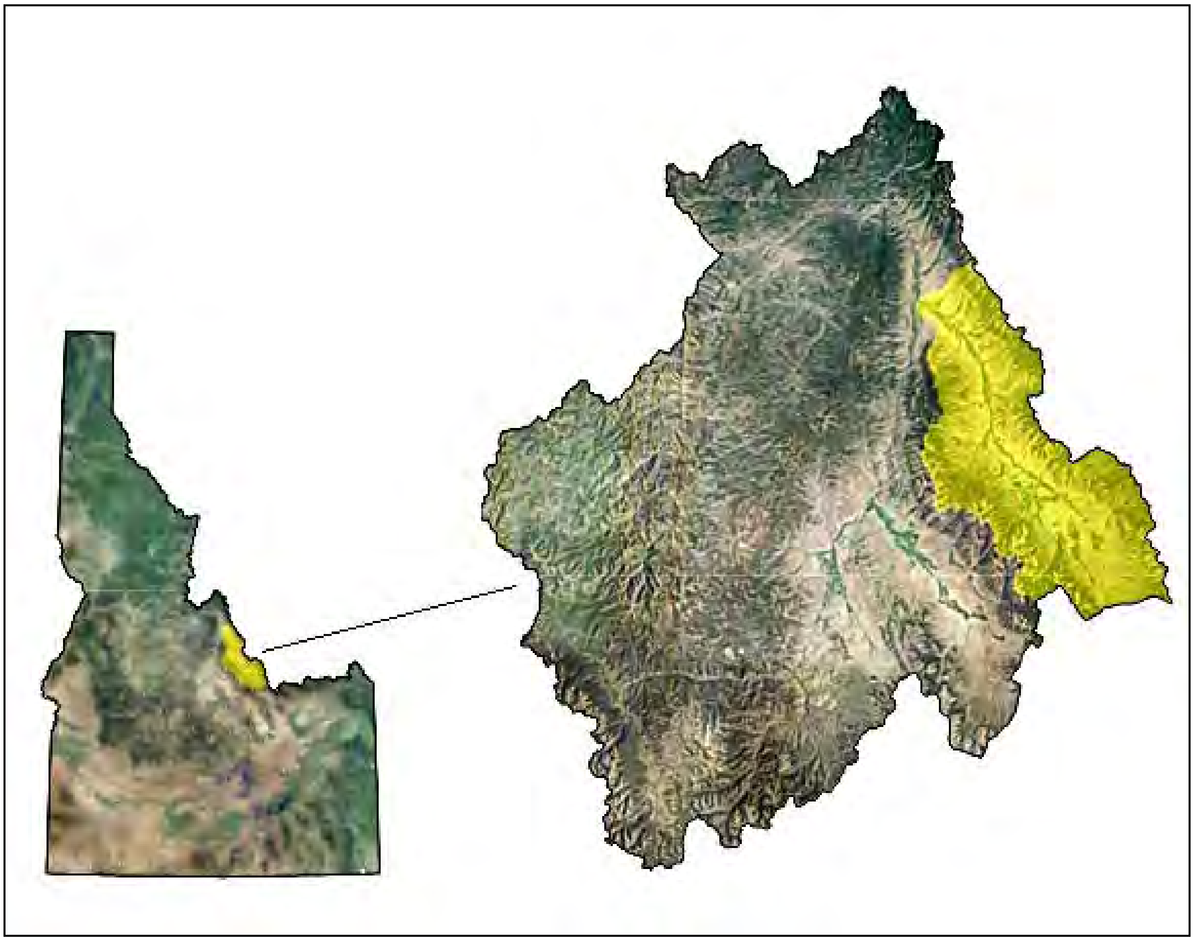

Figure 6. Location of the Lemhi River watershed in Idaho.

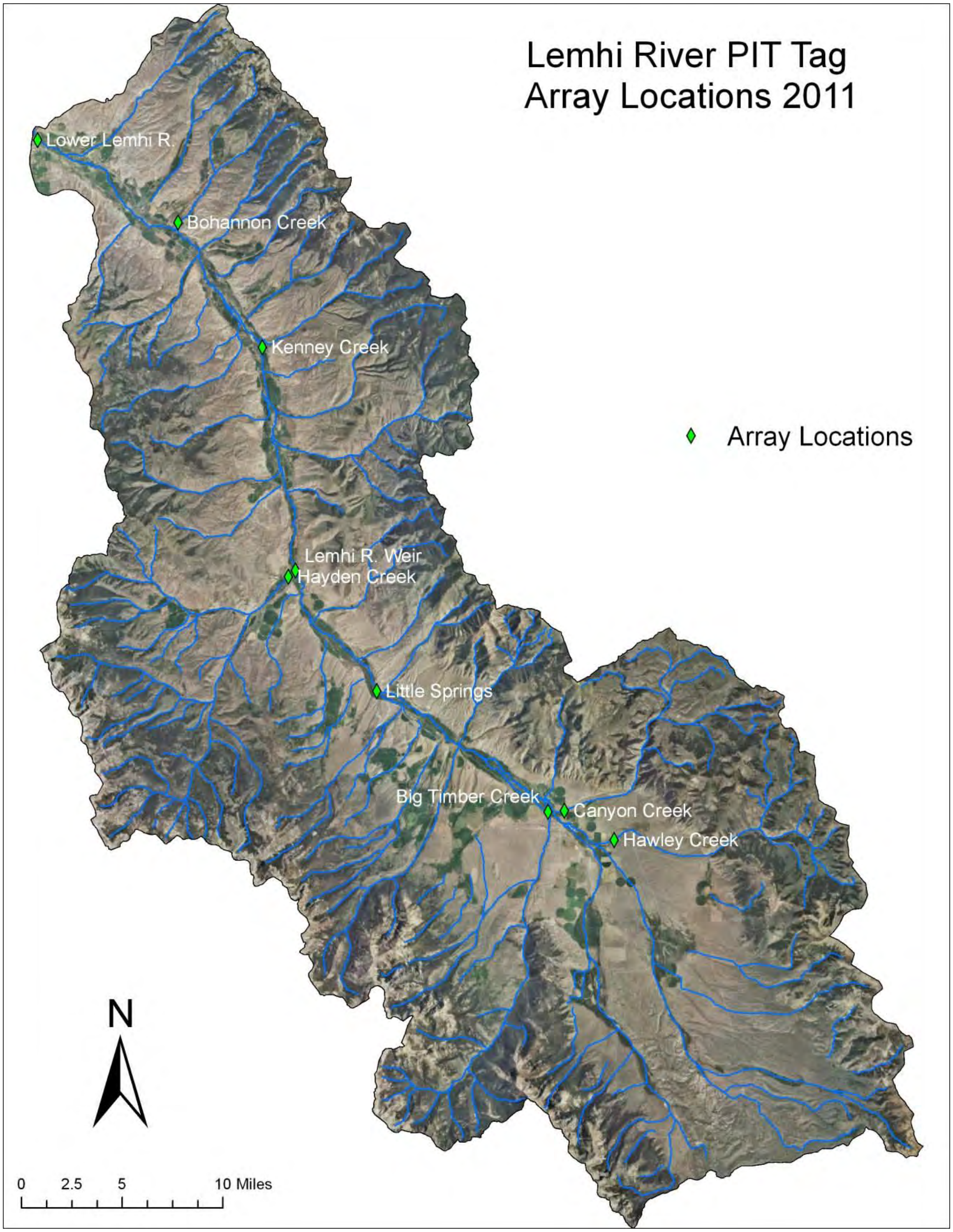

Figure 7. Map showing the locations of PIT tag arrays in the Lemhi drainage

Limiting Factors to be addressed

Agricultural development has affected the hydrology of the Lemhi River watershed. Because annual precipitation in the valley floor is less than 10 inches, crop production requires the diversion of surface water from the mainstem and tributaries for irrigation. Irrigation withdrawals in tributaries often exceed summer stream flows, resulting in complete dewatering in their lower reaches and loss of habitat connectivity between tributaries and the Lemhi River. Some irrigation structures block fish migration irrespective of the amount of flow available. Of the 31 tributaries to the Lemhi River, all but two have been functionally disconnected from the mainstem during part or all of the irrigation season (generally 1 April – 15 November) since water development began over 100 years ago. Hayden Creek and Big Springs Creek have remained connected. In some tributaries, water withdrawals may not entirely dewater a stream reach, but flows are reduced during certain periods of the irrigation season to a level that effectively create either a thermal or hydraulic barrier to certain life stages of fish. Thus, adult anadromous and stream resident/fluvial salmonids are unable to access high quality habitat for spawning and rearing. Mainstem flow, which is important for spawning and rearing, is reduced in the Lemhi River and thus thermal refugia are unavailable to or significantly reduced for salmonids in the mainstem river during summer. This negatively affects three important criteria that are necessary for their persistence: 1) abundance, 2) productivity, and 3) spatial distribution.

The effects of isolated tributary habitat on the distribution and abundance of salmonids in the Lemhi sub-basin are well documented. Currently, Chinook salmon production is limited to the upper Lemhi River and in Hayden Creek even though several other tributaries contain high intrinsic spawning potential for Chinook salmon. A fluvial trout distribution study implemented by the IDFG in the Lemhi sub-basin documented large bull trout tagged with radio transmitters migrating exclusively into the Hayden Creek watershed to spawn.

Abundance of resident/fluvial westslope cutthroat trout have declined dramatically in the Lemhi River and the lack of tributary habitat available is a suspected cause. Furthermore, it has been suggested that juvenile survival has been affected in the mainstem, in part because tributary flows have been altered. High volume flows necessary for maintaining the complexity of stream channels, removing fine sediments, and providing loose gravels for spawning are no longer available.

Restoration actions

Considerable planning has identified issues and prescribed mitigation actions for reconnecting Big Timber and Kenny creeks. For example, in 2005, the Idaho Fish and Game Department (IDFG), working collaboratively with the Upper Salmon Basin Watershed Project (USBWP) Technical Team, developed an extensive reconnect plan for Big Timber Creek that identifies fish migration barriers (e.g. diversion structures and dewatered stream reaches) and prescribes strategies to remove or modify these barriers. Similar planning has been done for other tributaries planned for reconnection, namely Canyon Creek and Little Springs Creek.

Experimental Design

The protocol described for the ISEMP Project is being used to effectively monitor the proposed habitat actions (Quantitative Consultants 2005). The ISEMP project has been integrated with the ongoing IMW project. The study design was developed specifically for the Lemhi Habitat Conservation Program. A summary description from Quantitative Consultants (2005) is provided below.

The primary goal of the ISEMP Project is to identify and quantify the effects of habitat modifications on the productivity and survival of focal anadromous and resident salmonids within the Lemhi watershed. The species targeted for improved productivity include Chinook salmon, steelhead, bull trout, and resident/fluvial rainbow trout and cutthroat trout. However, there are numerous obstacles to directly quantifying the effects of habitat restoration on these vital rates. For example, even significant increases in the abundance and quality of freshwater habitat may not result in quantifiable changes in juvenile abundance if out-of-subbasin mortality limits the number of spawning adults, and therefore mutes the response in juvenile abundance. Thus, this experimental framework includes the following components:

1. A watershed model that evaluates productivity and carrying capacity by life-cycle stage as a function of habitat availability and quality, and then simulates expected life-stage specific benefits from increased habitat availability or quality.
2. Reach-specific empirical measures of juvenile productivity, survival, and condition to determine whether tributary reconnection has provided high quality habitat that benefits fish vital rates (survival, growth etc.).
3. Measures of the movement and distribution of anadromous and resident fish to address the following questions:
    a) Are anadromous fish utilizing newly available habitat?
    b) Have the reconnections changed the distribution and connectivity of resident fish?

Thus, the experimental framework enables a quantitative evaluation of the potential benefits of habitat actions, using both coarse (e.g. Geographic Information Systems (GIS) based) or fine scale (e.g. reach) scale habitat measures. Secondly, the framework provides a robust design enabling an empirical evaluation of changes in juvenile survival, abundance, and condition while simultaneously providing key data classes for the habitat model (and employed to increase the reliability of coarse scale (i.e. GIS) measures). Finally, the framework enables an evaluation of population distribution and connectivity, which although difficult to assign a survival or productivity value, affects spatial structure, resilience, and diversity. The model can be used to determine the minimum change that would be necessary to return a significant empirical result, and likewise can determine how much change could occur without triggering a significant result. In short, we will know how effective habitat actions were at increasing the abundance and overall quality of habitat, the expected value of the habitat changes as a function of fish vital rates, the empirical response in fish vital rates, and the probability that the changes in vital rates would be detectable given the precision that accompanies various estimators.

The design is based on a model (Sharma et. al. 2005) designed to assess changes in habitat complexity and the affect it may have on fish productivity. Essential to the model are two components - habitat quality and quantity. These can either be quantified through GIS data, empirical data gathered in the field in relation to changes in some habitat attribute, or preferably a combination of the two. As applied here, coarse scale GIS-based habitat data are used to:

1. prioritize habitat actions when more detailed reach specific habitat data are not available;
2. predict the spatial extent and effect size of individual and aggregated habitat actions; and
3. apply randomized sampling to complement existing fixed sampling locations.

Empirical fish vital rate and habitat data will be used to:

1. measure habitat quality and quantity at reach (or tributary) scales;
2. validate GIS-based predictions of habitat quantity and quality; and
3. scale anticipated affect sizes to inform sampling intensity.

Response measures that will be monitored for these projects include adequate passage flows, the amount of wetted area provided by the target flow, the response of the riparian community, and changes in stream temperature. Fish response will include distribution of anadromous and resident/fluvial fish, survival, size and age distribution (mainly resident/fluvial trout), and abundance.

Refer to Appendix B, Integrated Status and Effectiveness Monitoring Project: Salmon Subbasin 2010 Annual Report for more detailed information on ISEMP methodology, relationship to IMW, and analysis.

** Number of years of pre-treatment fish and habitat data collections and the habitat protocols used (i.e. PIBO, AREMP, EMAP, CHAMPS, ODFW, TFW and others).*

The number of years of pre-treatment fish and habitat data collection varies by tributary or habitat improvement project area, mostly based on the timing of the habitat action (tributary reconnects) and the number of years that the IMW and ISEMP projects have been funded. For Kenney and Big Timber creeks, fish data collections started in 2008 and these surveys provide 3 years of pre-treatment fish data. Two years of pre-treatment fish data exists for Canyon Creek, Lemhi Little Springs, and Bohannon Creek. Two years of roving fish data also exist for Hayden Creek (the control stream).

Rotary screw traps provide longer-term data sets for juvenile salmon and steelhead abundance and migration timing in the Lemhi watershed. Screw traps are located downstream of all current Chinook salmon spawning areas. The Hayden Creek rotary screw trap was installed in the fall of 2006. The L3A rotary screw trap in the lower Lemhi River was installed in 2004. The Idaho Supplementation Studies (ISS) screw trap in the upper Lemhi (above Hayden Creek) provides data back to 1994.

Pre-treatment Chinook salmon redd count data exists for the Lemhi River back to 1992. Chinook salmon redd count data for Hayden Creek dates back to 1998. Steelhead and bull trout redd count data is also available in the Kenney, Big Timber, and Hayden drainages since 2008.

All habitat surveys are currently being done by the ISEMP crews. Habitat surveys started in 2009 using the PIBO protocol and provide 2 years of pre-treatment data. In 2011, ISEMP habitat sampling protocols converted to CHaMP. The collaboration between IMW and ISEMP in the Lemhi is an important component to current and future fish and habitat monitoring efforts. IMW is largely focused on sampling fish populations with an ISEMP field crew, while another ISEMP crew conducts habitat surveys. Multiple field crews significantly increases the number of sites that are sampled and enhances the ability of both projects to meet sampling objectives.

** A description of whether the locations where habitat transects are being measured are also being measured for salmonid densities.*

Yes, almost all roving fish survey sites have concurrent habitat surveys following CHaMP protocol are being done with the goal to relate fish densities with specific habitat characteristics. Results will guide future habitat actions by assessing the potential benefits of the action to fish populations.

** Number of years of completed habitat restoration treatments and the percentage of habitat restorations completed compared to the number estimated to be needed to be able to detect changes in fish abundance.*

In the IMW statement of work, these projects aimed at improving fish passage and reconnecting tributaries were to be the focus of the IMW fish monitoring efforts in the Lemhi River drainage:

1. L63 Siphon (OSC # 035 05 SA) – modify the L63/Big Timber Creek intercept. Project completed in 2010.

2. Highway 28 culvert replacement (OSC # 038 05 SA) – replace the existing culvert at the junction of Hwy 28 and Big Timber Creek with a fish friendly structure. Project completed in 2009.

3. Big Timber #2 diversion Modification (OSC # 036 05 SA) – modify the Big Timber Creek #2 diversion to provide fish passage (ongoing). Project has not been completed due to landownership.

4. Big Timber Reconnect & Upper Lemhi Flow Improvement (OCS # 007 06 SA) – provide 4.5 cfs to previously dewatered segments of Big Timber Creek and eliminate a diversion blocking fish passage to Canyon Creek. Project completed in 2010.

5. Little Spring Creek Pond Improvement – Construct a new spring channel to redirect 100% of spring flow around the pond and directly to Little Springs Creek to decrease water temperature entering Little Springs Creek. Project completed in 2010.

6. Canyon Creek Riparian Restoration – Remove unnatural, elevated stream bank, plant stream corridor with native willows, and construct riparian fencing all along 0.63 miles of stream. Project completed in 2011.

7. Canyon Creek Reconnect – Provides 4cfs year round minimum flow to reconnect Canyon Creek to the Lemhi River. Project completed in 2011.

8. Improve Flow in Big Timber Creek 1.4 – Provides an additional 1.4 cfs flow to lower Big timber Creek, bringing the total flow to ~ 6cfs. This additional flow results in a functional reconnect of Big Timber Creek. Project completed in 2011.

9. Kenney Creek Reconnect – Provides 4cfs year round minimum flow to reconnect Kenney Creek to the Lemhi River. Project completed in 2011.

10. Bohannon Creek Diversion consolidation, removal of fish passage barriers, increased flow – Provide additional flow to reconnect Bohannon Creek to the Lemhi River (2012 implementation).

11. Little Spring Creek Stream Channel Restoration – Create a functional spring creek channel, improve sinuosity, add channel complexity (project starting in late summer 2012)

The power to detect changes in Chinook salmon production resulting from tributary reconnects was estimated using the equation (from Parkinson et al. 1988):

$N = 100^2 k(SD/\overline{X})^2/p^2$,

Where N = required sample size (years) to detect a difference,

K = k value for a given value of α and β for one-tailed t-tests (Table 3).

SD = Standard Deviation of the mean.

$\overline{X}$ = Mean fish production.

P = Detectable change expressed as a percent of the mean.

Power analysis was conducted to estimate the time required to detect a given increase in fish production resulting from tributary reconnect projects. For the purpose of this analysis, we chose a 20% and a 50% increase in juvenile Chinook salmon production as the detectable levels of change.

We used an $\alpha = 0.10$ and a $\beta = 0.20$ (Power = 80%). The equation above resulted in a value of 5.1 years required to detect a 20% increase in juvenile Chinook salmon production under the current sampling design and 1 year to detect a 50% increase in production.

We compared juvenile Chinook salmon migration estimates and available habitat from the Lemhi River and Hayden Creek (control stream) to the potential change in production of juvenile Chinook salmon from reconnected streams in the Lemhi River watershed. In order to categorize streams based on habitat availability and quality, we used the habitat quality (potential) classifications by SHIPUSS (2005). SHIPUSS (2005) categorized streams into high (no major limiting factors and supports all expected life stages of historical species), medium (minor problems, but not severely limiting), and low (severely limiting or only supports one life stage) categories. For this analysis, if habitat quality was high we multiplied the total mainstem stream kilometers (km) by 75% to determine total amount of habitat available, if medium we used 50%, and if low we used 25% to determine total useable fish habitat. For example, the mainstem of Hayden Creek is 39.9 km long and is categorized as high thus producing an estimated useable habitat area of 29.9 km (0.75 X 39.9) (Table 7).

Work has been completed to reconnect three tributaries (Big Timber Creek, Kenney Creek, and Canyon Creek). Connecting these three tributaries would add 35.3 km (41.9% increase) of useable Chinook salmon spawning and rearing habitat (Table 8). Assuming similar habitat quality and production potential from these tributaries as is currently seen in Hayden Creek (313 juvenile Chinook salmon/km) we would expect to see an increase of approximately 11,000 juvenile Chinook salmon. This represents a 65.4% increase in overall juvenile Chinook salmon production (from 16,885 to 27,928 fish). If we assume a similar production level as is currently seen for the entire drainage (201 juvenile Chinook salmon/km), we would expect to see an increase of approximately 7,000 juvenile Chinook salmon (a 41.9% increase from 16,885 to 23,957 juveniles produced).

Therefore it is reasonable to expect that the current sampling design will be able to detect modest increases in juvenile Chinook salmon production resulting from reconnecting tributaries to the Lemhi River. We anticipate increased levels of precision and reduced variation in our production estimates in the future as monitoring efforts intensify. We will be able to partition Hayden Creek production from mainstem Lemhi River production and other tributary production as these tributaries get reconnected because they will be monitored with screw traps and PIT tag arrays. This will result in increased power to detect changes in juvenile Chinook salmon production.

Table 7. Juvenile Chinook salmon production estimates for the Lemhi River. Numbers are based on screw trap estimates of outmigrating juvenile Chinook salmon (fry, parr, presmolt, and smolt).

Stream Name	Sample Size (years)	Mean Total Production (95% CI)	Standard Deviation	Useable Habitat (Km)	Mean Juvenile Density (#/km)
Lemhi River (w/ Hayden Creek)	2	16,885 (13,827-20,903)	2,547	84.2	201
Hayden Creek	1	9,368 (8,766-10,057)	---	29.9	313

Table 8. Estimated juvenile Chinook salmon production potential after tributary reconnection to the Lemhi River.

Tributary	Useable Habitat (Km)	Estimated Production (based on 313 fish/Km)	% increase in production	Estimated Production (based on 201 fish/Km)	% increase in production
Canyon Creek	11.6	3,631	21.5	2,326	13.8
Big Timber Creek	14.0	4,383	26.0	2,807	16.6
Kenney Creek	9.7	3,029	17.9	1,939	11.5
Total	35.3	11,043	65.4	7,072	41.9

In summary, the three tributary reconnects used in this analysis have been completed and the monitoring infrastructure is in place to determine if fish utilize or access these tributaries. The one exception to this is the Big Timber Creek modification to diversion #2. This project is not likely to be completed in the immediate future due to landownership. However, the completed projects in Big timber Creek allow anadromous and resident fish access to the lower two miles of Big Timber Creek.

** A summary of fish abundance trends (adult spawners and juvenile migrants) for target species since the project began and whether they correlate with habitat improvements.*

Fish abundance trends are being monitored using rotary screw traps, roving fish and habitat surveys, PIT tag arrays, and redd counts. Rotary screw traps provide juvenile salmon and steelhead migration abundance estimates, migration timing, and survival estimates between critical reaches and to Lower Granite Dam. Roving fish surveys allow PIT tagging of juvenile fish to monitor fish movement patterns and to collect data on age structure, survival, growth, abundance, and distribution of fish populations in priority tributaries. Adult escapement estimates for Chinook salmon and steelhead are a combination of juvenile PIT tagging in the Lemhi subbasin, adult PIT tagging by ISEMP crews at Lower Granite Dam, and detections at PIT arrays as adults enter the Lemhi River.

Brood year juvenile Chinook salmon out-migration abundance estimates range from 9,368 (95% CI, 8,766-10,057) to 24,033 (95% CI, 20,215-29,546) from Hayden Creek (Table 9). For the L3A screw trap, brood year juvenile Chinook abundance estimates vary from 7,656 (95% CI, 6,318-9,426) to 21,001 (95% CI, 18,581-23,548) (Table 10). Hayden Creek rainbow trout/steelhead abundance estimates range from 8,733 (95% CI, 6,604-12,175) to 17,580 (95% CI, 13,282-23,325) (Table 11). Rainbow trout/steelhead abundance estimates from L3A range from 19,530 (95% CI, 15,439-24,088) to 37,170 (95% CI, 26,540-57,938) (Table 12). Low mark-recapture rates from the L3A screw trap result in poor fish abundance estimates, so trap operations will be significantly reduced to minimize equipment and personnel costs for operating this trap in the future. Migration abundance estimates for juvenile Chinook salmon and steelhead from the ISS Lemhi River weir screw trap was not included in this report.

Results from survival estimates show juvenile Chinook salmon smolts survive on average about 40% higher rate than presmolts from the Hayden Creek and L3A screw traps to Lower Granite Dam (Figures 8 and 9). Approximately 90-95% of juvenile Chinook salmon out-migrate in the fall as presmolts in the Lemhi subbasin, while the remaining 5-10% out-migrate during the spring as smolts. Travel time estimates between screw traps and Lower Granite Dam vary little between brood year presmolts and also between brood year smolts (Figures 10 and 11).

Annual redd counts for Chinook salmon show a similar trend between Hayden Creek and the Lemhi River. Total number of Chinook salmon redds observed declined after 2001-2002, but higher redd counts have been observed since 2008 (Figure 12). Juvenile Chinook salmon production per redd can be estimated by combining data from both redd counts and rotary screw traps. Results suggest Hayden Creek produces on average 3-6 times the number of juveniles per redd than the upper Lemhi River produces (Figure 13). However, the upper Lemhi River produces larger sized juvenile fish that likely have significantly higher downriver survival rates. Analysis of fish size and survival comparisons of juvenile Chinook salmon between Hayden Creek and Lemhi River is ongoing but haven't been completed in time for this report.

Analysis of the roving fish survey data have not been completed. However, preliminary results are shown in figures (Figures 14 and 15) and tables (Tables 13-17). Population estimates for the 2010 roving surveys and fish population estimates using both roving surveys and detections at PIT tag arrays have not been completed in time for this report.

Eight PIT tag arrays have been installed and are operating in the Lemhi subbasin. PIT tag arrays are being used with adult and juvenile PIT tagging to estimate adult escapement, juvenile abundance, survival, and growth at the reach and population scales. Adult escapement estimates for spring/summer Chinook salmon and steelhead are being estimated by combining adult PIT tagging at Lower Granite Dam and subsequent detections at PIT tag arrays (Table 18).

It's too early in the IMW project to estimate if fish abundance trends are directly correlated with any habitat actions. High water years have likely contributed to increased fish passage and improved fresh water survival rates the last few years, which may result in increased adult spawner and juvenile abundance. For example, last year an upstream shift in distribution of Chinook salmon redds in the upper Lemhi River was documented (Figure 16). Is this shift due to increased flow from Big Timber and Canyon creeks or due to a good water year?

This project is beginning to see results. This project has documented juvenile outmigration and adult escapement of steelhead into Big Timber Creek. A PIT tagged juvenile steelhead from Big Timber Creek was detected at Little Goose Dam in 2010 and a returning adult steelhead PIT tagged at Lower Granite Dam was detected at the Big Timber Creek array in 2011. Also, two juvenile Chinook salmon were captured in Canyon Creek in 2011. Juvenile Chinook salmon haven't been documented in Canyon Creek since the 1990's. However, it is important to note that as tributaries are reconnected, the first response will be for fish to redistribute into the newly accessible habitat. Determining whether or not this redistribution results in an overall increase in fish production and productivity will take much longer to document.

Table 9. Migration estimates of brood year juvenile Chinook salmon at the Hayden Creek screw trap.

			Abundance				
Brood Year	No. of redds	No. of redds/km	Estimate	Lower 95% CI	Upper 95% CI	SE	Juveniles/spawner
2006	13	1.3	9,368	8,766	10,057	328.8	328
2007	31	0.4	24,033	20,215	29,546	2320.7	352
2008	9	0.7	11,731	10,368	13,012	670.1	314
2009	17	1.6	18,262	16,385	20,604	1097.3	224

Table 10. Migration estimates of brood year juvenile Chinook salmon at the L3A screw trap.

	Abundance			
Brood Year	Estimate	Lower 95% CI	Upper 95% CI	SE
2004	17,728	14,356	21,874	1907.8
2005	16,042	13,297	19,932	1693.4
2006	7,656	6,318	9,426	783.8
2007	21,001	18,581	23,548	1282
2008	16,298	14,126	18,909	1208.4

Table 11. Migration estimates of juvenile steelhead at the Hayden Creek screw trap.

	Abundance			
Calendar Year	Estimate	Lower 95% CI	Upper 95% CI	SE
2009	17,580	13,282	23,325	2675.6
2010	8,733	6,604	12,175	1443.5
2011	10,038	6,848	16,202	2491.1

Table 12. Migration estimates of juvenile steelhead at the L3A screw trap.

	Abundance			
Calendar Year	Estimate	Lower 95% CI	Upper 95% CI	SE
2009	19,530	15,439	24,088	2187.3
2010	37,170	26,540	57,938	7770.8
2011	28,012	20,922	38,750	4841.6

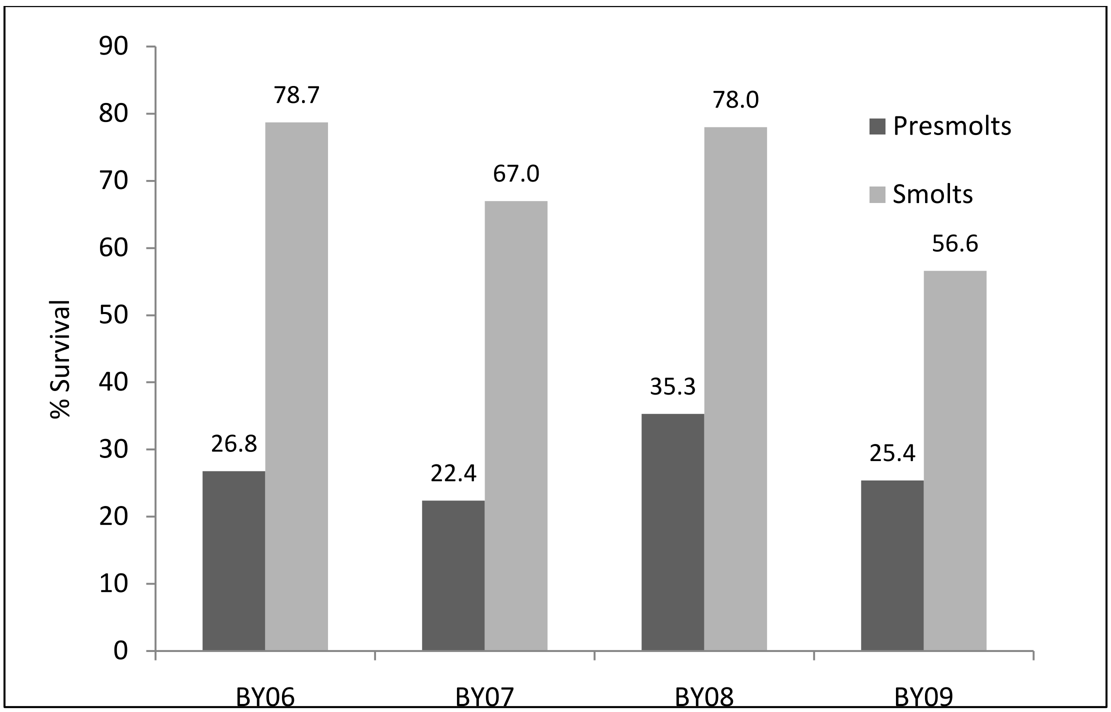

Figure 8. Survival estimates of brood year juvenile Chinook salmon from the Hayden Creek screw trap to Lower Granite Dam.

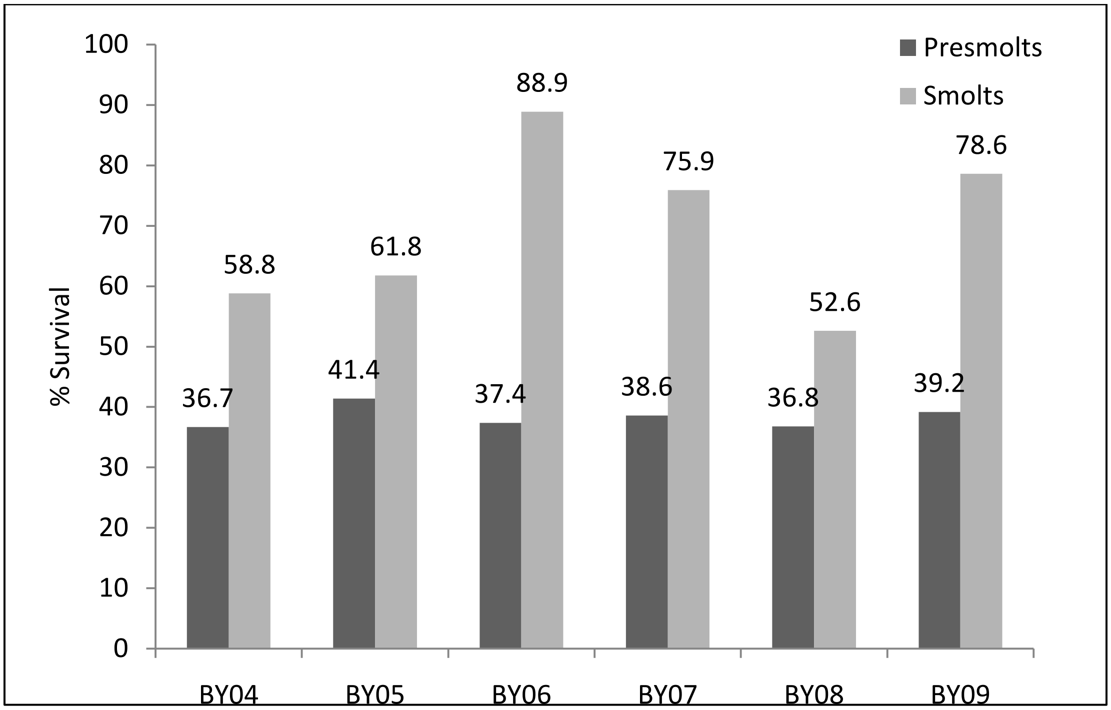

Figure 9. Survival estimates of brood year juvenile Chinook salmon from the L3A screw trap to Lower Granite Dam.

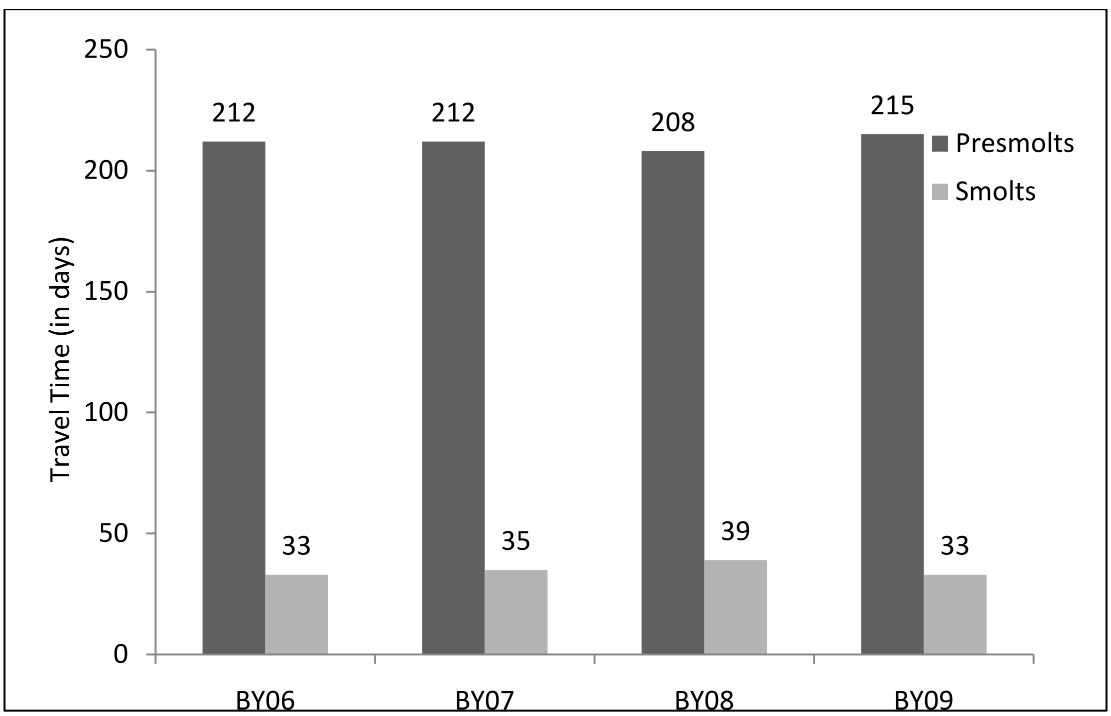

Figure 10. Travel time of brood year juvenile Chinook salmon from the Hayden Creek trap to Lower Granite Dam.

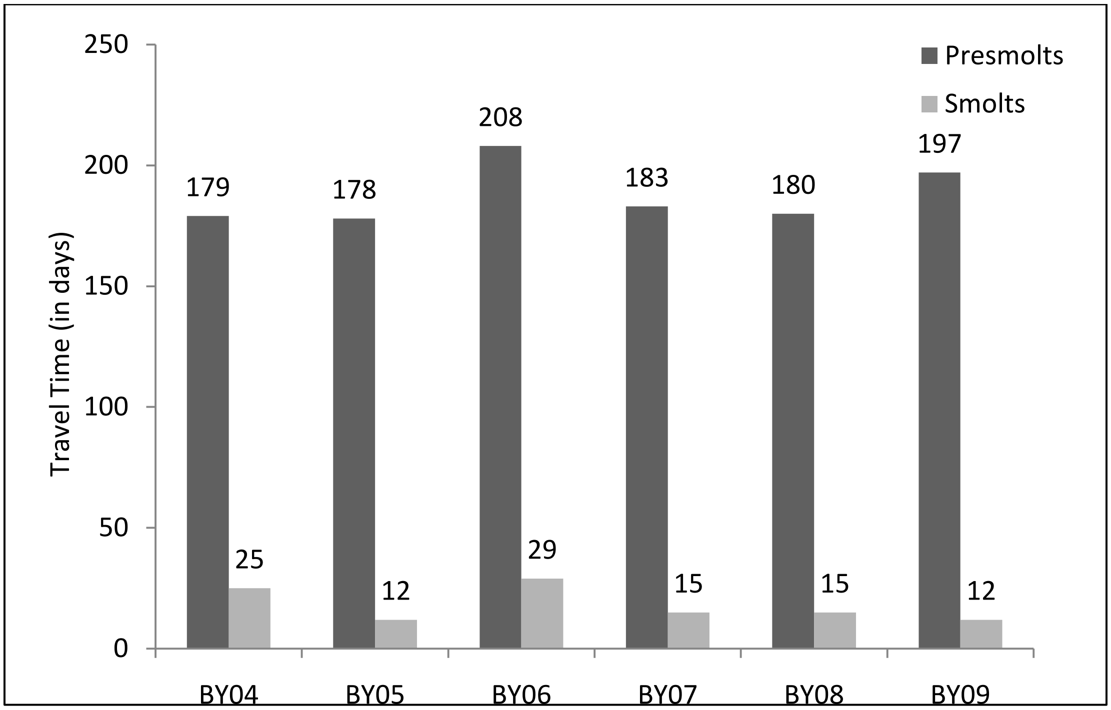

Figure 11. Travel times of brood year juvenile Chinook salmon from the L3A trap to Lower Granite Dam.

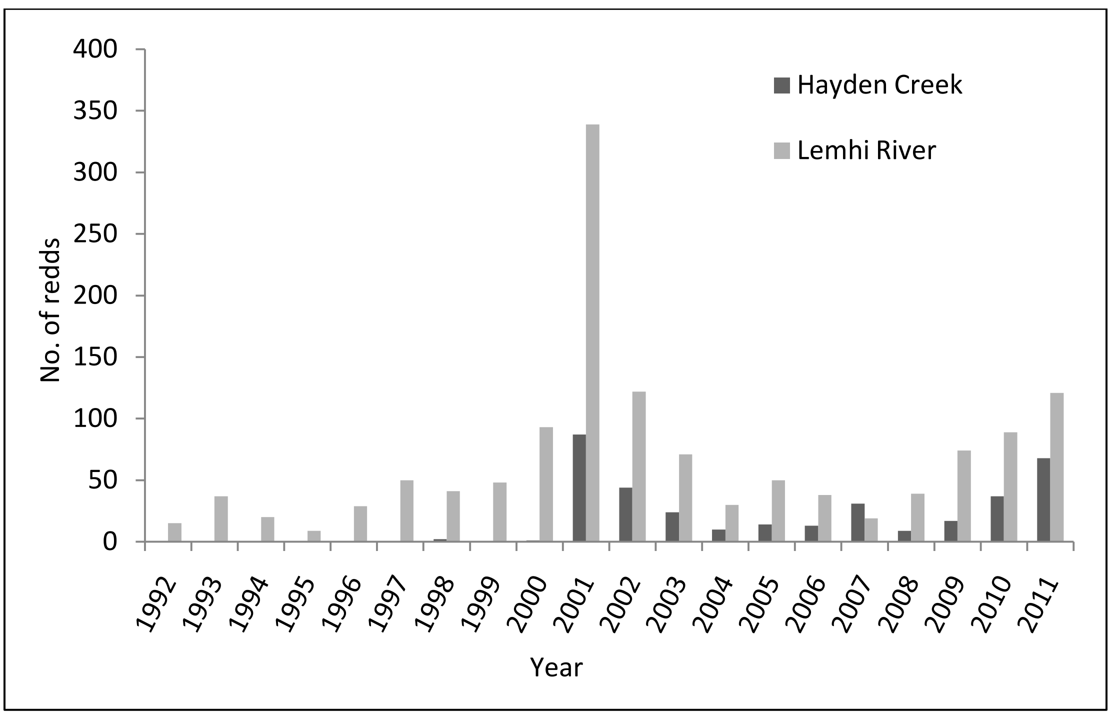

Figure 12. Summary of Chinook salmon redds for Hayden Creek and Lemhi River.

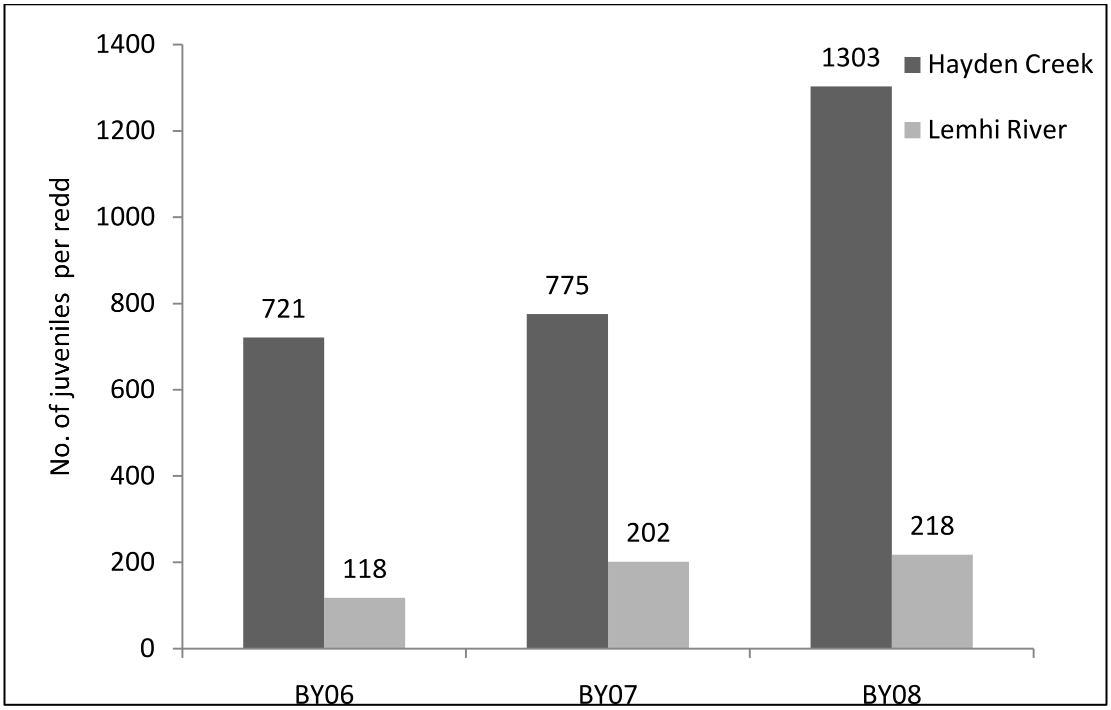

Figure 13. Number of brood year juvenile Chinook salmon produced per redd from Hayden Creek and the Lemhi River.

Table 13. Summary of roving PIT tagging effort by stream or drainage since 2008.

		PIT tagging by fish species			
Stream or drainage	Total no. of fish PIT tagged	Rainbow trout/steelhead	Chinook salmon	Cutthroat trout	Bull trout
Big Timber	723	622		58	51
Bohannon	165	126		1	37
Canyon	430	413	2	13	2
Hayden	1542	699	610	5	228
Kenney	695	533		103	59
Lemhi R.	4484	2536	1937		11
Little Springs Creek	33	33			

Table 14. Summary of PIT tag array detections from fish released from roving surveys.

		No. of unique detections of roving survey tagged and released fish			
Array	Total no. of PIT tagged fish released upstream of array	Rainbow trout/steelhead	Chinook salmon	Cutthroat trout	Bull trout
Big Timber	723	32			
Bohannon[c]	165				
Canyon	430	6			
Hayden	1542	110	137	1	14
Kenney	695	53			
Lemhi R. (weir)	5084 [a]	135	138		2
Lower Lemhi R. (LLR)[b]	8672 [b]	24	30		5
Little Springs Creek	33	2			

[a] Includes fish tagged and released in Big Springs and Little Springs.

[b] Includes all fish tagged and released from roving surveys.

[c] Site installed in November 2011.

Table 15. Salmonid species, number of fish observed, mean total length (mm), and size range (total length mm) for streams in the Lemhi River subbasin.

Stream	Year	No. Fish Observed	Salmonid Species[a]	Mean Total Length (mm)	Size Range (Total Length mm)
Bear Valley	2009	114	BU	173.6	60-550
	2011	49	BU	204.4	71-650
	2009	2	CT	197.5	180-215
	2011	1	CT	197	197
	2009	1	RBT	245.0	245
Big Timber	2009	55	BU	186.0	89-288
	2009	5	CT	154.0	134-196
	2009	182	RBT	167.0	72-296
	2011	69	RBT	145.4	85-252
	2011	21	EBT	175.4	145-241
Bohannon	2011	35	BU	150.7	59-209
Buck	2009	8	CT	165.4	90-240
	2009	2	RBT	215.5	196-235
Canyon	2009	1	CT	223.0	223
	2009	4	EBT	182.3	147-219
Canyon	2009	1	CT	223.0	223
	2009	4	EBT	182.3	147-219

Table 15 continued.

Stream	Year	No. Fish Observed	Salmonid Species[a]	Mean Total Length (mm)	Size Range (Total Length mm)
Cruikshank	2009	135	RBT	136.6	52-220
	2009	27	CT	131.1	62-225
Deer	2009	28	BU	170.2	85-255
	2009	5	CT	113.0	90-135
	2009	5	EBT	138.0	125-140
EF Bohannon	2011	6	BU	154.2	92-260
	2011	1	RBT	182.0	182
EF Hayden	2009	58	BU	176.5	60-349
	2009	8	CT	216.8	100-250
Ford	2009	8	CT	156.3	130-185
Frank Hall	2009	36	CT	113.9	70-195
Hayden	2009	84	BU	189.4	68-700
	2011	69	BU	191.2	59-330
	2009	82	CK	89.9	46-112
	2009	12	CT	223.3	59-350
	2011	14	CT	168.3	96-262
	2009	309	RBT	127.4	48-284
	2011	1	RBT	267.0	267
Kadletz	2009	20	BU	138.0	110-225
	2009	3	CT	101.7	70-160
Kenney	2009	7	BU	145.6	59-182
	2011	57	BU	143.2	74-332
	2009	14	CT	122.1	58-208
	2011	46	CT	164.4	57-260
	2009	3	EBT	100.0	74-120
	2011	2	EBT	109.0	92-126
	2009	87	RBT	137.5	66-224
	2011	62	RBT	114.9	50-231
Little Springs	2009	8	RBT	172.9	120-285
	2011	6	RBT	283.7	198-376
MF Little Timber	2009	13	CT	145.0	85-235
NF Little Timber	2009	1	BU	210.0	210
	2009	16	CT	145.3	95-230
Tobias	2009	40	CT	138.3	50-200
Trail	2009	61	CT	106.7	51-195
	2009	17	CTxRBT	116.5	77-144
	2009	30	RBT	108.2	59-225
Wright	2009	140	BU	164.6	54-266
	2009	1	CT	190.0	190

[a] BU = Bull trout, CT = Westslope cutthroat trout, EBT = Brook trout, CTxRBT = Apparent cutthroat trout x rainbow trout hybrid, and RBT = Rainbow trout/steelhead. Does not include mountain whitefish.

Table 16. Fish sampled, population estimates with 95% confidence intervals (CI), and species composition for streams surveyed in 2011.

					Species composition (%)			
Stream	Transect[a]	Sample Date	No. Fish Sampled	Population Estimate (95% CI)	CT	RBT	BU	EBT
Bear Valley	L	07/25/2011	10	--			100	
	M	07/27/2011	16	--			100	
	M	08/02/2011	24	26 (19, 33)		4	96	
Big Timber	L	07/26/2011	38	40 (32, 48)				
	L	07/29/2011	52	44 (22, 66)		63		37
Bohannon	L	07/21/2011	89	92 (87, 97)		100		
	U	07/22/2011	35	35 (34, 36)			100	
EF Bohannon	M	07/19/2011	7	7 (6, 8)		14	86	
Hayden	M	08/11/2011	37	--	19	3	78	
	M	08/15/2011	47	49 (44, 54)	15		85	
Kenney	L	07/18/2011	52	53 (47, 59)				
	M	07/28/2011	64	64 (62, 66)	28	19	53	
Kenney	M	08/08/2011	51	51 (49, 53)	55		45	
Little Springs	M	07/12/2011	6	6 (4, 8)		100		

[a] L = Lower reach, M = middle reach, and U = upper reach.

[b] CT = Westslope cutthroat trout, RBT = Rainbow trout/steelhead, BU = Bull trout, CTxRBT = Apparent cutthroat trout x rainbow trout hybrid, EBT = Brook trout, CK = Chinook salmon, and BUxEBT = Apparent bull trout x brook trout hybrid.

Table 17. Fish sampled, population estimates with 95% confidence intervals (CI), and species composition for streams surveyed in 2009.

Stream	Transect[a]	Sample Date	No. Fish Sampled	Population Estimate (95% CI)	Species composition (%) CT	RBT	BU	CTxRBT	EBT	CK
Bear Valley	L	07/27/2009	59	--	1	2	97			
	M	08/03/2009	31	--	3		97			
	M	08/18/2009	27	29 (23, 35)		4	96			
Big Timber	L	08/25/2009	7	--		86	14			
	M	08/19/2009	13	13 (11, 15)		92	8			
	M	09/15/2009	62	66 (61, 72)		92	8			
	M	09/29/2009	59	72 (66, 78)		98	2			
	U	09/14/2009	49	53 (45, 61)	10	10	80			
	U	09/17/2009	52	55 (49, 61)		95	5			
Buck	L	08/05/2009	10	--	80	20				
Canyon	L	06/16/2009	15	19 (6, 32)		73			27	
	L	06/18/2009	26	27 (23, 31)		100				
	L	07/06/2009	43	43 (40, 46)		100				
	L	09/09/2009	55	59 (51, 67)		100				
	U	06/15/2009	0	--						
	U	09/24/2009	0	--						
Cruikshank	U	06/18/2009	27	29 (23, 35)	100					
EF Hayden	L	08/03/2009	66	72 (63, 81)	12		88			
Frank Hall	M	07/15/2009	37	48 (27, 69)	100					
Hayden	L	08/31/2009	76	--		67	4			29
	L	09/21/2009	133	--		68	9			23
	L	09/30/2009	183	--		84	2			14
	M	08/04/2009	55	--	18	2	73			7
	M	08/17/2009	8	--		37	63			
Hayden	M	08/18/2009	30	--		33	67			
Kenney	L	07/21/2009	36	38 (31, 45)		100				
	L	09/03/2009	55	--	1	93	2		5	
	M	07/22/2009	20	--	65	5	30			
Lemhi River	L	08/10/2009	2	--		100				
	L	08/17/2009	7	--		100				
	M	08/25/2009	17	--	5	65	24			6
	M	08/24/2009	23	31 (27, 35)		78	5			17
	M	09/22/2009	46	--		85	2			13
	M	09/28/2009	12	--		92	8			
	U	08/19/2009	17	--		100				
	U	08/19/2009	1	--		100				
Little Springs	L	06/11/2009	5	--		100				
	M	06/11/2009	3	--		100				
	U	06/11/2009	0	--						
Little Timber	M	08/01/2009	0	--						
MF Little Timber	M	10/05/2009	13	--	100					
NF Little Timber	M	10/26/2009	17	--	94		6			

Table 17 continued.

Stream	Transect[a]	Sample Date	No. Fish Sampled	Population Estimate (95% CI)	Species composition (%)					
					CT	RBT	BU	CTxRBT	EBT	CK
Tobias	L	09/23/2009	41	--	100					
Trail	L	07/14/2009	16	--	12	69		19		
	L	07/14/2009	31	32 (28, 36)	62	19		19		
	L	07/15/2009	36	--	76			24		
	L	10/28/2009	30	--	54	46				
Wildcat	L	07/03/2009	0	--						
	L	09/24/2009	0	--						
Wright	L	10/26/2009	32	--	4		96			
	M	07/28/2009	51	--			100			
	M	08/05/2009	66	79 (61, 97)			100			

[a] L = transect's lower reach, M = middle reach, and U = upper reach.

[b] CT = Westslope cutthroat trout, RBT = Rainbow trout/steelhead, BU = Bull trout, CTxRBT = Apparent cutthroat trout x rainbow trout hybrid, EBT = Brook trout, and CK = Chinook salmon.

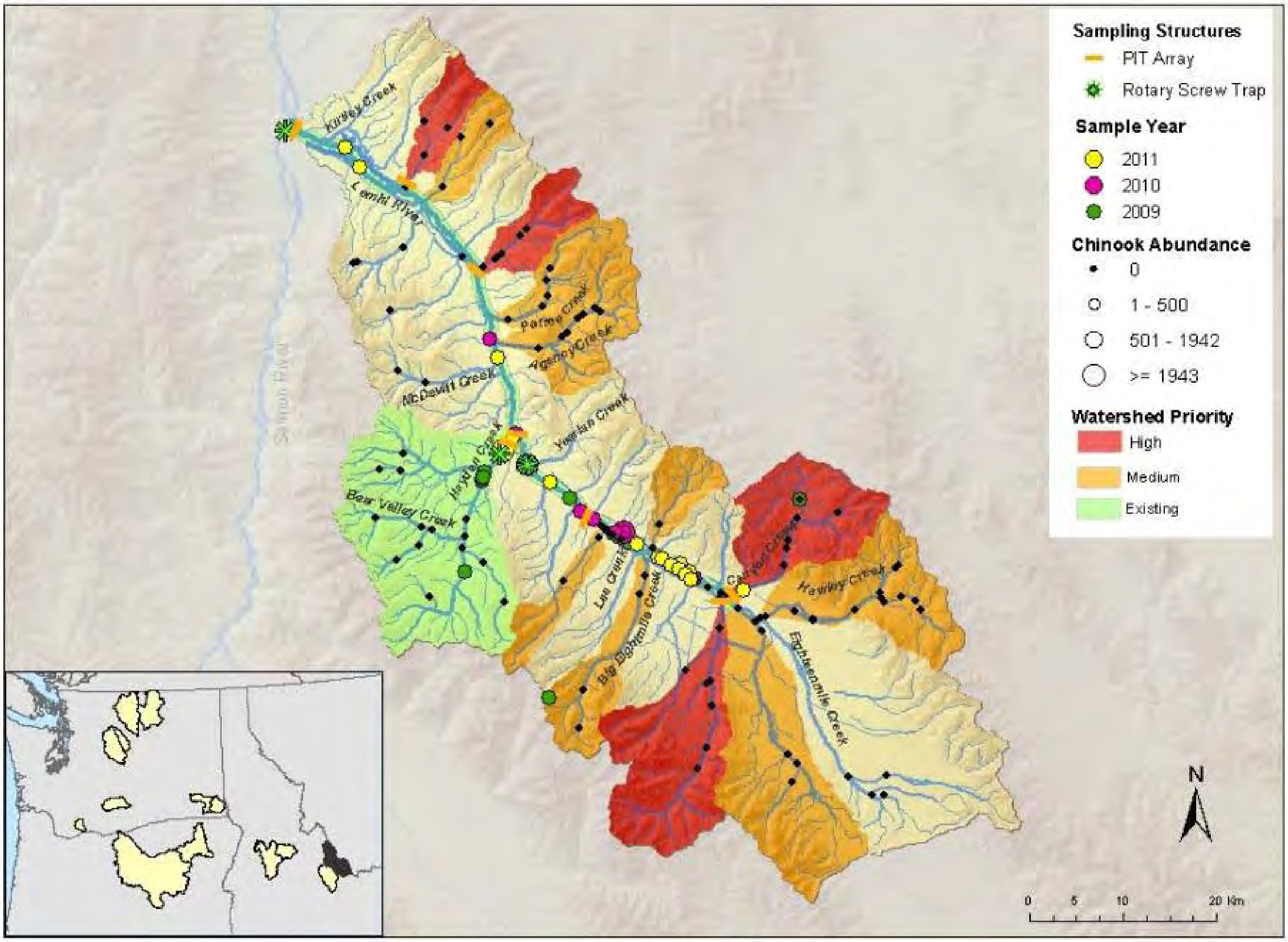

Figure 14. Location of juvenile sampling infrastructure and distribution and abundance of juvenile Chinook salmon obtained via remote juvenile surveys in the Lemhi River.

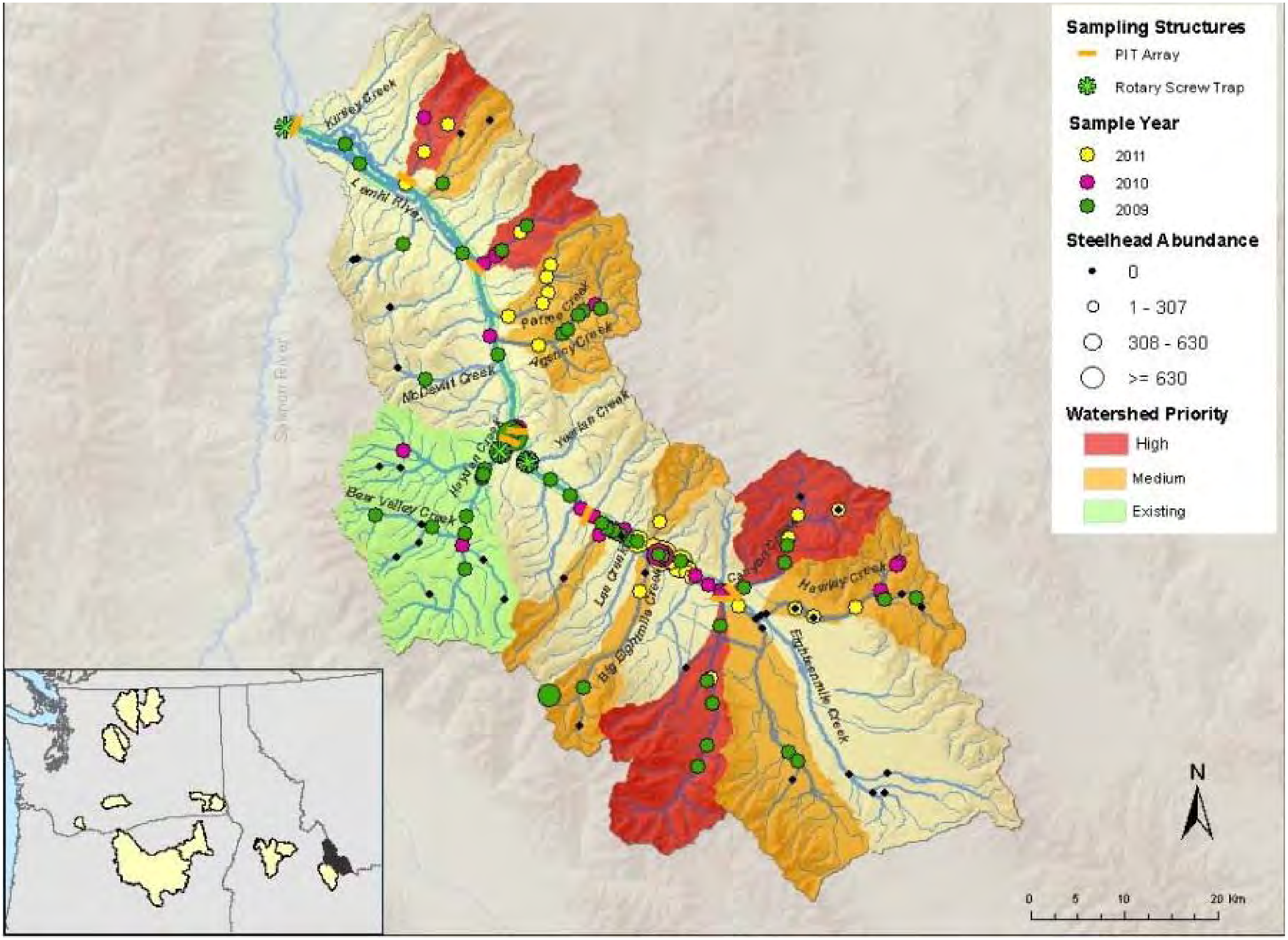

Figure 15. Location of juvenile sampling infrastructure and distribution and abundance of juvenile steelhead obtained via remote juvenile surveys in the Lemhi River.

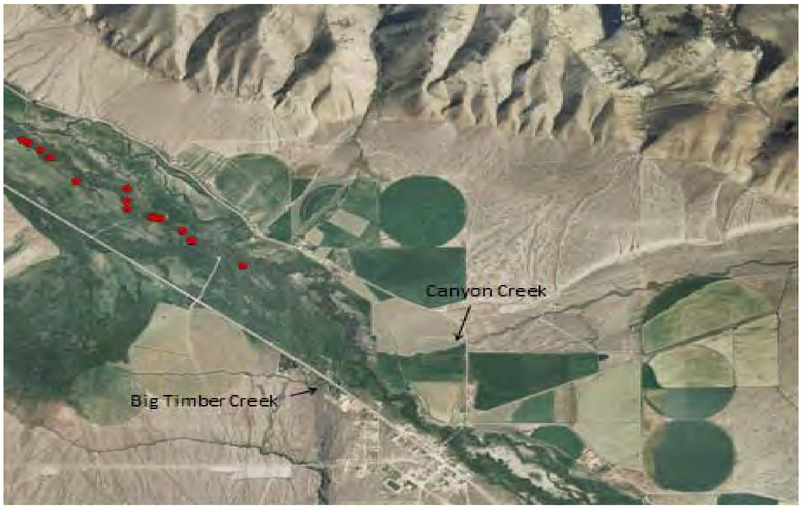

Figure 16. Locations of Chinook salmon redds in the upper Lemhi River for 2009 (top) and 2011 (bottom).

Table 18. Adult escapement estimates and 95% confidence intervals for steelhead and Chinook salmon into the Lemhi subbasin (Jody White-QCI, personal communication).

Species	Migration Year	Estimate	95% CI
Steelhead	2009-2010	630	455-928
	2010-2011	503	346-736
Chinook salmon	2010	262	243-281
	2011	337	380-560

<u> A summary of the results to date of any PIT tagging, radio tagging, or acoustic tagging underway.</u>*
PIT tagging- See the above question for results related to PIT tagging.

<u>Radio tagging</u>

Since 2008, a total of 43 adult Chinook salmon destined for the Lemhi subbasin have been radio tagged at the Lower Granite adult fish trap. Radio-telemetry is providing data on the movement, migration timing, and staging area selections of adult Chinook salmon. The telemetry study will describe important migration characteristics of adult Chinook salmon in the Lemhi River for the purpose of developing and implementing conservation actions designed to improve in-basin freshwater productivity. The objectives for this study include:

1. Determine adult Chinook salmon migration timing and success from Lower Granite Dam to spawning grounds in the Lemhi River watershed,
2. Identify stream flow and instream migration barriers in the Lemhi River watershed to guide project development for future habitat actions,
3. Monitor effectiveness of completed habitat actions on the mainstem river that were designed to improve stream flow and remove structural (i.e. irrigation diversion structures) migration barriers in the Lemhi River watershed,
4. Determine adult Chinook salmon distribution in the Lemhi River watershed.

Data on migration timing, distribution, and abundance of adult Chinook salmon in the Lemhi subbasin will guide the development and implementation of conservation actions designed to provide biologically sufficient migration conditions and improve spawning and rearing habitat. This study is also one of several steps necessary to monitor the effectiveness of ongoing conservation actions implemented in the Lemhi basin. Some of these actions are: 1) flow enhancement agreements in the lower Lemhi River to improve passage conditions into the basin, 2) improvements to irrigation diversions for the purpose of improving passage conditions and reducing entrainment, and 3) restoring connectivity between the Lemhi River and tributaries. Data gathered by this study will also steer an adaptive management program developed in the Lemhi subbasin.

In 2008, one adult Chinook salmon was radio tagged at Lower Granite Dam on June 14. This salmon was tracked manually via truck and foot upon arrival in the Salmon Region on July 3 in the North Fork area of the Salmon River. Tracking occurred on a daily basis until September 18th, when the carcass and tag were recovered shortly after spawning mortality. The single tagged fish staged for over a month in the Lemhi River, just above Hayden Creek, prior to moving into the spawning grounds in early September.

In 2009, 12 adult Chinook salmon were radio tagged at the Lower Granite Dam adult trap. Fish were radio tagged between May 9 and June 6. Nine of these fish originally PIT tagged as juveniles at the Lemhi weir screw trap, two at L3A trap, and one at the Hayden screw trap. A total of eight females and four males were radio tagged. Most of these fish staged in the upper section of the Lemhi River or in Hayden Creek. Only one fish staged in the Lemhi River downstream of Hayden Creek. Variation in travel time of Chinook salmon from Lower Granite Dam to the mouth of the Lemhi (541 RKM) was likely due to Salmon River flows in 2009. Fish radio tagged between May 9 and May 21, averaged 40 to 47 days (11.5 to 13.5 km/day) to reach the mouth of the Lemhi River. Fish tagged and release or recaptured during June, took 24 to 25 days (21.6 to 22.5 km/day) to reach the Lemhi River mouth.

Fifteen adult Chinook salmon, destined for the Lemhi subbasin, were radio tagged at Lower Granite Dam Adult Trap in 2010. Fish were radio tagged between May 3 and May 29. Nine of these fish were originally PIT tagged as juveniles at the Lemhi weir screw trap, 2 at L3A trap, and 4 at the Hayden screw trap. All fish were tagged during May and we saw little variation in travel time of returning adult Chinook salmon from Lower Granite Dam to the mouth of the Lemhi River (a total of RKM 541 from Lower Granite Adult Fish Trap). Nine radio tagged fish took 29 to 43 days (average of 12.6 to 18.7 km/day) to reach the mouth of the Lemhi River in 2010. However, one fish took 69 days (average of 7.8 km/day) to reach the Lemhi River. It is possible this fish migrated at a slower rate and was eventually delayed by increased spring flows in the Salmon River. The rest of the fish had already entered the Lemhi River prior to high flow events in the Salmon and Lemhi rivers. Upon arrival to the Lemhi River, adult salmon displayed variability in their movement patterns and staging area locations (Figure 17). Results suggest that 1) arrival time to the mouth of the Lemhi was similar for fish tagged throughout May 2010, 2) adults migrated to their staging areas soon after entering the Lemhi, and 3) staging areas were in close proximity to spawning areas, 4) rate of fish movement (km/day) significantly decreases when fish enter the Lemhi River. Once fish entered the Lemhi River in 2010, the results are similar compared to 2009 tracking results likely due to the second consecutive year of high water in the Lemhi subbasin. Higher flows the last two years has likely aided fish passage and reduced or eliminated any migration and temperature barriers for Chinook salmon in the Lemhi River.

Fifteen adult Chinook salmon were radio tagged at Lower Granite Dam Adult Trap in 2011. Fish were radio tagged between May 10th and May 29th. Ten of these fish originally PIT tagged as juveniles at the L3A rotary screw trap, 4 from the Hayden screw trap, and 1 unknown origin Wild Chinook salmon that was mistakenly radio tagged at Lower Granite. For 2011, only four radio tagged fish returned to the Salmon region. Three fish arrived between July 5th and July 7th, while the fourth Chinook salmon was first detected on July 25th. The fourth Chinook was detected in the Salmon River near the town of Shoup, but did not make it to the mouth of the Lemhi River. Travel time of returning adult Chinook salmon ranged from 44 to 53 days (average of 10.2 to 12.3 km/day) from Lower Granite Dam to the mouth of the Lemhi River. Travel times increased from previous years as fish were delayed by high spring flows in the Salmon River. Upon arrival to the Lemhi River, adult salmon displayed variability in their movement patterns and staging area selections. Results suggest that 1) arrival time to the mouth of the Lemhi was similar for all fish tagged in May 2011, 2) arrival timing of Chinook salmon were much later in 2011 than previous study years, 3) adults migrated to their staging areas soon after entering the Lemhi, and 4) staging areas were often in close proximity to spawning areas, 5) rate of fish movement (km/day) significantly decreases when fish enter the Lemhi River (Figure 18). Once fish entered the Lemhi River in 2011, the results were similar compared to previous tracking results, likely due to the second consecutive year of high water in the Lemhi subbasin that has likely aided fish passage and reduced or eliminated any migration and temperature barriers for Chinook salmon. However, return rates for radio tagged fish were well below previous years possibly due to higher flows and/or physical injuries sustained prior to radio tagging. NOAA documented several study target fish had seal bites or gill net injuries.

In summary, radio tagged Chinook have averaged 23 to 53 days in travel time from Lower Granite to the mouth of the Lemhi River. Travel time results show fish average rate of movement is between 10.2 to 23.5 km/day in the Salmon River. The lower rate of movement likely represents higher flows in the Salmon River, when fish are moving slowly or are holding. Prior to 2011, 70.4% (excluding the one angler pulled transmitter) of the radio tagged fish returned to the Lemhi drainage. In 2011, only 26.7% of the fish returned to the Lemhi drainage. Results suggest fish rate of movement (km/day) substantially declines as fish enter the Lemhi River, averaging 0 to 4.8 km/day. Fish appear to select staging areas downstream of or near their spawning location. Some Hayden Creek and upper Lemhi River bound Chinook salmon stage in the Lemhi River below the mouth of Hayden Creek, but the majority of fish typically stage in Hayden Creek or the upper Lemhi River. Previous telemetry studies have found Chinook salmon staging above and below the mouth of Hayden Creek and results suggest that staging area selection may be influenced by water quality conditions (e.g. temperature and flow) in the Lemhi River. This study has yet to collect migration data for Chinook salmon in a low water year, when we would likely be able to identify migration barriers and/or changes in migration behavior based on river flows in the Lemhi River.

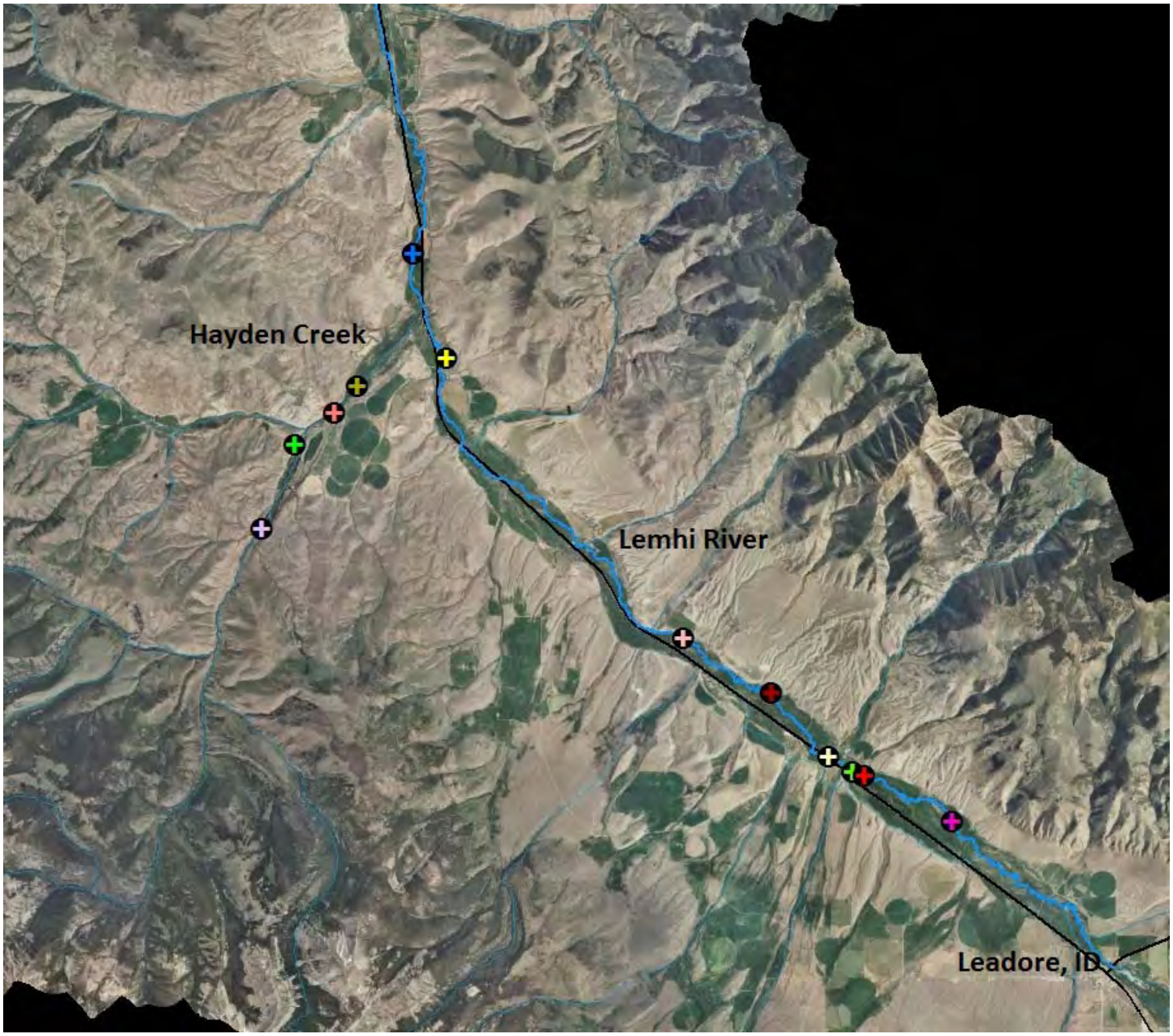

Figure 17. Staging areas of radio tagged adult Chinook salmon in Hayden Creek and Lemhi River from 2010-2011.

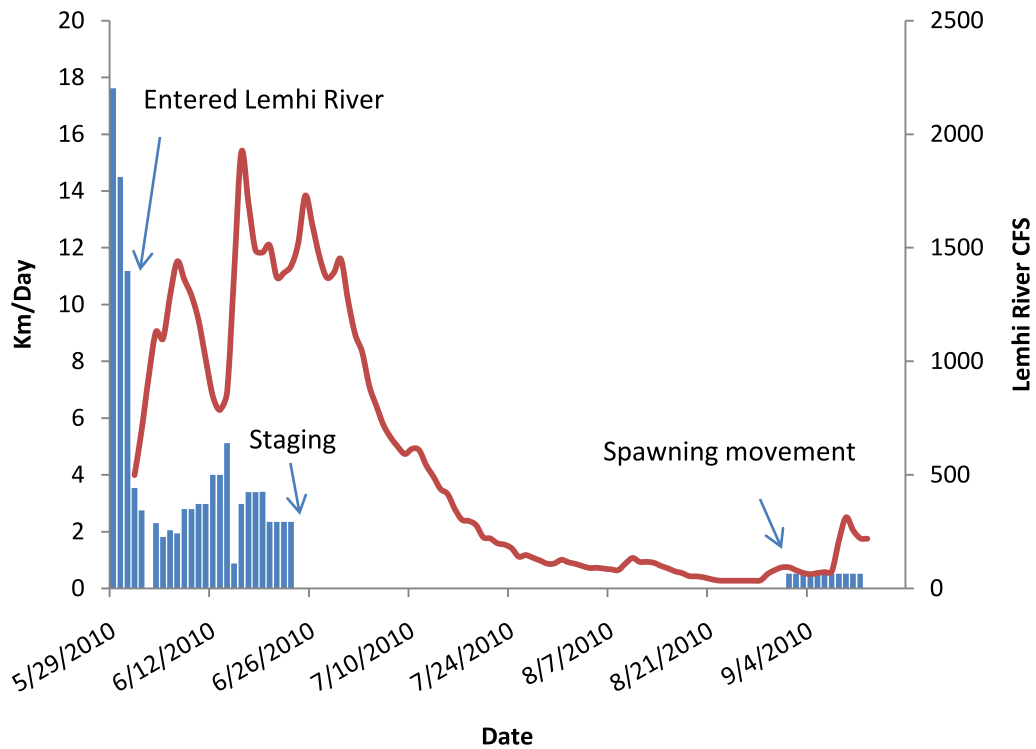

Figure 18. The rate of movement (km/day) of one adult Chinook salmon in the Salmon and Lemhi rivers.

<u> A summary of other habitat disturbances in the watershed that may be obscuring the IMW results.</u>*

High water years have created additional spawning areas for salmon and steelhead in Hayden Creek and the Lemhi River. Higher stream flows have likely improved migration conditions for resident and anadromous fish throughout the subbasin. High flows resulting from increased snowpack levels, spring rains, and reduced irrigation withdrawals may have increased fish production, survival, and abundance over the last few years.

<u> A list of partners who are cooperating to either monitor the IMW for fish or habitat or to place projects in the IMW. A description of their funding source if known.</u>*

The major collaborators monitoring fish or habitat include ISS (BPA funded), ISEMP (BPA funded), and the IDFG screen program (BPA funded). There are a wide variety of other aquatic habitat enhancement projects proposed or recently approved for funding by a number of different agencies and NGO’s. These include the Lemhi Land Trust, Bureau of Land Management, United States Forest Service, Trout Unlimited, Idaho Office of Species Conservation, Upper Salmon River basin Watershed Program, Lemhi Land and Soil Conservation District, Nature Conservancy, Shoshone-Bannock Tribe. Most of the funding comes from BPA, PCSRF, private matching donations, and the Snake River Basin Adjudication Trust Funds.

_ A summary of threats or obstacles, if any, to the successful completion of the IMW._*

The ISS project is nearing its completion and is a key collaborator in the Lemhi subbasin. Chinook salmon redd count and trapping data that is collected by ISS in the upper Lemhi River is an important component of the IMW fish and habitat monitoring efforts. If no replacement for ISS is funded or if potential data losses might occur with its replacement, IMW and/or other projects will have to evaluate their fish monitoring data requirements for fish monitoring.

IMW will need stable, long-term funding if the project is to be successful. The infrastructure has been put in place to evaluate the response of fish populations to tributary reconnects, but the timeframe in which fish populations may respond in a detectable level is uncertain. IMW funding levels have recently been significantly reduced. Reduced funding and uncertainty regarding long-term funding will compromise our ability to meet IMW project objectives, specifically the ability to sample enough sites in tributaries to detect changes in fish distribution, abundance, survival and growth and to deploy enough PIT tags.

* *_Date when the IMW was estimated to be able to provide results._*

As previously stated, we are beginning to see results as tributaries are reconnected to the Lemhi River. However, it is important to note that as tributaries are reconnected, the first response will be for fish to redistribute into the newly accessible habitat. Determining whether or not this redistribution results in an overall increase in fish production and productivity will take much longer to document. We anticipate that intensive monitoring of these tributary reconnects needs to continue for a minimum of five to ten years after each tributary has been fully reconnected and re-colonized by anadromous fish in order to detect a significant change in fish abundance on a watershed scale.

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APPENDIX A

POTLATCH RIVER STEELHEAD MONITORING AND EVALUATION PROJECT

ANNUAL REPORT (DRAFT)

2010