# IDAHO NATIVE SALMONID RESEARCH AND MONITORING UPDATE - 2014

Idaho Tributary Habitat Acquisition and Enhancement Program, Appendix A

Dissolved Gas Supersaturation Control, Mitigation, and Monitoring Program, Appendix F5

Prepared by:

Kenneth A. Bouwens
Regional Fisheries Biologist
Idaho Department of Fish and Game

Robert Jakubowski
Natural Resources Technician
Avista Corporation

September 2015


## TABLE OF CONTENTS

# INTRODUCTION

The Idaho Tributary Habitat Acquisition and Fishery Enhancement Program (Appendix A) and the Dissolved Gas Supersaturation Control, Mitigation, and Monitoring Program (Appendix F5) of the Clark Fork Settlement Agreement (CFSA), supports ongoing research and monitoring activities in Idaho tributaries. The purpose of these activities is to evaluate the ongoing efforts in aquatic habitat protection and enhancement and to address impacts related to load-following and dissolved gas supersaturation produced by the Clark Fork Projects. Research and monitoring activities have largely focused on monitoring abundance and distribution of salmonids in Idaho tributaries to Lake Pend Oreille (LPO) through completion of electrofishing surveys and Bull Trout *Salvelinus confluentus* redd counts. In 2011, a survival study was also initiated to evaluate in-lake survival of Bull Trout and Westslope Cutthroat Trout *Oncorhynchus clarkii lewisi*. This ongoing study will provide additional information on migratory patterns of these fishes in the system.

# IDAHO TRIBUTARY SALMONID ABUNDANCE MONITORING

## Methods

Monitoring surveys are conducted on 25 LPO tributaries on a five-year rotational basis. These surveys provide the ability to follow general trends in fish abundance, species composition, and distribution on a stream scale. This information will enable broad scale evaluation of the effects associated with efforts in aquatic habitat protection and restoration accomplished by CFSA activities. Monitoring surveys were completed on Granite, Gold, Strong, Johnson, and Twin creeks in 2014.

Stream survey reaches were established on systematic intervals ranging upstream from the mouth (Appendix A). Typically, a 100 m site was sampled for each kilometer of stream (section), except on longer streams, where an every-other kilometer section was sampled. Decisions to sample every other section were made depending on stream access constraints, expected fish densities, water availability, and time constraints. Stream distances were approximated in kilometers using GPS. The farthest upstream survey site was defined as the section where water was no longer found, where fish were no longer sampled and consequently not suspected to be present further upstream, or where consistent sampling results relative to species composition and/or abundance suggested further surveys would provide low expected variation among additional sample sites. Abundance estimates only included fish $\geq$75mm (total length; TL) due to sampling efficiency considerations. Sample sites were typically 100 m in length, and the average width of each site was calculated. Sample sites were closed using block nets at the downstream end of each survey site to prevent escapement during downstream electrofishing passes.

Fish were collected using a Smith-Root backpack electrofishing unit and pulsed DC settings, typically at 40-50 Hz, 2 ms, and 500 to 700 volts. Fish were identified to species, measured (TL; mm) and weighed (g). Species and hybrid crosses were identified phenotypically. Characteristics used in identifying Westslope Cutthroat *Oncorhynchus clarkii lewisi* x Rainbow *Oncorhynchus mykiss* trout hybrids included throat slashes typically of light intensity or broken in form and exhibiting heavy spotting below the lateral line and toward the anterior end of the fish. Bull Trout *Salvelinus confluentus* x Brook Trout *Salvelinus fontinalis* hybrids were identified as individuals exhibiting typical Bull Trout form, but with the presence of some

vermiculation and or light to dark irregular spotting on dorsal fin.

Genetic tissue samples were collected from Bull Trout, and all suspected Bull Trout hybrids. Subsamples of Westslope Cutthroat Trout, Rainbow Trout and Westslope Cutthroat x Rainbow Trout hybrids were sacrificed for otolith extraction and subsequent age estimation. Additionally, sex and maturity was determined for sacrificed fish by observing gonad development.

Multi-pass removal estimates (Zippin 1958) were conducted in combination with single pass samples to estimate fish abundance, by species, in each tributary stream. For each stream, a single site was randomly selected and a multi-pass estimate was generated for that section. For each multi-pass estimate, sequential passes were conducted until fish captures from a single pass did not exceed 20% of the total capture by species of the first pass. Typically, two or three passes were necessary to satisfy this criteria. Abundance estimates and associated 95% confidence intervals were derived for two and three pass samples using calculations for removal estimates in closed populations (Hayes et al. 2007). The total catch on the first pass was reported as the population estimate when no additional individuals of a particular species were captured on subsequent passes. In cases where the lower limit of a confidence interval was less than the total number of fish captured, the total number of fish captured was reported as the lower limit.

After conducting multi-pass sampling at a random site, the remaining sections of the stream were sampled using a single pass. This was done to increase the number of possible sample sites visited in a field season, as each single pass sample required less time to complete than a multi-pass sample. Abundances were estimated from single pass samples by generating a multi-pass regression model of abundance based on first pass collections (Meyer and Schill 1999). The multi-pass regression model was generated from data collected from 25 LPO tributary streams sampled between 2009 and 2014 (including the present years' data), on all target species (Ryan and Jakubowski 2011a, 2011b, 2012, Ryan et al. 2014).

Density estimates were reported as the number per 100 $m^2$. Average density estimates were calculated by species for all sections sampled that contained fish and may have included data from sections where a given species was not detected.

**Results**

Twenty-eight sections were surveyed within all sampled tributaries between July 8 and August 25, 2014. Water was present and an electrofishing survey was completed at 22 of the 28 sections visited (Table 1). Fish were detected at all 22 of the sites sampled.

Data were added to a regression model to estimate fish abundance from a single pass based on first pass collections (Figure 1) of a multi-pass estimate. Based on the developed linear model, the first pass collections described approximately 99% of the variation in estimated abundance from multi-pass samples (n=123, $p<0.01$).

*Granite Creek*

Five sections of Granite Creek were sampled in 2014 (Table 1; Appendix A-1). Westslope Cutthroat Trout and Bull Trout were the predominant species captured (Table 2); although, a small number of Westslope Cutthroat Trout X Rainbow Trout hybrids were observed in the lower portion of the stream, even though no apparent pure-strain Rainbow Trout were encountered (Table 3). The estimated Bull Trout density of 12.7 fish/100 $m^2$ in section seven was the highest Bull Trout density encountered among all sections sampled in 2014 (Table 2), and the overall Bull Trout density of 6.3 fish/100 $m^2$ was the highest estimate of Bull Trout abundance in all LPO tributaries since routine monitoring began in 2009 (Table 3). This represented an increase of nearly 2 fish/100 $m^2$ since 2009 (Table 4).

*Gold Creek*

Nine sections were identified for sampling in Gold Creek; however, sections three through five were dry and could not be sampled (Table 1; Appendix A-2). The fish assemblage downstream of the dry sections consisted of mainly Bull Trout and Westslope Cutthroat Trout, although there were *Oncorhynchus* hybrids encountered at low densities. Westslope Cutthroat Trout were the only species sampled above the dry sections, which were encountered at densities ranging from 43.1 to 66.8 fish/100 $m^2$ (Table 2). Gold Creek supported the highest density of Westslope Cutthroat Trout among all streams sampled in 2014 which also represented one of the highest density estimates on record for all LPO tributaries (Table 3). Since 2009, estimated Bull Trout density in Gold Creek has decreased by about 2 fish/100 $m^2$, but Westslope Cutthroat Trout density increased from approximately 24 to 32 fish/100 $m^2$ (Table 4).

*Strong Creek*

The uppermost reach (Section 4) of Strong Creek was dry during mid-August in 2014 (Table 1; Appendix A-3). Bull Trout density increased from 2.2 to 7.5 fish/100 $m^2$ between sections 1 and 2, but none were sampled in Section 3. Westslope Cutthroat Trout were measured at densities ranging from 17.0 to 20.7 fish/100 $m^2$ in the three sampled sections (Table 2). Strong Creek supported the third highest density of both Bull Trout and Westslope Cutthroat Trout among the streams sampled in 2014 (Table 3). The densities of both Bull Trout and Westslope Cutthroat Trout increased substantially since 2009 (Table 4).

*Johnson Creek*

Only the three downstream-most sections of Johnson Creek were sampled in 2014 because section 4 was inaccessible and Section 5 was dry (Table 1; Appendix A-4). Bull Trout were only found in Section 1, (downstream of a permanent waterfall migration barrier), while Westslope

Cutthroat Trout were found in all three surveyed sections, peaking at a density of 10.5 fish/100 $m^2$ in Section 2. Compared to other sampled tributaries the estimated Bull Trout (1.0 fish/100 $m^2$) and Westslope Cutthroat Trout (7.0 fish/100 $m^2$) densities in Johnson Creek were moderate (Table 3). Estimated Bull Trout density was slightly lower in 2014 as compared to 2009, while Westslope Cutthroat Trout density increased from 5.1 to 7.0 fish/100 $m^2$.

*Twin Creek*

Five sections in the lower seven kilometers of Twin Creek were sampled in 2014 (Table 1; Appendix A-5). Brook Trout, Brown Trout *Salmo trutta*, Rainbow Trout, Westslope Cutthroat Trout, Westslope Cutthroat x Rainbow Trout hybrids and Bull Trout were all sampled in the lower two kilometers of Twin Creek while only Brook Trout and Westslope Cutthroat Trout were sampled upstream of a barrier waterfall located at approximately stream kilometer three (Table 2). Brook Trout density in Twin Creek (7.6 fish/100 $m^2$) was among the highest estimated in the LPO tributaries while Westslope Cutthroat Trout and Bull Trout densities were relatively low (Table 3). Brook Trout density has increased from 2.7 to 7.6 fish/100 $m^2$ since 2009 (Table 4).

Table 1. Locations (UTM) of survey sections sampled during 2014 Lake Pend Oreille tributary abundance monitoring efforts. Waypoints represent the approximate lower extent of each survey section. Site length and average wetted width at the time of sampling are listed for each survey site.

| Stream | Section | Date | Datum | Zone | Easting | Northing | Site Length (m) | Avg. Width (m) |
|---|---|---|---|---|---|---|---|---|
| Granite Creek | 1 | 7/15/2014 | WGS84 | 11U | 543415 | 5326191 | 100 | 4.3 |
| | 3 | 7/16/2014 | WGS84 | 11U | 545205 | 5326073 | 100 | 6.6 |
| | 5 | 7/17/2014 | WGS84 | 11U | 546921 | 5326562 | 100 | 6.6 |
| | 7 | 7/22/2014 | WGS84 | 11U | 548457 | 5325585 | 100 | 4.8 |
| | 9 | 7/23/2014 | WGS84 | 11U | 549074 | 5324124 | 100 | 4.7 |
| Gold Creek | 1 | 7/28/2014 | WGS84 | 11U | 541227 | 5312552 | 100 | 8.1 |
| | 2 | 7/29/2014 | WGS84 | 11T | 541400 | 5312225 | 100 | 6.2 |
| | 3 | 7/31/2014 | | | | | Dry | |
| | 4 | 7/31/2014 | | | | | Dry | |
| | 5 | 7/31/2014 | | | | | Dry | |
| | 6 | 7/31/2014 | WGS84 | 11T | 541944 | 5308760 | 77 | 1.7 |
| | 7 | 8/25/2014 | WGS84 | 11T | 542272 | 5307878 | 100 | 2.0 |
| | 8 | 8/21/2014 | WGS84 | 11T | 542409 | 5306806 | 100 | 2.2 |
| | 9 | 8/21/2014 | WGS84 | 11T | 542569 | 5306040 | 100 | 1.2 |
| Strong Creek | 1 | 8/4/2014 | WGS84 | 11U | 552179 | 5343608 | 100 | 3.2 |
| | 2 | 8/11/2014 | WGS84 | 11U | 552968 | 5344710 | 100 | 3.4 |
| | 3 | 8/4/2014 | WGS84 | 11U | 553437 | 5345715 | 100 | 3.5 |
| | 4 | 8/14/2014 | WGS84 | 11U | 553947 | 5346600 | Dry | |
| Johnson Creek | 1 | 7/10/2014 | WGS84 | 11U | 557464 | 5331105 | 100 | 6.1 |
| | 2 | 7/10/2014 | WGS84 | 11U | 556632 | 5330289 | 100 | 5.2 |
| | 3 | 7/14/2014 | WGS84 | 11U | 556416 | 5329743 | 100 | 4.2 |
| | 4 | 7/14/2014 | WGS84 | 11U | | | No Access | |
| | 5 | 7/14/2014 | WGS84 | 11U | | | Dry | |

Table 1. Continued.

| Stream | Section | Date | Datum | Zone | Easting | Northing | Site Length (m) | Avg. Width (m) |
|---|---|---|---|---|---|---|---|---|
| Twin Creek | 1 | 7/8/2014 | WGS84 | 11U | 565023 | 5326476 | 100 | 4.0 |
| | 2 | 7/8/2014 | WGS84 | 11U | 564998 | 5325394 | 100 | 3.7 |
| | 3 | 7/9/2014 | WGS84 | 11U | 564262 | 5324682 | 100 | 4.1 |
| | 5 | 7/9/2014 | WGS84 | 11U | 562965 | 5323531 | 100 | 4.4 |
| | 7 | 7/9/2014 | WGS84 | 11U | 562167 | 5322087 | 100 | 4.5 |

Table 2. Tributary monitoring results by stream, sampled site, and species in 2014. Site number corresponds approximately to stream km, measured upstream from the stream's lower-most confluence. Only fish ≥ 75 mm were included in abundance estimates (Est n).

| Stream | Site | Species | Min TL | Max TL | Est n | 95% CI- | 95% CI + | Fish/100 $m^2$ |
|---|---|---|---|---|---|---|---|---|
| Granite Creek | 1 | BLT | 104 | 160 | 8 | 6 | 16 | 1.9 |
| | 1 | WCT | 75 | 171 | 35 | 28 | 43 | 8.2 |
| | 1 | WRHY | 77 | 87 | 3 | 2 | 11 | 0.7 |
| | 3 | BLT | 110 | 277 | 26 | 21 | 34 | 4.0 |
| | 3 | WCT | 76 | 212 | 40 | 32 | 48 | 6.1 |
| | 5 | BLT | 98 | 155 | 18 | 14 | 26 | 2.7 |
| | 5 | WCT | 70 | 224 | 15 | 12 | 23 | 2.3 |
| | 7 | BLT | 88 | 147 | 60 | 59 | 63 | 12.7 |
| | 7 | WCT | 75 | 234 | 61 | 59 | 65 | 12.8 |
| | 9 | BLT | 79 | 154 | 48 | 41 | 56 | 10.4 |
| | 9 | WCT | 85 | 199 | 12 | 9 | 19 | 2.5 |
| Gold Creek | 1 | BBHY | 178 | 178 | 2 | 1 | 10 | 0.2 |
| | 1 | BLT | 95 | 207 | 50 | 42 | 57 | 6.1 |
| | 1 | WCT | 88 | 208 | 18 | 14 | 26 | 2.2 |
| | 1 | WRHY | 99 | 205 | 7 | 5 | 14 | 0.8 |
| | 2 | BLT | 90 | 189 | 53 | 46 | 61 | 8.6 |
| | 2 | WCT | 89 | 211 | 30 | 24 | 38 | 4.9 |
| | 2 | WRHY | 109 | 176 | 3 | 2 | 11 | 0.5 |
| | 3 | | | | | | | |
| | 4 | | | | | | | |
| | 5 | | | | | | | |
| | 6 | WCT | 76 | 179 | 67 | 59 | 75 | 50.2 |
| | 7 | WCT | 75 | 218 | 133 | 130 | 138 | 66.8 |
| | 8 | WCT | 75 | 193 | 55 | 47 | 62 | 25.0 |
| | 9 | WCT | 85 | 172 | 52 | 44 | 60 | 43.1 |

Table 2. Continued.

| Stream | Site | Species | Min TL | Max TL | Est n | 95% CI- | 95% CI + | Fish/100 $m^2$ |
|---|---|---|---|---|---|---|---|---|
| Strong Creek | 1 | BLT | 110 | 126 | 7 | 7 | 8 | 2.2 |
| | 1 | WCT | 75 | 217 | 55 | 55 | 56 | 17.0 |
| | 2 | BLT | 86 | 121 | 25 | 20 | 33 | 7.5 |
| | 2 | WCT | 75 | 269 | 69 | 62 | 77 | 20.7 |
| | 3 | WCT | 75 | 228 | 68 | 60 | 76 | 19.4 |
| Johnson Creek | 1 | BLT | 85 | 153 | 19 | 18 | 21 | 3.1 |
| | 1 | WCT | 75 | 144 | 20 | 20 | 22 | 3.3 |
| | 2 | WCT | 75 | 258 | 55 | 47 | 62 | 10.5 |
| | 3 | WCT | 83 | 207 | 30 | 24 | 38 | 7.2 |
| | 4 | | | | | | | |
| | 5 | | | | | | | |
| Twin Creek | 1 | BRK | 66 | 221 | 18 | 14 | 26 | 4.4 |
| | 1 | BRN | 99 | 342 | 10 | 8 | 18 | 2.6 |
| | 1 | RBT | 96 | 159 | 10 | 8 | 18 | 2.6 |
| | 1 | WRHY | 90 | 103 | 4 | 3 | 12 | 1.0 |
| | 2 | BLT | 175 | 203 | 2 | 2 | 4 | 0.6 |
| | 2 | BRK | 99 | 237 | 7 | 7 | 7 | 1.9 |
| | 2 | RBT | 98 | 169 | 14 | 14 | 15 | 3.8 |
| | 2 | WCT | 80 | 162 | 7 | 7 | 9 | 2.0 |
| | 2 | WRHY | 72 | 184 | 22 | 22 | 23 | 6.0 |
| | 3 | BRK | 95 | 199 | 51 | 43 | 59 | 12.6 |
| | 3 | WCT | 91 | 177 | 4 | 3 | 12 | 1.0 |
| | 5 | BRK | 75 | 196 | 84 | 76 | 92 | 19.2 |
| | 5 | WCT | 79 | 187 | 14 | 11 | 22 | 3.2 |
| | 7 | WCT | 76 | 182 | 45 | 37 | 53 | 10.0 |

BRN = Brown Trout
BLT = Bull Trout
BRK = Brook Trout
MWF = Mountain Whitefish
RBT = Rainbow Trout
SCL = unidentified sculpin spp.
WCT = Westslope Cutthroat Trout
WRHY = Westslope Cutthroat Trout x Rainbow Trout hybrid

Table 3. Mean estimated density (fish/100m$^2$) of sampled salmonids from Lake Pend Oreille tributary monitoring efforts 2009-2014. Density estimates represent only fish ≥ 75 mm. Average density values were calculated by species for all surveyed sections per stream.

| Stream | Year last surveyed | BBHY | BLT | BRK | BRN | MWF | RBT | WCT | WRHY |
|---|---|---|---|---|---|---|---|---|---|
| Granite Creek | 2014 | 0.0 | 6.3 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | <0.1 |
| Gold Creek | 2014 | <0.1 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 32.0 | 0.2 |
| Strong Creek | 2014 | 0.0 | 3.2 | 0.0 | 0.0 | 0.0 | <0.1 | 19.0 | <0.1 |
| Johnson Creek | 2014 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.0 | 0.0 |
| Twin Creek | 2014 | 0.0 | 0.1 | 7.6 | 0.5 | 0.0 | 1.3 | 3.3 | 1.4 |
| | | | | | | | | | |
| Berry Creek | 2013 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.5 | 11.0 | 0.8 |
| Char Creek | 2013 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 75.0 | 0.0 |
| Jeru Creek | 2013 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.7 | 5.6 | 3.1 |
| Mosquito Creek | 2013 | 0.0 | 0.0 | 4.9 | 0.2 | 0.0 | 0.0 | 3.4 | 0.2 |
| S. F. Grouse Cr | 2013 | 0.0 | 1.3 | 3.0 | 0.0 | 0.0 | 7.6 | 1.3 | 3.3 |
| Spring Creek | 2013 | 0.0 | 0.0 | 16.5 | 0.1 | 0.1 | 0.2 | 0.9 | 0.3 |
| | | | | | | | | | |
| E.F. Lightning Creek | 2012 | 0.5 | 3.1 | 0.1 | 0.0 | 0.0 | 2.8 | 4.5 | 0.4 |
| Hellroaring Creek | 2012 | 0.0 | 0.2 | <0.1 | 0.0 | 0.0 | 4.0 | 0.0 | 0.2 |
| McCormick Creek | 2012 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.5 | 1.7 | 0.3 |
| Porcupine Creek | 2012 | 0.0 | 1.0 | 5.4 | 0.0 | 0.0 | 0.0 | 10.5 | 0.9 |
| Rattle Creek | 2012 | 0.0 | 4.6 | 0.0 | 0.0 | 0.0 | 0.6 | 5.8 | 0.1 |
| Savage Creek | 2012 | 0.0 | 5.1 | 0.0 | 0.0 | 0.0 | <0.1 | 3.9 | 0.7 |
| Wellington Creek | 2012 | 0.0 | 1.3 | 0.1 | 0.0 | 0.0 | 0.5 | 10.4 | 0.4 |
| | | | | | | | | | |
| Caribou Creek | 2011 | 0.0 | 3.1 | 0.3 | 0.0 | 0.0 | 1.2 | 6.1 | 0.7 |
| Morris Creek | 2011 | 0.0 | 5.8 | 0.0 | 0.0 | 0.0 | 0.0 | 7.0 | 1.8 |
| Trestle Creek | 2011 | 0.0 | 1.8 | 0.0 | 0.0 | 0.1 | <0.1 | 4.5 | 1.0 |

Table 3. Continued.

| Stream | Year last surveyed | BBHY | BLT | BRK | BRN | MWF | RBT | WCT | WRHY |
|---|---|---|---|---|---|---|---|---|---|
| Grouse Creek | 2010 | 0.2 | 3.5 | 0.4 | 0.0 | 0.6 | 8.2 | 3.6 | 0.3 |
| N.F. Grouse Creek | 2010 | 0.0 | 0.0 | 4.1 | 0.0 | 0.0 | 5.0 | 5.9 | 0.3 |
| Rapid Lighting Creek | 2010 | 0.0 | <0.1 | 3.2 | 0.0 | 1.2 | 1.0 | 5.2 | 0.3 |
| West Gold Creek | 2009 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 43.7 | 0.0 |

BBHY = Brook Trout x Bull Trout hybrid
BLT = Bull Trout
BRK = Brook Trout
BRN = Brown Trout
MWF = Mountain Whitefish
RBT = Rainbow Trout
WCT = Westslope Cutthroat Trout
WRHY = Westslope Cutthroat x Rainbow Trout hybrid

Table 4. Current year and historic salmonid density (fish/100m$^2$) estimates by tributary stream, 2009-2014.

| Stream | Year | BBHY | BLT | BRK | BRN | MWF | RBT | WCT | WRHY |
|---|---|---|---|---|---|---|---|---|---|
| Granite Creek | 2009 | 0.0 | 4.6 | 0.0 | 0.0 | 0.2 | 0.0 | 6.7 | 0.0 |
| | 2014 | 0.0 | 6.3 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | <0.1 |
| Gold Creek | 2009 | 0.0 | 4.4 | 0.0 | 0.0 | 0.0 | 0.0 | 23.6 | <0.1 |
| | 2014 | <0.1 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 32.0 | 0.2 |
| Strong Creek | 2009 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | 7.2 | 0.1 |
| | 2014 | 0.0 | 3.2 | 0.0 | 0.0 | 0.0 | <0.1 | 19.0 | <0.1 |
| Johnson Creek | 2009 | 0.0 | 1.4 | 0.0 | 0.0 | 0.0 | 0.0 | 5.1 | 0.0 |
| | 2014 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.0 | 0.0 |
| Twin Creek | 2009 | 0.0 | 0.0 | 2.7 | 0.3 | 0.0 | 2.0 | 3.8 | 0.0 |
| | 2014 | 0.0 | 0.1 | 7.6 | 0.5 | 0.0 | 1.3 | 3.3 | 1.4 |

BBHY = Brook Trout x Bull Trout hybrid
BLT = Bull Trout
BRK = Brook Trout
BRN = Brown Trout
MWF = Mountain Whitefish
RBT = Rainbow Trout
WCT = Westslope Cutthroat Trout
WRHY = Westslope Cutthroat x Rainbow Trout hybrid

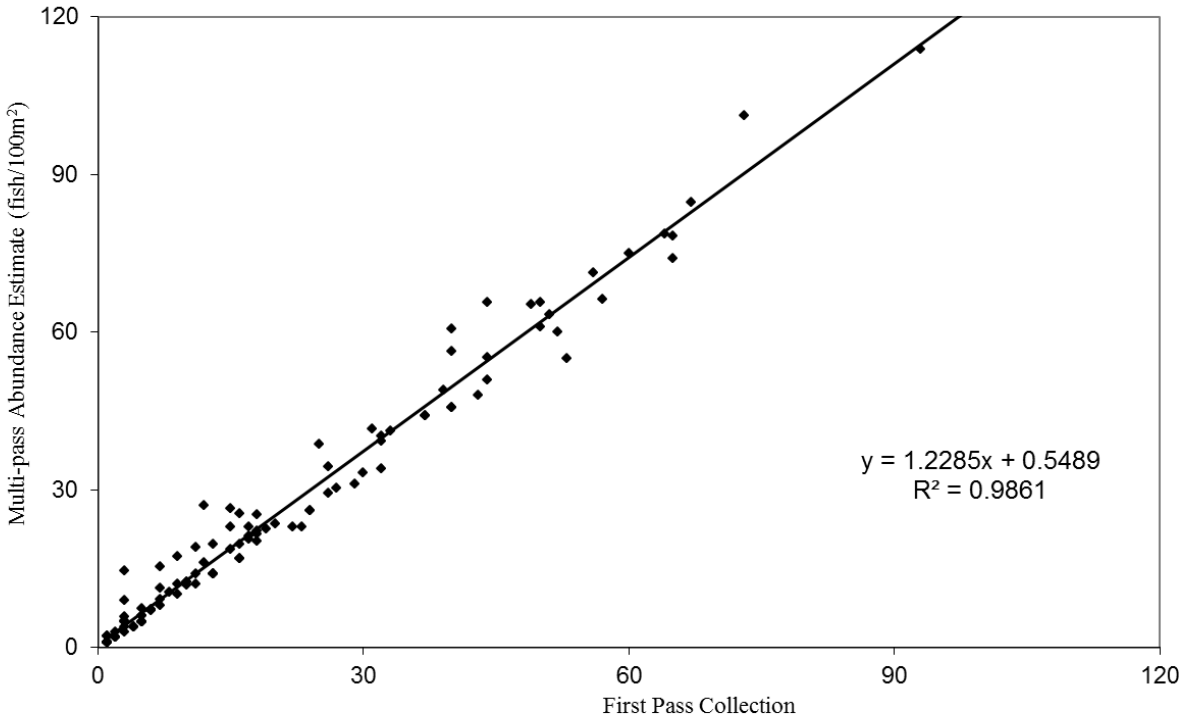



Figure 1. Regression model of the estimated trout abundance using multi-pass methods by the number captured on the first pass. Data represent combined 2009 - 2014 multi-pass removal efforts for trout > 75 mm total length in Lake Pend Oreille, Idaho tributaries.

## PEND OREILLE BASIN BULL TROUT REDD MONITORING

### Methods

Idaho Department of Fish and Game, Avista, US Fish and Wildlife Service, Idaho Department of Lands, and US Forest Service staff conducted Bull Trout redd counts on 19 tributaries to Lake Pend Oreille (LPO) or the Clark Fork River in 2014. In addition, Kalispel Tribe employees completed surveys on the Middle Fork East River and Uleda Creek (tributaries to the lower Priest River). Redds were located visually by walking standardized sections within each tributary (Table 1). Bull Trout redds were defined as areas of clean gravels at least 0.3 x 0.6 m in size with gravels at least 76 mm in diameter having been moved by the fish, and with a mound of loose gravel downstream from a depression (Pratt 1984). In areas where one redd was superimposed over another, each distinct depression was counted as an individual redd. Redd surveys were conducted during standardized time periods in October. Beginning in 2012, redd surveys were discontinued on the Clark Fork River and Twin Creek because counts at both of these locations were believed to be influenced heavily by ongoing upstream Bull Trout transport programs and provided little meaningful long-term index information. In addition, no survey was completed on Char Creek above a fish passage barrier first noted in 2008. The observed barrier was located approximately 150 m upstream from the confluence with East Fork Lightning Creek.

### Results

Lake Pend Oreille core area redd counts were completed between October 9 and 20, 2014. Streamflow conditions were considered favorable for accurate counts. However, sunny conditions in September and October promoted high algal growth, which may have obscured some redds in more open areas.

A total of 717 Bull Trout redds were counted among all surveyed streams (Table 2). The six index streams counted consistently since 1983 accounted for 369 (52%) of the total redds (Table 2). Overall counts were below the previous ten-year averages for both total (828) and index (499) counts , but well within the range of variability documented over the last 30+ years (Figures 1 and 2).

Redd count data are inherently variable due to changing survey conditions, variable spawning timing, and variability among surveyors. These data are collected to provide general long-term trend data and it is appropriate to interpret these data cautiously, particularly over short time periods.

Table 1. Survey streams for annual Bull Trout redd counts in tributaries to Lake Pend Oreille, Idaho.

| Stream | Section Description (approximate length; km) |
|---|---|
| Caribou Cr | Between Caribou Creek road crossings at 1 km and 7 km (6.0) |
| Char Cr | Mouth to falls (1.2) |
| Clark Fork River | Spawning channel (N/A) |
| East Fork Lightning Cr[a] | Savage to Thunder Creek (5.0) |
| Gold Cr[a] | Mouth to 0.2 km upstream of W. Gold confluence (2.4) |
| Granite Cr | Mouth to road 278 crossing (6.4) |
| Grouse Cr[a] | Flume Creek to 2.4 km beyond gate at end of road 280 (6.5) |
| Hellroaring Cr | Mouth to falls (2.4) |
| Johnson Cr[a] | Mouth to falls (1.5) |
| Lightning Cr | Rattle to Quartz (3.2) |
| Morris Cr | Mouth to trail 132 crossing (2.5) |
| N Gold Cr[a] | Mouth to falls (1.2) |
| Pack River | Road 231 bridge near McCormick Cr. to Falls located 0.4 km downstream of W. Branch (2.8) |
| Porcupine Cr | Mouth to S. Fork (3.2) |
| Rattle Cr | Mouth to falls by upper bridge (5.7) |
| Savage Cr | Mouth to trail 61 crossing (2.0) |
| Strong Cr | Mouth upstream 3 km (3.0) |
| Sullivan Springs | Mouth upstream 0.4 km (0.4) |
| Trestle Cr[a] | 1.6 km upstream of mouth to 0.5 km upstream of the road 275 switchback (10.4 km); 0.5 km upstream of road 275 switchback upstream to confluence with first southeast bank un-named tributary (0.5 km) |
| Twin Cr | Mouth to River Road (1.5) |
| Wellington Cr | Mouth to falls (0.5) |

[a] Denotes "index" stream

Table 2. Bull Trout redd counts by year from tributaries of Lake Pend Oreille, Clark Fork River, and Pend Oreille River, Idaho.

| Stream (* Index) | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 04 - 13 Ave. | 94 - 13 Ave. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E. F. Lightning * | 110 | 24 | 132 | 8 | 59 | 79 | 100 | 29 | -- | 32 | 27 | 28 | 3 | 49 | 22 | 64 | 44 | 54 | 36 | 58 | 38 | 77 | 50 | 51 | 34 | 38 | 85 | 26 | 64 | 11 | 26 | 22 | 46 | 43 |
| Johnson Cr. * | 13 | 33 | 23 | 36 | 10 | 4 | 17 | 33 | 25 | 16 | 23 | 3 | 4 | 5 | 27 | 17 | 31 | 4 | 34 | 31 | 0 | 32 | 45 | 28 | 32 | 40 | 47 | 57 | 54 | 54 | 50 | 21 | 44 | 30 |
| Trestle Cr. * | 298 | 272 | 298 | 147 | 230 | 236 | 217 | 274 | 220 | 134 | 304 | 276 | 140 | 243 | 221 | 330 | 253 | 301 | 335 | 333 | 361 | 102 | 174 | 395 | 145 | 183 | 279 | 188 | 178 | 187 | 133 | 159 | 196 | 238 |
| Grouse Cr. * | 2 | 108 | 55 | 13 | 56 | 24 | 50 | 48 | 33 | 17 | 23 | 18 | 0 | 50 | 8 | 44 | 50 | 77 | 18 | 42 | 45 | 28 | 77 | 55 | 38 | 31 | 51 | 27 | 116 | 69 | 12 | 54 | 50 | 43 |
| North Gold Cr. * | 16 | 37 | 52 | 8 | 36 | 24 | 37 | 35 | 41 | 41 | 32 | 27 | 31 | 39 | 19 | 22 | 16 | 19 | 16 | 24 | 21 | 56 | 34 | 30 | 28 | 17 | 28 | 28 | 6 | 3 | 28 | 25 | 26 | 25 |
| Gold Cr. * | 131 | 124 | 111 | 78 | 62 | 111 | 122 | 84 | 104 | 93 | 120 | 164 | 95 | 100 | 76 | 120 | 147 | 168 | 127 | 203 | 126 | 167 | 200 | 235 | 179 | 73 | 107 | 130 | 56 | 110 | 106 | 88 | 136 | 134 |
| Clark Fork R. | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2 | 8 | 17 | 18 | 3 | 7 | 8 | 5 | 5 | 6 | 7 | 8 | 1 | 0 | 3 | 2 | 0 | 1 | 0 | 0 | -- | -- | -- | 1 | 5 |
| Lightning Cr. | 28 | 9 | 46 | 14 | 4 | -- | -- | -- | -- | 11 | 2 | 5 | 0 | 6 | 0 | 3 | 16 | 4 | 7 | 8 | 8 | 9 | 22 | 9 | 3 | 10 | 11 | 0 | 20 | 1 | 1 | 4 | 9 | 7 |
| Savage Cr. | 36 | 12 | 29 | -- | 0 | -- | -- | -- | -- | 1 | 6 | 6 | 0 | 0 | 0 | 0 | 4 | 2 | 4 | 15 | 7 | 15 | 7 | 25 | 0 | 8 | 5 | 6 | 1 | -- | 5 | 6 | 8 | 6 |
| Char Cr. | 18 | 9 | 11 | 0 | 2 | -- | -- | -- | -- | 9 | 37 | 13 | 2 | 14 | 1 | 16 | 17 | 11 | 2 | 8 | 7 | 14 | 15 | 20 | 1 | 5 | 1 | 4 | 9 | 0 | 4 | 2 | 7 | 8 |
| Porcupine Cr. | 37 | 52 | 32 | 1 | 9 | -- | -- | -- | -- | 4 | 6 | 1 | 2 | 0 | 0 | 0 | 4 | 4 | 0 | 0 | 5 | 10 | 14 | 8 | 8 | 8 | 15 | 11 | 13 | 2 | 4 | 15 | 9 | 5 |
| Wellington Cr. | 21 | 18 | 15 | 7 | 2 | -- | -- | -- | -- | 9 | 4 | 9 | 1 | 5 | 2 | 1 | 22 | 8 | 7 | 7 | 8 | 7 | 6 | 29 | 9 | 10 | 4 | 7 | 6 | 5 | 5 | 11 | 9 | 8 |
| Rattle Cr. | 51 | 32 | 21 | 10 | 35 | -- | -- | -- | -- | 10 | 8 | 0 | 1 | 10 | 2 | 15 | 13 | 12 | 67 | 33 | 37 | 34 | 34 | 21 | 2 | 24 | 62 | 43 | 65 | 59 | 8 | 63 | 35 | 27 |
| Twin Cr. | 7 | 25 | 5 | 28 | 0 | -- | -- | -- | -- | 3 | 4 | 0 | 5 | 16 | 6 | 10 | 19 | 10 | 1 | 8 | 3 | 6 | 7 | 11 | 0 | 4 | 0 | 0 | 1 | -- | -- | -- | 4 | 6 |
| Morris Cr. | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | 1 | 0 | 7 | 1 | 1 | 3 | 16 | 0 | 6 | 6 | 9 | 0 | 0 | 3 | 14 | 4 | 4 |
| Strong Creek | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 2 | -- | -- | -- | -- | -- | 0 | -- | 0 | -- | -- | -- | 7 | 6 | 2 | 11 | 3 | 47 | 17 | 11 | 9 |
| Pack River | 34 | 37 | 49 | 25 | 14 | -- | -- | -- | -- | 65 | 21 | 22 | 0 | 6 | 4 | 17 | 0 | 8 | 28 | 22 | 24 | 31 | 53 | 44 | 16 | 11 | 4 | 0 | 1 | 7 | 6 | 1 | 17 | 15 |
| Granite Cr. | 3 | 81 | 37 | 37 | 30 | -- | -- | -- | -- | 0 | 7 | 11 | 9 | 47 | 90 | 49 | 41 | 25 | 7 | 57 | 101 | 149 | 132 | 166 | 104 | 52 | 106 | 75 | 129 | 68 | 217 | 115 | 120 | 82 |
| Sullivan Springs | 9 | 8 | 14 | -- | 6 | -- | -- | -- | -- | 0 | 24 | 31 | 9 | 15 | 42 | 10 | 22 | 19 | 8 | 15 | 12 | 14 | 15 | 28 | 17 | 7 | 2 | 9 | 11 | 4 | 11 | 4 | 12 | 15 |
| W. Gold | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4 | 0 | 7 | 5 | 4 | 0 | 8 | 29 | 10 | 7 | 7 |
| M.F. East River | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4 | 8 | 21 | 20 | 48 | 71 | 34 | 36 | 25 | 22 | 28 | 28 | 25 | 51 | 34 | 28 |
| Uleda Creek | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 3 | 4 | 3 | 7 | 4 | 7 | 2 | 7 | 16 | 6 | 9 | 24 | 14 | 26 | 10 | 8 |
| N.F. East River | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 | 0 | 0 | -- | 0 | -- | 0 | -- | -- | -- | -- | 0 | 0 |
| Caribou | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 37 | 6 | 47 | 9 | 30 | 30 |
| Hellroaring | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 3 | -- | -- | 3 | 3 |
| Total 6 index streams | 570 | 598 | 671 | 290 | 453 | 478 | 543 | 503 | 423 | 333 | 529 | 516 | 273 | 486 | 373 | 597 | 541 | 623 | 566 | 691 | 591 | 462 | 580 | 794 | 456 | 382 | 597 | 456 | 474 | 434 | 355 | 369 | 499 | 512 |
| Total of all streams | 814 | 881 | 930 | 412 | 555 | 478 | 543 | 503 | 423 | 447 | 656 | 631 | 320 | 610 | 527 | 726 | 705 | 732 | 710 | 890 | 836 | 781 | 940 | 1256 | 654 | 584 | 866 | 654 | 815 | 652 | 781 | 717 | 828 | 786 |

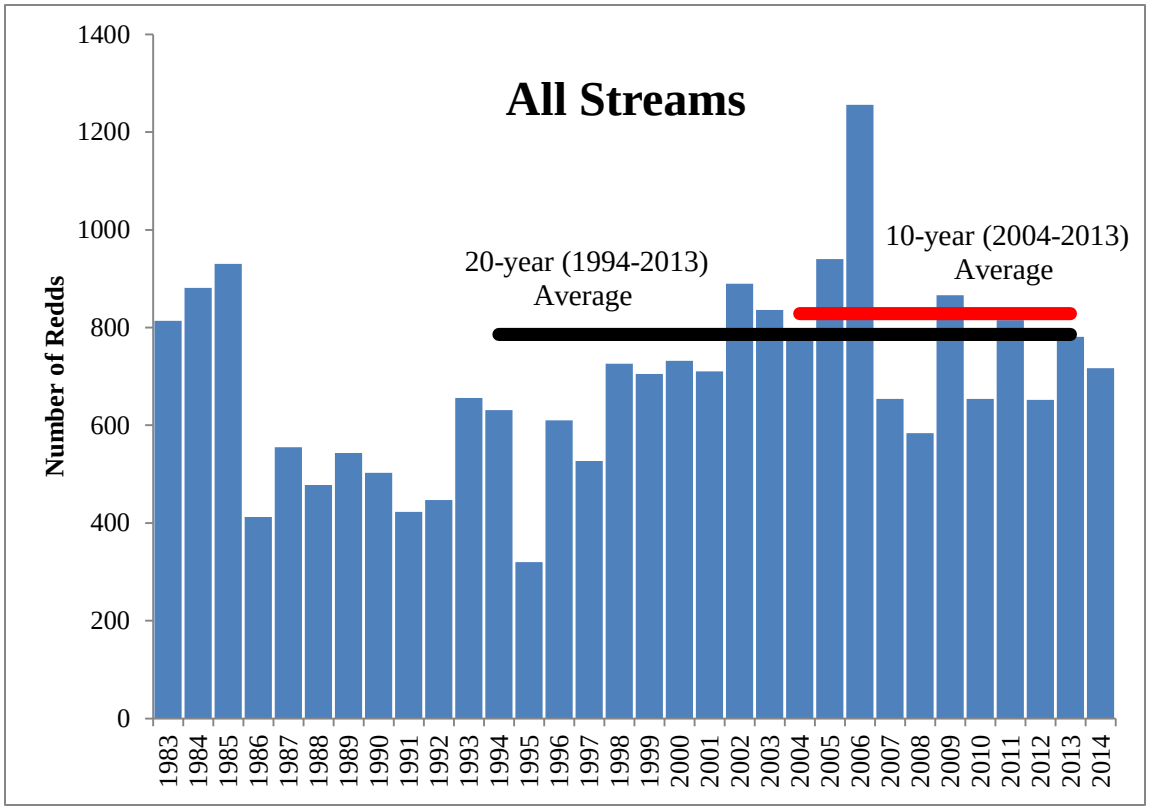



Figure 1. Number of Bull Trout redds counted in all surveyed streams in the Lake Pend Oreille drainage, 1983 to 2014.

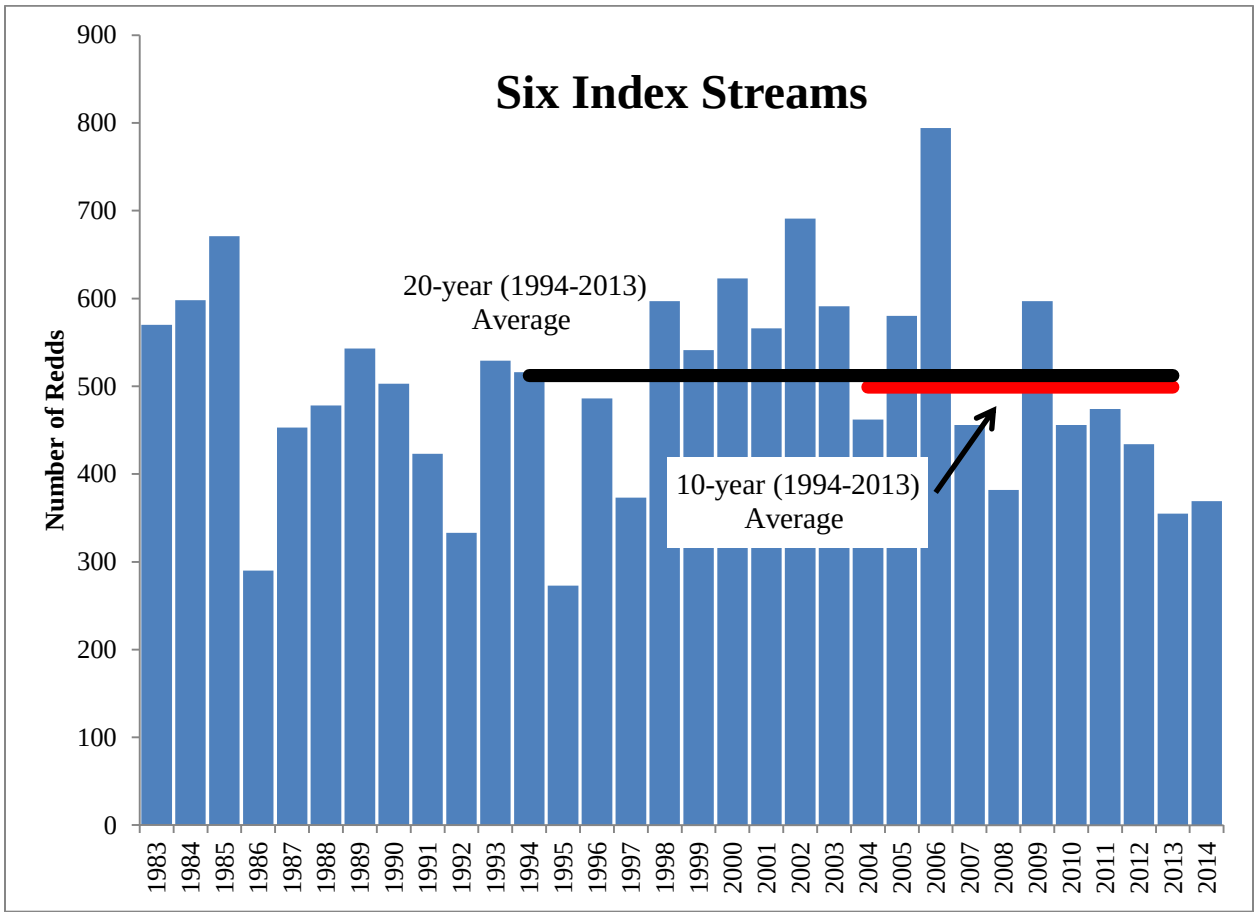



Figure 2. Number of Bull Trout redds counted in six index streams in the Lake Pend Oreille drainage, 1983 to 2014.

## LAKE PEND OREILLE SURVIVAL STUDY

### Methods

A study was initiated in 2011 to estimate Bull Trout survival from juvenile outmigration to adult return using half duplex (HDX) Passive Integrated Transponder (PIT) tag technology. Bull Trout in-lake survival will be estimated by monitoring juvenile Bull Trout emigration to Lake Pend Oreille (LPO) from selected tributaries and quantifying subsequent returns of adult Bull Trout to these tributaries. This project was proposed as a follow up to previous estimation of in-lake survival using similar techniques, which was completed in 2008 (Ryan et al. 2009). It is anticipated that ongoing predator suppression activities on LPO will increase in-lake Bull Trout survival by reducing direct mortality and competition, while increasing available food resources (e.g., kokanee) for Bull Trout. This project will allow for quantification of in-lake survival rates in the coming years.

Two tributary systems were selected for this study: Granite Creek, a tributary on the eastern shoreline of LPO, and Trestle Creek, a tributary entering LPO on the northern shoreline. Both tributaries support Bull Trout and Westslope Cutthroat Trout and sporadic spawning populations of both early- and late-run kokanee (*Oncorhynchus nerka*). Both tributaries have been influenced by habitat restoration and conservation efforts through Clark Fork Settlement Agreement (CFSA) programs. These tributaries have accessible locations and land ownership that allow for installation of PIT tag antenna arrays.

Granite Creek Bull Trout redd counts have varied considerably since standard redd surveys began in 1983, with annual totals ranging from 0 to 217. Significant in-stream habitat restoration was completed on Granite Creek during the mid-2000's to improve fish passage conditions. In addition, acquisition of important stream side properties has supported ongoing conservation efforts in this drainage by reducing potential conflicts with residential development. Improved adult escapement in recent years has been largely credited to these efforts. The average number of redds in Granite Creek over the last 10 years was 120, ranging from 52 in 2008 to 217 in 2013.

Trestle Creek has consistently supported one of the largest populations of spawning Bull Trout in the LPO system. The average number of redds counted in Trestle Creek over the last 10 years was 196, ranging from 102 in 2004 to 395 in 2006. Physical habitat conditions in this stream are generally considered to be good, and Trestle Creek is considered a highest priority tributary stream in the Lake Pend Oreille watershed (PBTAT 1998). Legacy effects from past logging and road construction as well as potential impacts from future timber harvest and road construction have largely been addressed in the watershed.

Remote HDX PIT tag antenna arrays have been operating nearly continuously in Granite and Trestle creeks since 2011 to detect emigrating Bull Trout juveniles and immigrating adult Bull Trout. Antenna arrays consist of two independent, swim-through loop-style, antennas that provide tag detection and allow for determination of travel direction. Antenna loops were constructed of 10 gauge THHN multi-stranded copper wire. Each antenna loop was constructed to span the bankfull channel width. Wire loops were encased in standard garden hose and/or

PVC-lined air hose for protection. Wire loops were suspended from a rope spanning the creek channel and anchored to the channel bottom using rebar stakes with affixed hooks. Antennas were operated by multi-antenna HDX readers (Oregon RFID). A single multi-antenna HDX reader was installed at each tributary location to operate two antennas positioned in an array approximately 10 m apart. Readers were powered by 120 volt AC power converted to 12 volt DC power either through an AC/DC power converter or through the use of a DC battery charging system.

PIT tag antenna arrays were operated continuously post-installation. Antenna performance was monitored and stored data was downloaded periodically during operation. When antenna performance was found to be limited or failures were found, the antenna were retuned or repaired as soon as possible. A waterproof marker tag (Oregon RFID) mounted within the field of one antenna loop per array was used to monitor antenna operation between data downloads. The placed marker tag was set to reveal a test tag at approximately 15 minute intervals. Test tag detection was used as an indication of proper antenna operation.

Juvenile Bull Trout and Westslope Cutthroat Trout were tagged with 12 mm HDX PIT tags to monitor migration and subsequent immigration in LPO tributaries. Juvenile fish were collected for tagging opportunistically throughout the occupied reaches of each stream using standard electrofishing techniques, usually during August and September. Collected fish were anesthetized, measured to the nearest mm, PIT tagged, and released. Only fish equal or greater than 100 mm were tagged. PIT tags were injected in the anterior dorsal sinus using 1.4 mm syringes. Tagged fish were observed during recovery from anesthetic to insure all tagged fish survived. Collected fish were released within the same general area in which they were collected.

Individual tag detections downloaded from the PIT tag array readers included tag identification number, time and date of detection, and a record of which antenna in the array detection occurred. Tag detections at each antenna in the array allowed for determination of the direction of travel and estimation of antenna detection efficiency. Direction of travel was determined by looking at the order of detection between paired antennas in the array. In instances where fish were detected on only one of the antennas in the array, it was assumed the fish passed the other antenna and had moved past the array.

**Results**

Based on marker tag detection, our HDX PIT tag antenna arrays on Granite and Trestle Creeks were operational for nearly 100% of the reporting period in 2014. No specific operational issues occurred during this period.

An additional 83 Bull Trout and 37 Westslope Cutthroat Trout were tagged in Granite Creek (Tables 1 and 2), and an additional 50 Bull Trout and 42 Westslope Cutthroat Trout were tagged in Trestle Creek (Tables 3 and 4) in 2014. Overall, 366 Bull Trout and 398 Westslope Cutthroat Trout have been tagged in Granite Creek, and 317 Bull Trout and 368 Westslope Cutthroat Trout have been tagged in Trestle Creek.

Through the end of 2014, approximately 24% of the PIT tagged Bull Trout and 30% of the PIT tagged Westslope Cutthroat Trout have been detected leaving Granite Creek. None of the Bull Trout have returned to Granite Creek from Lake Pend Oreille (Table 1), while four Westslope Cutthroat Trout (all tagged in 2012) have returned (Table 2). A smaller percentage of both Bull Trout (12%) and Westslope Cutthroat Trout (7%) have been detected leaving Trestle Creek, and only one returning adult Bull Trout has been detected in Trestle Creek thus far (Tables 3 and 4).

It is important to note that these data are preliminary and should not be interpreted as survival estimates. Detection data have not been adjusted for antenna efficiency, and especially for more recently tagged fish, not enough time has passed to allow for each tagging year's cohort to mature. It is anticipated that increased detections of maturing cohorts in the coming years will enable calculation of in-lake survival.

Table 1. Numbers of Bull Trout tagged, detected leaving Granite Creek, and detected re-entering Granite Creek, by tagging year, 2011-2014.

| | | No. Detected Out | | | | | | No. Detected Back | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year Tagged | Number Tagged | 2011 | 2012 | 2013 | 2014 | Total | % | 2013 | 2014 | Total | % |
| 2011 | 263 | 33 | 30 | 0 | 0 | 63 | 24.0 | 0 | 0 | 0 | 0.0 |
| 2012 | 20 | | 6 | 6 | 0 | 12 | 60.0 | 0 | 0 | 0 | 0.0 |
| 2013 | 0 | | | | | | | | | | |
| 2014 | 83 | | | | 14 | 14 | 16.9 | | 0 | 0 | 0.0 |
| Total | 366 | 33 | 36 | 6 | 14 | 89 | 24.3 | | | 0 | 0.0 |

Table 2. Numbers of Westslope Cutthroat Trout tagged, detected leaving Granite Creek, and detected reentering Granite Creek, by tagging year, 2011-2014.

| | | No. Detected Out | | | | | | No. Detected Back | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Year Tagged | Number Tagged | 2011 | 2012 | 2013 | 2014 | Total | % | 2013 | 2014 | Total | % |
| 2011 | 0 | | | | | | | | | | |
| 2012 | 199 | | 13 | 8 | 3 | 24 | 12.1 | 3 | 1 | 4 | 16.7 |
| 2013 | 162 | | | 31 | 28 | 59 | 36.4 | 0 | 0 | 0 | 0.0 |
| 2014 | 37 | | | | 0 | 0 | 0.0 | | 0 | 0 | |
| Total | 398 | 0 | 13 | 39 | 31 | 83 | 20.9 | | | 4 | 4.8 |

Table 3. Numbers of Bull Trout tagged, detected leaving Trestle Creek, and detected reentering Trestle Creek, by tagging year, 2011-2014.

| Year Tagged | Number Tagged | No. Detected Out | | | | | | No. Detected Back | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2011 | 2012 | 2013 | 2014 | Total | % | 2013 | 2014 | Total | % |
| 2011 | 197 | 25 | 5 | 2 | 0 | 32 | 16.2 | | 1 | 1 | 3.1 |
| 2012 | 70 | | 4 | 1 | 0 | 5 | 7.1 | 0 | 0 | 0 | 0.0 |
| 2013 | 0 | | | | | | | | | | |
| 2014 | 50 | | | | 2 | 2 | 4.0 | | 0 | 0 | 0.0 |
| Total | 317 | 25 | 9 | 3 | 2 | 39 | 12.3 | | | 1 | 2.6 |

Table 4. Numbers of Westslope Cutthroat Trout tagged, detected leaving Trestle Creek, and detected reentering Trestle Creek, by tagging year, 2011-2014.

| Year Tagged | Number Tagged | No. Detected Out | | | | | | No. Detected Back | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2011 | 2012 | 2013 | 2014 | Total | % | 2013 | 2014 | Total | % |
| 2011 | 0 | | | | | | | | | | |
| 2012 | 196 | | 0 | 18 | 0 | 18 | 9.2 | 0 | 0 | 0 | 0.0 |
| 2013 | 130 | | | 2 | 4 | 6 | 4.6 | 0 | 0 | 0 | 0.0 |
| 2014 | 42 | | | | 2 | 2 | 4.8 | | 0 | 0 | 0.0 |
| Total | 368 | 0 | 0 | 20 | 6 | 26 | 7.1 | | | 0 | 0.0 |

## PORCUPINE LAKE MONITORING

In 2010, non-native Brook Trout were removed from Porcupine Lake in the Lightning Creek drainage using chemical treatment. Porcupine Lake was then stocked with approximately 4,800 Westslope Cutthroat fry in 2011 and about 2,400 Westslope Cutthroat fry 2012. A survey of the post-stocking fish population was first undertaken in 2013. No fish were captured in gillnet gear during that event, although some small fish were noticed rising. It was unclear if the stocked fish had not yet grown to a size where they would be caught in the gill net gear, if survival of the stocked fish was low, or both.

To attempt to answer these questions, Porcupine Lake was sampled again in 2014. The objective of this work was to document survival and growth of Westslope Cutthroat Trout and to monitor the lake for potential Brook Trout inhabitance. Gill net gear was set overnight and five Westslope Cutthroat and no Brook Trout were captured.

In addition, an environmental DNA (eDNA) sample was taken from the outlet stream looking for evidence of Brook Trout remaining in the system. This technique is very sensitive for detecting the presence of the targeted species. A water sample is taken and the sample is assayed for DNA of the species in question; in this case, Brook Trout. No brook trout DNA was detected, which supports our conclusion that the 2010 suppression efforts were successful.

## ACKNOWLEDGEMENTS

The authors would like to thank all those that contributed to this work. Avista Corp. employees John Suhfras and Rex Philpott assisted with stream monitoring and Bull Trout redd counts. Scott Deeds (USFWS), USFS employees Kevin Davis and Rich Dunn, IDFG employees Bill Ament, TJ Ross, Casey Yallaly, Bill Harryman, Nick Wahl, Rob Ryan, and Tom Whalen, IDL employee Chris Teeter, and Kalispell Tribe employees Ryan McNee and Todd Anderson all assisted with LPO Bull Trout redd counts. Avista Corp. biologists Shana Bernall, Sean Moran, Eric Oldenburg, and Joe DosSantos as well as Wade Fredenberg (USFWS) and Andy Dux (IDFG) reviewed previous versions of this report.

## REFERENCES


Hayes, D. B., J. R. Bence, T. J. Kwak, and B. E. Thompson. 2007. Abundance, biomass, and production in Analysis and interpretation of freshwater fisheries data, C. S. Guy and M. L. Brown, editors. American Fisheries Society,Bethesda, Maryland.

Meyer, K. and D. Schill. 1999. Using single-pass electrofishing along with multi-pass removals to predict trout abundance. Fisheries Research Brief 99-01, Idaho Department of Fish and Game, Boise Idaho.

Panhandle Bull Trout Technical Advisory Team. 1998. Lake Pend Oreille key watershed Bull Trout problem assessment. Idaho Department of Environmental Quality, Boise.

Pratt, K. 1984. Pend Oreille trout and char life history study. Report to the Idaho Department of Fish and Game and the Lake Pend Oreille Idaho Club. Boise, Idaho.

Ryan, R., C.C. Downs, and R. Jakubowski. 2009. Lake Pend Oreille/Clark Fork River fishery research and monitoring, 2007 progress report. Report to Avista Corporation, Spokane, Washington.

Ryan, R. and R. Jakubowski. 2011a. Native salmonid research and monitoring progress update, 2009. Report to Avista Corporation, Spokane, Washington.

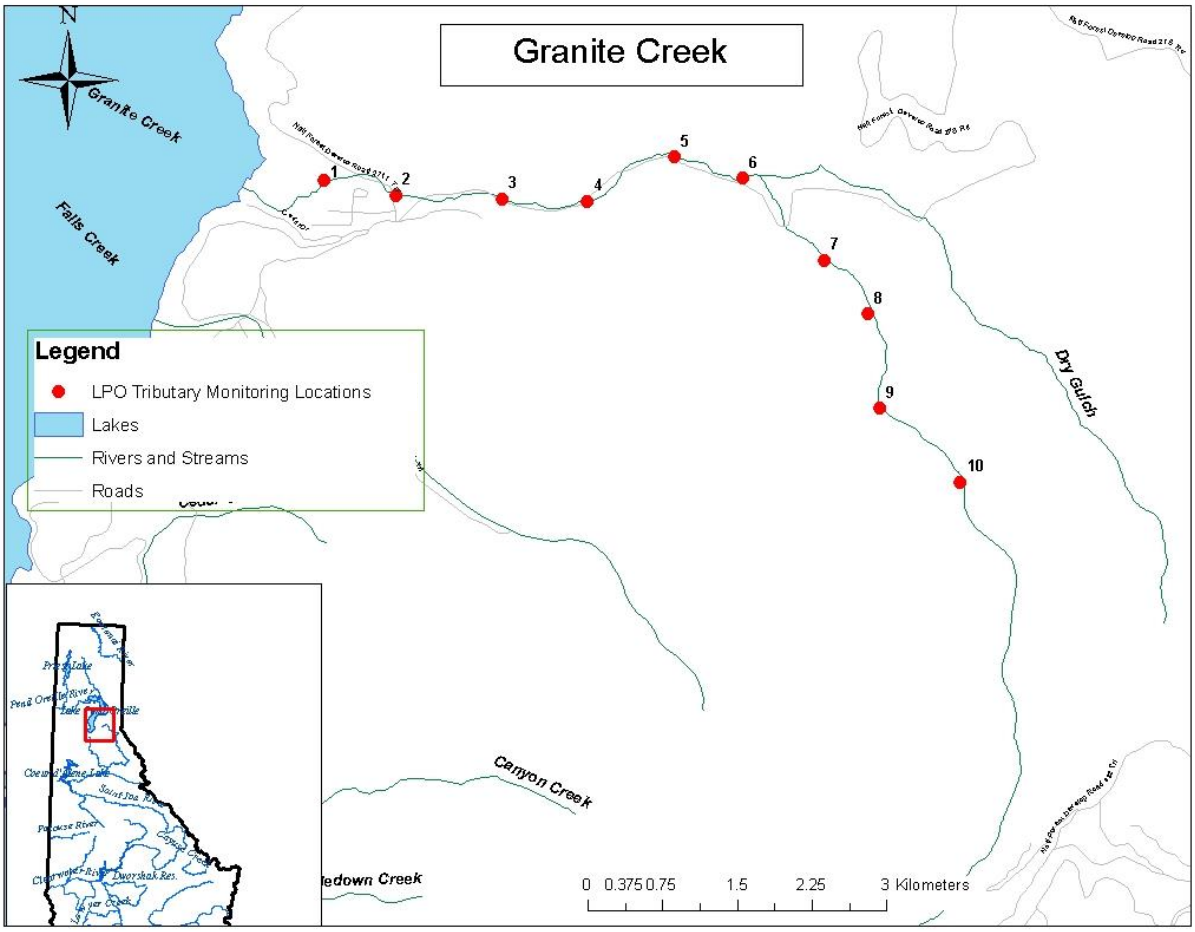
Ryan, R. and R. Jakubowski. 2011b. Native salmonid research and monitoring progress update, 2010. Report to Avista Corporation, Spokane, Washington.

Ryan, R. and R. Jakubowski. 2012. Idaho native salmonid research and monitoring report, 2011 progress report. Report to Avista Corporation, Spokane, Washington.

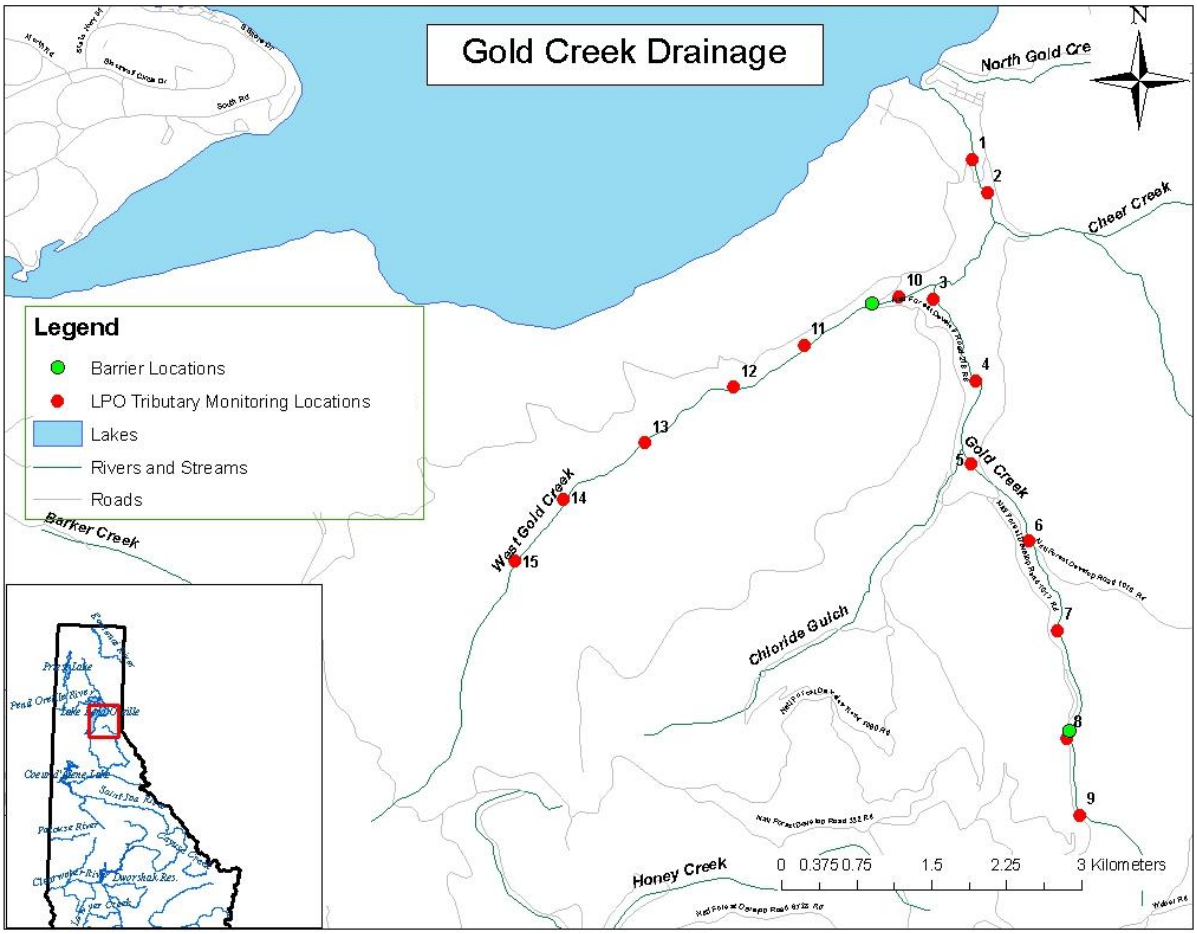
Ryan, R, R. Jakubowski, and K. Yallaly, Idaho Native Salmonid Research and Monitoring Update – 2013. Report to Avista Corporation, Spokane, Washington.

Zippin, C. 1958. The removal method of population estimation. Journal of Wildlife Management. 22(1):82-90.

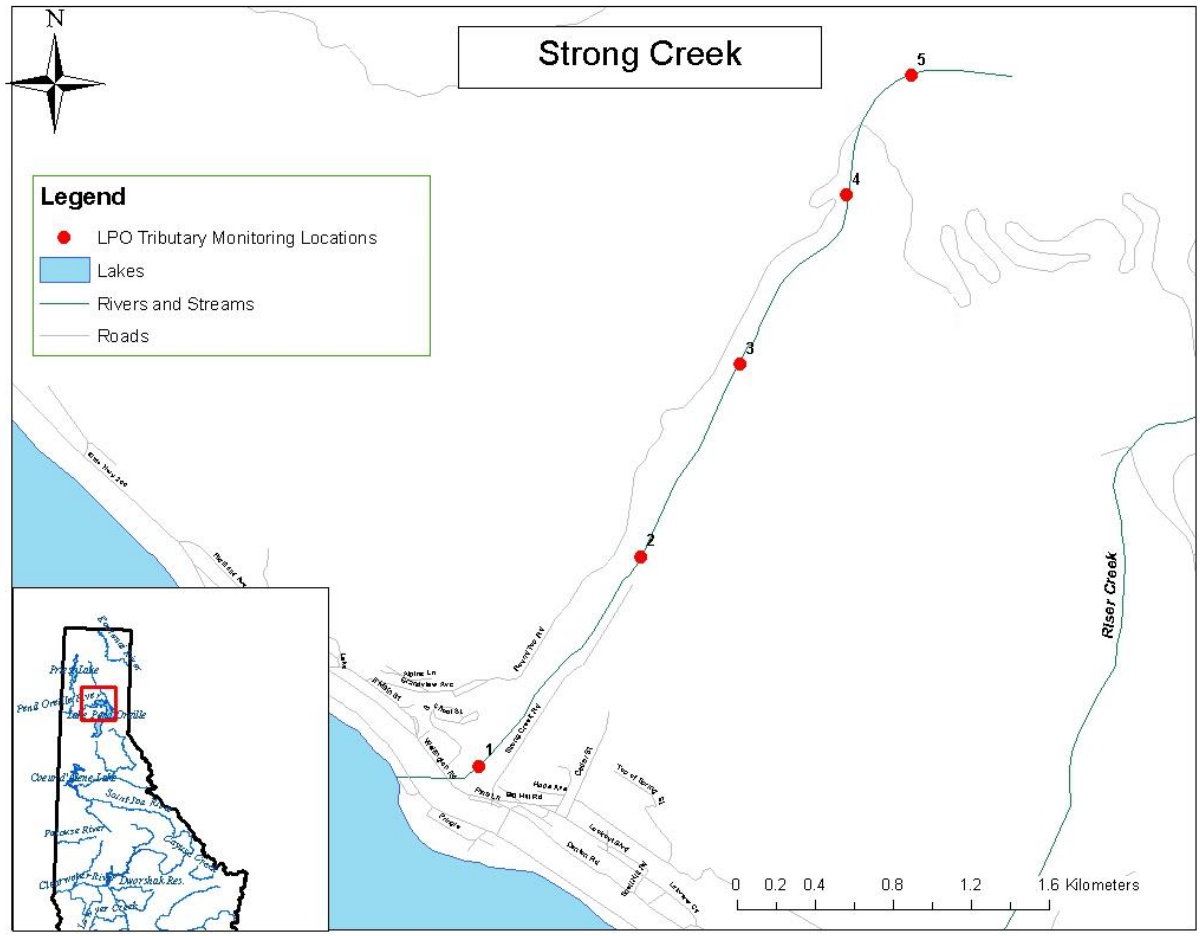
## APPENDIX A. LAKE PEND OREILLE TRIBUTARY MONITORING MAPS



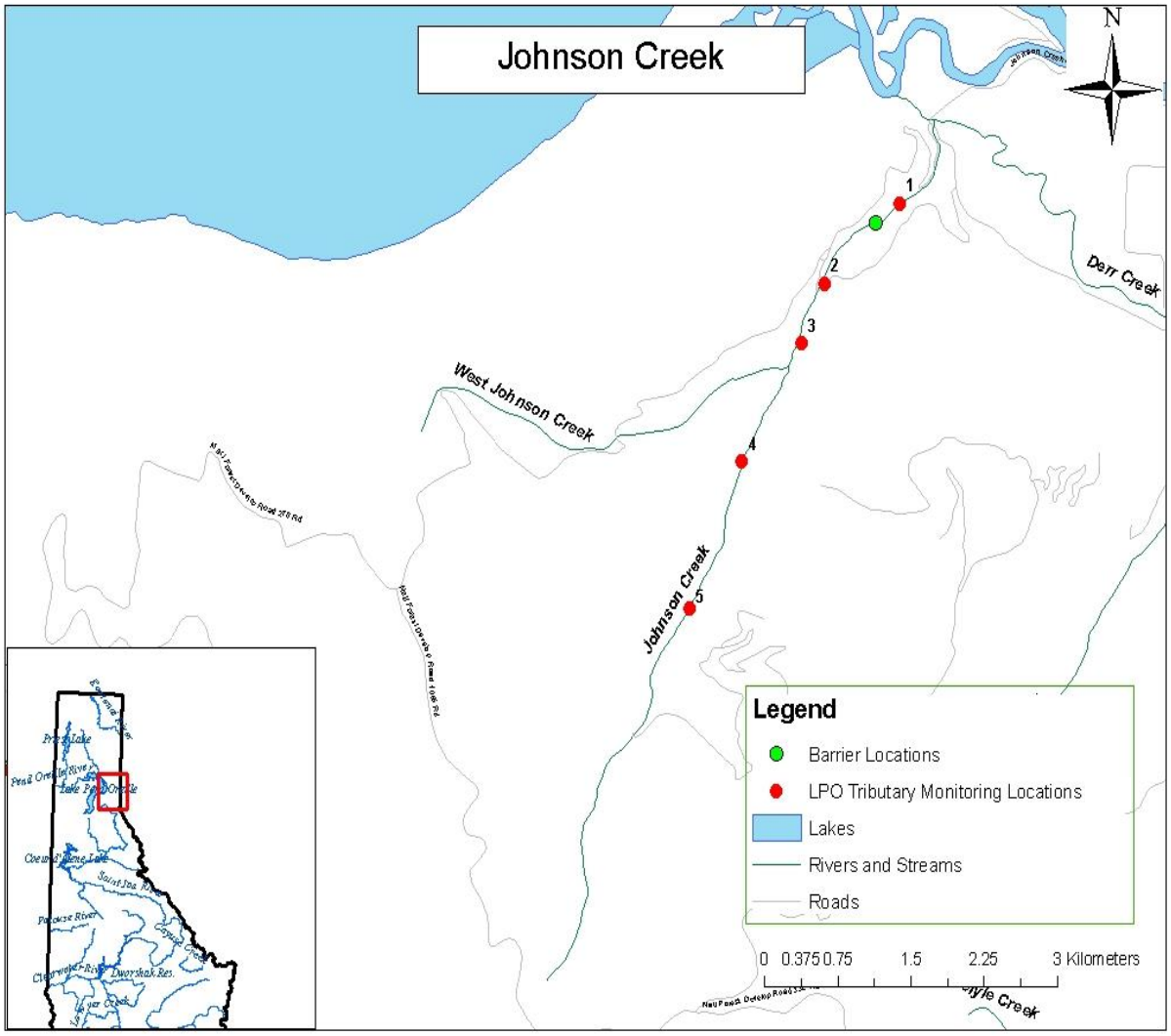

Appendix A-1. Tributary monitoring locations on Granite Creek. Monitoring locations are numbered to correspond with approximate distance upstream (km) from Lake Pend Oreille.



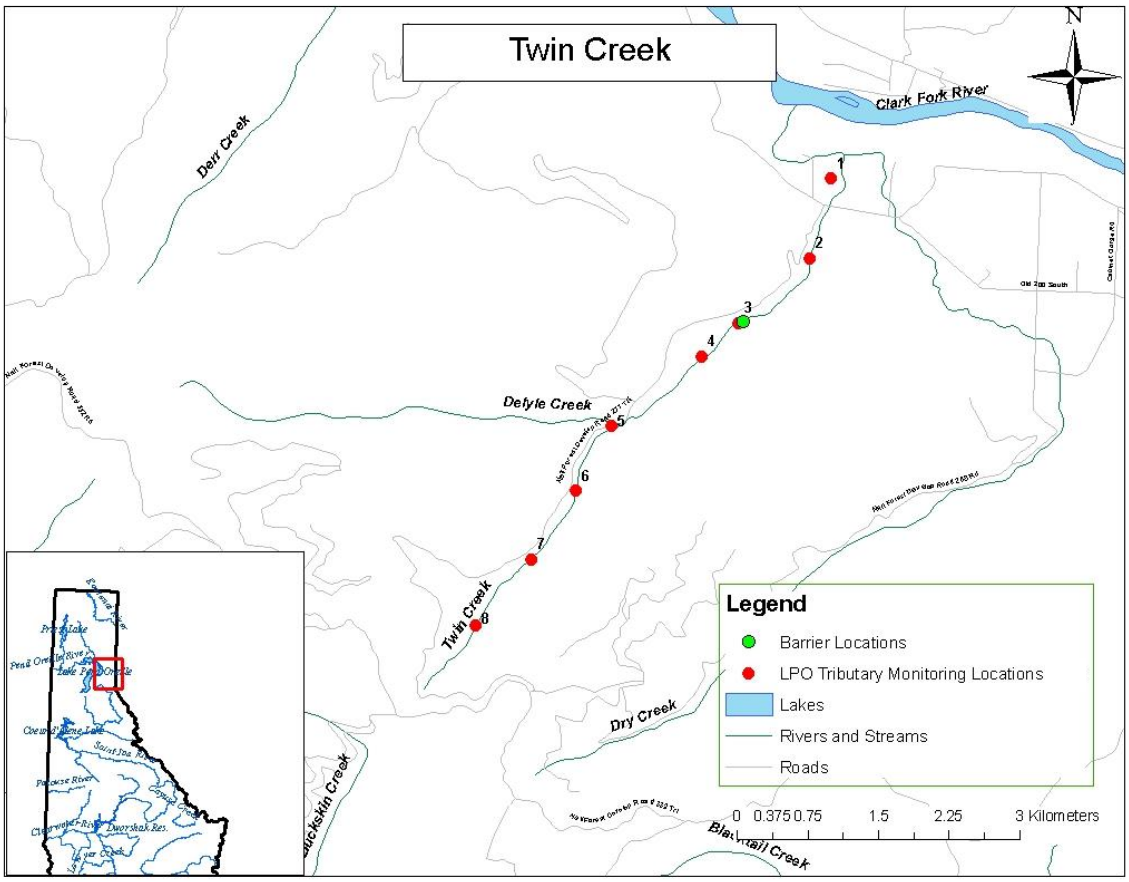

Appendix A-2. Tributary monitoring locations on Gold Creek. Monitoring locations are numbered to correspond with approximate distance upstream (km) from Lake Pend Oreille.




Appendix A-3. Tributary monitoring locations on Strong Creek. Monitoring locations are numbered to correspond with approximate distance upstream (km) from Lake Pend Oreille.




Appendix A-4. Tributary monitoring locations on Johnson Creek. Monitoring locations are numbered to correspond with approximate distance upstream (km) from the confluence with Derr Creek.




Appendix A-5. Tributary monitoring locations on Twin Creek. The monitoring location is numbered to correspond with approximate distance upstream (km) from the confluence with the Clark Fork River.