White Salmon River Bull Trout: Patches, Occupancy and Distribution

2010 Progress Report

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Introduction

Bull trout (*Salvelinus confluentus*) were listed threatened in the coterminous United States November 1, 1999 (USFWS 1999). Previously, the Columbia River distinct population segment (DPS) of bull trout had been listed as threatened since June 10, 1998. Factors contributing to the listing of bull trout include range wide declines in distribution, abundance and habitat quality. Land and water uses that alter or disrupt habitat requirements of bull trout can threaten the persistence of the species. Examples of such activities include: dams as well as water diversions, timber extraction, mining, grazing, agriculture, nonnative fish competition and/or hybridization, poaching, past fish eradication projects, and channelization of streams. Threats to the persistence of bull trout are prevalent throughout the Columbia River basin (USFWS 2000, 2002).

Flowing from the south side of the 3,742 m peak of Mount Adams, the White Salmon River drains into the Columbia River at river km 269 (Figure 1). Many of the upper tributaries of the White Salmon River are high gradient seasonal streams created by snow and glacial run off. Relatively low gradient tributaries such as Trout Lake Creek enter the mainstem from the west. Within the drainage, Condit Dam lies approximately 5.3 km upstream from the Columbia River confluence. PacifiCorp, a utilities company that owns and operates Condit Dam, has proposed to decommission this dam and remove it in the fall of 2011. This dam was constructed in 1913 and has since been a barrier to fish migrating upstream. Upon removal, the subbasin will be reconnected with the Columbia River.

Core habitat, habitat that could supply all elements for the persistence of a species, has been identified for bull trout within the White Salmon River (USFWS 2002). Two sightings of bull trout in the White Salmon River above Condit Dam have been recorded in the past two decades by Washington Department of Fish and Wildlife biologists, one during a gillnet operation in 1986 and one during a creel census in 1989 (USFWS 2002). Recent investigations have yet to produce observations (Byrne et al. 2001, Silver et al. 2009a, Silver et al. 2009b, Silver et al. 2010, Thiesfeld et al. 2001).

One objective of our work is to delineate bull trout patches (putative population boundaries) in the White Salmon River subbasin (following Dunham and Rieman, 1999, as modified in USFWS 2008). Patches are intended to represent areas that can support spawning and early rearing (i.e., age 0-2 fish). In addition, bull trout occupancy of the patches as well as bull trout distribution within occupied patches will be determined both pre- and post-dam removal. Given the unique circumstances of this situation (i.e., removal of a dam behind which bull trout are likely, functionally extirpated), this initial work will provide a quantitative baseline against which to compare changes in occupancy and distribution of bull trout in the White

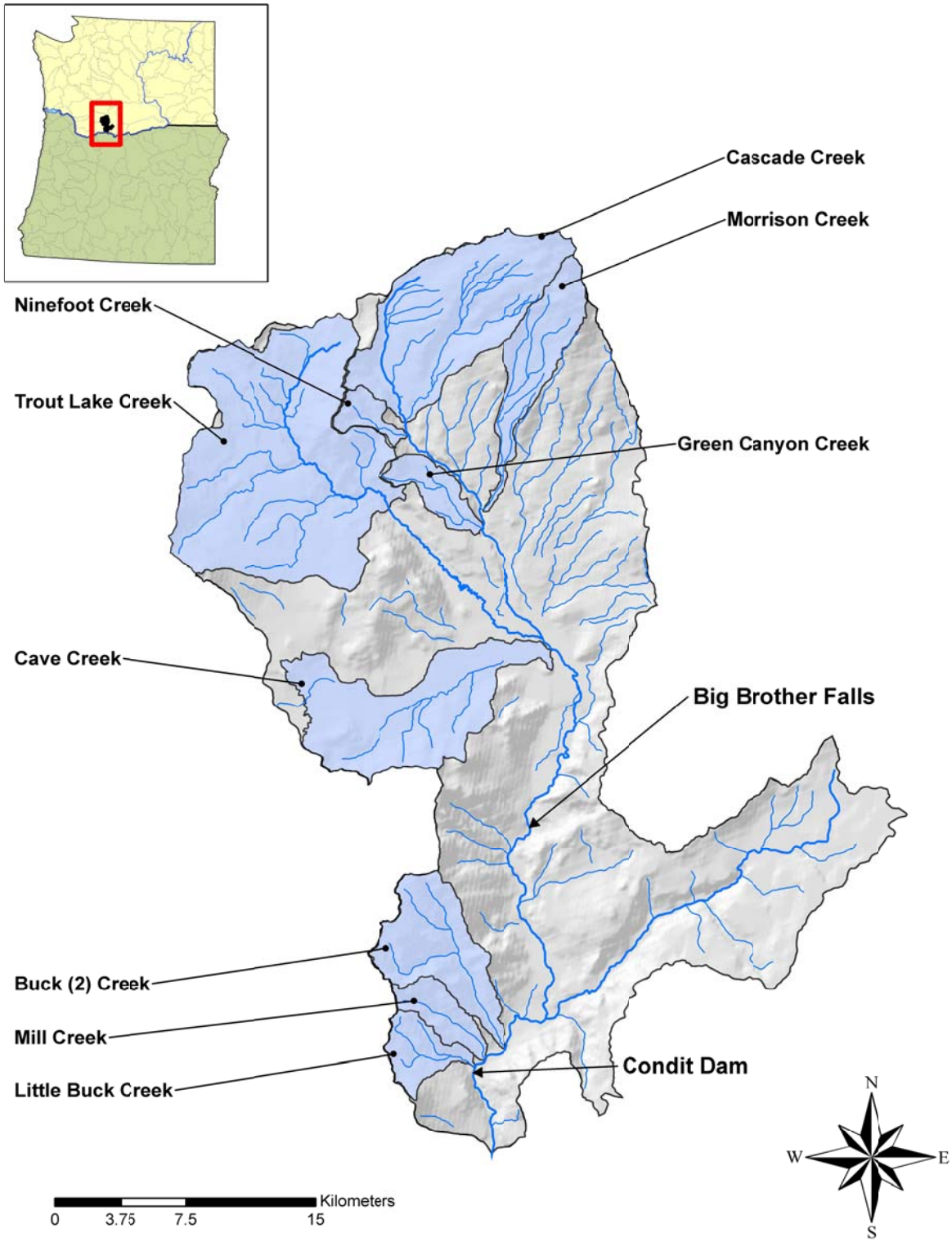


Figure 1. White Salmon River subbasin patch delineation.

Salmon River subbasin subsequent to reconnection of the system with the mainstem Columbia River.

Guidance from the Bull Trout Recovery Monitoring and Evaluation Group (USFWS 2008) recommends utilizing maximum annual stream temperature, stream size and catchment area as filters for determining potential bull trout habitat. Many other factors identified by Dunham and Rieman (1999) may also influence bull trout distribution (e.g., connectivity, stream gradient, geology, hydrologic regimes, presence of nonnative species, road density, solar radiation). However, maximum annual stream temperature (and the corresponding elevation) effectively dictates the range of this species (Rieman and McIntyre 1995) and patch size (catchment area) may be the most important factor determining bull trout occurrence (Dunham and Rieman 1999). Utilizing these three filters provides the opportunity to evaluate this approach as a tool driven by information that most managers can readily acquire.

The use of these three filters provides a starting point for determining a framework by which the distribution of bull trout within a subbasin can be evaluated. There may be exceptions to the potential distribution identified using this tool. Some bull trout populations may exist outside these patches due to geologic anomalies or other factors in the subbasin. Bull trout distribution within an identified patch may be limited or nonexistent due to barriers, hydrologic regimes or other factors. However, by using this tool, it is possible to implement a sampling approach that focuses limited resources in areas that may have a relatively high probability of supporting bull trout populations in a subbasin.

By investigating the possible distribution of bull trout within the White Salmon River drainage, we can improve our understanding of this threatened species. This work will establish a quantitative baseline for bull trout occupancy and distribution in this subbasin prior to the removal of Condit Dam. Implementation of this approach through a long-term monitoring program subsequent to dam removal will provide information on recolonization of bull trout. This understanding will allow us to work towards restoration and recovery of bull trout populations within the Coastal Recovery Unit as well as range wide. Specific tasks for 2010 were to assess bull trout occupancy in five patches within the White Salmon River subbasin.

Methods

Patch Delineation

Patches were delineated in 2007 and revised in 2009 (Figure 1; Silver et al. 2009a, 2010).

Occupancy and Distribution

Randomly selected, spatially balanced sample reaches (50 m reaches) were determined for all patches in 2007 (Silver et al. 2009a). Using backpack electrofishing, the site-specific detection probability for bull trout in the Lewis River, a similar subbasin, was 37.5% (Cook et al. 2009). No site-specific detection probability information is available specifically for the White Salmon River, so available data from the Lewis River was used as a surrogate. Assuming this detection probability, guidance provided by RMEG (USFWS 2008) indicates that if three reaches per patch were sampled with a backpack electrofisher and less than two age classes of bull trout were captured, we could be 80% certain that the patch was unoccupied by a population of bull trout (95% if seven reaches are sampled). Given the lack of empirical information in the White Salmon subbasin, the top seven reaches were sampled in an attempt to ensure at least an 80% confidence level that bull trout were not present when not detected. If at least two age classes (as determined by size classes > 30 mm different in fork length) of bull trout were captured within the patch, it was considered occupied by a population.

Sampling was conducted for occupancy and distribution assessments using backpack electrofishing. Each 50 m reach was sampled by a crew of two from the downstream to the upstream boundary without a blocknet (Silver et al 2009a). All fish captured were identified. Length and mass were documented to facilitate size class determination. *Salvelinus* species were carefully scrutinized for diagnostic features (e.g., vermiculation, black markings on fins, halos) before identification (Holton and Johnson 1996), as both bull trout and brook trout (*Salvelinus fontinalis*) may inhabit these watersheds and hybridization between the two could occur. Trout fry (TF) were identified as *Oncorhynchus* spp. when too small to reliably differentiate as *O. clarki* or *O. mykiss*. All fish captured were released alive within the sampled reach.

After the completion of fish sampling, habitat data was collected from the study reach. The gradient of each sampling reach was measured using a hand-held clinometer. Gradient was measured and recorded twice in each reach, from the top of the reach to the middle, and again from the middle to the bottom of the reach. The eye level height of the person sighting the gradient was measured against the person standing downstream. One surveyor stood level with the water's edge upstream and measured the percent gradient against the second surveyor standing downstream at level with the water's edge.

Transects were flagged along the thalweg at every 10 meter mark from 0 to 50 meters. Channel dimensions were then measured along each of the six designated transects within the 50 meter sampling reach. For each transect, measurements were completed for the current wetted width, maximum depth along the transect line, and depth recordings at ¼, ½, and ¾ distance across the wetted width.

Within each reach, large woody debris (LWD) was categorized and counted. Wood was classified into four categories: LWD > 10 cm in diameter and > 3 m in length, LWD > 60 cm in diameter and > 10 m in length, root wads and LWD piles (aggregates of > 4 pieces of wood together). Only pieces of wood directly within the channel or within one meter of the water's surface were considered.

The number, type and size of undercut banks were measured along both sides of the sampling reach. Undercuts were defined as areas under boulders, banks, wood, or bedrock along the stream bank that were > 5 cm deep, > 10 cm in length, and > 5 cm in height (e.g., PIBO; Kershner et al. 2004). Only undercuts within 0.5 meter of the stream surface were considered.

Thermographs

To further improve the understanding of water temperature characteristics in the White Salmon River subbasin, 19 individual HOBO Water Temp Pro thermographs were deployed in summer 2009 and downloaded in summer 2010 (Table 1 and Figure 2). These thermographs record water temperatures every 30 minutes. They were redeployed and data will again be downloaded in summer 2011.

Table 1. Thermograph deployment within the White Salmon River subbasin.

Reach ID #	Location	Elevation (m)	Comments
1	Buck Creek below dam	109	20m d/s bridge, Next to pipe
2	Lower Middle Fork Buck Creek	166	10m below old road crossing
3	Middle Fork Buck Creek	218	Upstream of culvert
4	Upper Middle Fork Buck Creek	289	End of road walk right to ck.
5	Cave Creek (Rd. 86)	232	Downstream of culvert
6	Cave Creek (Rd. 8620)	251	Upstream of culvert
7	Lemei Trailhead	338	Dry-Not deployed
8	Cultis Creek Campground	371	Downstream of culvert
9	Meadow Creek Campground	385	Upstream of culvert
10	Little Goose Creek (Rd. 88)	289	Downstream of culvert
11	Cultis Creek (Rd. 88 & 081)	320	Upstream of culvert
12	Trout Lk Ck Trailhead 2000	309	Upstream of bridge
13	Wicky Cr. (Rd. 8031)	290	Downstream of culvert
14	Morrison Cr. (Rd. 775)	345	End of road, below trib.
15	Crofton Ridge East Trailhead	422	Downstream of culvert
16	Salt Creek Trailhead	308	Downstream of bridge
17	Cascade Creek Trail	341	Wired to tree root near trail
18	Lower Ninefoot Cr.	311	Tied into a log jam
19	Middle Ninefoot Cr. (Rd. 2360)	347	Wired to rebar in bank
20	Upper Ninefoot Cr. (Rd. 041)	379	Upstream of road

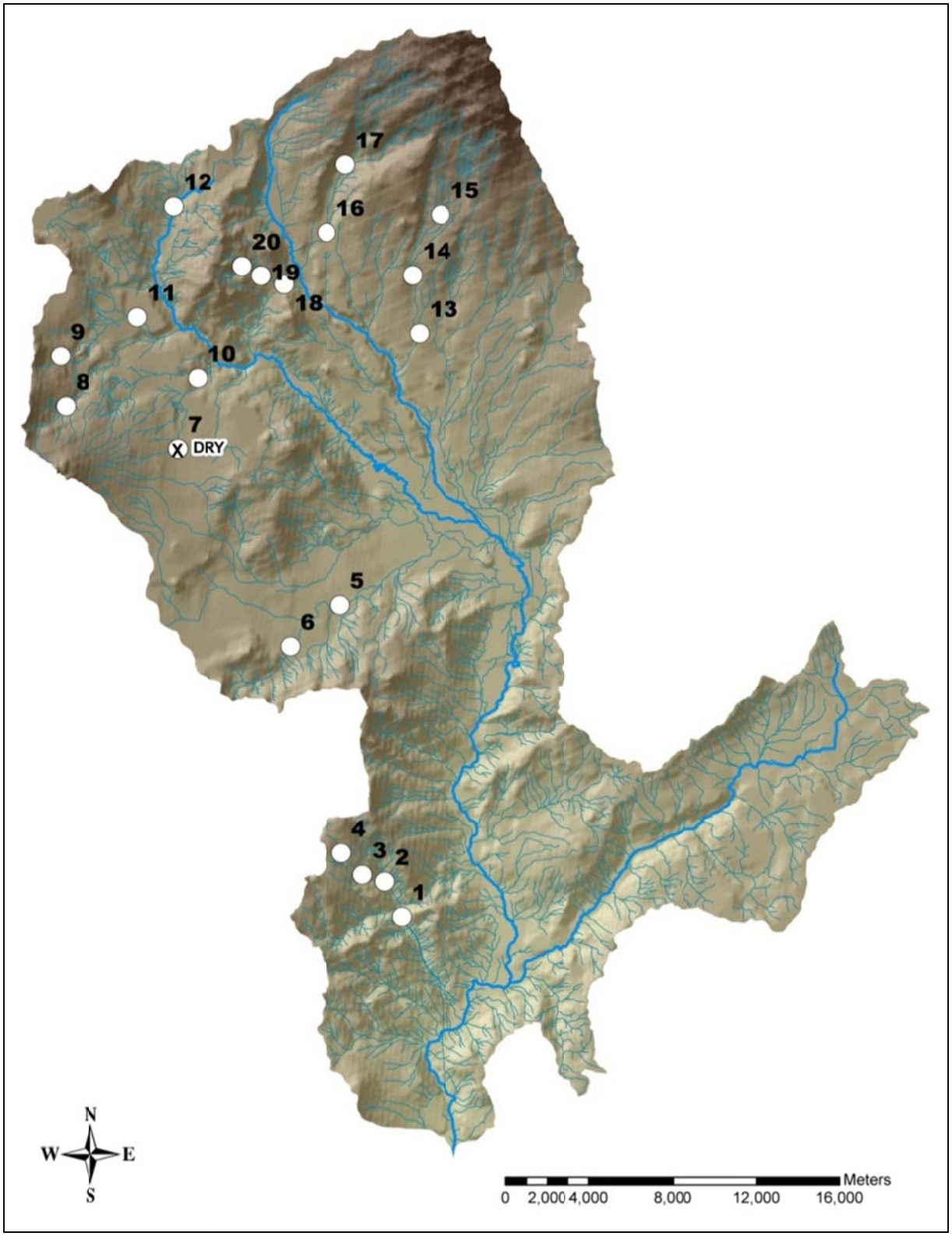


Figure 2. Thermograph locations within the White Salmon River subbasin.

Results

Occupancy and Distribution

Field work in the White Salmon River basin occurred between June 9 and July 8, 2010. A total of 27 reaches in five patches (Cave Creek, Green Canyon Creek, McIlroy Canyon, Ninefoot Creek, Phelps Creek) were sampled (Table 2, Figure 3). Electrofishing efforts for all reaches of the White Salmon subbasin totaled 4,706 seconds, with an average of 214 seconds electrofished in each reach.

Table 2. Reaches sampled and species captured 2010.

Patch	Reach(s)	Date	Sample Status	Species	Non-Salmonid Species	Comments
Cave Creek	1	6/22	Sampled	Brook Trout		
	2	6/21	Sampled	Brook Trout		
	3	6/22	Sampled	Brook Trout		
	4	6/21	Sampled		Salamander and tadpoles	No Fish
	5	6/22	Sampled			No Fish
	6	6/22	Sampled			No Fish
	7	6/22	Not Sampled			Dry
	8	6/23	Sampled			Fry observed
Green Canyon Creek	1	6/14	Sampled	*O. mykiss*		
	2	6/14	Not Sampled			Dry
	3	6/16	Sampled		Salamander	No Fish
	4	6/14	Not Sampled			Dry
	5	6/14	Not Sampled			Dry
	6	6/15	Sampled			No Fish
	7	6/15	Sampled		Cottid sp.	
	8	6/15	Sampled			No Fish
	9	6/14	Not Sampled			Dry
	10	6/16	Sampled	*O. mykiss*		
	11	6/15	Sampled			No Fish
McIlroy Canyon	1, 2, 3, 4, 5, 6	6/09	Not Sampled			Barrier at the mouth
Ninefoot Creek	1	6/09	Sampled			No Fish
	2	7/08	Sampled			No Fish
	3	7/07	Sampled			No Fish
	4	7/07	Sampled			No Fish
	5	6/29	Sampled			No Fish
	6	7/08	Sampled		Salamanders	No Fish
	7	6/29	Sampled	*O. mykiss*	Tadpoles	
Phelps Creek	4	6/09	Sampled		Salamander	No Fish

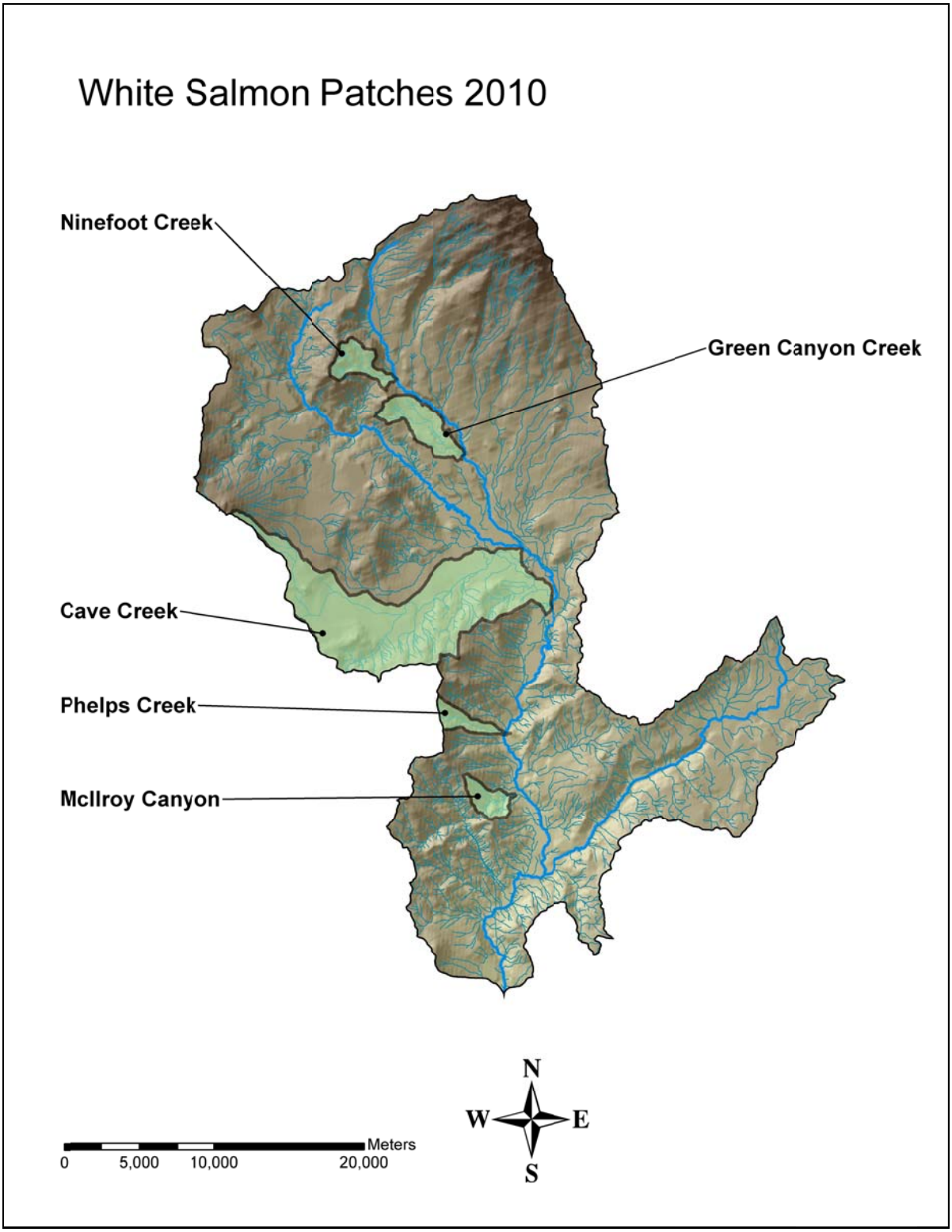


Figure 3. Patches sampled in the White Salmon subbasin in 2010

The Cave Creek patch was reassessed in 2009 to identify sample reaches in permanent streams (Figure 4). Seven reaches were sampled. Brook trout (*Salvelinus fontinalis*) were captured in three reaches. No bull trout were captured. Mean temperature for this patch during sampling was 10.6 °C (range 7.0 – 17.0 °C) (Table 3).

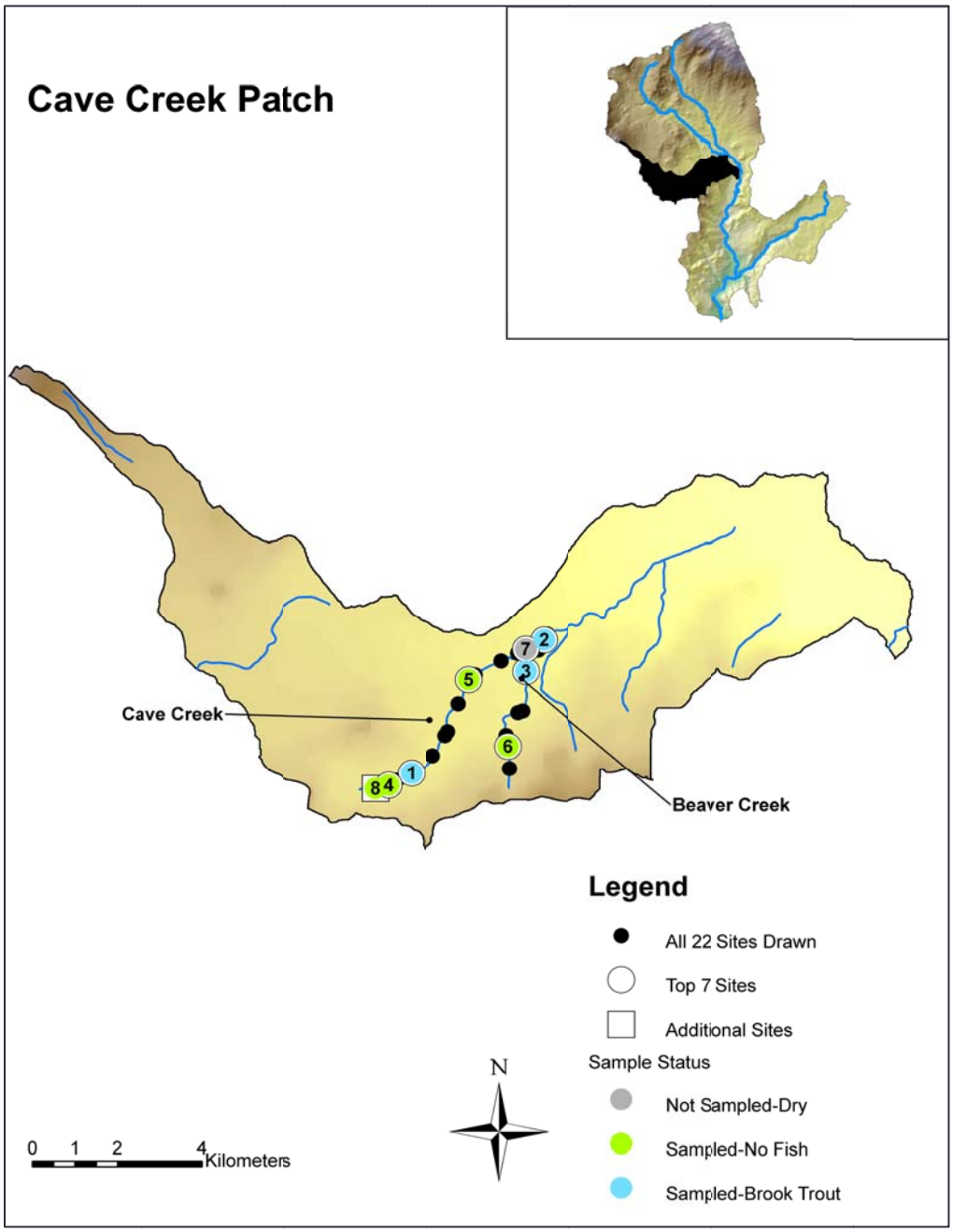


Figure 4. Reaches in Cave Creek Patch including all reaches drawn within patch, top 7 reaches (identified by number), and any additional reaches included in sampling because one or more of the top seven could not be sampled, as well as species captured within sampled reaches.

Seven reaches were sampled in the Green Canyon Creek patch (Figure 5). *O. mykiss* were captured in two reaches. No bull trout were captured. Mean temperature for this patch during sampling was 7.5 °C (range 6.5 – 9.0 °C) (Table 3).

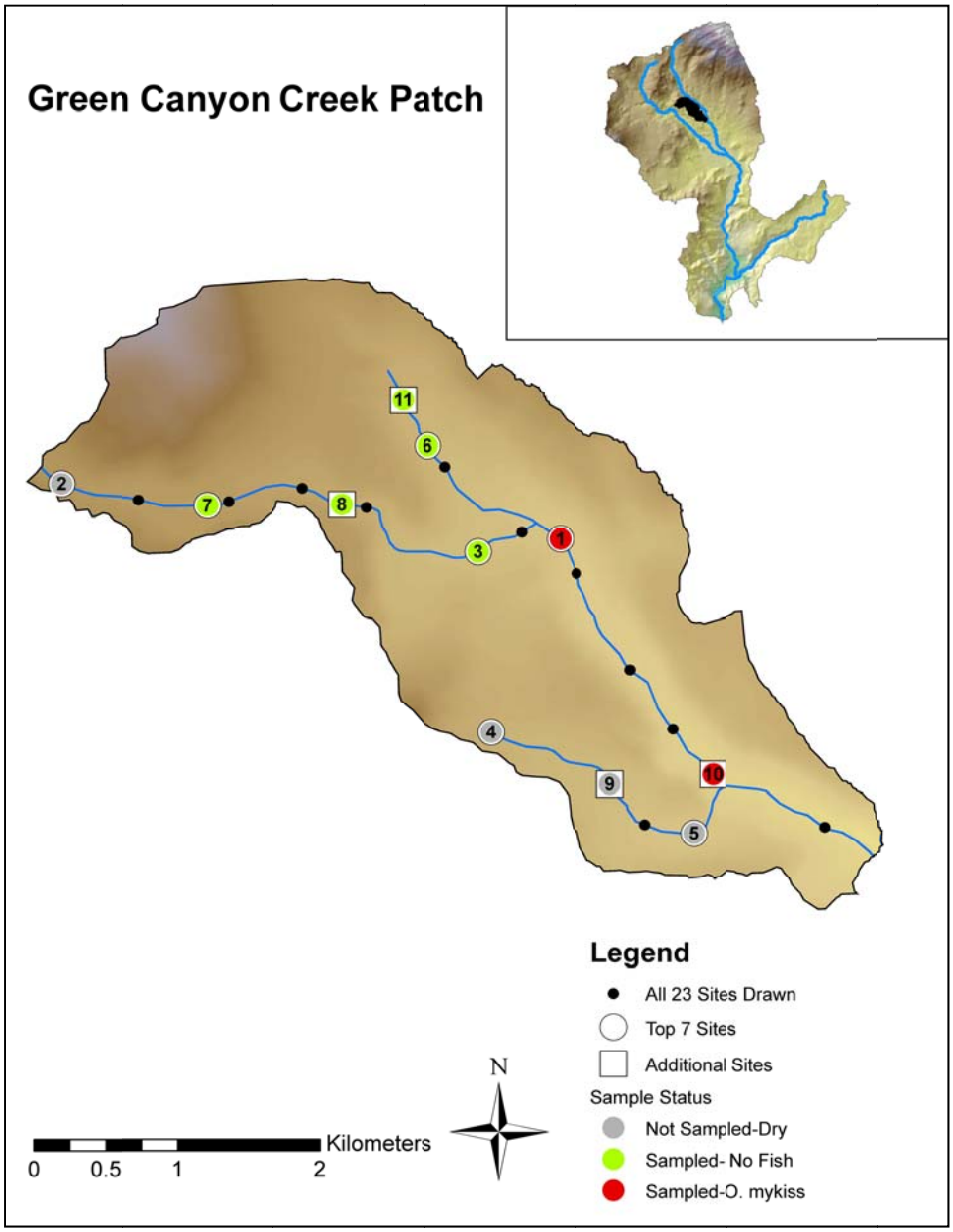


Figure 5. Reaches in Green Canyon Creek Patch including all reaches drawn within patch, top 7 reaches , and any additional reaches (identified by number) included in sampling because one or more of the top seven could not be sampled, as well as species captured within sampled reaches.

No reaches were sampled in the McIlroy Canyon patch and it is considered not occupied by bull trout (Figure 6). Anecdotal information indicates the stream is seasonally intermittent. In addition, there is a 7 m barrier located at the confluence with the White Salmon River preventing upstream migration of bull trout (Figure 9a).

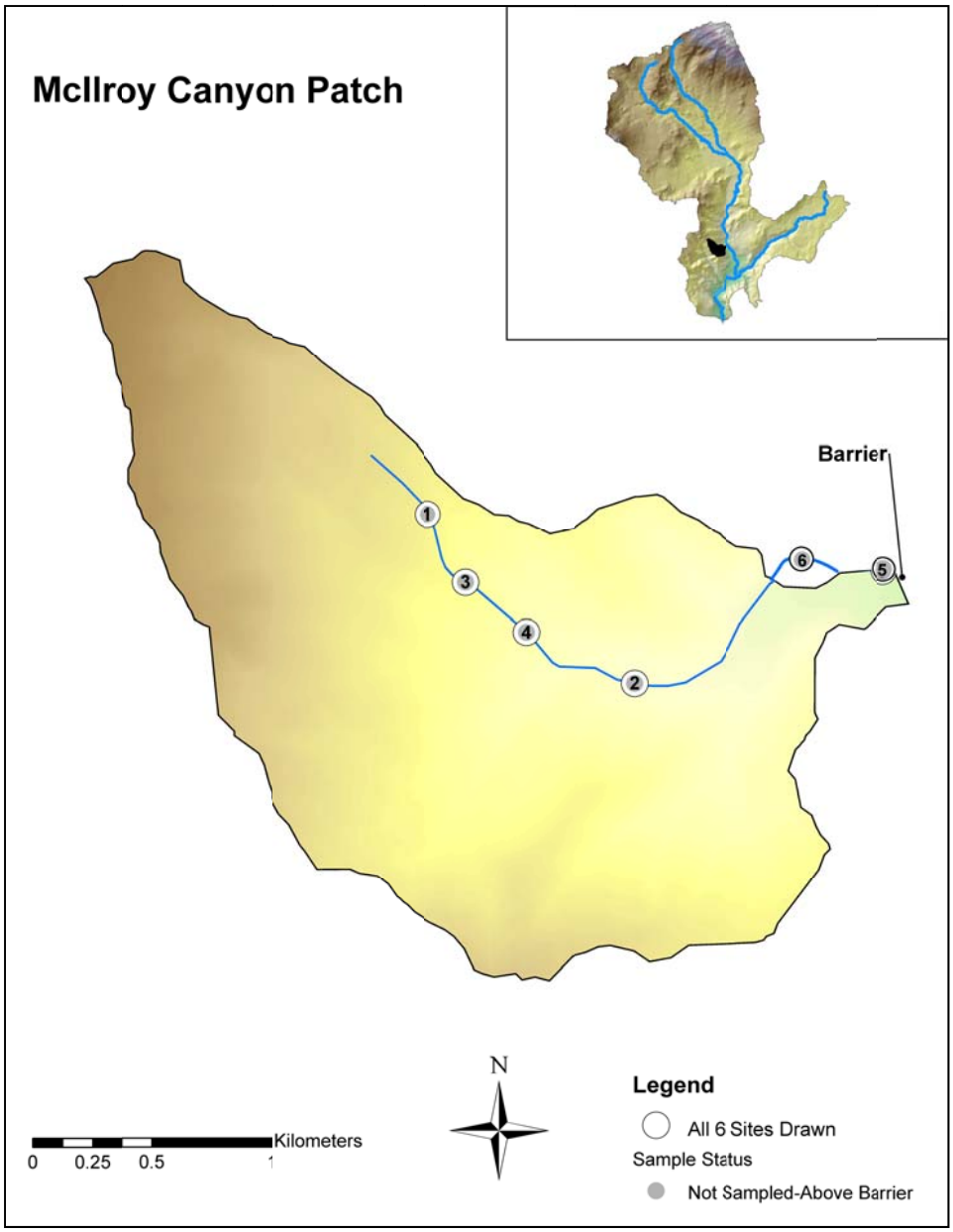


Figure 6. Reaches (identified by number) in the McIlroy Canyon Patch including all reaches drawn within the patch.

Seven reaches were sampled in the Ninefoot Creek patch (Figure 7). *O. mykiss* were observed in one reach. No bull trout were captured. A perched culvert (2 m above stream) is a potential fish passage barrier located at the lower end of the system (Figure 9b). Mean temperature for this patch during sampling was 5.9 °C (range 4.4 – 7.0 °C) (Table 3).

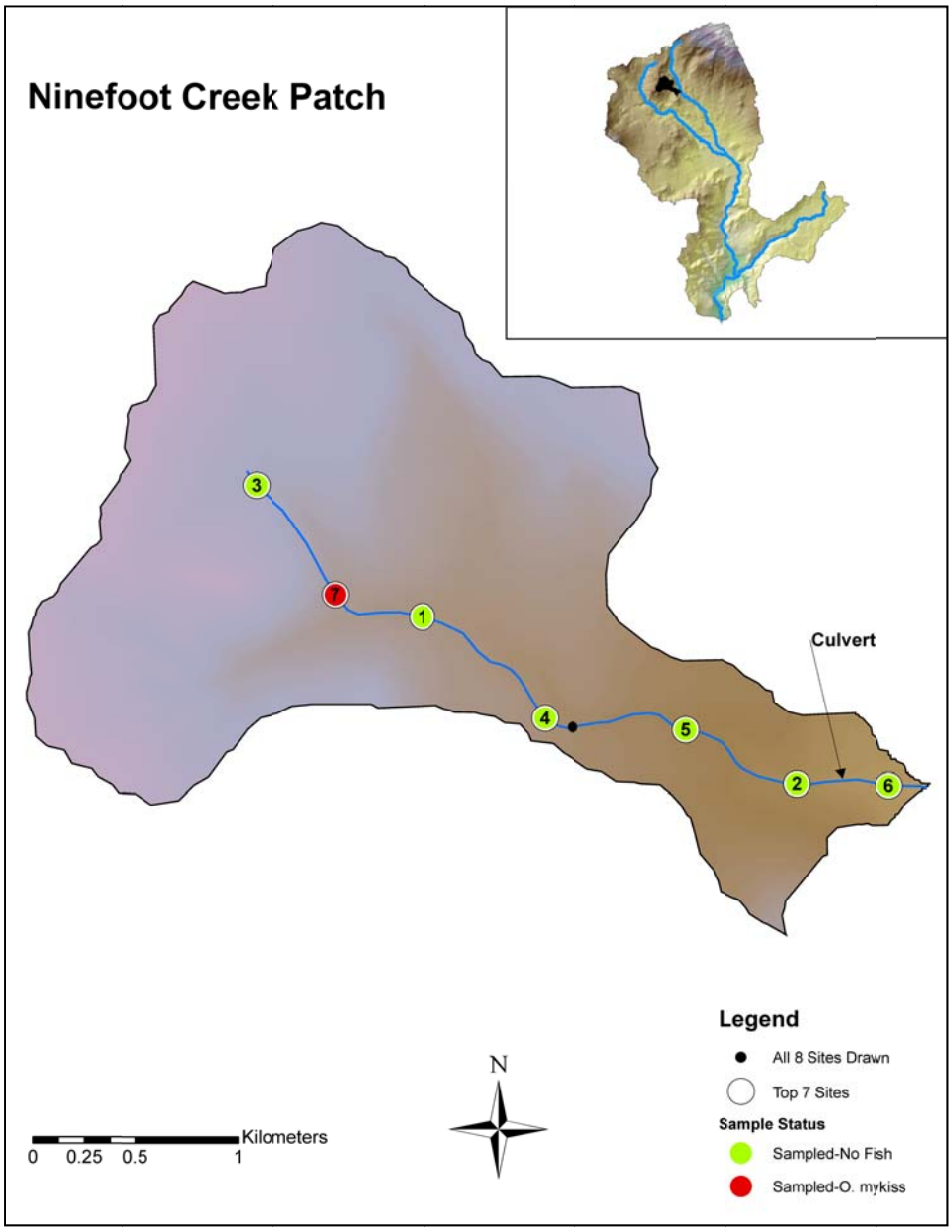


Figure 7. Reaches in Ninefoot Creek Patch including all reaches drawn within patch, the top 7 reaches (identified by number), as well as species captured within sampled reaches.

One reach was sampled in the Phelps Creek patch above a 3 m waterfall (Figure 8, Figure 9c). No fish were found and no habitat data was collected. Two reaches below the waterfall were sampled in 2008 resulting in the capture of *O. mykiss* at two reaches (Silver et al. 2009b). Below the waterfall, the Phelps Creek patch is less than 400 hectares and this patch is no longer considered viable for bull trout.

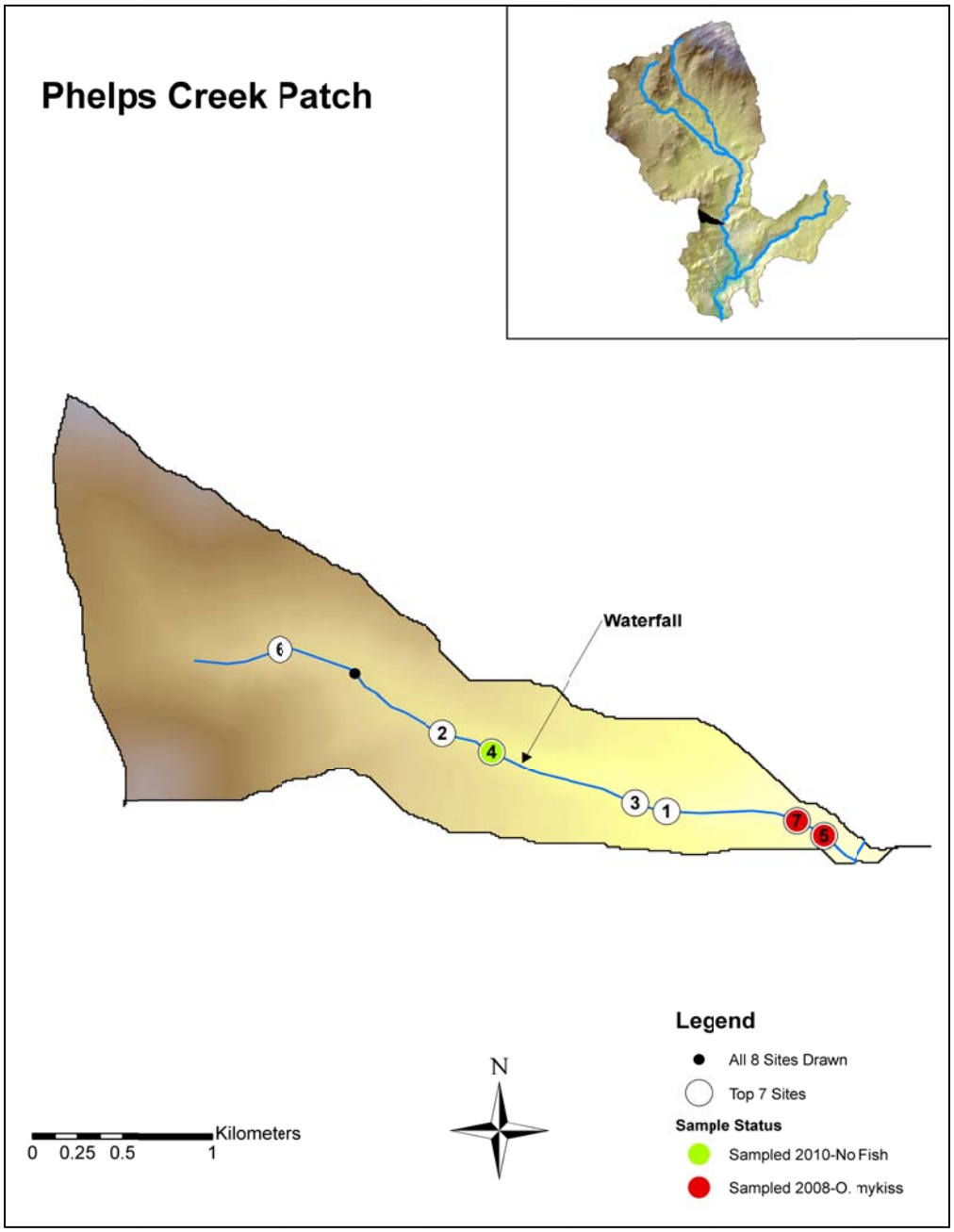
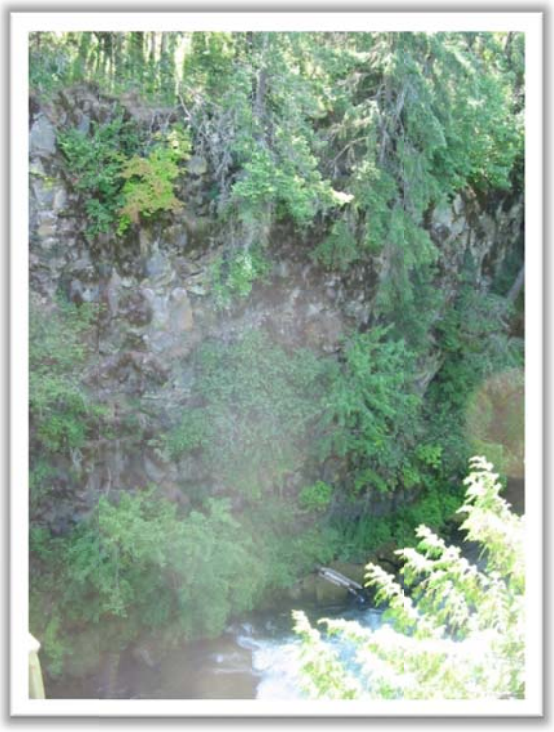


Figure 8. Reaches in Phelps Creek Patch including all reaches drawn within patch, the top 7 reaches (identified by number), as well as species captured within sampled reaches



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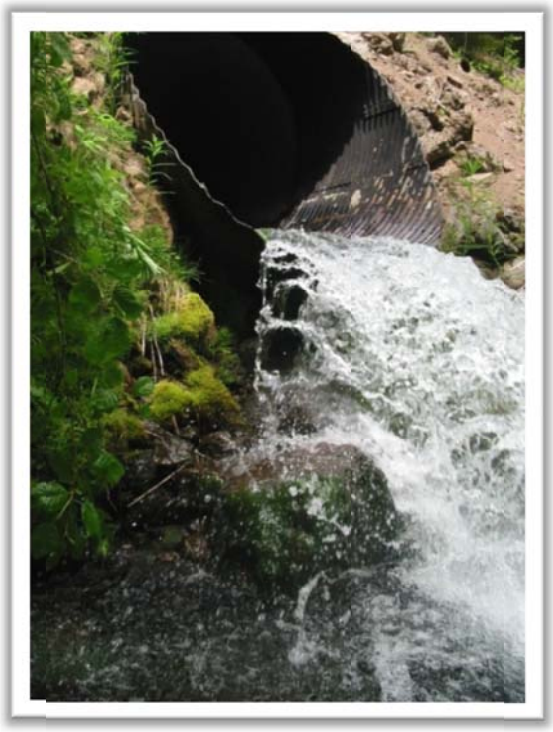


b)

c)

Figure 9. Potential fish passage barriers to upstream migration of bull trout in the White Salmon subbasin: a) McIlroy Canyon at White Salmon confluence, b) Ninefoot Creek culvert under NFR 23, c) Phelps Creek waterfall. See figures 6-8 for locations of these.

Table 3. Habitat data collected in 2010.

Cave Creek							
Reach	1	2	3	4	5	6	8
Date	6/22	6/21	6/22	6/21	6/22	6/22	6/23
Time Start	10:21	10:54	13:05	12:33	12:06	10:38	11:55
Time End	11:11	11:35	14:00	12:58	12:26	11:05	12:34
Temperature (°C)	13.0	7.0	7.0	17.0	12.0	7.0	11.0
Conductivity (µs)	50	50	40	70	50	50	40
Reach Length (m)	50	50	50	50	50	50	50
Clinometer Top (%)	0	0.75	3.0	0	1.0	16.0	2.0
Clinometer Bottom (%)	0	0.75	3.0	0	1.0	9.0	2.0
Clinometer Average (%)	0	0.75	3.0	0	1.0	12.5	2.0
# >3m length >10cm diameter	12	2	6	5	7	8	19
LWD Piles (>4 pieces of LWD together)	0	0	1	0	0	0	2
# >10 m in length >60 cm diameter	1	0	1	0	0	6	1
# Root Wads	3	2	2	0	1	2	0
Mean Wetted Width (m)	4.60	1.68	2.78	1.93	2.88	2.60	4.7
Mean Depth (m)	0.69	0.09	0.17	0.07	0.18	0.08	0.21

Green Canyon Creek							
Reach	2	4	7	8	9	11	12
Date	6/14	6/16	6/15	6/15	6/15	6/16	6/15
Time Start	13:33	10:50	11:05	12:34	13:06	12:05	10:05
Time End	14:27	11:30	11:20	12:53	13:35	12:50	10:41
Temperature (°C)	8.0	7.5	6.5	9.0	8.0	6.5	7.0
Conductivity (µs)	N/A	60	50	80	70	50	50
Reach Length (m)	50	50	50	50	50	50	50
Clinometer Top (%)	1.5	1.0	1.0	2.0	1.5	1.5	2.0
Clinometer Bottom (%)	3.0	3.0	1.0	2.0	2.0	1.5	2.0
Clinometer Average (%)	2.25	2.0	1.0	2.0	1.75	1.5	2.0
# >3m length >10cm diameter	9	8	22	11	19	15	10
LWD Piles (>4 pieces of LWD together)	1	0	0	1	1	1	0
# >10 m in length >60 cm diameter	10	3	3	3	6	5	4
# Root Wads	0	1	0	2	2	1	0
Mean Wetted Width (m)	3.12	2.38	2.72	2.40	1.48	3.05	2.32
Mean Depth (m)	0.16	0.23	0.24	0.25	0.17	0.18	0.13

Table 3. (cont.) Habitat data collected in 2010.

Ninefoot Creek							
Reach	1	2	3	4	5	6	7
Date	6/09	7/08	7/07	7/07	6/29	7/08	6/29
Time Start	12:00	9:45	10:42	12:40	11:15	11:15	9:53
Time End	12:45	10:33	11:30	13:35	11:49	11:37	10:36
Temperature (°C)	4.4	7.0	5.5	7.0	5.5	7.5	4.5
Conductivity (µs)	30.5	27.8	18.4	26.9	30.0	29.7	20.0
Reach Length (m)	50	50	50	50	50	50	50
Clinometer Top (%)	5.0	6.0	3.0	6.0	6.5	7.0	5.0
Clinometer Bottom (%)	5.5	5.5	4.0	4.0	6.5	7.0	7.0
Clinometer Average (%)	5.25	5.75	4.0	5.0	6.5	7.0	6.5
# >3m length >10cm diameter	8	2	5	18	10	26	10
LWD Piles (>4 pieces of LWD together)	0	0	0	2	0	5	2
# >10 m in length >60 cm diameter	1	15	1	0	4	0	8
# Root Wads	0	2	0	0	1	3	2
Mean Wetted Width (m)	3.98	5.00	1.50	4.10	3.20	5.30	2.40
Mean Depth (m)	0.27	0.17	0.01	0.14	0.21	0.16	0.11

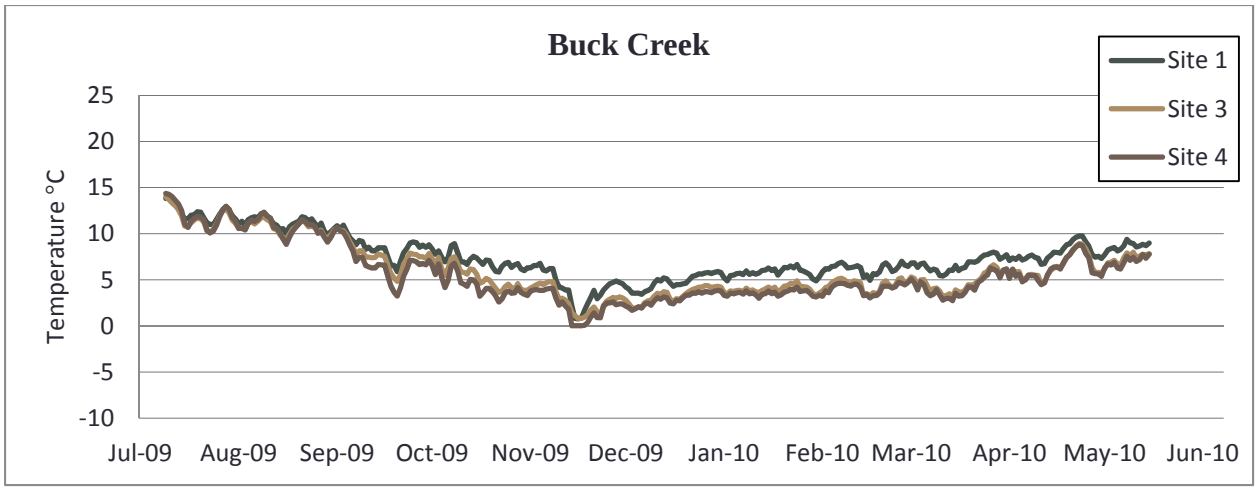
Thermographs

Of the 19 temperature loggers deployed in 2009, 17 were successfully recovered and downloaded (Table 4). Annual peak maximum daily temperature recorded across sites ranged from 9.09 – 18.53 ^{o}C (Figure 10). It is possible that the annual peak maximum daily temperature was not captured during this period of record. However, the data suggests that it was captured for all sites, with the exception of sites 1, 3, and 4, where the peak was recorded the day after deployment.

Table 4. Thermograph locations, deployment and download dates, minimum, maximum and average temperatures recorded (refer to Figure 2 for logger locations).

Reach ID #	Location	Patch	Elevation (m)	Deployed	Download	Max Temp.°C 2009-2010	Max Temp. Date
1	Buck Creek	Buck (2) Creek	109	7/31/2009	6/7/2010	13.88	8/2/2009
2	Lower Middle Fork Buck Creek	Buck (2) Creek	166	7/31/2009	N/A	N/A	N/A
3	Middle Fork Buck Creek	Buck (2) Creek	218	7/31/2009	6/7/2010	14.00	8/1/2009
4	Upper Middle Fork Buck Creek	Buck (2) Creek	289	7/31/2009	6/7/2010	14.36	8/1/2009
5	Cave Creek	Cave Creek	232	7/22/2009	6/4/2010	16.70	8/1/2009
6	Cave Creek	Cave Creek	251	7/22/2009	6/4/2010	23.57	8/3/2009
7	Lemei Trailhead	Trout Lake Creek	338	N/A	N/A	N/A	N/A
8	Cultis Creek Campground	Trout Lake Creek	371	7/24/2009	7/7/2010	13.67	8/2/2009
9	Meadow Creek Campground	Trout Lake Creek	385	7/24/2009	7/7/2010	10.98	8/1/2009
10	Little Goose Creek	Trout Lake Creek	289	7/24/2009	6/7/2010	17.32	8/1/2009
11	Cultis Creek	Trout Lake Creek	320	7/24/2009	N/A	N/A	N/A
12	Trout Lake Ck Trailhead	Trout Lake Creek	309	7/23/2009	6/7/2010	18.53*	7/31/2009
13	Wicky Cr.	Morrison Creek	290	7/22/2009	6/4/2010	9.29	7/28/2009
14	Morrison Cr.	Morrison Creek	345	7/22/2009	6/4/2010	9.09	7/29/2009
15	Crofton Ridge East Trailhead	Morrison Creek	422	7/22/2009	6/4/2010	14.86	7/31/2009
16	Salt Creek Trailhead	Cascade Creek	308	7/23/2009	6/7/2010	17.96	7/31/2009
17	Cascade Creek Trail	Cascade Creek	341	7/23/2009	6/9/2010	16.39	7/29/2009
18	Lower Ninefoot Cr.	Ninefoot Creek	311	7/23/2009	6/9/2010	13.06	8/1/2009
19	Middle Ninefoot Cr.	Ninefoot Creek	347	7/23/2009	6/9/2010	18.79	8/2/2009
20	Upper Ninefoot Cr.	Ninefoot Creek	379	7/23/2009	6/29/2010	13.38	8/1/2009

*Temperature logger not in water at time of download



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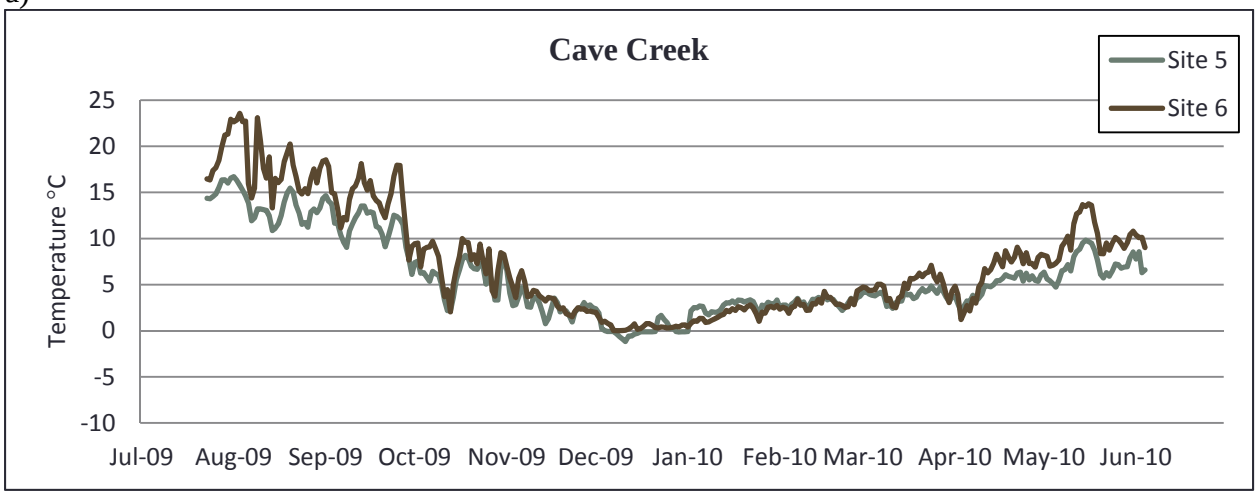

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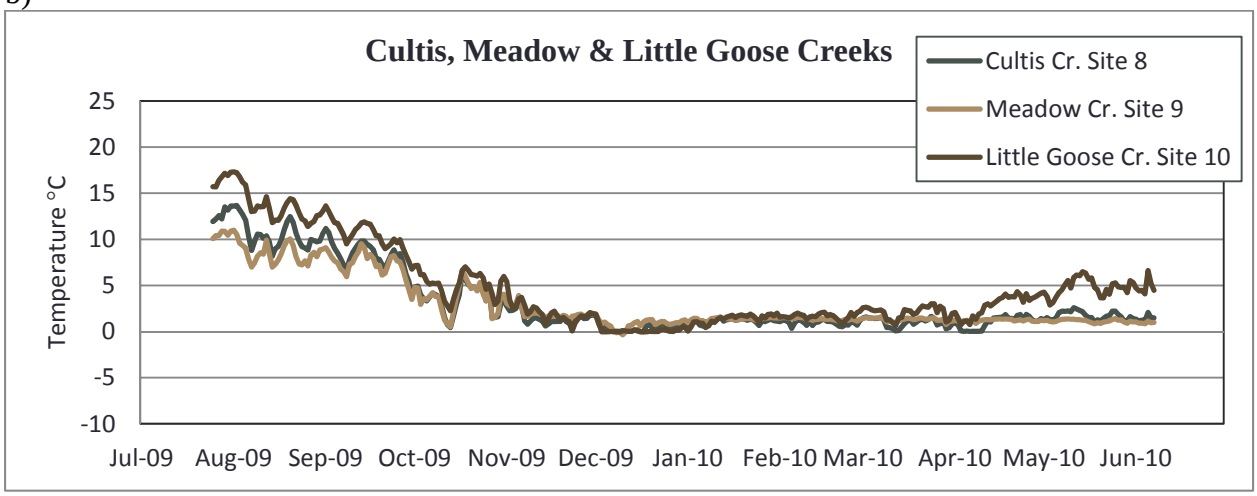
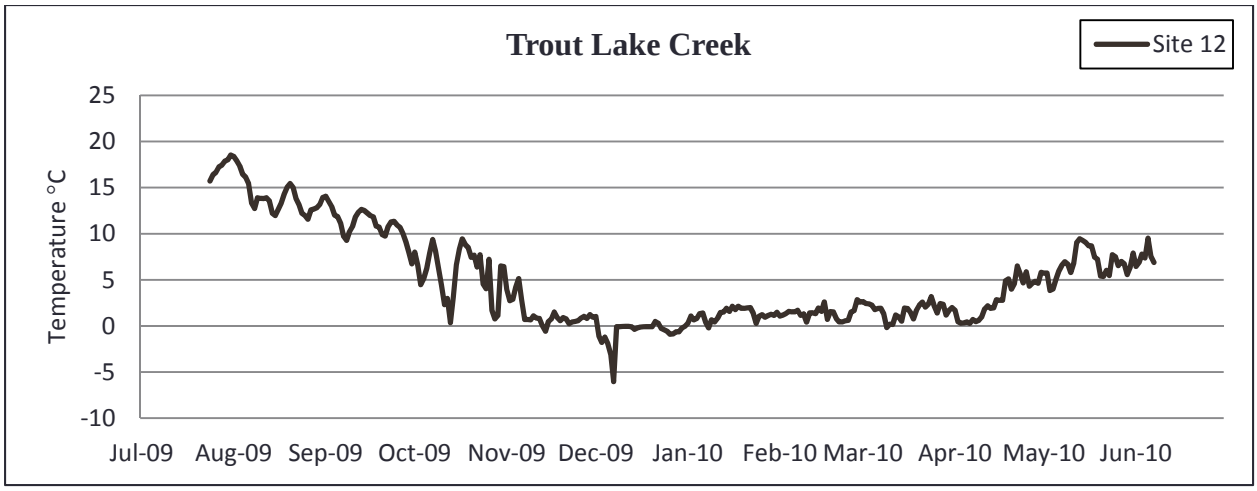


c)

Figure 10. Maximum daily temperature at thermographs from the White Salmon subbasin located in a) Buck Creek, b) Cave Creek, c) Cultis Creek, Meadow Creek, Little Goose Creek, d) Trout Lake Creek, e) Morrison Creek, f) Cascade Creek, and g) Ninefoot Creek.



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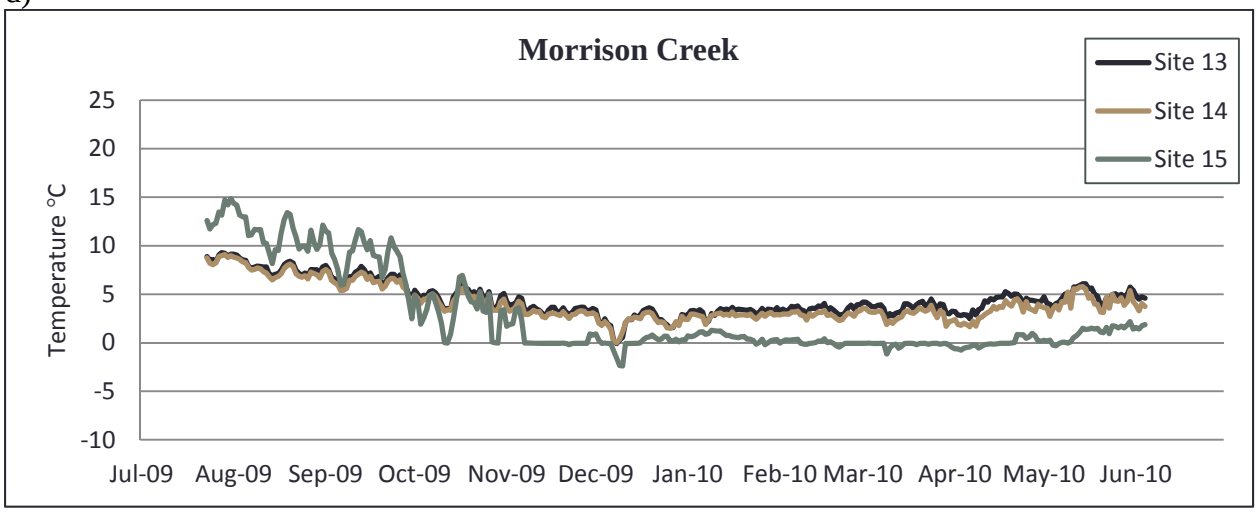

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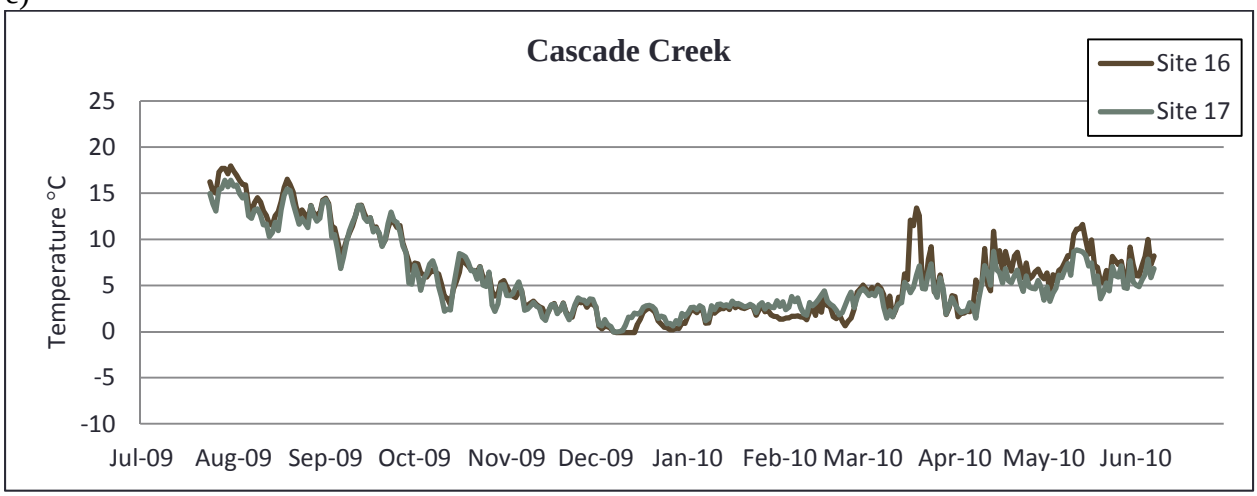
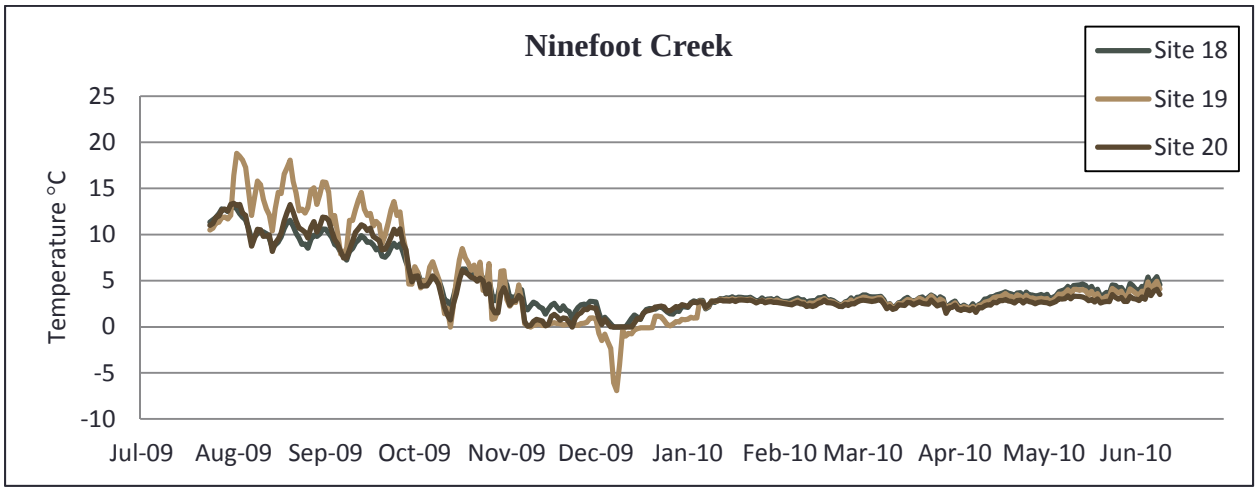


f)

Figure 10. (cont.) Maximum daily temperature at thermographs from the White Salmon subbasin located in a) Buck Creek, b) Cave Creek, c) Cultis Creek, Meadow Creek, Little Goose Creek, d) Trout Lake Creek, e) Morrison Creek, f) Cascade Creek, and g) Ninefoot Creek.



g)

Figure 10. (cont.) Maximum daily temperature at thermographs from the White Salmon subbasin located in a) Buck Creek, b) Cave Creek, c) Cultis Creek, Meadow Creek, Little Goose Creek, d) Trout Lake Creek, e) Morrison Creek, f) Cascade Creek, and g) Ninefoot Creek.

Findings

To date, bull trout have not been collected or observed in the White Salmon River subbasin through these efforts. Thus, we conclude that 0% (0 of 3) of the patches completed in 2010 and 0% (0 of 18) of the patches sampled since 2007 in the White Salmon River subbasin are occupied by bull trout (see Silver et al. 2009a, 2009b, 2010).

Results document fish passage barriers and lack of water within patches, contributing to originally presumed patches no longer being considered patches due to a size less than 400 hectares. Based on available habitat with appropriate water temperature, catchment area and stream size, nine patches have now been identified as potential habitat to support bull trout in the White Salmon River subbasin (Table 5, Figure 11).

Big Brother Falls is a 7 m waterfall located on the White Salmon River at river km 26.1 and is a likely migration barrier to fluvial bull trout due to its height (Figure 11). Patches above the falls (Cascade Cr., Cave Cr., Green Canyon Cr., Morrison Cr., Ninefoot Cr., and Trout Lake Cr.) either never supported bull trout or no longer have residents. Given the lack of bull trout in these patches, it is likely bull trout did not colonize these areas prior to the formation of these falls. Furthermore, it is unlikely they will reestablish these patches naturally. Reintroduction efforts involving transplants and/or hatchery stocking would be needed. Two of these patches (Cave Cr. and Trout Lake Cr.) currently support brook trout, which hybridize with bull trout. The remaining three patches (Buck (2) Creek, Mill Creek, and Little Buck Creek) are the only patches that will be accessible to bull trout that utilize the mainstem Columbia River.

This pre-dam removal assessment is the first instance of this monitoring approach being used to establish a quantitative baseline of bull trout occupancy and distribution. The resulting lack of bull trout in the subbasin coupled with the plan to utilize this approach for long-term monitoring may provide an opportunity to test the sensitivity of the approach (i.e., detection) as bull trout recovery proceeds in the White Salmon River.

Table 5. Patches delineated in the White Salmon River subbasin, year delineated and sampled. Patches were eliminated due to unviable habitat (i.e., barriers, temperature). Patches considered viable have habitat that will support bull trout (i.e., temperature, patch size). Accessible patches are below Big Brother Falls. Inaccessible patches are below Big Brother Falls.

Patch Name	Year Delineated	Year Sampled	Accessible	Sample Results	Status Reason	Patch Status
Bear Cr.	2007	2009	N/A	Dry Connection	Unviable habitat	**Eliminated**
Bear Valley	2007	2009	N/A	Dry	Unviable habitat	**Eliminated**
Buck (2) Cr.	2007	2009	Yes	No bull trout	7 Reaches sampled	**Viable**
Buck Cr.	2007	2007	N/A	Dry	Unviable habitat	**Eliminated**
Cascade Cr.	2007	2007	No	No bull trout	7 Reaches sampled	**Viable**
Cave Cr.	2009	2010	No	No bull trout	7 Reaches sampled	**Viable**
Dry Cr.	2007	2008	N/A	Dry	Unviable habitat	**Eliminated**
Gilmer Cr.	2007	2009	N/A	Water temperature too high	Unviable habitat	**Eliminated**
Gotchen Cr.	2007	2007	N/A	Dry	Unviable habitat	**Eliminated**
Green Canyon Cr.	2009	2010	No	No bull trout	7 Reaches sampled	**Viable**
Green Canyon	2007	2009	N/A	Undersized catchment area	Unviable habitat	**Eliminated**
Guler Mountain	2007	2009	N/A	Dry	Unviable habitat	**Eliminated**
Little Buck Cr.	2007	2008	Yes	No bull trout	7 Reaches sampled	**Viable**
McIlroy Canyon	2009	2010	N/A	Barrier/Dry	Unviable habitat	**Eliminated**
Mill Cr.	2007	2008	Yes	No bull trout	7 Reaches sampled	**Viable**
Morrison Cr.	2007	2007	No	No bull trout	7 Reaches sampled	**Viable**
Ninefoot Cr.	2009	2010	No	No bull trout	7 Reaches sampled	**Viable**
Phelps Cr.	2007	2008, 2010	N/A	Barrier/Undersized	Unviable habitat	**Eliminated**
Smeltzer Mill	2007	2009	N/A	Dry	Unviable habitat	**Eliminated**
Trout Lake Cr.	2007	2007	No	No Bull Trout	7 Reaches sampled	**Viable**
Wieberg Cr.	2007	2008, 2009	N/A	Dry above barrier Undersized	Unviable habitat	**Eliminated**

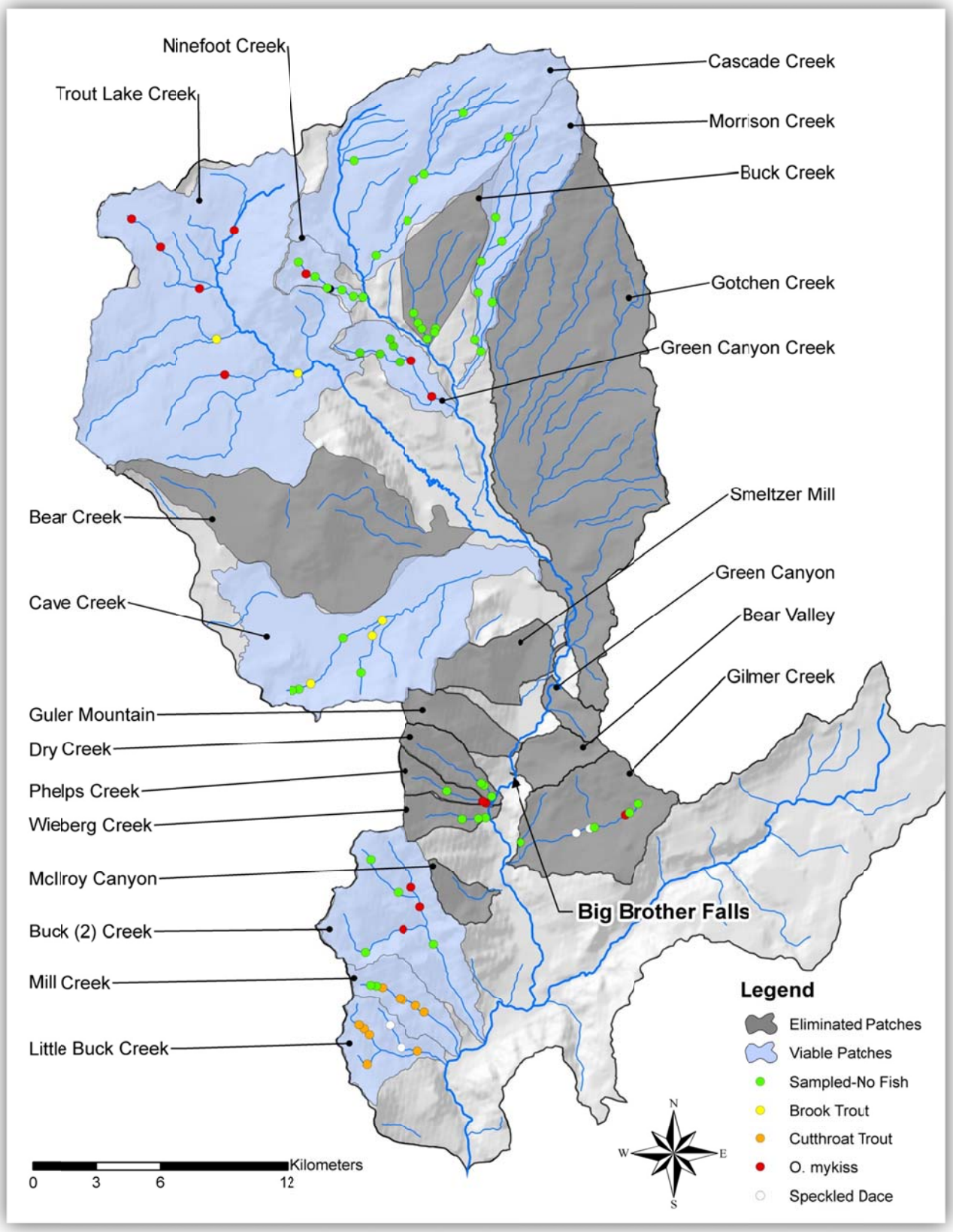


Figure 11. Status of patch viability and species found.

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