2011 Sawtooth Aquatic Management Indicator Species Monitoring Report

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Introduction

In order to evaluate the effects of management practices on fisheries and wildlife resources, the U.S. Forest Service monitors select species whose population trends are believed to reflect the effects of management activities on Forest ecosystems. These species are termed "management indicator species" (MIS) and the rationale for MIS monitoring is outlined in federal regulation 36 CFR 219.19.

> *"In order to estimate the effects of each alternative on fish and wildlife populations, certain vertebrate and/or invertebrate species present in the area shall be identified and selected as management indicator species and the reasons for their selection will be stated. These species shall be selected because their population changes are believed to indicate the effects of management activities."*
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> *"Population trends of the management indicator species will be monitored and relationships to habitat changes determined."*

An important principal to the MIS foundation is that monitoring results must allow managers to answer questions about population trends. Historically, monitoring of habitat was used as a surrogate for direct quantification of MIS populations. However, recent court cases (*Sierra Club v. Martin*, 168 F.3d 1 (11th Cir. 1999)) have ruled that assessing changes in habitat will no longer be accepted as a substitute for direct monitoring of populations. The Forest Service has an obligation to collect and analyze quantitative population trend data at both the Forest-plan and project level.

In response to issues raised by court challenges, the Sawtooth, Boise, and Payette National Forests (Southwest Idaho Ecogroup) revisited aquatic MIS species for the Draft Forest Plan EIS to determine if population data were sufficient to determine trend at the Forest scale.

Following this reevaluation, bull trout (*Salvelinus confluentus)* was selected as the aquatic MIS species (for a full explanation of the MIS review, see Aquatic Management Indicator Species for the Boise, Payette, and Sawtooth Forest Plan Revision, 2003). Bull trout were selected because the species is sensitive to habitat changes, dependent upon habitat conditions that are important to many aquatic organisms, relatively well understood by Forest biologists, and widely distributed across the Ecogroup. In addition, local bull trout populations are not influenced by stocking and likely persist at relatively small spatial scales that do not extend beyond Forest boundaries. Therefore, Forest bull trout populations are probably not heavily influenced by activities occurring outside Forest domains, and therefore changes in local bull trout populations are more likely to reflect local management activities on the Forest.

Protocol

Objectives

- Over the existing life of the Forest Plan for the Boise, Sawtooth, and Payette National Forests, determine the status and trend in distribution of bull trout within and among patches of suitable habitat within each subbasin across the planning area.
- To the full extent practicable, use the best available peer-reviewed science to allow formal inferences about observed status and trends in the distribution of bull trout.

Rationale

Monitoring is focused on patterns of occurrence of juvenile bull trout (<150 mm) for two reasons. First, presence of juvenile bull trout is an indicator of key spawning and rearing areas within a patch. These areas represent habitats that are essential for bull trout population viability within a patch. Other habitats within stream networks may be important for ranging or migrating individuals, but tracking fish in these areas is cost prohibitive and time consuming. Second, sampling patterns of occurrence requires less intense sampling than estimating abundance and is based on a peer-reviewed protocol for sampling of small bull trout (Peterson et al. 2002); similar protocols for larger, more mobile fish have not been developed. Key metrics for monitoring trends will be the proportion of habitat patches occupied in each subbasin across time and the spatial pattern of occupied patches.

Methods

Monitoring follows procedures specified by (Peterson et al. 2002)[1], with the following specific procedures and modifications.

Sampling frame - The fundamental unit for inference is a patch, defined following procedures outlined in Peterson, et al. (2002) and further clarified by the U.S. Fish and Wildlife Service Bull Trout Recovery Monitoring and Evaluation Group. The procedure involves delineating suitable habitats for bull trout within a patch to locate samples and making inferences about presence.

Downstream patch boundaries were delineated by 1600 meter elevation contours in the Boise and South Fork Payette River basins, based on previous research in the basins relating the distribution of juvenile bull trout to elevation. Outside of these basins, downstream patch boundaries correspond to stream temperature <15^{o}C (highest seven-day moving average of maximum daily temperature). Downstream limits to patches may also correspond to a confluence with a stream that is classified as too large for bull trout spawning, based on observed relationships between spawning use and stream size, as revealed by redd counts, direct observation of fish, radio telemetry, or other evidence.

During monitoring, efforts will be made to distinguish between "realized" and "potential" patch boundaries. The term "realized" refers to actual stream habitat that is used by bull trout. Realized boundaries may be less than potential boundaries, due to the influence of a number of factors, such as nonnative brook trout, dewatering of stream channels, or habitat alterations that increase stream temperature. The term "potential" refers to the maximum extent of coldwater naturally attainable, absent of irreversible human influences. This assumes the distribution of suitably cold water is the ultimate factor limiting the distribution of small bull trout.

In the upstream direction, stream networks will be truncated to include only those segments[2] with stream gradient of less than 20%. Further, all headwater areas within catchments corresponding to a contributing area of less than 500 hectares will be removed from sampling frames, due to low probability of bull trout occurrence (Dunham and Rieman 1999, as cited in Peterson et al. 2002). Information on local barriers will also be considered in truncating stream networks. For example, it may not be necessary to sample upstream of high natural waterfalls which prevents upstream passage of bull trout.

Metadata - For each patch, criteria for delineating down- and up-stream boundaries of the stream network to be sampled will be documented as metadata to accompany spatial data.

Sample allocation - Individual samples will be allocated to all patches within a Forest or subbasin. Within patches, only suitable habitat will be inventoried for informal and formal surveys. Suitable habitat is defined according to wetted width (greater than 2 meters), stream gradient (less than 20%), water temperatures (15 °C or less, 7-day average summer maximum), and connectivity (no natural or anthropogenic barriers).

Sampling unit - The fundamental sampling unit will be a 100 meter length of stream.

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[1] Available at www.fisheries.org and www.fs.fed.us/rm/boise

[2] Stream segments are defined as lengths of stream within drainage networks that are delineated on the up- and down-stream ends by tributary confluences.

Sampling method - Daytime electrofishing will be used to capture fish, with a variable number of passes, depending on site conditions. Habitat variables will also be measured to estimate sampling efficiencies. From 2004 to 2008 single and multiple pass electrofishing with blocknets was completed at random sites within each patch. However, random sites were not monumented to allow the site to be located and resurveyed. In 2009, sampling was changed to only single pass electrofishing without blocknets based on discussions with the Rocky Mountain Research Station. This change was made to increase the number of sample sites completed each year. But it was also made since the overall monitoring objective was only to show bull trout presence/absence and trend within patches over time. However, this approach did not allow the Forest to track fish abundance at smaller scales if desired and has not provided other state and federal agencies the information they often desire. To address this, the Forest in 2011 modified our sampling approach. All patches that do not support bull trout would continue to have single pass electrofishing with no blocknets. All patches that support bull trout would have at least three multiple-pass electrofishing sites without blocknets. We choose not to install blocknets because Young and Schmetterling (2004) found that electrofishing without blocknets on small streams did not appear to cause fish to flee the sample site and that the effect fish movement had on abundance estimates was minor. Random multiple-pass sites were selected in the lower, middle, and upper portions of each occupied patch. Each of these sites was monumented by placing metal tags at the beginning of the reach and GPS coordinates were recorded. Several photo points (beginning, middle, and end of transect) were also established. Each monumented site will be resampled either annually in our sentinel patches or every 3 to 5 years.

Depletion estimates were calculated for sites sampled where bull trout were captured using Microfish 3.0 population parameter calculation software (www.MicroFish.org 2005) (Van Deventer, 1989). In the future once we begin to accumulate enough multiple-pass information, we plan to analyze the relationship between first pass catches and population estimates from three-pass removals.

Random sampling - Sample sites within each patch can be determined using a variety of designs (e.g., representative reach, systematic, random, cluster, or convenience sampling). Probabilistic designs are usually best because site selection is randomized, each site has an equal selection probability, statistically valid, and unbiased estimates are provided. Purely random selection, however, can also result in spatial clustering of sites that may not adequately represent the strong environmental gradients that typically occur in small mountain streams. To address this issue, the Environmental Protection Agency's Environmental Monitoring and Assessment Program (EMAP) developed the Generalized Random Tessellation Stratified design (GRTS; Stevens and Olsen 2004). GRTS uses a randomized hierarchical grid that arrays sites throughout a stream network to achieve spatial representation. Sites using this EMAP approach were generated for all patches to establish potential sample locations. Once this first set of random sites is generated & surveyed, the same sites will be resampled on subsequent surveys in the future.

Selection of sample sites from the GRTS list were based on the unique identifier associated with each GRTS site. So, for example, if 20 GRTS sites are generated for a patch, and eight will be sampled in the field, the sites with the eight lowest identifiers were selected in sequential order. Once in the field, sites were sampled in any sequence that was logistically convenient whenever all sites are sampled. Once bull trout are detected, further sampling is unnecessary unless done for other reasons (e.g., development and refinement of detection efficiency, etc.). If bull trout are not detected, all identified sites within a patch must be sampled to reach the predefined probability of occurrence without detection.

Formal vs. informal sampling - Informal sampling (e.g. snorkeling, electrofishing, weirs, etc.) will be used initially to determine presence of juvenile bull trout, when deemed appropriate by local biologists. If juvenile bull trout are detected the informal sampling effort can cease, unless the local biologists wants to better determine distribution within the patch. If juvenile bull trout are not detected, it will be necessary to conduct formal sampling, as prescribed to estimate probability of presence in cases where bull trout are not detected (Peterson et al. 2002, Peterson and Dunham 2003). Site level detection probabilities will be estimated as outlined in Peterson et al. (2002) or through empirical methods based on repeated sampling of occupied patches and habitat information collected throughout the monitoring effort.

Sampling schedule - Initially, four patch types were recognized: 1) Known presence within last 7 years; 2) Likely present due to good habitat or detection > 7 years previous; 3) Likely not present due to poor habitat and bull trout not detected within last 7 years; 4) Patches without data. Patches will be defined relative to "potential" to support bull trout as defined above. Over the 2003-2018 Forest Plan timeline, targeted patches in categories 1 and 2 will be sampled at least twice. Initial sampling will be completed within first 7 years of the Forest Plan, preferably with as much time as possible in-between successive samples for each patch. Patches in category 3 will be sampled at least once. Additional sampling or re-sampling will be conducted if there is specific reason to do so (e.g., passage restoration, habitat improvement). Based on results following sampling, patch strata will be updated yearly (Table 1).

Table 1 - Number of bull trout patches on the Sawtooth National Forest within each subbasin by category prior to 2011 sampling.

Category	S.F. Boise Subbasin	M.F./N.F Boise Subbasin	S.F. Payette Subbasin	Upper Salmon Subbasin	Total
1	13	4	2	17	36
2	7	1	2	7	17
3	22	0	0	28	50
4	0	0	0	0	0
Total	42	5	4	52	103

Using data from the past 7 years (since 2004), all of the category 1 and 2 patches in the Middle Fork/North Fork Boise River, South Fork Boise River, Upper Salmon, and S.F. Payette subbasins have been sampled (Table 2).

Table 2 - Number of bull trout patches by category on the Sawtooth NF and the number surveyed within the last 7 years (since 2004) within each subbasin based on 2011 sampling.

Category	S.F. Boise Subbasin		N.F. and M.F. Boise Subbasin		S.F. Payette Subbasin		Upper Salmon Subbasin		Total	
	Patches	Surveyed	Patches	Surveyed	Patches	Surveyed	Patches	Surveyed	Patches	Surveyed
1	13	13 (100%)	4	4 (100%)	2	2 (100%)	17	17 (100%)	36	36 (100%)
2	7	7 (100%)	1	1 (100%)	2	2 (100%)	7	7 (100%)	17	17 (100%)
4	0	0	0	0	0	0	0	0	0	0 (0%)
Total	20	20 (100%)	5	5 (100%)	4	4 (100%)	24	24 (100%)	53	53 (100%)
3	22	18 (82%)	0	0	0	0	28	23 (82%)	50	41 (82%)

Sentinel Streams - In 2009 sentinel streams were established in the S.F. Boise (Boardman, Skeleton, Deadwood, and Paradise) and Upper Salmon (Pole, Iron, and Big Boulder) to detect expansion of bull trout populations within downstream marginal habitats or to detect changes in bull trout distribution within suitable areas within a patch. These streams were selected because

they represent broad thermal ranges, are near occupied patches which may be more easily colonized, and/or are the focus of restoration actions that may make habitat more suitable for bull trout. All sentinel streams will be sampled annually to detect subtle changes in stream temperatures and bull trout distributions over time.

PIBO Monitoring Sites - To evaluate trends in habitat and watershed condition, the Sawtooth National Forest has worked with the PACFISH/INFISH Biological Opinion (PIBO) monitoring program in Logan, Utah. This monitoring approach evaluates the trend of select Watershed Condition Indicators (WCIs) across subwatersheds where PIBO integrator reaches have been established. An integrator reach is the lowest stream reach within the subwatershed that has greater than 50% federal ownership upstream of the sample reach, contains no tributary junctions or beaver activity, and has a stream gradient less than 3%. It is assumed that integrator reaches would be responsive to all management activities that occurred upstream or around the reach. Each integrator reach has been sampled during one of the first five years (2001 to 2005), and will be resampled on a five-year rotation after 2006.

To evaluate select WCIs an integrity index of physical habitat indicators was used. Physical stream habitat and landscape data from reference reaches were used to develop an index of physical habitat condition. PIBO identified candidate attributes from the 17 total attributes collected at PIBO sample sites using a three-step sequence. First, PIBO selected those physical habitat attributes that exhibited relatively low sampling variation based on reaches repeat-sampled within a year, which enabled empirical estimates of signal/noise (Kaufmann 1999). Next, PIBO tested whether attributes with low sampling variation were responsive to management actions. As such, PIBO evaluated the responsiveness of each attribute to management activities by comparing the means of each candidate attribute from reference reaches and managed reaches. Finally, PIBO minimized redundancy of those attributes that met the specific criteria in the first two steps to avoid over-weighting certain components of the physical instream habitat represented in the overall index. Here, PIBO calculated Pearson correlation coefficients for all remaining candidate attributes and considered attributes redundant if correlation coefficients exceeded 0.70.

Once attributes were selected, PIBO used the Forests reference sites to construct the index. Specifically, PIBO incorporated landscape and climatic covariates into multiple linear regression analyses to control for inherent differences in physical habitat attributes among reaches. PIBO used the residuals from these analyses to score individual attributes and summed the 7 attributes (i.e. d50, average bank angle, the percent of fine sediment in pool tails, the frequency of large woody debris (pieces/km), the volume of LWD, the percent of pool habitat, and the average residual pool depth) retained in the index for an overall index of abiotic condition (range = 0-100). PIBO incorporated the data from managed sites (both landscape and field data) into the regression models used to develop the index (from reference sites) to calculate and score the residuals and overall index for managed sites (again ranging from 0-100).

2011 Results and Discussion

Monitoring for bull trout on the Sawtooth National Forest occurred in 12 patches in 2011 (Figure 1). In the S.F. Boise subbasins, six patches were surveyed using formal protocols. Of these patches, juvenile bull trout were observed in Boardman, Deadwood, and Skeleton Creeks. In the Upper Salmon six patches were sampled and juvenile bull trout were observed in Germania and Big Boulder Creeks. Discussion of changes in bull trout distribution within a patch or abundance is discussed below for each patch.

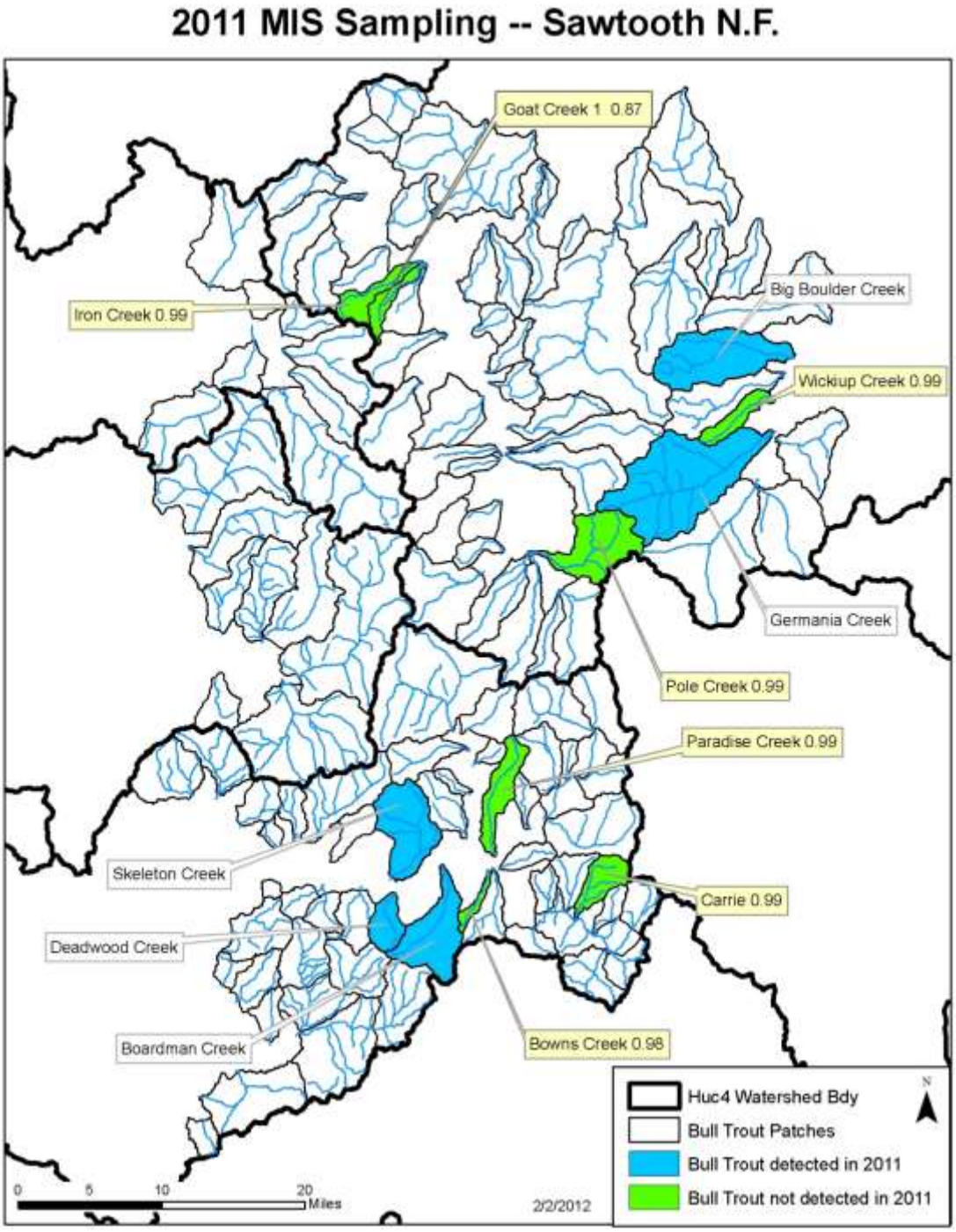

Figure 1 - Bull trout patches sampled and probabilities of detection on the northern portion of the Sawtooth N.F. (2011).

Patches Where Bull Trout Were Detected

Boardman Creek – Bull trout continue to be distributed throughout this 12,561 acre (10.9 accessible miles) patch (Figure 2). Juvenile bull trout were observed in 8 of the 14 100m electrofishing sites. A total of 70 bull trout were captured at the 8 sites. Population estimates ranged from 3 to 18 fish per reach (Table 3), with the highest estimates observed in the headwater sites of the mainstem of Boardman Creek above the Smoky Dome confluence and Smoky Dome Creek. Bull trout ranged from 63mm to 250mm total length and dominant age classes were 0+, 1+, and 2+. Findings from the 2011 survey are consistent with other surveys (i.e. the Idaho Fish and Game 1993, 1999, and 2000, and Bureau of Reclamation, Boise National Forest, and Rocky Mountain Research Station in 2001, and Sawtooth National Forest 2002-2009) completed in this patch.

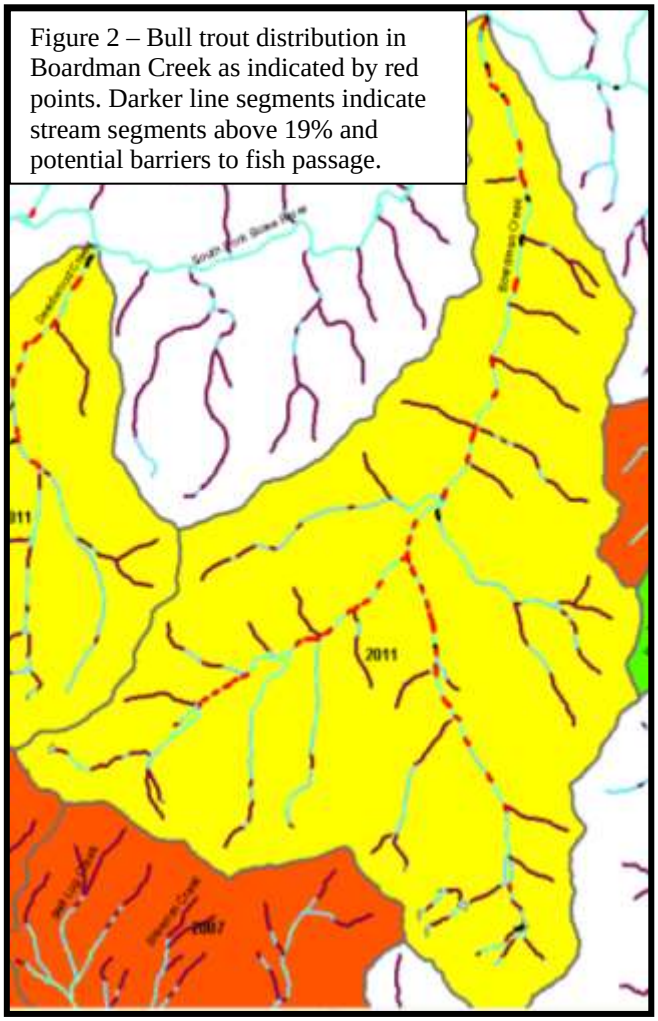

Figure 2 – Bull trout distribution in Boardman Creek as indicated by red points. Darker line segments indicate stream segments above 19% and potential barriers to fish passage.

A small tributary of Boardman Creek drains a cirque pond, called Boardman Creek Lake. IDFG stocking records indicate that this lake has been stocked with several strains of rainbow/redband trout beginning in 1967. Redband trout have been observed at most of the Boardman Creek sites and all of the Smoky Dome sites. It is assumed that most redband are native fish, but some may have been influenced by past stocking.

Stream temperatures (MWMT) near the mouth of Boardman Creek from 2002 through 2007 ranged from approximately 14.0°C to nearly 18.0°C. However, the 7-day max for stream temperatures higher in the subwatershed, where bull trout are known to spawn and rear, typically ranged from approximately 10.0°C to 12.0°C. These stream temperature readings suggest that temperatures are higher than desired for bull trout lower in the subwatershed, but temperatures are optimal or close to optimal in a substantial portion of upper Boardman and Smoky Dome Creeks.

In general, stream habitat is considered in good condition across the drainage (Figure 3),

Figure 3 – Habitat conditions in Boardman Creek

although fine sediment may be elevated from historic sheep grazing and mining in the headwaters of Smoky Dome Creek, headwater roads, and streamside trails. There is good connectivity to the S.F. Boise River with no known barriers. A PIBO integrator reach is located just above the confluence with the S.F. Boise River. The habitat index score from 2005 survey is 35.1 and in 2010 29.5 indicating poorer habitat conditions within this site compared to reference streams. PIBO found habitat indices averaged 63.4 in unmanaged reference, habitat. PIBO also concluded that habitat in good condition had scores 70 and above, habitat in a moderate condition averaged a 40-70 score, and habitat in poor condition averaged less than a 40 score for streams within the Southwest Idaho Ecogroup. Subtle changes in PIBO scores between 2005 and 2010 appear to be from a decrease in the number of pools, woody debris frequency and volume.

Table – 2011 bull and rainbow trout densities and population estimates in Boardman Creek

Transect (rivermile)	Number of Passes	Transect Length (m)	Species	Number Caught	Total Length (mm)		Density (fish/100m^2)	Pop Estimate (Fish ≥ 60 mm)
					Mean	Range		
1.55	3	96	Bull Trout	11	103	67-144	2.24	11
			Rainbow Trout	2	165	140-190	0.48	2
5.01	3	87	Bull Trout	3	115	84-164	0.53	3
			Rainbow Trout	8	157	100-210	1.41	8
7.71	3	77	Bull Trout	18	113	63-151	2.67	18
			Rainbow Trout	5	200	143-248	0.75	5

Deadwood Creek – Juvenile bull trout were detected at three of the four 100m electrofishing sites within this 4,558 acre (2.22 accessible miles) patch (Figure 4). A total of 22 bull trout were captured at the 3 sites. Population estimates ranged from 2 to 8 fish (Table 4) with higher estimates observed in headwater sites. Bull trout ranged from 90mm to 245mm total length and the dominant age classes were 1+, 2+, and 3+. Bull trout distribution in 2011 continues to mirror what has been observed in previous surveys (Idaho Fish and Game and Boise/Sawtooth National Forests 1991, 1994, 1998, and 2003). Bull trout (presumably migratory individuals) appeared in each of the IDFG Deadwood Creek samples. Several other salmonid species, including redband, westslope cutthroat trout and kokanee salmon, were also collected during these surveys. The presumed origin of the cutthroat trout is Heart Lake, in the Deadwood Creek drainage, which has been stocked approximately every 2-3 years since 1972 by IDFG.. Redband trout were the only other species observed during the 2011 surveys.

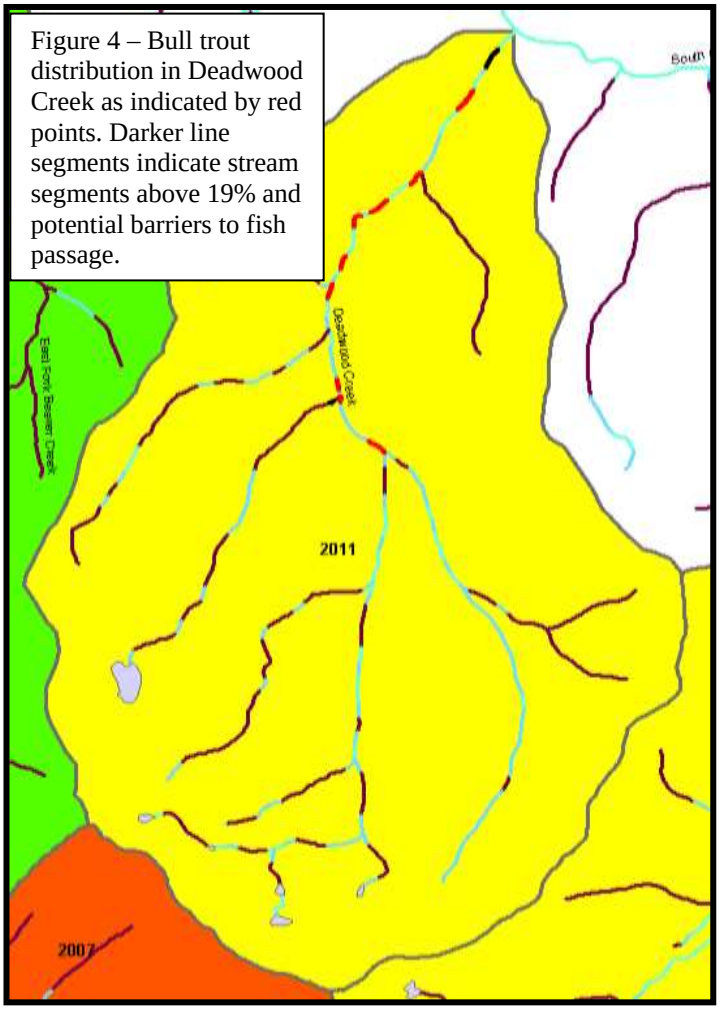

Figure 4 – Bull trout distribution in Deadwood Creek as indicated by red points. Darker line segments indicate stream segments above 19% and potential barriers to fish passage.

Habitat conditions within Deadwood Creek are believed to be in good condition and there is good connectivity to this patch from the S.F. Boise River. 7-day max temps at the mouth of Deadwood Creek in 2003, 2004, and 2007 ranged between 15°C and 16°C. Livestock grazing has occurred within the patch since late in the 19th century, but major reductions in sheep numbers have been made.

Table 4 – 2011 bull and rainbow trout densities and population estimates in Deadwood Creek

Transect (rivermile)	Number of Passes	Transect Length (m)	Species	Number Caught	Total Length (mm)		Density (fish/100m^2)	Population Estimates (Fish ≥ 60 mm)
					Mean	Range		
0.53	3	82	Bull Trout	2	137	105-184	0.59	2
			Rainbow Trout	5	124	76-171	1.48	6
2.95	3	85	Bull Trout	8	191	149-245	2.04	8
			Rainbow Trout	2	134	131-137	0.51	2
			Cutthroat Trout	2	156	154-158	0.51	2

Skeleton Creek – Juvenile bull trout were detected at 10 of the 16 100m electrofishing sites within this 4,558 acre (2.22 accessible miles) patch (Figure 5). A total of 154 bull trout were captured at the 10 sites. Population estimates ranged from 1 to 58 fish (Table 5) with higher estimates observed at the headwater sites; especially in the W.F. Skeleton Creek. These estimates are higher than those observed in 2003 by the Sawtooth National Forest (Kenney 2003). Population estimates from this 2003 survey ranged from 0-31 fish. Bull trout ranged from 85mm to 248mm total length and dominant age classes are1+, 2+, 3+ and 4+. Findings from the 2011 survey are consistent with other surveys (i.e. the Idaho Fish and Game 1994, 1999, and 2000, and Bureau of Reclamation, Boise National Forest, and Rocky Mountain Research Station in 2001, and Sawtooth National Forest 2002-2009) completed on the mainstem of Skeleton and W.F. Skeleton Creeks in this patch.

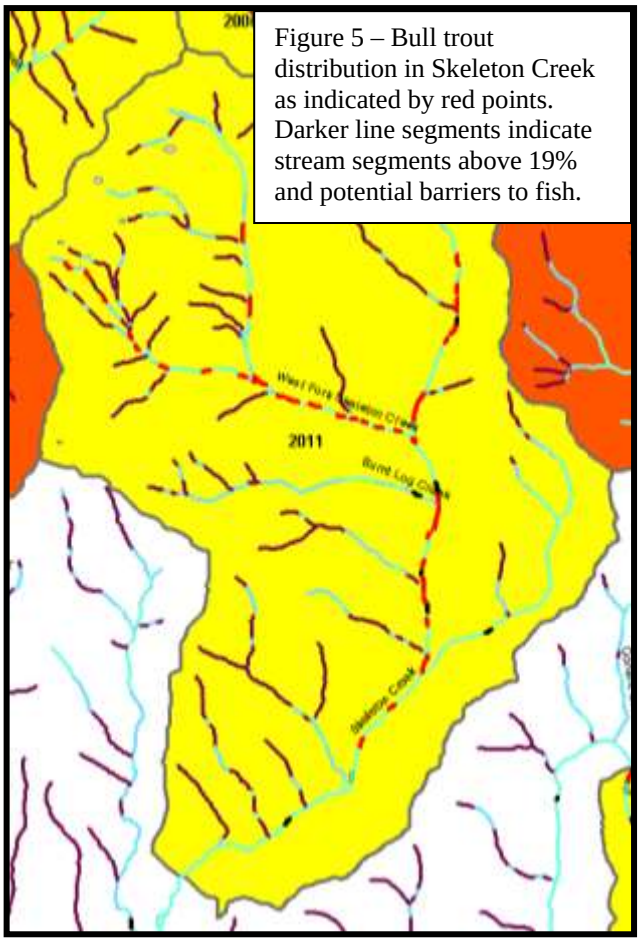

Figure 5 – Bull trout distribution in Skeleton Creek as indicated by red points. Darker line segments indicate stream segments above 19% and potential barriers to fish.

The radio-telemetry study by Partridge et al. (2000) also showed the presence of migratory bull trout in the mainstem of Skeleton Creek, the East and West Forks of Skeleton Creek, as well as Burnt Log Creek. Specifically, in 1998, a 420 mm bull trout was tracked to Burnt Log Creek and a 500 mm fish was last located in Skeleton Creek, while in 1999 a 425mm bull trout was located first in the East Fork and then in the West Fork and a second fish, 515 mm in length, was located in the West Fork. The largest fish found in 2011 surveys was 260 mm at river mile 8.59. Weir counts from 2002 through 2005 captured only a limited amount of large (>300 mm)

individuals out-migrating after spawning in these years. Therefore, the size of the spawning population is unclear, although the subpopulation may include a resident spawning component that would likely remain undetected due to lack of migration and therefore low probability of capture by the weir. .

Seven-day max weekly max temperatures near the confluence of Skeleton Creek with the S.F. Boise River in 2001 through 2007 ranged from 18 to 19.5°C. However, MWMT stream temperatures are considerably cooler in headwater locations, as evidenced by temperature samples recorded at electrofishing sites and the presence of a reproducing bull trout population. Thermographs placed in Skeleton Creek within the patch recorded 7-day maximum temperatures from 13.7 to 9.9°C.

In general, stream habitat is in good condition in the drainage, although fine sediment is likely elevated from historic sheep grazing, logging, and mining in the headwaters. There is good connectivity to the S.F. Boise River with no known barriers. A PIBO integrator reach is located just above the confluence with the S.F. Boise River. The habitat index score from 2005 survey is 18.8 and 44.4 in 2010 indicating moderate habitat conditions when compared to reference streams. Changes in PIBO scores between 2005 and 2010 appear to be from an increase in the pool depth and substrate size.

Table 5 – 2011 bull and rainbow trout densities and population estimates in Skeleton Creek

Transect (rivermile)	Number of Passes	Transect Length (m)	Species	Number Caught	Total Length (mm)		Density (fish/100m^2)	Pop Estimates (Fish ≥ 60 mm)
					Mean	Range		
5.08	3	97	Bull Trout	1	165	--	0.17	1
			Rainbow Trout	21	160	104-229	3.54	21
6.54	3	85	Bull Trout	7	137	116-146	1.19	24
			Rainbow Trout	46	151	68-209	7.84	67
10.96	3	96	Bull Trout	55	162	85-248	14.69	58
			Rainbow Trout	6	181	154-196	1.6	6

Germania Creek – Bull trout are present throughout this patch, including exclusive use of habitat upstream of a 30-foot vertical falls near the mouth of Chamberlain Creek. Juvenile bull trout were detected at 5 of the 7 100m electrofishing sites within this 32,033 acre (18.2 accessible miles) patch (Figure 6). A total of 35 bull trout of differing age classes were captured at 6 sites. Population estimates ranged from 11 to 14 fish (Table 6) with higher estimates observed at the headwater sites and in Chamberlain Creek. Bull trout ranged from 94mm to 250mm total length and dominant age classes were 1+, 2+, and 3+. Bull trout had been detected previously in Germania Creek in 1992 and 2004 by the Sawtooth National Forest. Bull trout have also been observed in lower Washington, MacRae, and Galena Creeks.

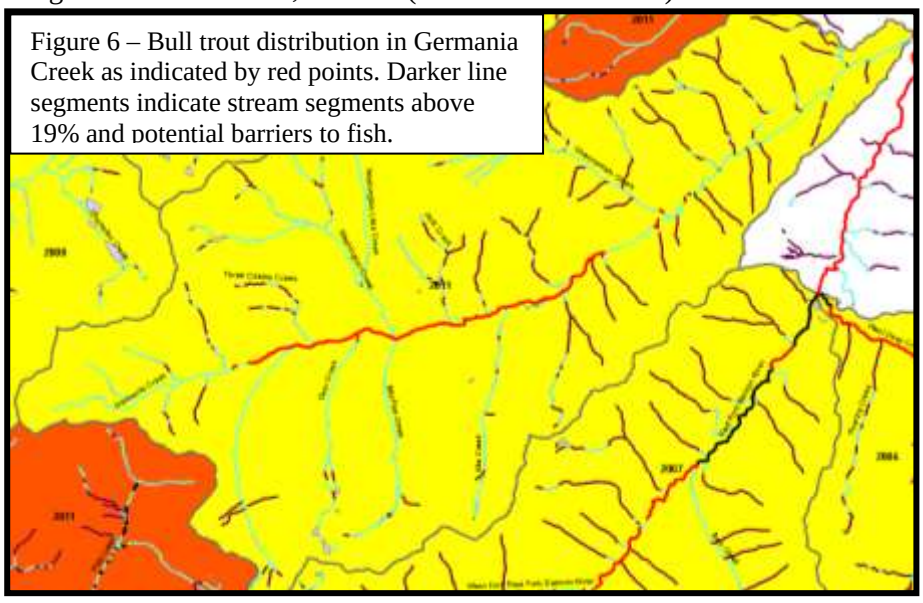

Figure 6 – Bull trout distribution in Germania Creek as indicated by red points. Darker line segments indicate stream segments above 19% and potential barriers to fish.

Water temperatures recorded for Germania Creek in 1994 remained less than 15°C over the entire patch. Season maximum temperatures above the falls from 2004-2009 ranged from 8.6-12.7°C during the summer months. Streams within this patch originate in high elevations and flow much of their lengths to the mouth through shaded environments.

Aquatic habitats within this patch are believed to be at or near natural conditions in most areas, although fine sediment may be elevated from sheep grazing and mining occurring in the headwaters. Patented mining claims exist within Washington Basin, although none are currently active. In 2001, a concentrated summer convective storm passed through the mid portions of the Germania drainage. As a result, substantial debris flows burst from several tributaries on either side of the drainage dumping thousands of cubic yards of sediment and debris into Germania Creek. Most pools downstream of the event were filled with sediment. However, much of the finest sediment was flushed downstream the following spring. Some areas and habitat features remain less than their potential, such as bank stability in response reaches. Conditions are believed to be continuing to improve from past intensive uses, primarily sheep and cattle grazing.

A PIBO integrator reach is located just above the confluence with the S.F. Boise River. The habitat index score from 2005 survey is 28.7 and in 2010 27.0 indicating poor habitat conditions when compared to reference streams. Minor changes in PIBO scores between 2005 and 2010 appear to be from an increase in the pool depth, decrease in percent fines in pool tailouts, but a decrease in the frequency of pools.

Table 6 – 2011 trout densities and population estimates in Germania Creek

Transect (rivermile)	Number of Passes	Transect Length (m)	Species	Number Caught	Total Length (mm)		Density (fish/100m^2)	Pop estimate (Fish ≥ 60 mm)
					Mean	Range		
17.88	3	103.7	Bull Trout	12	141	94-213	3.97	14
0.19	3	71	Bull Trout	11	150	60-220	3.87	11
			Westslope Cutthroat	3	182	155-220	1.05	3

Big Boulder Creek – Juvenile bull trout were detected in the three of the 10 100m electrofishing sites on the mainstem Big Boulder and Jim Creeks in 2011 within this 17,712 acre (7.64 accessible miles) patch (Figure 7). A total of 26 bull trout of all age classes were captured at 3sites. Population estimates ranged from 1 to 7 fish (Table 7) with higher estimates observed just below the barrier falls. These estimates are higher than those found by the Salmon Challis N.F. in Upper Salmon River tributaries (Gamett et al. 2010). Bull trout ranged from 90mm to 200mm total length and dominant age classes are1+, 2+, and 3+.

Bull trout distribution in 2011 continues to be similar to what has been observed in past surveys. Bull trout had been detected previously in Big Boulder in 2006 and 2009 by the Sawtooth National Forest. In 2009 bull trout were found in lower Jim Creek (0.6 miles above the Big Boulder confluence) which is just downstream of barrier falls. Bull trout were also found again up to the barrier falls (1.9 miles above the Jim Creek confluence) in the main channel of Big Boulder Creek. Above these falls only stocked rainbow, westslope cutthroat or hybrids were found at the five surveyed transects. Extensive snorkel surveys of Big Boulder Creek in 2000 also observed steelhead/redband trout, bull trout, cutthroat, and brook trout below the falls, and redband and cutthroat above the falls. Below the falls, both resident and fluvial bull trout were observed.

Water temperatures monitored in the lower reaches of Big Boulder Creek from May to mid-August 1994 recorded MWMT temperatures less than 16.0°C. Recent temperature monitoring in 2006 and 2010 found stream temperatures of 16.0°C and 13.5°C in Boulder Creek and 14.8°C in 2005 in Jim Creek.

Management disturbances during the past century have been extreme in some areas of this patch, near and below the Livingston Mill mine. In 1925 a power dam was constructed on the mainstem and operated until it was abandoned in 1941. In 1991 a passable notch was cut in the dam, and the accumulated sediments upstream removed. This dam eliminated all migratory fish from E.F. Salmon River from reaching headwater habitat for almost 50 years. Fluvial bull trout have since been observed upstream of the dam.

Portions of the Big Boulder Creek subwatershed has been extensively mined since the 1920's contaminating soils in the valley bottom with zinc, lead, and arsenic. In the 1960s Big Boulder Creek was diverted into a low sagebrush swale near the Livingston Mill to avoid growing conflicts with the mine tailings. The fine textured soils and shallow roots within the swale quickly gave way and an extensive blowout emerged and expanded over the following decades – up to 25 feet in depth, 250 feet across, and nearly ¼ mile in length. Tens of thousands of cubic yards of sediment buried downstream habitats and initiated similar channel responses. Efforts to prevent further expansion of the blowout and rehabilitate the area were attempted in 1994 and have been partially successful.

In 2008 shallow tailings and contaminated soils within the Livingston Mill site were "treated in place" in an on-site repository. All but approximately 120 of the 71,600 cubic yards were placed in a central repository. The remaining 120 cubic yards were treated in place with a mixture of compost and soil amendments.

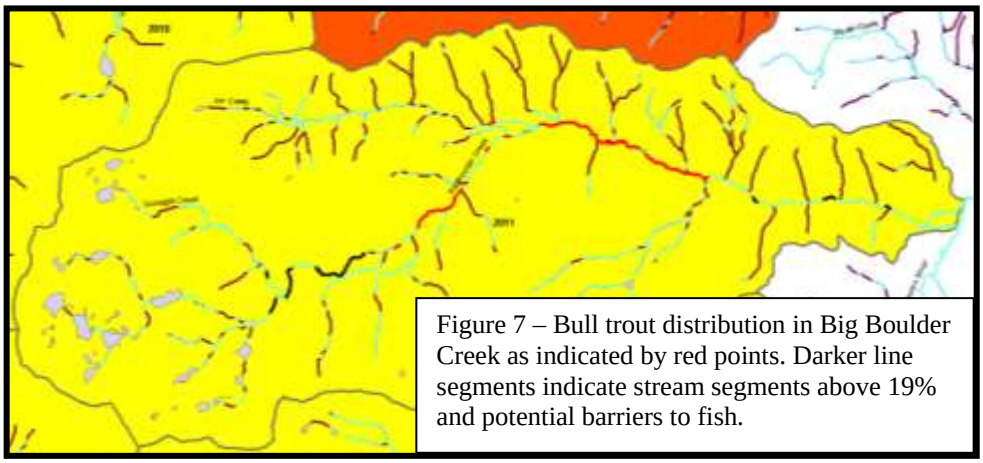

Figure 7 – Bull trout distribution in Big Boulder Creek as indicated by red points. Darker line segments indicate stream segments above 19% and potential barriers to fish.

Treatments have reduced exposure to potential contaminants of concern and should in time improve water quality in Jim Creek and Big Boulder Creek by decreasing contaminant loading from the mine tailings areas.

The Big Boulder Creek road (#667) is cut into the steep slope sitting immediately above Big Boulder Creek. The road suffers chronic erosion problems brought on from this untenable location, and from inadequate surface, cut, and fill slope drainage. Chronic disturbance has also occurred from sheep and cattle grazing on public and private lands. Cattle grazing had impacted (i.e. compaction, pedestal formation, and excessive browse) riparian areas below Livingston Mill and within select headwater tributaries. However, this drainage has been rested since 2004 and many impacted areas are beginning to recover. Finally, near the mouth on BLM and private lands, much of Big Boulder Creek is diverted in the summer for irrigation purposes before reaching the East Fork.

A PIBO integrator reach is located 0.89 miles below the Livingston Mill Mine. The habitat index score from 2005 survey is 57.9 and in 2010 49.4 indicating moderate habitat conditions within this site compared to reference streams. Changes in PIBO scores between 2005 and 2010 appear to be from decreases in the number of pools, pool depth, streambank stability, and woody debris frequency and volume.

Table 7 – 2011 trout densities and population estimates in Big Boulder Creek

Transect (rivermile)	Number of Passes	Transect Length (m)	Species	Number Caught	Total Length (mm)		Density (fish/100m^2)	Pop Estimates (Fish ≥ 60 mm)
					Mean	Range		
7.5	3	108	Bull Trout	2	137	102-172	0.33	2
			Rainbow Trout	1	73	--	0.16	1
			Westslope Cutthroat	3	201	129-251	0.49	5
			Cut-Bow	1	138	--	0.16	1
0.77	3	92	Bull Trout	1	162	--	0.45	1
10.1	3	103	Bull Trout	7	156	90-200	0.92	7
			Westslope Cutthroat	2	172	139-205	0.26	2
14.0	3	115	Westslope Cutthroat	3	187	171-200	0.31	3
			Cut-Bow	5	143	90-240	0.53	8

Patches Where Bull Trout Were Not Detected

Bull trout were not detected in Carrie, Bowns, Paradise Creeks in the S.F. Boise subbasin, and Pole, Iron, Goat, and Wickiup Creeks in the Upper Salmon subbasin. Sampling results and potential reasons bull trout have not been found are discussed in detail below.

Carrie Creek - Bull trout were not detected despite 10 100m electrofishing sites (probability of detection 0.99) suggesting that this 5,420 acre patch (8.29 accessible miles) continue to not support a reproducing population. Survey results are similar to what was found by Sawtooth N.F. surveys in 2000 (10 100m sites), and 2006 (4 100m sties). However, one subadult bull trout (175mm) was observed in Carrie Creek, below the Little Smoky Bridge, by the Sawtooth NF fisheries crew during electrofishing surveys in 2001. Redband trout were present in all sampled stream reaches of Carrie Creek, while sculpin were also present in the lower reaches of the streams. No bull trout were detected at any sites documented by Partridge et al. (2000), but redband trout were captured, while sculpin were recorded at most of the sites.

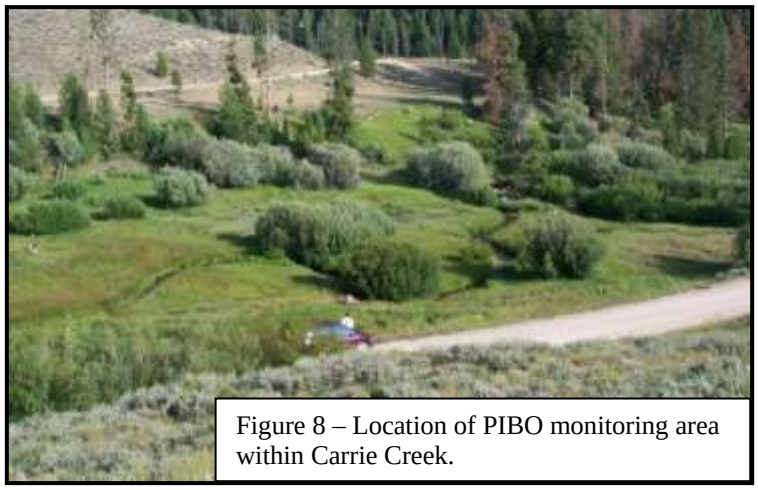

Figure 8 – Location of PIBO monitoring area within Carrie Creek.

Although this patch appears to have water temperatures in the headwaters (MWMT 11.6°C) that are cold enough to support bull trout, water temperatures are marginal in the lower 2.5 miles of Carrie Creek, below King of the West tributary (MWMT 15.3°C to 18.9°C).

A PIBO integrator reach is located approximately 0.20 miles below the Little Smoky confluence (Figure 8). The habitat index score from 2002 survey is 32.2 and in 2007 33.4 indicating poor habitat conditions within this site compared to reference streams. Impaired conditions may be the result of a lack of large woody debris and large pools due to management activities and/or natural sites conditions that may not support these habitat features compared to reference areas. It also may be due to elevated sediment from management activities. The 227 Ketchum-Featherville road parallels most of Carrie Creek. There has also been heavy historic mining, cattle and sheep grazing, and dispersed recreation along many of the stream channels within this drainage.

Bowns Creek - Bull trout were not detected despite 6 100m electrofishing sites (probability of detection 0.98) suggesting that this 1,556 acre patch (0.77 accessible miles) continues to not support a reproducing population. Brook trout were captured in the lower 0.5 mile and redband trout in the lower 1.5 miles. Findings are similar to surveys completed by IDFG (Partridge et al. 2000) in 1994 and 1998 (at 5,500 and 5,720 feet), and the Sawtooth N.F in 2004.

Habitat conditions are believed to be "functioning at risk" from increased sediment from roads, trails, and current/historic sheep grazing. Peak temperature in Bowns Creek near its mouth was 13°C in 2005.

Paradise Creek – Bull trout were not detected despite 13 100m electrofishing sites (probability of detection 0.99) suggesting that this 7,213 acre patch (8.02 accessible miles) continue to not support a reproducing population. One subadult bull trout (197 mm) was found in 2009 in the lower reaches of the patch. But this is the only bull trout ever observed in this patch. IDFG records (Partridge et al. 2000) show three electrofishing sites on Paradise Creek in 1993, one site in 1995, one in 1996 and two sites in 1997, at elevations ranging from 5,570 to 6,760 feet. No bull trout were observed, but brook trout were captured at six of the seven sites (at 6,590 feet, in 1997). Mottled sculpin were recorded at all of the sites, and redband trout at all but the most downstream sampling reach.

Bull trout are believed to not occupy this patch because of elevated summer water temperatures (MWMT 17.1^{o}C to 18^{o}C) at the mouth, high natural sediment levels, presence of brook trout, and historic sheep grazing. However, the stream habitat within the headwaters of this patch is considered in relatively good condition with adequate water temperature for bull trout (less than 15 ^{o}C). Since habitat is slowly recovering from historic management activities, this patch has a high potential to support bull trout if the brook trout population was extirpated.

Pole Creek **-** Bull trout were not detected despite 13 100m electrofishing sites (probability of detection 0.99) in the mainstem of the Pole Creek, Twin and Rainbow Creeks within this 13,023 acre patch. Only brook trout, westslope cutthroat and sculpin were observed. This suggests there is a high probability that this patch does not support a reproducing bull trout population despite 10.1 miles of habitat above the diversion. No bull trout were observed above the PC7 diversion during a 2004 IDFG or 2009 Forest Service surveys. However, bull trout were observed above the PC7 diversion in prior years.

Bull trout are believed to not occupy this patch because of warm summer water temperatures (MWMT 16°C to 20°C) on private property and the historic/current effects of water withdrawals lower in the drainage. Prior to 1982, Pole Creek was seasonally isolated by seven irrigation diversions in the lower 4.5 miles of the drainage. During the irrigation season, these water diversions severely reduced the available fish habitat and, in very low water years, prevented upstream migration by fish to unaffected habitat above the diversions. These diversion points were also sources of fish entrainment from Pole Creek to irrigation ditches. Since consolidation

into one diversion in 1983, dewatered conditions have occurred less frequently. However, passage issues and habitat impacts still persist. IDFG recently concluded that the presence of a low water barrier upstream of the hydro-power plant return flow and the irrigation diversion structure may be a key reason for the absence of fluvial bull trout in the Pole Creek (IDFG 2005a).

Other conditions that may have contributed to bull trout absence include: (1) impaired habitat conditions on private due to grazing and irrigation pivots; (2) complete and partial culvert barriers (one on private property and three barriers on the Forest above the PC7 diversion); (3) elevated instream sediment from historic mining, high route density and sheep grazing; and (4) high brook trout densities (6.1 fish/100m^2).

Stream habitat in the headwaters of this patch is in relatively good condition. Stream temperature (MWMT) measured in Pole Creek (approx. 25 miles below Twin Creek) by the USFS in 2005 was well within the optimal range for bull trout (11.6ºC). Although some localized impacts from sheep grazing, system and non-system roads, and developed and dispersed recreation occur.

A PIBO integrator reach is located 4.57 miles upstream of the Salmon River confluence just above the PC7 water diversion. The habitat index score from 2005 survey is 66.8 and in 2010 50.3 indicating moderate habitat conditions within this site compared to reference streams. Changes in PIBO scores between 2005 and 2010 appear to be from an increase in fine sediment in pool tailouts.

Iron Creek – Bull trout were not detected despite 11 100m electrofishing sites (probability of detection 0.99) in the mainstem of the Iron Creek within this 5,055 acre patch. However, wandering subadults or migratory adult bull trout were found in 1993 below and just above the Highway 21 culvert. Brook trout and sculpin were found at all sites during the 2011 surveys. This suggests there is a high probability this patch does not support a reproducing bull trout population despite this patch supporting 5.28 miles of habitat.

Idaho Fish and Game surveys in 2004 completed five 100m multiple pass surveys on the National Forest (IDFG 2005b). Results documented the presence of Chinook salmon (Oncorhynchus tshawytscha) just above the private property boundary, westslope cutthroat trout (O. clarki lewisi), steelhead/rainbow trout, brook trout and golden trout (O. mykiss aguabonita). Brook trout were widespread throughout the watershed, possibly suppressing the density or presence of native fish species, including bull trout. The highest brook trout densities over 70 mm was 3.6 fish/100m^2 below Alpine Lake (site SVCIC-05). Brook trout distributions are likely the result of extensive stocking efforts in streams and high mountain lakes, and downstream movement into mainstem or adjacent tributary habitat. No bull trout were observed from any of the Iron Creek electrofishing sites.

Bull trout are believed to be absent from this patch due to warm summer water temperatures (season max of 27.2°C with a MWMT of 24.8°C) below the lowest diversion on private property, historic/current effects of water withdrawals that dewater habitat lower in the drainage, culvert barriers on Highway 21 and road #619 to the Iron Creek subdivision that are seasonal barriers to 5.7 miles of habitat, passage barriers from water diversion weirs, localized impacts to riparian areas from roads and dispersed recreation sites, and stream/riparian impacts from grazing on private lands.

Habitat in the headwaters (upstream of the highest diversion) of this patch is in a moderate condition with adequate water temperatures peaking at 14°C to 16°C. Fine sediment is moderate to high in many areas due to natural granitic geology.

Goat Creek – Bull trout were not detected in the 3 100m electrofishing sites (probability of detection 0.87) in the mainstem of the Goat Creek within this 3,379 acre patch. Only brook trout (*Salvelinus fontinalis*) and sculpin were detected. Idaho Fish and Game completed three 100m electrofishing single pass surveys on the Forest above private land in 2004. Brook trout were sampled at all three sites with densities ranging from 2.4 fish/100m^2 to 3.9 fish/100m^2. No Chinook salmon or bull trout were observed at any of the sample sites. Two juvenile O. mykiss (126-127mm total length) were found just above the private property boundary and six westslope cutthroat (*O. clarki lewisi*) (0.8 fish/100m^2) were found in the two upper most sites. The low densities or complete absence of some native salmonids may in part be due to the prevalence of brook trout in Goat Creek. Chinook salmon have been found at times lower in the drainage, just above or below Highway 21 near the Valley Creek confluence.

Overall watershed condition is "functioning at risk" due to warm summer water temperatures (20 °C in late July and early August in reaches influenced by water diversions) on private property, historic/current effects of water withdrawals that dewater habitat lower in the drainage, high brook trout densities, passage barriers associated with some of the 14 water diversions lower in the drainage, high levels of fine sediment from granitic origins and management influences, and stream/riparian impacts from grazing on private lands.

Habitat above the upper most diversion is believed to be in better condition and supports cooler water temperatures (MWMT < 16 °C). The mean daily average water temperature at the mid-Goat Creek site was 10.3°C and the maximum instantaneous temperature recorded was 15.9°C as measured on August 15, 2004.

A PIBO sentinel site is located on the Forest 3.37 miles upstream of the Valley Creek confluence. This site is measured annually to evaluate annual variability and rate of change of each measured attribute (Figures 9 and 10). The habitat index score from 2002 to 2010 has ranged from 41.8 (2007) to 23.3 (2009) indicating poor to moderate habitat conditions within this site compared to reference streams. Changes in PIBO scores between 2002 and 2010 appear to be from a decrease in large woody debris, decrease in pool frequency, and an increase in fine sediment in pool tailouts. It is unknown to what degree changes are caused by natural changes (e.g. high flows, etc.)

Figure 9 – PIBO Sentinel Site 7/26/2006

Figure 10 – PIBO Sentinel Site 8/4/2010

***Wickiup Creek* –** Bull trout were not detected in the 9 100m electrofishing sites (probability of detection 0.99) in the mainstem of the Wickiup Creek within this 4,191 acre patch. Only a few westslope cutthroat trout (60-179mm) were found at one site. Westslope cutthroat was also the only species found in 2004 surveys completed by the Sawtooth N.F. A culvert barrier just above the confluence at Wickiup Creek prevents juveniles and adult salmonids from the E.F. Salmon River accessing habitat upstream. A small water diversion upstream of the culvert may also create passage issues. There are also several high gradient sections (>19%) lower in the drainage that may inhibit fish from the E.F. Salmon River from accessing most of this drainage. Due to these factors it is unlikely Wickiup Creek historically supported a migratory bull trout population.

Watershed condition in Wickiup Creek is believed to be slightly departed from natural conditions. Many of the riparian habitats within accessible areas are small and often tightly confined, and as such have in the past been intensively grazed by livestock. Stream habitats have been altered through mechanisms such as bank trampling, and chiseling, and, with a reduction in integrity, channels have become entrenched. During May to mid-August 1994-1996 temperatures in Wickiup Creek remained below 16°C.

Summary – The 2011 data continues to show that occupied juvenile bull trout patches are larger (15,994) than unoccupied patches (5,691) (Table 8). Occupied patches also have more accessible miles (9.99 vs. 3.47), better connectivity within and to the patch, no brook trout present, colder MWMT (16.2°C vs. 19.3°C), better watershed conditions as determined by the matrix of pathways and indicators, but comparable PIBO index scores (37.6 vs. 41.9) than unoccupied patches.

Although the factors that influence which patches are occupied or unoccupied are complex, other studies have made similar conclusions to the observations stated above. Rieman and McIntyre (1995) found that patch size was highly significant in determining bull trout presence. Subwatersheds whose overall aquatic conditions are "functioning appropriately" generally have good water quality; lower route densities or no roads; fewer grazing impacts; and fewer dispersed recreation opportunities. Subwatersheds whose overall aquatic conditions are considered "functioning at unacceptable risk" generally have poorer water quality; more culverts or water diversion barriers, simplified habitat conditions, higher route densities, more grazing impacts, and more dispersed recreation. These conditions, coupled with the presence of non-native brook trout in some patches, appear to have made it more difficult for bull trout to maintain or reestablish a local population within a patch.

Table 8 – Important indicators within occupied and unoccupied patches

Patch Name	Patch Acres	Accessible Habitat Miles	Connectivity	% of Miles with Brook Trout	MWMT °C	PIBO Integrity Index	Watershed Condition
Occupied Patches							
Boardman Creek	12,561	10.90	Unimpaired	0.00	10-17.9	29.5 (2010)	**FA**
Deadwood Creek	4,558	2.22	Unimpaired	0.00	15-16	--	**FA**
Skeleton Creek	13,108	11.02	Unimpaired	0.00	9.9-16	44.4 (2010)	**FR**
Germania Creek	32,033	18.16	Unimpaired	0.00	9.3-15.3	27.0 (2010)	**FR**
Big Boulder Creek	17,712	7.64	Unimpaired	0.00	13.5-16	49.4 (2010)	**FR**
Average or Range	15,994	9.99	--	0.00	11.5-16.2	37.6	**FA-FR**
Unoccupied Patches							

Carrie Creek	5,420	8.29	Unimpaired	0.00	11.6-18.9	33.4 (2007)	**FUR**
Bowns Creek	1,557	0.05	Impaired	33.00	12.2	--	**FUR**
Iron Creek	5,055	1.00	Impaired	100.00	14-24.8	--	**FR**
Paradise Creek	7,213	8.02	Unimpaired	58.00	12.1-18	--	**FR**
Pole Creek	13,023	4.57	Impaired	90.00	12-20	66.8 (2010)	**FR**
Goat Creek	3,379	2.31	Impaired	100.00	14.8-21.9	25.5 (2010)	**FR**
Wickiup Creek	4,191	0.03	Impaired	0.00	10.8-12.2	--	**FR**
Average or Range	5,691	3.47	--	33-100	12.5-19.3	41.9	**FUR-FR**

Table 9 - Fish species detected during 2011 MIS sampling on the Sawtooth N.F.

		Species Observed						
Subbasin	**Patch**	**Bull Trout**	**Brook Trout**	**Rainbow Trout**	**Westslope Cutthroat Trout**	**Chinook Salmon**	**Sculpin**	**Whitefish**
Upper Salmon	Pole Creek		+		+		+	
Upper Salmon	Wickiup Creek				+			
Upper Salmon	Iron Creek		+				+	
Upper Salmon	Goat Creek		+				+	
Upper Salmon	Big Boulder Creek	+		+	+			
Upper Salmon	Germania Creek	+			+			
S.F. Boise	Boardman Creek	+		+			+	
S.F. Boise	Deadwood Creek	+		+				
S.F. Boise	Skeleton Creek	+		+			+	
S.F. Boise	Carrie Creek			+			+	
S.F. Boise	Bowns Creek		+	+				
S.F. Boise	Paradise Creek		+	+			+	

Bull Trout Detection Probabilities

Electrofishing data collected since 2004 allows for an empirical estimate of probability of detection that is independent from detection probabilities that are modeled by the Western Division of the American Fisheries Society (WDAFS) protocol. Empirical estimates are derived by randomly sampling in patches known to support a local bull trout population and then dividing the number of sites where juvenile bull trout were detected by the number of sites where juvenile bull trout were not observed (Table 10). This estimate can then be used to assess the level of uncertainty associated with a patch where no juvenile bull trout are observed.

When monitoring began in 2004 probabilities of detection at a patch scale typically ranged from 0.21 (3-100m sites) to 0.52 (8-100m sites) using the WDAFS estimates. This implied that we could only be 21-52% confident that bull trout densities in patches where juveniles were not detected were lower than others observed in the Salmon, Clearwater and Boise subbasins in Idaho.

After eight years of sampling every bull trout patch on the Forest it appears that the densities, sampling efficiencies, and site level detection probabilities are higher than those estimated by WDAFS. This has been noted by other sampling efforts in the Boise and Payette subbasins (Rieman and Kellett, personal communication). We have found that when juvenile bull trout are

present, they were usually observed during the first electrofishing pass of the first sample site within a patch when there is good electrofishing efficiency. This suggests that in occupied patches, bull trout are relatively easy to detect. With current empirical site-level estimates of detection probabilities, cumulative patch level probabilities approach 0.49 per site or 0.87 when 3 sites are sampled within a patch. This implies that we have a higher level of confidence that juvenile bull trout are either at extremely low densities or are not present within the patch. However, absence can never be 100% certain unless perhaps the stream is dewatered.

Table 10 - Overall site-level empirical estimate of bull trout detection probabilities.

Subbasin	Patch	# of Sites Sampled	# with BLT	# with Juv. BLT
Upper Salmon	West Pass	6	4	2
Upper Salmon	Bowery Creek	13	5	5
Upper Salmon	Big Boulder	38	20	13
Upper Salmon	Little Boulder	4	4	3
Upper Salmon	Slate	6	2	0
Upper Salmon	Warm Spring (Pigtail/Martin/Garland)	28	13	9
Upper Salmon	E.F. Valley Creek	5	5	5
Upper Salmon	Fishhook	4	4	3
Upper Salmon	Crooked	7	1	1
Upper Salmon	Champion Creek	3	1	1
Upper Salmon	Germania Creek	7	6	5
S.F. Payette	Trail Creek	4	3	2
M.F./N.F. Boise	Queens River	7	4	1
S.F. Boise	Boardman Creek	14	11	8
S.F. Boise	Skeleton Creek	16	14	10
S.F. Boise	Deadwood Creek	11	10	10
S.F. Boise	Willow Creek	5	5	4
S.F. Boise	Big Peak	8	8	7
S.F. Boise	N.F. Big Smoky	5	4	4
S.F. Boise	Bluff	2	2	2
S.F. Boise	Upper Big Smoky	4	4	4
S.F. Boise	W.F. Big Smoky	3	2	1
S.F. Boise	Bear	5	3	3
S.F. Boise	Upper S.F. Boise	11	3	2
S.F. Boise	Emma Creek	6	4	4
Total		222	142	109
Empirical Estimate of Probability of Detection				**109/222 = 0.49**

Table 11 - Summary of results from 2011 aquatic MIS sampling on the Sawtooth N.F.

Subbasin	Patch	Strata Designation in 2010	Bull Trout Detected	# Sites sampled	# Sites where Bull Trout < 150mm were found	Empirical Probability Of Detection
Upper Salmon	Pole Creek	3	-	13	0	0.99
Upper Salmon	Iron Creek	3	-	11	0	0.99
Upper Salmon	Goat Creek	3	-	3	0	0.87
Upper Salmon	Big Boulder Creek	1	+	10	3	NA
Upper Salmon	Wickiup Creek	3	-	9	0	0.99
Upper Salmon	Germania Creek	1	+	7	5	NA

S.F. Boise	Boardman Creek	1	+	14	8	NA
S.F. Boise	Deadwood Creek	1	+	4	3	NA
S.F. Boise	Paradise Creek	2	-	13	0	0.99
S.F. Boise	Skeleton Creek	1	+	16	10	NA
S.F. Boise	Carrie Creek	2	-	10	0	0.99
S.F. Boise	Bowns Creek	3	-	6	0	0.98

Bull Trout Trends on the Sawtooth National Forest Since 2004

In 2004, fisheries staff identified and stratified 97 bull trout patches on the Sawtooth NF. Since that time six additional patches have been identified in the Upper Salmon subbasin and one dropped in the S.F. Boise subbasin resulting in 102 patches on the Forest. During the 2004 to 2011 field seasons, crews completed MIS protocol surveys in 100% of the category 1-2 patches. Bull trout presence was confirmed in 36 patches; habitat was determined to be suitable but no bull trout were detected in 17 patches; and habitat was determined to be unsuitable in 50 patches.

Data collected over the past eight years were compared with information collected prior to 2004 to provide a preliminary indication of bull trout trend across the planning unit. Results from this comparison indicate a slight increase in bull trout distribution in the S.F. Boise, M.F./N.F Boise, and Upper Salmon subbasins. Bull trout were probably present, but previously undetected, in many of the patches that are now reclassified as occupied (category 1). Still, the data indicates that bull trout presence is more robust than previously thought in 2004 and that bull trout are still occupying most patches where previously detected. Table 12 shows an increase in the number of unsuitable/inaccessible patches in the S.F. Boise and Upper Salmon subbasins. These patches were reclassified as unsuitable based on recently acquired data that documented unfavorable existing conditions such as streams with culvert barriers, maximum weekly maximum temperature that exceed 15 °C over most of the available habitat, abundant brook trout populations, and no strong bull trout populations in adjacent streams.

Table 12 - Comparison of bull trout patch strata 2004-2011.

Category	**S.F. Boise Subbasin**		**N.F. and M.F. Boise Subbasin**		**S.F. Payette Subbasin**		**Upper Salmon Subbasin**	
	# Patches 2004	# Patches 2011	# Patches 2004	# Patches 2011	# Patches 2004	# Patches 2011	# Patches 2004	# Patches 2011
1 – Occupied	11	13	4	4	0	2	6	17
2 – Suitable/Unoccupied	22	7	1	1	4	2	28	7
3 – Unsuitable/Inaccessible	10	22	0	0	0	0	3	28
4 - Unsurveyed	0	0	0	0	0	0	8	0
Total	43	42	5	5	4	4	45	52

Conclusion

A variety of factors influences the distribution of bull trout populations across the Sawtooth National Forest. As has been reported in the literature, results from our MIS sampling indicate that patch size, stream temperature, patch connectivity, habitat condition, and the occurrence of brook trout can all influence the presence or absence of reproducing bull trout populations. Information collected over the past eight years has better defined bull trout distributions within patches and across each subbasin. At the subbasin scale it appears bull trout local populations have remained stable since 2003 with the exception of the loss of a hybridized population in Crooked Creek. We have also found more occupied patches than previously thought. However, this doesn't imply bull trout have expanded their range. Only that we have confirmed their

presence in streams that likely supported them all along. In 2011, bull trout populations continue to occupy Boardman, Deadwood, Skeleton, Big Boulder, and Germania patches and are absent in Paradise, Bowns, Carrie, Wickiup, Pole, and Iron patches with detection probabilities ranging from of 0.87 to 0.99.

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