2010 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."*

"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 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 bull trout populations will more likely reflect local management activities.

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 populations. 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. In the future we intend to explore indices of abundance and distribution within individual streams that may be useful to characterize linkages with local management.

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 access (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 conditions. Habitat variables needed to estimate sampling efficiencies will be measured. In 2009, sampling was changed from multiple electrofishing passes with blocknets to one electrofishing pass with no blocknets based on discussions with the Rocky Mountain Research Station. In 2011, however, the Forest will establish multiple electrofishing pass sites without blocknets at a select number of monumented sites in patches where bull trout have been found in previous surveys to explore changes in abundance at each site and the relationship between first pass catches and population estimates from three-pass. Several photo points (beginning, middle, and end of transect) will also be established at each monumented sites.

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, and statistically valid, 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 will be 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 2010 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	35
2	7	1	2	8	16
3	22	0	0	27	50
4	0	0	0	0	0
Total	42	5	4	51	102

Using data from the past 7 years (since 2003), 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 2003) within each subbasin based on 2010 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	35 (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	27 (96%)	50	45 (90%)

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 all subwatersheds where PIBO integrator reaches have been established. An integrator reach is the lowest-most 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).

2010 Results and Discussion

Monitoring for bull trout on the Sawtooth National Forest occurred in 18 patches in 2010 (Figure 1). In the S.F. Boise subbasins, seven patches were surveyed using formal protocols. Of these patches, juvenile bull trout were observed in Boardman, Deadwood, Big Peak, Bluff, and N.F. Big Smoky Creeks. In the Upper Salmon juvenile bull trout were found in Bowery and Big Boulder Creeks. Finally, in the M.F. Boise juvenile bull trout were found in Queens River. Discussion of changes in bull trout distribution within a patch or abundance is discussed below for each patch.

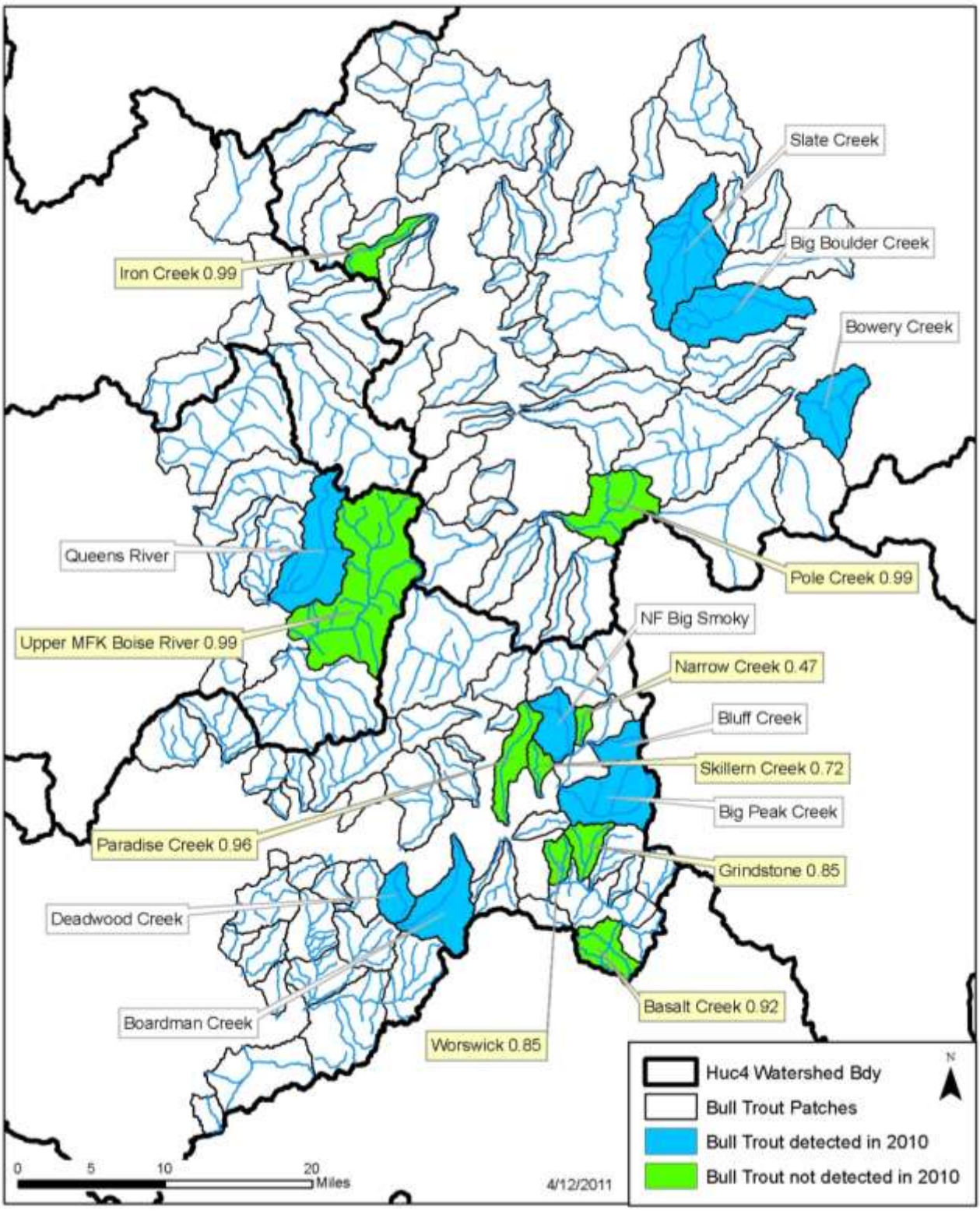

Figure 1 - Bull trout patches sampled and probabilities of detection on the North Zone of the Sawtooth N.F. (2010).

Patches Where Bull Trout Were Detected

Boardman Creek – Bull trout continue to be well distributed within this 12,561 acre (10.9 accessible miles) patch (Figure 2). Juvenile bull trout were found in 12 of the 17 100m electrofishing sites. The greatest numbers of juveniles were observed in headwater sites in the mainstem Boardman Creek above the Smoky Dome confluence and Smoky Dome Creek. Larger migratory fish (>400mm) were also observed in these headwater sites. Findings from the 2010 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. The radio-telemetry study by Partridge et al. (2000) showed the presence of migratory bull trout in Boardman Creek. Specifically, in 1998, a 430 mm bull trout was tracked to Boardman Creek, while in 1999; individuals of 525 and 580 mm bull trout were located in the headwaters of this stream. Radio-telemetry information can be interpreted to show that a substantial number of adfluvial migrants use Boardman and Smoky Dome creeks.

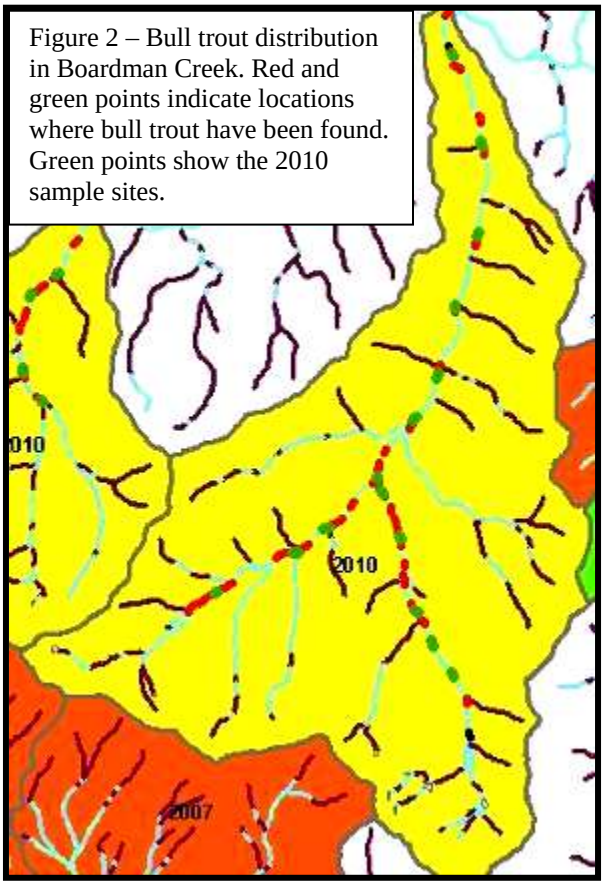

Figure 2 – Bull trout distribution in Boardman Creek. Red and green points indicate locations where bull trout have been found. Green points show the 2010 sample sites.

A small tributary of Boardman Creek drains a cirque pond, called Deadwood Creek Lake. IDFG stocking records indicate that this lake has been stocked with several strains of rainbow/redband trout. 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.

MWMT near the mouth of Boardman Creek from 2002 through 2007 ranged from approximately 14.0°C to nearly 18°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 about 10°C to 12.0°C. 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 in good condition across the drainage, 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 a pooper condition averaged less than a 40 a score for streams within the Southwest Idaho Ecogroup. Changes in PIBO scores between 2005 and 2010 appear to be from decreases in the number of pools and woody debris frequency and volume.

Deadwood Creek – Juvenile bull trout were detected at all four 100m electrofishing sites within this 4,558 acre (2.22 accessible miles) patch (Figure 3). Bull trout distribution in 2010 mirrors 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 and 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 is stocked by IDFG. Redband trout were the only other species observed during the 2010 surveys.

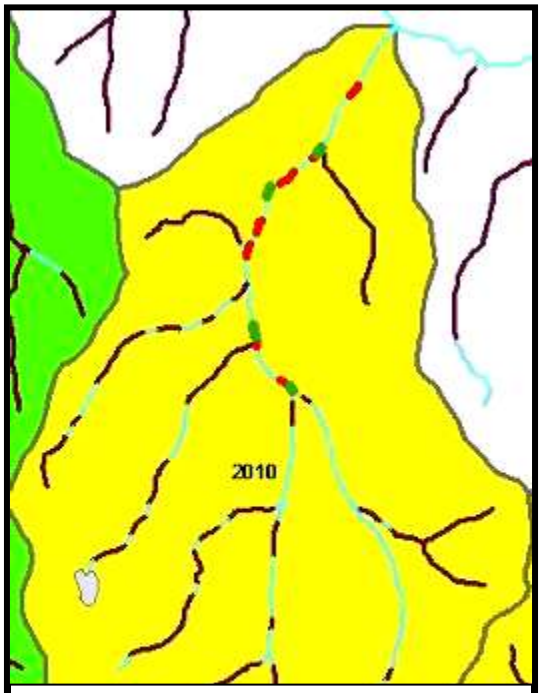

Figure 3 – Bull trout distribution in Deadwood Creek. Red and green points indicate locations where bull trout have been found. Green points show the 2010 sample sites.

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 since historic highs.

Big Peak Creek – Juvenile bull trout were detected in three of the four 100m electrofishing sites within this 14,486 acre (8.95 accessible miles) patch (Figure 4). Bull trout distribution in 2010 mirrors what had been found in during the 2004 Sawtooth NF surveys. Partridge et al. (2000) showed the presence of migratory bull trout in Big Peak Creek. Specifically, in 1998, a 480 mm bull trout was tracked to Big Peak Creek, while in 1999, two bull trout (of 440 and 480 mm) were located in this stream. Radio-tagged bull trout were found up to just below the East Fork-West Fork confluence (about 6,720 feet). Redband trout were

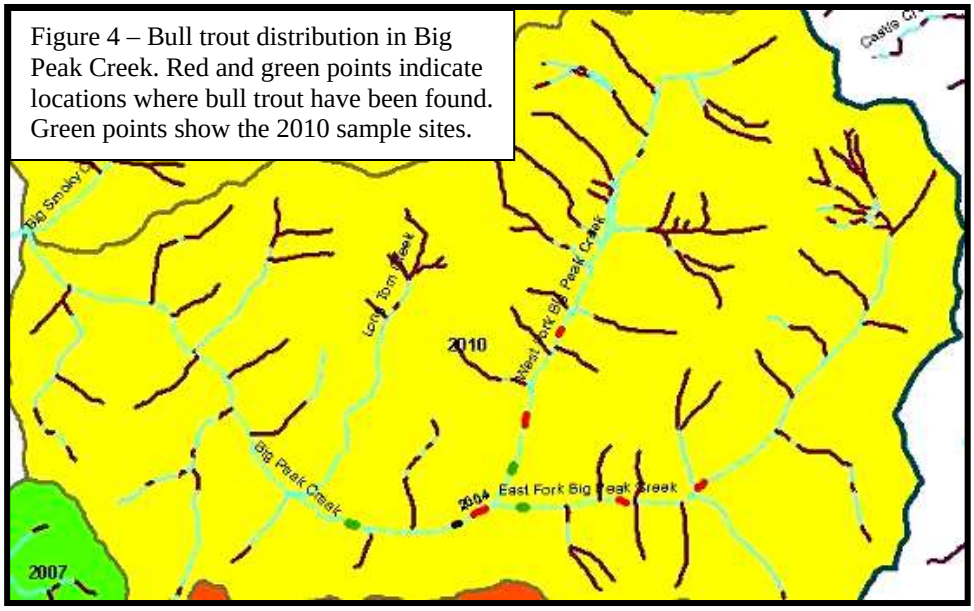

Figure 4 – Bull trout distribution in Big Peak Creek. Red and green points indicate locations where bull trout have been found. Green points show the 2010 sample sites.

also detected in the 2010 surveys.

The MWMT in 2004 in Big Peak Creek was 12.5°C just downstream of the forks and in 2006 MWMT was measured in W.F. Smoky Creek at 13.2°C, so stream temperatures are well within the range considered optimal for bull trout.

Habitat connectivity is considered excellent within this patch. Occasional debris jams occur in a canyon section lower down in the patch which may impede access. These debris dams could be from a1997 avalanche that removed 3 - 4 acres of timber and rock. Habitat may also be impacted from historic and current sheep grazing, but overall habitat is generally in good condition.

Bluff Creek – Juvenile bull trout were detected in the one 100m electrofishing site within this 4,354 acre (2.41 accessible miles) patch. Surveys by the Sawtooth NF in 2005 also observed juvenile bull trout upstream of the 2010 site (Figure 5). IDFG (Partridge et al. 2000) surveyed this patch in 1993 in which they observed two bull trout. Finally, Sawtooth NF staff conducting habitat surveys during the summer of 2001 observed at least one large (~500 mm) bull trout in the lower section of Bluff Creek, so it is likely that this patch supports migratory bull trout.

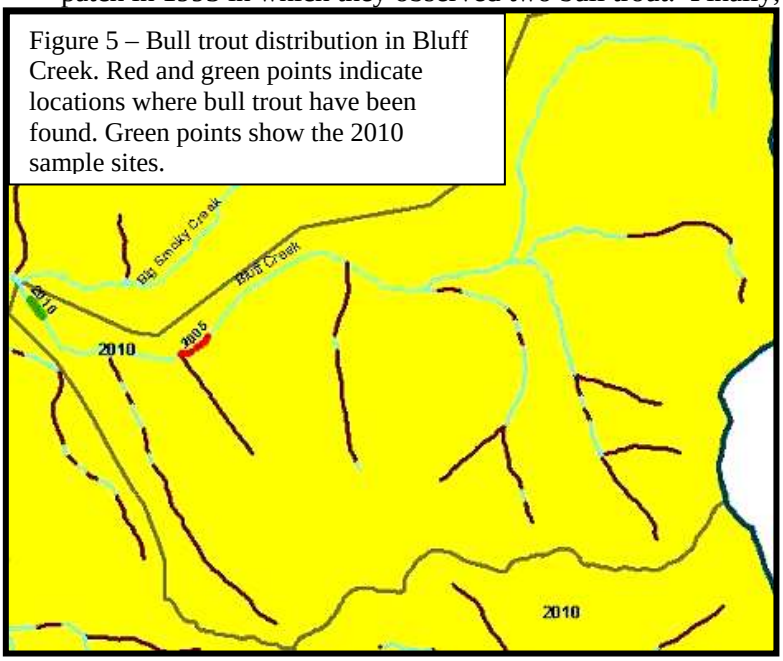

Figure 5 – Bull trout distribution in Bluff Creek. Red and green points indicate locations where bull trout have been found. Green points show the 2010 sample sites.

Peak Stream temperatures (MWMT) during 2005 were observed during late July and August in which they did not exceed 10 C. No human made barriers are known at any flow regime**.** The only known substantial impact within the patch is historic sheep grazing. Current grazing within the patch, however, is likely not sufficient to retard recovery.

N.F. Big Smoky Creek – Juvenile bull trout were detected in the one of the two 100m electrofishing sites within this 7,037 acre (4.22 accessible miles) patch. Bull trout distribution in 2010 is similar to what has been found in past surveys (Figure 6). IDFG (Partridge et al. 2000) electrofished three sites in 1993 on the N.F. Big Smoky and, six sites on the N.F. Big Smoky and Snowslide Creek in 1999. Sampling at the North Fork sites did not reveal any bull trout, but redband trout and sculpin were present at all six sites. On Snowslide Creek, bull trout and redband trout were sampled at only at the lower-most site, but no fish were present at the two higher-elevation sites (7,310 and 7,800 feet).

7-day max temps are not available, but existing temperature readings suggest that stream temperatures are within desired range for bull trout. The Boise National Forest in 1993 measured 11.5°C on 8/24 @ 1700 in NF Big Smoky Creek and 8°C on 8/25 @ 2000 in NF Big Smoky Creek above Snowslide

Habitat connectivity is considered excellent within this patch. Instream sediment may be slightly elevated from historic and current sheep grazing. A PIBO integrator reach is located just above the confluence with the Big Smoky Creek. The habitat index score from 2002 survey is 48.2 and in 2007 39.4 indicating moderate habitat conditions within this site compared to reference streams. Changes in PIBO scores between 2002 and 2007 appear to be from decreases in the number of pools and woody debris frequency and volume.

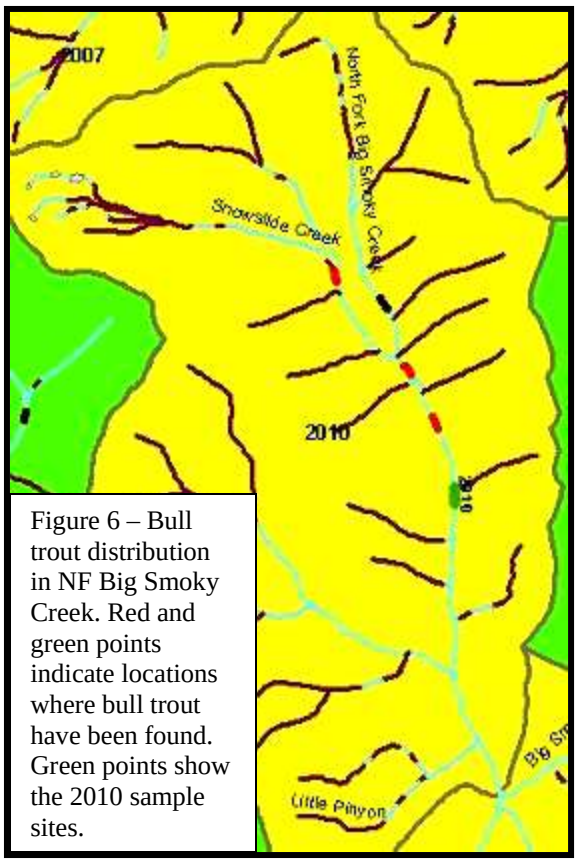

Figure 6 – Bull trout distribution in NF Big Smoky Creek. Red and green points indicate locations where bull trout have been found. Green points show the 2010 sample sites.

Bowery Creek – Juvenile bull trout were detected in the five of the 15 100m electrofishing sites on the mainstem Bowery Creek in 2010 within this 11,173 acre patch (Figure 7). Westslope cutthroat were found in most sites in the mainstem, North Fork, and Long Tom Creek. Bull trout had been detected previously at one site above Long Tom Creek by the Salmon Challis National Forest during their 2006 surveys (Gamett and Bartel 2008). Bull and rainbow trout had also been found throughout the mainstem of Bowery Cr during 1999 snorkeling surveys by the Sawtooth National Forest.

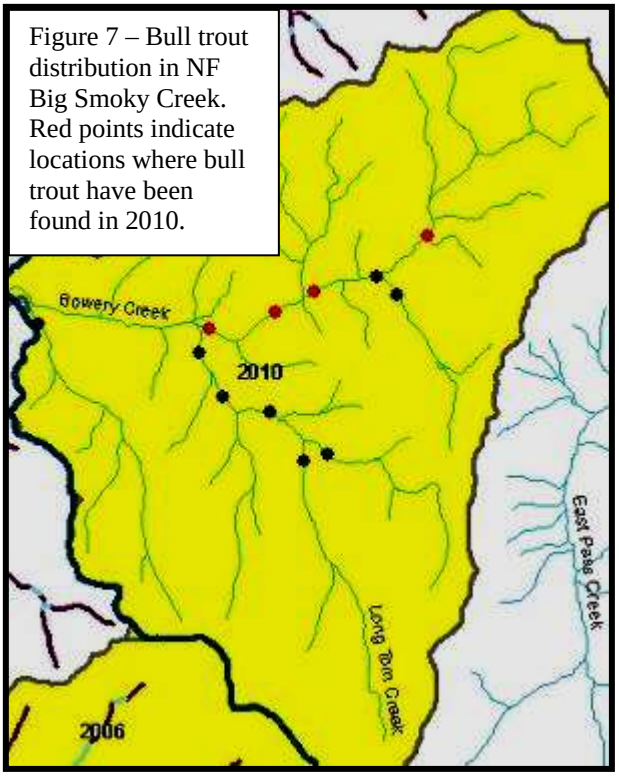

Figure 7 – Bull trout distribution in NF Big Smoky Creek. Red points indicate locations where bull trout have been found in 2010.

Water temperatures monitored at the mouth of Bowery Creek in August and September 1999 recorded temperatures near optimum for bull trout, at less than 13° C. Where temperatures were monitored for the summer season from 2002-2007 in Bowery Creek, water temperatures remained below 15°C.

Overall the habitat is in good condition with many indictors, in many tributaries, functioning appropriately. However, some affects have occurred and persist from grazing, diversions, and private uses. At the mouth, just feet before joining the East Fork, a diversion removes water for irrigation

purposes on nearby private land. This diversion is unscreened and may entrain fish into the irrigation ditch. It also may delay or prevent upstream migration of bull trout during low flows. Riparian impacts from livestock grazing have occurred in low stream gradient response reaches. Although generally improving, chronic effects from grazing persist in these response reaches and headwater wet stinger and pocket meadows in this drainage.

Big Boulder Creek – Juvenile bull trout were detected in the three of the 13 100m electrofishing sites on the mainstem Big Boulder and Jim Creeks in 2010 within this 17,712 acre (7.64 accessible miles) patch (Figure 8). Bull trout distribution in 2010 is similar to what has been found 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 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 temperatures less than 16°C. Recent temperature monitoring in 2006 and 2010 found stream temperatures of 16°C and 13.5°C in Boulder Creek and 14.8°C in 2005 in Jim Creek.

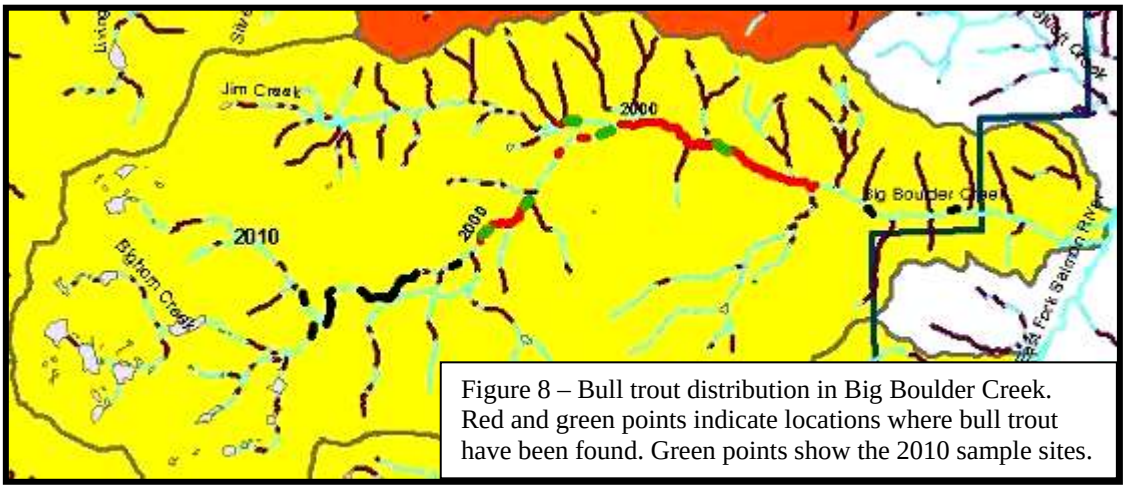

Figure 8 – Bull trout distribution in Big Boulder Creek. Red and green points indicate locations where bull trout have been found. Green points show the 2010 sample sites.

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. 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.

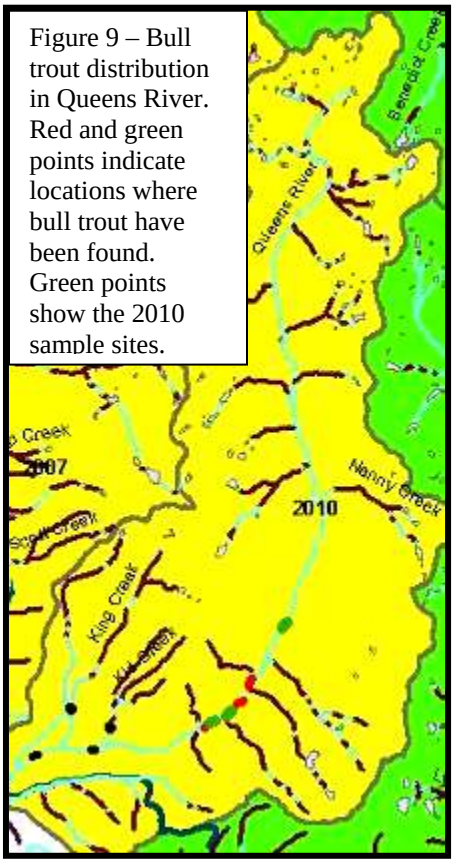

Figure 9 – Bull trout distribution in Queens River. Red and green points indicate locations where bull trout have been found. Green points show the 2010 sample sites.

Queens River – Juvenile bull trout were detected in the one of the seven 100m electrofishing sites on the mainstem Queens River in 2010 (Figure 9). However, larger adult bull trout (190mm – 360mm) were found at three additional sites within this 17,967 acre (10.61 accessible miles) patch. Redband trout and sculpin were also found in most sites. Bull trout distribution in 2010 is similar to what has been found in past surveys by the Rocky Mountain Research Station (RMRS) in 1997 (Rieman et al. 2006) and Bureau of Reclamation in 2001 (Salow and Hostettler 2004). The RMRS electrofished 17 sites (at least two pools with the length averaging about 36 m) finding 1.3 to 1.5 bull trout/ 100 m^2.

Water temperatures monitored in the lower reaches of Queens River recorded MWMT temperatures less than 13.3°C from 1996 to 1999. Recent temperature monitoring in 2006 found stream temperatures of 14.8°C. Overall habitat conditions are considered good with almost the entire stream occurring within wilderness. Fine sediment may be slightly elevated outside the wilderness where some suction dredge mining has occurred. There is also a non-motorized trail that follows most of the

river's length. However, this trail receives yearly maintenance (i.e. clearing fallen trees and drainage structures) and is considered to be in good repair.

A PIBO integrator reach is located 2.5 miles upstream of the trailhead. The habitat index score from 2005 survey is 56.3 and in 2010 58.9 indicating moderate habitat conditions within this site compared to reference streams. 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 a pooper condition averaged less than a 40 a score for streams within the Southwest Idaho Ecogroup.

Patches Where Bull Trout Were Not Detected

Bull trout were not detected in Worswick, Basalt, Skillern, Grindstone, and Narrow Creeks in the S.F. Boise subbasin, Pole, Iron, Silver Rule/Carbonate (Trib to Slate Creek) Creeks in the Upper Salmon subbasin, and M.F. Boise River in the M.F./N.F. Boise subbasin. Sampling results and potential reasons bull trout have not been found are discussed in detail below.

Narrow Creek - Probabilities of detection for the one site in Narrow Creek were 0.47, but the stream appears to provide too little habitat (i.e. avg. wetted width 1.73m and 2.25 miles of accessible habitat) within this 1,543 acre patch to support a reproducing bull trout population.

Basalt Creek - Probabilities of detection for the four sites in Basalt Creek was 0.92 suggesting there is a high level of certainty that a reproducing bull trout population is not present within this 7,056 acre (3.09 accessible miles) patch. Bull trout were not detected despite electrofishing surveys (four 100m sites) in 1993 and 1997 by IDFG (Partridge et al. 2000), and Forest Service surveys in 1999/2000 (seventeen 75-125m sites) and 2009 (three 100m sites) on Basalt, Cannonball, and Sawmill Gulch Creeks within this patch. Only redband trout, sculpin and bridgelip suckers have been found in this patch. Bull trout are believed to be absent within this patch because of the low elevation terrain, warm summer water temperatures (MWMT 21^{o}C to 23 ^{o}C), lack of a migratory population in the Little Smoky drainage, high natural sediment levels, and impaired habitat from roads and historic intense cattle grazing.

Worswick and Grindstone Creeks - Three electrofishing sites each were completed on Worswick (2,930 acres and 3.7 accessible miles) and Grindstone (4,663 acres and 5.2 accessible miles) Creeks in the Little Smoky drainage in 2010. Probabilities of detection for each of these steams were 0.85 continuing to support the conclusion that reproducing bull trout populations are not present. IDFG records (Partridge et al. 2000) show one electrofishing site on Worswick Creek in 1997, as well as three sites in 1999. Grindstone Creek was electrofished once in 1993 and 1996 and three times in each of 1998 and 1999. No bull trout were observed at any of the Worswick-Grindstone sites documented by Partridge et al. (2000), but redband trout were captured in all but one of the fourteen sampling efforts, while mountain whitefish, sculpin, longnose dace, redside shiners, and/or suckers were recorded at one or more of the sites.

In 1999 and 2000 (SNF 1999, 2000), SNF crews sampled two sites on Worswick Creek and six sites on Grindstone Creek. Each of the electrofishing transects ranged from 100 to 200+ meters in length. In the Worswick-Grindstone subwatershed in 2001 SNF crews conducted continuous electrofishing surveys in Worswick Creek, the East Fork of Worswick Creek, Grindstone Creek, and the West Fork of Grindstone Creek. Grindstone Creek and its West Fork were electrofished from their mouths to a point where extremely few fish were collected. Although this amounted to a substantial sampling effort, no bull trout were collected. In addition to the fish species that

were noted as occurring in the subwatershed by Partridge et al. (2000), the 1999 and 2000 SNF surveys also detected the presence of northern pikeminnow and hatchery rainbow trout.

Bull trout are believed to not occupy this patch because of a summer thermal barrier in lower Worswick due to the hot springs, warm summer water temperatures (MWMT 16^{o}C to 21^{o}C), lack of a migratory population in the Little Smoky drainage, high natural sediment levels, impaired habitat from roads, dispersed recreation, fuelwood collection, and cattle grazing.

A PIBO integrator reach is located 0.4 miles from the mouth of Grindstone Creek, upstream of the Little Smoky confluence. The habitat index score from 2002 survey is 16.8 and in 2007 29.2 indicating poor habitat conditions within this site compared to reference streams. Changes in PIBO scores between 2002 and 2007 appear to be from decreases in fine sediment in pool tailouts and an improvement in streambank stability.

Paradise Creek – Bull trout were not detected despite five 100m electrofishing sites (probability of detection 0.96) suggesting that this 7,213 acre patch (8.02 accessible miles) does 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 found 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 sampled, 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 downstream-most 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 habitat within the headwaters of this patch is 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 could be removed.

Skillern Creek – Probabilities of detection for the two sites in Skillern Creek were 0.72 and the stream appears to provide too little habitat (i.e. avg. wetted width 2.2m and 2.0 miles of accessible habitat) to support a reproducing bull trout population in this 2,403 acre patch, despite relatively cold water temperatures (spot measurements of 11°C on 8/28 @ 1400 in 1993). According to IDFG records (Partridge et al. 2000), Skillern Creek was sampled once in 1993. Only redband trout and sculpin were captured in Skillern Creek by the IDFG and Forest Service surveys. Bull trout are believed to not occupy this patch because elevated instream sediment from natural and heavy historic grazing impacts and several natural partial fish passage impediments in lower Skillern Creek that may impede bull trout.

Pole Creek - Bull trout were not detected despite seventeen 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 (*Salvelinus fontinalis*) and sculpin were found. This suggests there is a high probability 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 affects 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 2005).

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 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 nine 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 in Iron Creek. Brook trout (*Salvelinus fontinalis*) and sculpin were found at all sites, while steelhead/rainbow (*Oncorhynchus mykiss)*, westslope cutthroat, and rainbow/cutthroat hybrids were found in headwater reaches during the 2010 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 National Forest (IDFG 2005). 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 affects 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.

Slate Creek (Silver Rule/Carbonate Creeks) – Silver Rule and Carbonate Creeks were electrofished to determine the presence of TES listed fish for the Carbonate Mine Reclamation project. No fish were found during the two 100m transects in lower Carbonate Creek. The stream is very small and has a steep gradient over most of its length. Only westslope cutthroat trout were observed in the one 100m transect in 2010. Observations are similar to those made in 2008, when only westslope cutthroat were found in Silver Rule Creek. However, bull trout may have been observed in Silver Rule Creek in 2000 from a streambank recon survey. A small number of bull trout have been found lower in Slate Creek during 2006 surveys.

Upper M.F. Boise River – Bull trout were not detected despite twelve 100m electrofishing sites (probability of detection 0.99) in the mainstem of the M.F. Boise River and Mattingly Creek within this 40,746 acre patch. Brook trout (Salvelinus fontinalis), rainbow trout (Oncorhynchus mykiss), stocked cutthroat, and sculpin were found at the majority of sites. This suggests there is a high probability this patch does not support a reproducing bull trout population despite supporting at least 15.57 miles of accessible habitat. The Boise National Forest (1993 and 2001) and Bureau of Reclamation (2001 and 2003) also only found rainbow and brook trout during their electrofishing surveys (Salow and Hostettler 2004).

Given the amount and quality of habitat in the M.F. Boise River patch it is surprising bull trout have not been found in the last 18 years. This is especially puzzling since bull trout have been found in the Yuba River just downstream of this patch. It is believed migratory bull trout from lower in the drainage have limited access to this patch. The Atlanta (Kirby) Dam a 45 foot high hydropower facility located on the M.F. Boise River a short distance downstream of the town of Atlanta completely blocked migratory bull trout from upstream habitat since the early 1900's until a fish ladder was constructed in 1999 (Steed et al. 1998). A low number of adfluvial or migratory bull trout have been sampled above Atlanta (Kirby) Dam since the ladder was constructed (J. Dillon, Idaho Department of Fish and Game, pers comm. 2004). However, since this time there have been problems with the operator not taking care of the fish ladder preventing it from working at best efficiency.

Competition and hybridization with brook trout may be a key reason bull trout have not been detected. Brook trout have been found in almost all sample sites and well into the headwaters of this patch. They are probably present from escapees from alpine lakes. Warm summer water temperatures (MWMT 19°C to 30.7°C) have been recorded below Leggit Creek and may limit summer rearing. Bull trout may also have been impacted by habitat modifications from historic placer mining, roads, and timber harvest lower in the patch. High levels of natural sediment from erodible granitic parent material likely exacerbate these impacts. However, the majority of this patch occurs in the Sawtooth Wilderness where management impacts have been limited and habitat is in relatively good condition (MWMT 14.1°C to 15.9°C).

A PIBO integrator reach is located 0.16 miles upstream of the Mattingly Creek confluence. The habitat index score from 2003 survey is 40.3 and in 2008 47.9 indicating moderate habitat conditions within this site compared to reference streams. Changes in PIBO scores between 2003

and 2008 appear to be from a decrease in fine sediment in pool tailouts and an increase in large woody debris.

Summary – Patches occupied by juvenile bull trout are larger than unoccupied (11,231 vs. 9,404) (Table 3). This difference is even larger (11,231 vs. 6,173) when only patches with unimpaired connectivity is considered. Occupied patches also have more accessible miles (19.03 vs. 6.08), better connectivity within and to the patch, no brook trout present, colder MWMT (13.3°C vs. 19°C), superior watershed conditions as determined by the watershed condition indicators, and slightly better PIBO scores (50.0 vs. 48.0) 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. Kershner et al. (2004) also found that physical habitat within more managed watersheds contained significantly shallower residual pool depths, higher bank angles, fewer undercut banks, and smaller median particle sizes. The lower index scores in unoccupied bull trout patches suggest that some of these indicators may have also been degraded by management activities. 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 3 – 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	12,561	10.90	Unimpaired	0.00	10-12	29.5-35.1	**FA**
Deadwood Creek	4,558	2.22	Unimpaired	0.00	15-16	--	**FA**
Big Peak Creek	14,486	8.95	Unimpaired	0.00	12.5-13.2	--	**FR**
Bluff Creek	4,354	2.41	Unimpaired	0.00	10	--	**FA**
N.F. Big Smoky Creek	7,037	4.22	Unimpaired	0.00	11.5	39.4-48.2	**FA**
Big Boulder Creek	17,712	7.64	Unimpaired	0.00	13.5-16	49.4-57.9	**FR**
Bowery Creek	11,173	7.20	Unimpaired	0.00	13	--	**FR**
Queens River	17,967	10.61	Unimpaired	0.00	13.3-14.8	56.3-58.9	**FA**
Average or Range	11,231	19.03	--	0.00	12.9-13.3	43.7-50.0	**FR-FA**
Unoccupied Patches							
Basalt Creek	7,056	3.09	Impaired	0.00	21-23	--	**FUR**
Grindstone	4,663	5.18	Unimpaired	0.00	19.3	16.8-29.2	**FUR**
Iron Creek	5,055	5.28	Impaired	100.00	14-24.8	--	**FR**
Narrow Creek	1,543	2.25	Unimpaired	0.00	8.0	--	**FA**
Paradise Creek	7,213	8.02	Unimpaired	58.00	12.1-18	--	**FR**
Pole Creek	13,023	9.60	Impaired	90.00	12-20	50.3-66.8	**FR**
Skillern Creek	2,403	2.00	Unimpaired	0.00	8.5	--	**FR**

Upper MFK Boise River	40,746	15.57	Impaired	0.00	16-19	40.3-47.9	**FR**
Worswick	2,930	3.70	Unimpaired	0.00	17.1	--	**FUR**
Average or Range	9,404	6.08	--	58-100	15-17.5	35.8-48.0	**FUR-FA**

Table 4 - Fish species detected during 2010 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	Bowery Creek	+			+			
Upper Salmon	Iron Creek		+	+	+		+	
Upper Salmon	Big Boulder Creek	+		+	+			
Upper Salmon	Slate Creek (Carbonate/Silver Rule)				+			
N.F./M.F. Boise River	M.F. Boise River		+	+			+	
N.F./M.F. Boise River	Queens River	+		+			+	+
S.F. Boise	Boardman Creek	+		+			+	
S.F. Boise	Deadwood Creek	+		+				
S.F. Boise	Worswick Creek			+			+	
S.F. Boise	Grindstone Creek			+			+	
S.F. Boise	Narrow Creek			+				
S.F. Boise	Basalt Creek			+				
S.F. Boise	Skillern Creek			+				
S.F. Boise	Big Peak Creek	+		+				
S.F. Boise	Paradise Creek		+	+				
S.F. Boise	Bluff Creek	+		+				
S.F. Boise	N.F. Big Smoky	+		+				

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 5). 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 six years of sampling almost 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 0.47 per site or 0.85 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 5 - 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	28	14	10
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
S.F. Payette	Trail Creek	4	3	2
M.F./N.F. Boise	Queens River	7	4	1
S.F. Boise	Deadwood Creek	7	7	7
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		171	95	80
Empirical Estimate of Probability of Detection				**80/171 = 0.47**

Table 6 - Summary of results from 2010 aquatic MIS sampling on the Sawtooth N.F.

Subbasin	Patch	Strata Designation in 2009	Bull Trout Detected	# Sites sampled	# Sites where Bull Trout < 150mm were found	Empirical Probability Of Detection
Upper Salmon	Pole Creek	3	-	17	0	0.99
Upper Salmon	Bowery Creek	1	+	15	5	NA
Upper Salmon	Iron Creek	2	-	8	0	0.99
Upper Salmon	Big Boulder Creek	1	+	13	3	NA
Upper Salmon	Slate Creek (Carbonate/Silver Rule)	1	-	3	0	0.85
M.F./N.F. Boise	M.F. Boise River	2	-	12	0	0.99
M.F./N.F. Boise	Queens River	1	+	7	1	NA
S.F. Boise	Boardman Creek	1	+	17	12	NA
S.F. Boise	Deadwood Creek	1	+	4	4	NA
S.F. Boise	Big Peak Creek	1	+	4	3	NA
S.F. Boise	Grindstone Creek	3	-	3	0	0.85
S.F. Boise	Worswick Creek	3	-	3	0	0.85
S.F. Boise	Narrow Creek	2	-	1	0	0.47

S.F. Boise	Paradise Creek	2	-	5	0	0.96
S.F. Boise	Basalt Creek	3	-	4	0	0.92
S.F. Boise	Bluff Creek	1	+	1	1	NA
S.F. Boise	N.F. Big Smoky	1	+	2	1	NA
S.F. Boise	Skillern Creek	2	-	2	0	0.72

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 2010 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 49 patches.

Data collected over the past six 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 7 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 7 - Comparison of bull trout patch strata 2004-2010.

Category	**S.F. Boise Subbasin**		**N.F. and M.F. Boise Subbasin**		**S.F. Payette Subbasin**		**Upper Salmon Subbasin**	
	# Patches 2004	# Patches 2010	# Patches 2004	# Patches 2010	# Patches 2004	# Patches 2010	# Patches 2004	# Patches 2010
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	27
4 - Unsurveyed	0	0	0	0	0	0	8	0
Total	43	42	5	5	4	4	45	51

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 six 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. Still, the data indicates that bull trout presence is more robust than previously thought.

In 2010, bull trout populations continue to occupy historically occupied patches, including Boardman, Deadwood, Big Peak, N.F. Big Smoky, Bowery, Big Boulder, and Queens River. Bull trout continue to be absent in Basalt, Grindstone, Worswick, Narrow, Skillern, Upper M.F. Boise River, Pole, and Iron Creeks with detection probabilities ranging from of 0.47 to 0.99.

After many years of sampling the Sawtooth National Forest now has a comprehensive baseline of bull trout presence/absence on the Forest. In future years we will evaluate changes in population abundance at repeat sample sites as well as distribution changes within each patch..

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