2008 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 criterion integral to the MIS foundation is that monitoring results must allow managers to answer questions about population trends. Historically, monitoring of habitat was used a surrogate for direct quantification of MIS populations. However, recent court cases (*Sierra Club v. Martin*, 168 F.3d 1 (11^{th} 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 the population data were sufficient to determine trend at the Forest scale.

Following this reevaluation, bull trout 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. As a result, 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 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 and small resident bull trout (<150 mm) for two reasons. First, presence of small bull trout is an indicator of key spawning and rearing areas. 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 much more difficult. 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 both

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

down- and upstream limits to potentially suitable habitats for bull trout within stream networks, and thus the area for locating samples, and making inferences about presence.

Downstream patch boundaries were delineated by 1600 meter elevation contours in Boise and South Fork Payette River basins, based on previous research in the basins relating the distribution of small bull trout to elevation. Outside of these basins, downstream patch boundaries correspond to stream temperature <15°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 habitat that is used by bull trout. This may be less than potentially occupied habitat, due to the influence of other 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 reversible 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 valley bottom slopes 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 that prevent 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). Sites within each patch will be located by dividing the suitable habitat into 100m segments and then randomly selecting the segments.

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

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. The sequence or order of sampling within patches is assumed to be unimportant, in terms of estimating probability of presence.

Formal vs. informal sampling - Informal sampling will be used initially to determine presence of juvenile bull trout, when deemed appropriate by local biologists. If juvenile bull trout are

[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.

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. If juvenile bull trout are detected during formal sampling, crews may either elect to cease efforts and move to other patches or continue sampling to better determine distribution within the patch and augment the development of the empirical models.

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 and last 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 2008 sampling.

Category	S.F. Boise Subbasin	M.F./N.F Boise Subbasin	S.F. Payette Subbasin	Upper Salmon Subbasin	Total
1	12	4	2	17	35
2	6	1	2	7	16
3	24	0	0	26	50
4	0	0	0	1	1
Total	42	5	4	51	102

Using data from the past 7 years (since 2002), all of the patches in the Middle Fork/North Fork Boise River, Upper Salmon, and S.F. Payette subbasins have been sampled. In the South Fork Boise River 95% of the patches 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 2002) within each subbasin based on 2008 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%)	16	16 (100%)	35	35 (100%)
2	6	5 (83%)	1	1 (100%)	2	2 (100%)	8	8 (100%)	17	16 (94%)
4	0	0	0	0	0	0	0	0	0	0 (0%)
Total	19	18 (95%)	5	5 (100%)	4	4 (100%)	24	24 (100%)	52	51 (98%)
3	23	14 (61%)	0	0	0	0	27	25 (93%)	50	39 (78%)

2008 Results and Discussion

Monitoring for bull trout on the Sawtooth National Forest occurred in 21 patches in 2008 (Figure 1). In the S.F. Boise subbasins, ten patches were surveyed. Of these patches, bull trout reproduction was observed in Boardman, Skeleton, Willow, and Deadwood Creeks; two subadult bull trout were sampled in Shake Creek, but evidence for a reproducing population (individuals <150 mm) in that stream is not present. In Skeleton and Boardman creeks, bull trout had been found each year sampled since 1994. Bull trout had also been observed in Willow Creek during surveys in 1993 and 2003, and Deadwood Creek in 1993, 1994, and 2003, so their detection in 2008 was anticipated. The Deadwood Creek bull trout population is apparently healthy, but is restricted to less than 2 miles of habitat by an apparent upstream passage barrier at an elevation of about 2,000 m and seems to be the smallest occupied patch in the portion of the South Fork Boise subbasin on the Forest. Sampling on Willow Creek was limited to the lower half of the patch, but bull trout <150 mm seemed to be fairly common at a lower elevation than was observed in 2003. Much of the Willow Creek patch (as well as much of the non-occupied Marsh, Shake, and Big Water Gulch patches) burned in the South Barker fire in August and September 2008 and will be subject to monitoring in 2009 and future years to help assess impacts to the bull trout population.

The two subadult-sized bull trout sampled in Shake Creek in 2008 were also not completely unanticipated, as one 215 mm individual had been detected in sampling in 2002. The sampling crew discovered a steep cascade on Shake Creek in 2008 at an elevation of about 1,700 m, and the absence of all fish at sampling sites upstream of this feature in 2008 and in prior years helps to explain the apparent lack of a reproducing population of bull trout in this patch. While the nominal patch size and upper drainage water temperature of Shake Creek appear to be suitable for bull trout, the lower section of the stream accessible to migratory fish is apparently some combination of too warm and too short to support reproduction by this species. Relatively high fine sediment levels may also be a problem and the category/size of the Shake Creek patch will be re-evaluated. A similar situation may also exist in Big Water Gulch Creek, where one subadult-sized bull trout was sampled in the past (in 1994), but where a small falls exists in the lower half of the drainage; in this case, however, redband trout are present to the headwaters of the stream, so the impassable nature of the falls is not a certainty.

Bull tout were not detected in Marsh, W.F. and E.F. Kelly, and Salt Creeks despite 3-7 100m electrofishing passes per patch. Probabilities of detection in these patches ranged from 0.90 to 0.99 suggesting there is a higher level of certainty that a reproducing population is not present. All patches had been surveyed previously in either 2002 or 2003. Sub-adult bull trout were found in Salt Creek, but no juvenile bull trout were detected despite extensive electrofishing surveys in each patch.

During 2008 in the Salmon subbasin ten patches were electrofished using formal protocols. Of the patches sampled, two patches (Champion Creek and Warm Springs Creek) were occupied by juvenile bull trout (Figure 1). Bull trout had been detected previously in these patches and water temperature was below 15°C for most of the patch areas. Electrofishing surveys failed to detect bull trout in the Meadow, Fisher, Mays, Redfish Lake, Crooked, Stanley Lake, Hell Roaring, and Frenchman patches. Probabilities of detection in the patches ranged from 0.54 to 0.97. Bull trout had not been found by previous surveys in Fisher or Frenchman Creeks, so the 2008 survey continue to show that conditions are not conducive to supporting bull trout or that they occur in very low densities. In the Crooked Creek, two hybrid bull/brook trout were observed in the very headwaters of this patch and no pure strain bull trout were noted in 2005 surveys. It is possible bull trout have been completely hybridized in this patch.

Bull trout are present in Redfish Lake, and spawning is known to occur in the Fishhook Creek tributary to the lake. Fishhook Creek is its own patch, however, and the headwater section of Redfish Lake Creek sampled in 2008 is blocked by an upstream passage barrier a short distance upstream from the lake and is otherwise dominated by brook trout. Stanley Lake likely supported a bull trout population at one time, but it is probable that introduced lake trout and installation of a rough fish barrier in the 1960's caused the extirpation of this population. Lady Face Falls, approximately 2 miles above the Stanley Lake, excludes all upstream fish migration. Five sample sites above the falls completed in 2008 failed to find bull trout. Only native westslope cutthroat trout and rainbow and brook trout from lake stocking were found. The remaining patches sampled in 2008 in the upper Salmon subbasin are relatively small, but it seems likely that some once supported bull trout populations that have since been extirpated because of the introduction of brook trout, existence or construction of impassible upstream barriers, and possibly other factors.

The large Upper South Fork Payette patch in the subbasin of the same name was sampled in 2008 to a detection probability of 0.99. Given that bull trout inhabit other parts of the subbasin on and off the Forest it seems possible that bull trout once inhabited a portion of this patch, but a natural upstream barrier is present lower in the patch and brook trout were the dominant salmonid species sampled in 2008.

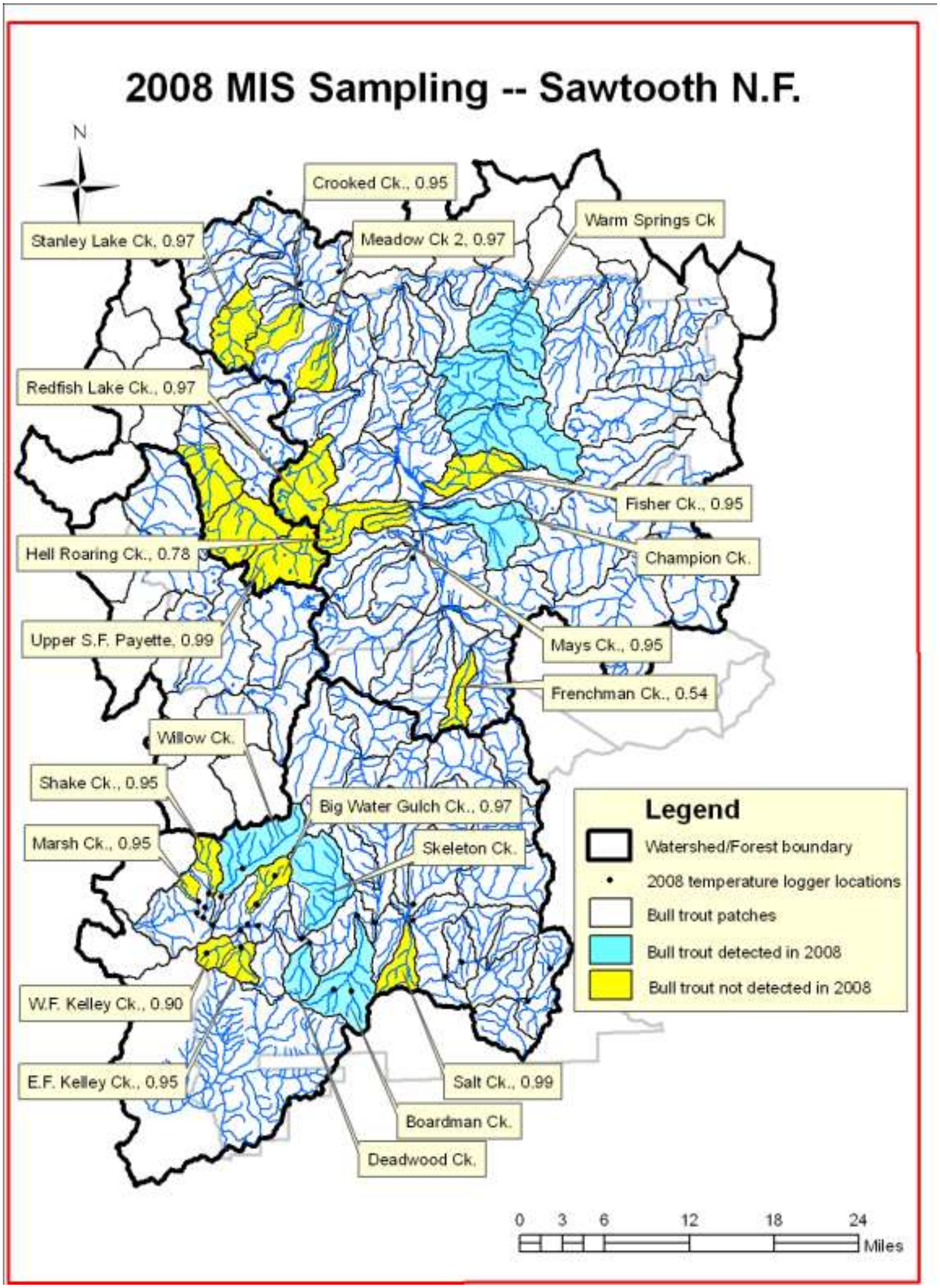


Figure 1 - Bull trout patches sampled, probabilities of detection and temperature loggers deployed on the North Zone of the Sawtooth N.F. (2007).

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 2008 field seasons, crews completed MIS protocol surveys in 51 of the 52 category 1-3 patches (98%). Bull trout presence was confirmed in 35 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 five years were compared with information collected prior to 2004 to provide a preliminary indication of bull trout trend across the planning unit (Table 3). Results from this comparison indicate a slight increase in bull trout distribution in the S.F. Boise, S.F. Payette, and Upper Salmon subbasins over the last five years. 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 and that bull trout are still occupying most patches where previously detected. Table 3 also 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 daily 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. The following provides further explanations on how many of these factors are influencing bull trout presence and trend.

One of the most important factors influencing bull trout presence is water temperature. Bull trout are among the most thermally sensitive species and their occurrence declines rapidly as maximum daily maximum temperature (MDMT) and maximum weekly maximum temperature (MWMT, the mean of daily maximum water temperatures measured over the warmest consecutive seven-day period) exceed 15 °C. Many of the patches with local and potential populations where bull trout have not been found have MDMT above 15 °C. For example, lower Lime Creek and Little Smoky Creek (both potential populations in the S.F. Boise subbasin) have MDMT above 17 °C. Some accessible headwater reaches support water temperatures below 15 °C, but not over enough area to sustain a viable local population.

The second factor influencing bull trout trend is the presence of brook trout. In several patches brook trout are widespread with very high densities. Brook trout are believed to be one of the reasons why bull trout have not been found recently in the Fisher, Frenchman, Mays, and Crooked Creek local populations. Rieman and McIntyre (1993) concluded that brook trout presence and density were important variables explaining the observed distributions and number of bull trout among streams. Brook trout are frequently implicated in the decline of bull trout, impacting populations through introgressive hybridization, and possibly through interactive segregation (Rieman and McIntyre 1993). For example, in the upper Salmon patches where bull trout were observed, brook trout comprised 5% of the salmonids captured. In contrast, in the patches where bull trout were not observed, brook trout comprised 91% of all captured salmonids. It is possible that when brook trout abundance (or density) reaches a certain threshold, bull trout persistence within a patch is unlikely.

The third factor influencing bull trout trend is habitat access. Forty of the 50 patches (80%) where habitat is unsuitable (category 3) on the Forest have or had some type of known fish barrier (e.g. rough fish, culvert, diversion, steep gradient chutes, and/or falls). Bull trout have clearly not had access or there is not enough available habitat above these barriers to support a viable resident population.

Finally, some patches and potential populations (i.e. N.F., M.F. and S.F. Lime Creeks in the S.F. Boise River subbasin) may not sustain bull trout because migratory or neighboring tributary populations are not strong enough to support the colonization of unoccupied habitat. Rieman and McIntyre (1995) found that bull trout never occurred in tributary streams without also occurring in the associated main stems.

These factors individually or in collectively are likely influencing the ability of bull trout populations to occupy patches within designated local or potential populations under the draft recovery plan. These and other factors will be investigated further as the Forest continues to monitor bull trout.

Table 3 - Comparison of bull trout patch strata 2004-2008.

Category	S.F. Boise Subbasin		N.F. and M.F. Boise Subbasin		S.F. Payette Subbasin		Upper Salmon Subbasin	
	# Patches 2004	# Patches 2008	# Patches 2004	# Patches 2008	# Patches 2004	# Patches 2008	# Patches 2004	# Patches 2008
1 – Occupied	11	13	4	4	0	2	6	16
2 – Suitable/Unoccupied	22	6	1	1	4	2	28	8
3 – Unsuitable/Inaccessible	10	23	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

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 4). 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 five 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. 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 0.54 per site or 0.97 when 5 sites are sampled within a patch. This implies that we have a much higher confidence that bull trout densities in patches where juveniles are not detected are lower than densities in other occupied patches in the Salmon, Clearwater and

Boise subbasins in Idaho. In other words there is a higher probability 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. Results and estimates of probabilities of detection for 2007 sample patches are noted in Table 5.

Table 4 - 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	Big Boulder	4	2	2
Upper Salmon	Little Boulder	4	4	3
Upper Salmon	Slate	6	2	0
Upper Salmon	Warm Springs (Pigtail/Martin)	8	4	4
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. Boise	Deadwood Creek	3	3	3
S.F. Boise	Willow Creek	5	5	4
S.F. Boise	Big Peak	5	5	5
S.F. Boise	N.F. Big Smoky	3	3	3
S.F. Boise	Bluff	1	1	1
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
Total		87	56	47
Empirical Estimate of Probability of Detection				**47/87 = 0.54**

Table 5 - Summary of results from 2008 aquatic MIS sampling on the Sawtooth N.F.

Subbasin	Patch	Strata Designation in 2007	Bull Trout Detected	# Sites sampled	# Sites where Bull Trout < 150mm were found	Empirical Probability Of Detection
Upper Salmon	Meadow Creek 2	3	-	5	0	0.97
Upper Salmon	Fisher Creek	3	-	4	0	0.95
Upper Salmon	Champion Creek	1	+	3	1	NA
Upper Salmon	Mays Creek	3	-	4	0	0.95
Upper Salmon	Upper Redfish Lake Creek	4	+	5	0	0.97
Upper Salmon	Crooked Creek	1	-	4	0	0.95
Upper Salmon	Stanley Lake Creek	3	-	5	0	0.97
Upper Salmon	Warm Springs Creek	1	+	3	2	NA
Upper Salmon	Hell Roaring Creek	1	-	2	0	0.78
Upper Salmon	Frenchman Creek	3	-	1	0	0.54
S.F. Payette	Upper S.F. Payette	2	-	7	0	0.99
S.F. Boise	Boardman Creek	1	+	19	12	NA
S.F. Boise	Shake Creek	3	+	4	0	0.95
S.F. Boise	Marsh Creek	3	-	4	0	0.95
S.F. Boise	W.F. Kelley Creek	3	-	3	0	0.90
S.F. Boise	E.F. Kelley Creek	3	-	4	0	0.95
S.F. Boise	Deadwood Creek	1	+	5	3	NA
S.F. Boise	Willow Creek	1	+	5	3	NA
S.F. Boise	Salt Creek	2	-	7	0	0.99
S.F. Boise	Skeleton Creek	1	+	14	8	NA
S.F. Boise	Big Water Gulch	3	-	5	0	0.97

Current data also suggests that bull trout are detected more frequently in relatively large patches (2,665 to 51,774 acres) vs. smaller patches (951 to 40,747 acres) (Figure 2). For example, larger patches may have a higher probability of providing the right flows, stream gradients, water temperatures, and habitat necessary for bull trout persistence. Studies in western Montana (Rich 1996) and southwest Idaho (Rieman and McIntyre 1995; Dunham and Rieman 1999) showed that bull trout are less likely to occur in streams less than two meters in width and less than 500 ha (1,236 acres) in size. Rieman and McIntyre (1995) found that patch size was highly significant in determining bull trout presence. Logistic regression model and the empirical frequency distribution suggested that the probability of observing bull trout exceeded 0.80 at the largest patch sizes, was about 0.50 for patches between 2,000 and 3,000 ha, and was less than 0.10 for patches less than 1,000 ha. Data we have collected supports these findings and imply that probabilities of detection are very low when patches are even 1600 ha (3,954 acres) in size. Bull trout do use small streams (down to 2 m), but apparently at a lower frequency than larger streams.

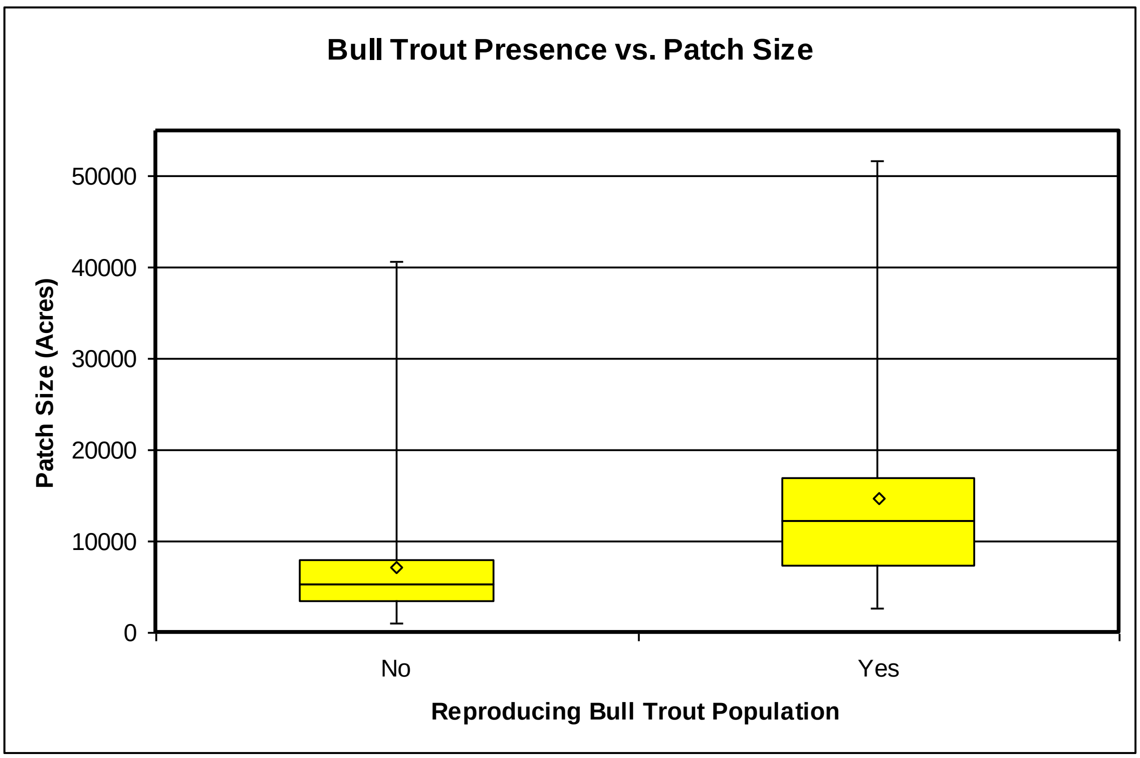
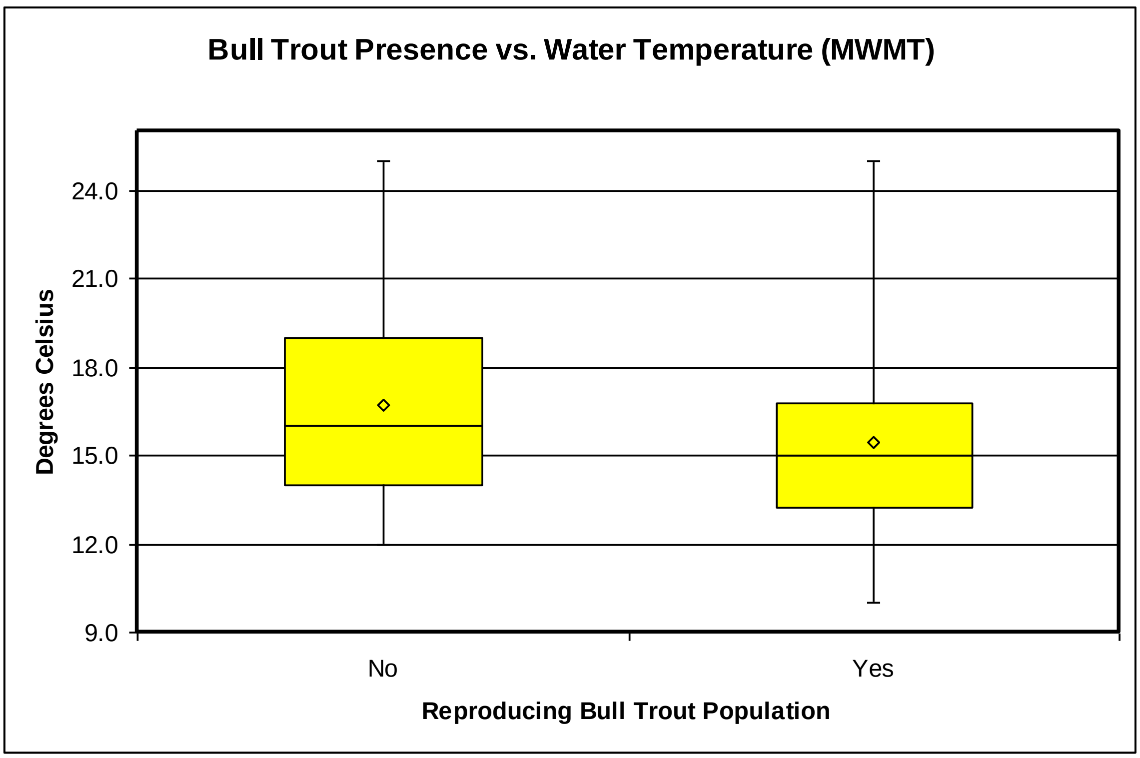


Figure 2 - Patch size (acres) in patches where bull trout were not detected vs. those where bull trout were observed. Figure includes 2001 – 2008 data. Bars denote 25-75% quartiles, while horizontal line on bar indicates median value, diamond shows mean. Whiskers denote full range of values. Total sample size for “No” is 64 patches, “Yes” is 33.

Patch Stream Temperature Monitoring

Monitoring stream temperatures allows Forest biologists to assess the influence of management practices on water temperatures (Meehan 1991), predict species distributions (Dunham et al. 2003), and update MIS patch strata. As such, stream temperature monitoring plays a critical role in this aquatic MIS approach. During 2008 in the Boise and Salmon subbasins, 35 temperature loggers were deployed (Figure 1). Because maximum water temperatures on the Sawtooth tend to occur between mid-July and mid-September (Sawtooth NF. unpublished data), water temperature loggers are deployed in early summer (prior to July 1) and recovered in early fall (after Sept 1). Gamett (2002) found that mean water temperature (July 1 to September 30) appeared to be the most effective in describing bull trout abundance in the Little Lost river drainage. In addition, Dunham (2003) found that the probability of bull trout occurrence was relatively high (>0.50) in streams with a maximum daily maximum temperature (MWMT, the warmest daily water temperature recorded during a given year or survey) <14-16° C.

Maximum daily maximum temperature (MDMT) and maximum weekly maximum temperature (MWMT, the mean of daily maximum water temperatures measured over the warmest consecutive seven-day period) were calculated for each patch and provide important information for managers when classifying patches into strata or assessing the presence or absence of bull trout. Even though no statistically significant relationship appears to exist (possibly because some patch lower boundaries should be adjusted upstream), median MWMT temperatures where bull trout were observed were lower than median MWMT temperatures where bull trout were not observed (Figure 3). The higher end of the range in patches with reproducing bull trout is do to water withdrawals from irrigation diversions lower in the patch, not natural conditions.



<u>Figure 3</u> – Highest maximum weekly maximum temperature (MWMT) in ºC) measured within patch. Figure includes 2001 – 2008 data. Bars denote 25-75% quartiles, while horizontal line on bar indicates median value, diamond shows mean. Whiskers denote full range of values. Total sample size for “No” is 53 patches, “Yes” is 26.

Barriers

MIS results will also help managers assess the influence of fish passage barriers on bull trout populations. Passage barriers can have a strong influence upon species distributions as well as the life-history expression of fish populations. Current results suggest that patches must be large (greater than 2000 ha) in order for isolated bull trout populations to persist and barriers that isolate small watersheds might prevent bull trout persistence (Figure 4). Fish passage barriers can provide positive or negative influences on bull trout populations, depending upon a variety of factors, including the presence of exotic species, the size of the isolated population, habitat conditions above and below the barrier, etc. Further MIS monitoring will assist in the evaluation of the influence of barriers on the persistence of bull trout populations on the Sawtooth N.F.

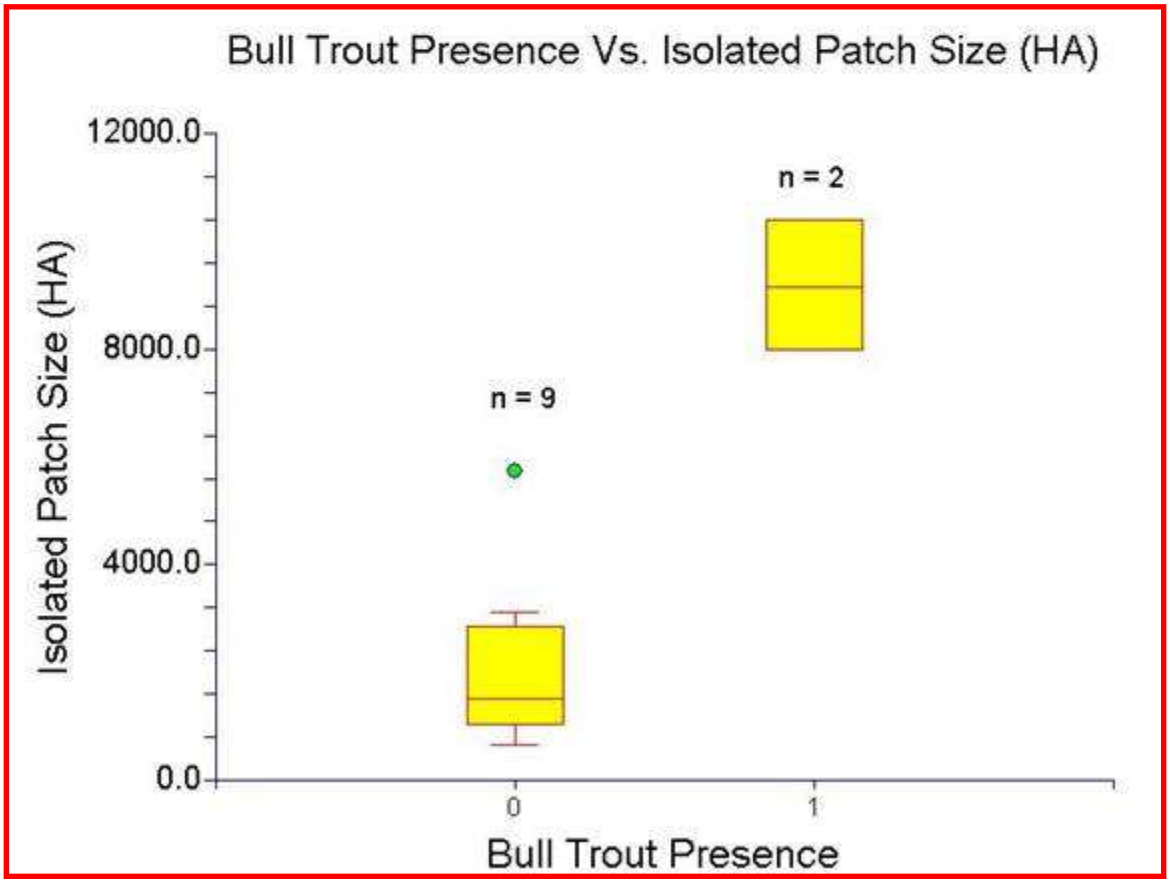


Figure 4 - Isolated patch size where bull trout were detected (1) or were not observed (0). Figure includes 2004-2007 data.

Conclusion

A variety of factors can influence the distribution of bull trout populations. As has been reported in the literature, results from MIS sampling on the Sawtooth N.F. indicates that patch size, stream temperature, fish passage barriers, and the occurrence of brook trout can all be associated with bull trout presence and persistence. In 2008, bull trout populations continue to occupy historically occupied patches, including Boardman, Skeleton, Willow, Deadwood, Champion, and Warm Springs Creek. Two bull trout were sampled in Shake Creek, but a reproducing population does not appear to exist in this patch.

Bull trout continue to absent in Marsh, Big Water Gulch, W.F. Kelley, E.F. Kelley, Salt, Meadow, Fisher, Mays, Crooked, Hell Roaring, Upper Redfish, Frenchman, and Stanley Lake Creeks and the upper South Fork Payette River with detection probabilities ranging from of 0.54 to 0.99.

Sampling over the past five years has better defined bull trout distributions in the S.F. Boise, S.F. Payette, and Upper Salmon subbasins. Data indicates that bull trout presence is more robust than previously thought and that bull trout are still occupying most patches where previously detected. Additional sampling over the life of the Forest plan will continue to refine bull trout distributions and habitat requirements of bull trout populations on the Sawtooth N.F.

Table 6 - Fish species detected during 2008 MIS sampling on the Sawtooth N.F.

		Species Observed						
Subbasin	**Patch**	**BLT**	**BKT**	**RBT**	**CCT**	**CHS**	**SCP**	**WHF**
Upper Salmon	Meadow Creek 2		+	+		+		
Upper Salmon	Fisher Creek		+	+	+		+	
Upper Salmon	Champion Creek	+	+	+	+	+	+	
Upper Salmon	Mays Creek		+				+	
Upper Salmon	Upper Redfish Lake Creek	+	+	+	+	+	+	
Upper Salmon	Crooked Creek		+	+			+	
Upper Salmon	Stanley Lake Creek		+	+	+			
Upper Salmon	Warm Springs Creek	+		+	+			
Upper Salmon	Hell Roaring Creek		+	+	+			
Upper Salmon	Frenchman Creek		+		+			
S.F. Payette	Upper S.F. Payette		+		+			
S.F. Boise	Skeleton Creek	+		+			+	
S.F. Boise	Boardman Creek	+		+			+	
S.F. Boise	Marsh Creek			+				
S.F. Boise	W.F. Kelley Creek			+				
S.F. Boise	E.F. Kelley Creek			+			+	
S.F. Boise	Deadwood Creek	+		+			+	
S.F. Boise	Willow Creek	+		+			+	
S.F. Boise	Salt Creek		+	+			+	
S.F. Boise	Shake Creek	+		+			+	
S.F. Boise	Big Water Gulch			+			+	

Note: BLT = bull trout, BKT = brook trout, RBT = redband/rainbow trout, CCT = westslope cutthroat trout, CHS = Chinook salmon, SCP = sculpin, whitefish = WHF.

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