Appendix A: Region 1 Email Regarding Jeopardy Analysis.

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To Tim Bodurtha/R6/FWS/DOI@FWS, Lori Nordstrom/R6/FWS/DOI@FWS, Kate Walker/R6/FWS/DOI@FWS
cc
bcc
Subject subpopulation jeopardy and DPS jeopardy

hey folks: attached is the jeopardy approach that Region 1 has developed to address section 7 until the Recovery Plan is finalized, as we discussed and for your review and comments; I will copy Jill separately, because I wanted to delve into a few issues with you three per our recent and brief conversation after the BT meeting.

You mentioned that the approach caused you some concern, because any (or many) action(s) in the Bitterroot watershed would lead to a jeopardy conclusion under the approach (focusing the J analysis on a subpopulation). The status review/science assessment states that 24 of the 27 subpopulations in the basin are currently at risk of extirpation.

To start, let's address the Warm Springs Creek subpopulation, which I infer is one of the most important subpopulations in the basin because of strong numbers, although apparently only resident forms are present. Because of this status, I would suggest that if a proposed action were to be reasonably certain to result in an appreciable reduction in this subpopulation to the extent that its continued survival was in question, a FWS biologist might find her/him self contemplating a jeopardy BO, even if the jeopardy analysis was based on the DPS. This is because, although only one of the 141 subpopulations in the DPS is theoretically affected, the loss of that one, especially the most robust in the basin containing 27 subpopulations, would appreciably reduce the DPS in the wild in terms of reproductive capability and numbers of individuals, if not distribution as well.

For the next case, let's consider the weakest subpopulation in the Bitterroot basin, whatever one that may be. The status review states that some of these are composed of low numbers of individuals and declining. I suggest that the same biologist would come to the same conclusion relative to the same proposed action, were it to affect this small subpopulation, because the result would be the same, an appreciable reduction in the functionality of the DPS due to reduced reproductive capability, reduced numbers of individuals, and possibly reduced distribution. To come to a different conclusion, one would have to accept the notion that some individual subpopulations are dispensable (not an important factor relative to the three components of a jeopardy analysis - numbers, reproductive capability, and distribution of the DPS).

So, if one can accept the notion that some subpopulations are indeed dispensable (not an important factor relative to the three components of a jeopardy analysis - numbers, reproductive capability, and distribution), then there is a big difference between focusing the jeopardy analysis on the DPS vs. the subpopulation. But, if one can support the position that, because bull trout distribution has been reduced to only 45% of the historical range in the Columbia River DPS, with similar affects to the parameters of numbers of individuals and reproductive capability, further reductions in these parameters to the point of jeopardizing the continuing existence of the remaining subpopulations would appreciably reduce the viability of the DPS as a whole in terms of numbers, reproduction and distribution, then there is no difference between the two scales of analysis.

Finally, if one were embrace the last sentence, above, the question might arise: if there is no difference, then why go to the trouble of justifying a new scale of analysis (at the subpopulation level)? I guess the answer is that many of our folks were having a difficult time envisioning a potential jeopardy scenario relative to, for example, an action affecting only one of 141 subpopulations for a DPS that is spread over such a large area, and presenting a sound rationale for such an argument in a biological opinion. By plugging in the new scale of analysis rationale, that argument is presented and the biologist can focus on analyzing the effects at hand and determining if indeed the action in question represents the likelihood of jeopardizing the continued existence of the subpopulation in question.

Your comments and further discussion are encouraged!

bulltrout.wpd

[This discussion should be placed in the "Status of the Species" section of Biological Opinions addressing effects to bull trout.]

STATUS OF THE SPECIES

Bull trout were listed under the Act as threatened within the coterminous United States on November 1, 1999 (64 FR 58910). This listing encompasses five previously recognized distinct population segments (DPS) of the bull trout: Klamath River, Columbia River, Jarbidge River, Coastal-Puget Sound, and St. Mary-Belly River. Factors contributing to the decline of bull trout populations are identified in the listing rule and include: restriction of migratory routes by dams and other unnatural barriers; forest management, grazing, and agricultural practices; road construction; mining; introduction of non-native species; and residential development resulting in adverse habitat modification, overharvest, and poaching.

The listing rule specifies that, in recognition of the scientific basis for the identification of bull trout DPSs (i.e., population segments are disjunct and geographically isolated from one another with no genetic interchange between them due to natural and man-made barriers), for the purposes of consultation and recovery planning these DPSs will serve as interim recovery units in the absence of an approved recovery plan. On that basis, the geographic scope of jeopardy analyses for actions under formal consultation will be at the DPS level as opposed to the entire coterminous United States range of this species.

[Insert the appropriate DPS status discussions below into the opinion.]

Bull Trout Status in the Klamath River Basin DPS

Bull trout have been extirpated from several streams in this DPS. Although migratory forms were present historically, bull trout currently occur only as resident forms in headwater streams. Currently, seven subpopulations of the bull trout occur within the basin. The risk of extinction for this DPS over the next 100 years has been estimated at 70 to 90 percent (K. Schroeder and H. Weeks, OCAFS, *in litt.* 1997 *in* 63 FR 31647). The Service considers six of the seven bull trout subpopulations in the basin to be at risk of extirpation from naturally occurring events due to their depressed status (63 FR 31647). Reductions in the amount of riparian vegetation and road construction in the Klamath River basin due to timber harvest, grazing, and agricultural practices have contributed to bull trout habitat degradation through elevated stream temperatures, increased sedimentation, and channel embeddedness.

Bull Trout Status in the Columbia River Basin DPS

Bull trout are estimated to occur in approximately 45% of their historical range in the Columbia River basin (Quigley and Arbelbide 1997 *in* 63 FR 31647). Currently, 141 subpopulations of the bull trout are known to occur in the basin. The Service considers 71 of these subpopulations to be at risk of extirpation from naturally occurring events due to their depressed status (63 FR 31647). The listing rule characterizes the Columbia River DPS as having some strongholds, but generally occurring as isolated subpopulations, without a migratory life form to maintain the biological cohesiveness of the subpopulations, and with trends in abundance declining or of unknown status.

Extensive habitat loss and fragmentation of subpopulations have been documented for bull trout in the Columbia River basin and elsewhere within its range (Rieman and McIntyre 1993). Reductions in the amount of riparian vegetation and road construction in the Columbia River basin due to timber harvest, grazing, and agricultural practices have contributed to habitat degradation through elevated stream temperatures, increased sedimentation, and channel embeddedness. Mining activities have further compromised habitat conditions by discharging waste materials into streams and diverting and altering stream channels. Residential development has also threatened water quality by introducing domestic sewage and altering riparian conditions. Dams of all sizes (i.e., mainstem hydropower and tributary irrigation diversions) have severely limited migration of bull trout in the Columbia River basin.

Bull Trout Status in the Coastal-Puget Sound DPS

At least 22 of the 34 subpopulations of the bull trout within this DPS are affected by past or present forest management activities such as timber harvest and road construction (64 FR 58910). Other subpopulations within this DPS occur in National Parks or Wilderness Areas and are not affected by such activities. Agriculture, urbanization, and man-made barriers are also significant factors affecting habitat utilized by bull trout. Over 35 percent of natural forested areas in the Puget Sound region have been eliminated (WDFW 1997 *in* 64 FR 58910). Of the 34 subpopulations identified within the DPS, 11 are likely to be affected by elevated stream temperatures resulting from past forest practices (Phinney and Bucknell 1975; Williams et al. 1975; Hiss and Knudsen 1993; EDFW 1997a; WDOE 1997 *in* 64 FR 58910). Within National Forests in Washington, large deep pools have been reduced by 58 percent due to sedimentation and loss of pool forming structures (USDA et al. 1993 *in* 64 FR 58910), resulting in significant habitat loss for bull trout.

Bull Trout Status in the St. Mary-Belly River DPS

Bull trout in this DPS are fragmented and isolated by dams and diversions. Seasonal dewatering of streams reduces the amount of habitat available, and unscreened diversions may result in entrainment of bull trout, effectively removing them from the reproductive population. Historical and continuing harvest of bull trout has contributed to low abundance levels. Forest management practices, livestock grazing, and mining are not considered major factors affecting this DPS (64 FR 58910).

Bull Trout Status in the Jarbidge River DPS

This DPS is extremely depressed, consisting of only an estimated 50-125 spawners throughout the basin annually. Degraded habitat conditions (channelization, removal of large woody debris) resulting from long term human activities, such as road development, mining and residential development, has resulted in decreased stream channel stability and elevated water temperatures. Impassable culverts may also prohibit bull trout from accessing additional habitat (63 FR 31693).

Rangewide Conservation Needs of the Bull Trout

Recovery of bull trout in the Klamath River, Columbia River, and Coastal-Puget Sound DPSs is likely to be enhanced through future reductions in the adverse effects resulting from timber harvest and road building, including remedying legacy effects from past activities. Improved grazing practices will benefit bull trout in the Klamath and Columbia River DPSs. Providing for both upstream and downstream passage at dams and culverts of all sizes will facilitate recolonization of previously occupied habitat and promote genetic exchange throughout the Columbia River, Coastal-Puget Sound, Jarbidge, and St. Mary-Belly River DPSs. Screening water diversions will prevent entrainment of bull trout throughout the Columbia River, Klamath River, and St. Mary-Belly River DPSs. Improvement of agricultural practices affecting water quality will benefit bull trout within the Columbia River, Klamath River, and Coastal-Puget Sound DPSs. Similarly, improved approaches to increased urbanization, such as requiring setbacks from stream banks and avoiding contamination of streams, will contribute to the recovery of the Coastal-Puget Sound and Columbia River DPSs.

Relative to other salmonids, bull trout survival is likely to be more dependent on habitat conditions that more closely resemble the historical, undisturbed environment because (1) they are top carnivores that are more vulnerable to environmental disturbances and more prone to extinction than species at lower trophic levels (M.Gilpin *in litt.* 1996); (2) their delayed sexual maturity (5-7 years; Rieman and McIntyre 1993) is likely to prolong recovery time from the effects of adverse actions; (3) unlike anadromous salmon, bull trout display little or no anadromy (i.e., none for the Columbia River, Jarbidge River, St. Mary-Belly River, and Klamath River DPSs) and, therefore, spend their entire life cycle in freshwater habitat, making them especially vulnerable to habitat disturbance; (4) bull trout require a long incubation and nursery period of time (220+ days) prior to fry emergence, making them especially vulnerable to water temperature changes, sediment deposition, and bedload movement; (5) bull trout juveniles are strongly associated with cover, including the interstitial spaces in the substrate, which makes them especially vulnerable to effects of sediment deposition, bedload movement, and changes in channel morphology (Weaver and Fraley 1991); (6) bull trout are vulnerable to hybridization with brook trout, a widely introduced species, as well as competition with other introduced exotics (e.g., lake trout) that can displace native bull trout; and (7) bull trout require colder water temperature than other native salmonids (Rieman and McIntyre 1993), thus restricting the available habitat compared to other salmonids and making them especially vulnerable to habitat alterations that affect stream temperatures.

Relationship of Subpopulations to Survival and Recovery of Bull Trout in a DPS

Leary and Allendorf (1997) reported evidence of genetic divergence among bull trout subpopulations, indicating relatively little genetic exchange between them. Recolonization of habitat where isolated bull trout subpopulations have been lost is either unlikely to occur (Rieman and McIntyre 1993) or will only occur over extremely lengthy time periods. Remnant or regional populations without the connectivity to refound or support local populations have a greater likelihood of extinction (Rieman and McIntyre 1993, Rieman et al. 1997, Montana Bull Trout Scientific Group 1998).

Healy and Prince (1995) reported that, because phenotypic diversity is a consequence of the genotype interacting with the habitat, the conservation of phenotypic diversity is achieved through conservation of the subpopulation within its habitat. They further note that adaptive variation among salmonids has been observed to occur under relatively short time frames (e.g., changes in genetic composition of salmonids raised in hatcheries; rapid emergence of divergent phenotypes for salmonids introduced to new environments). Healy and Prince (1995) conclude that while the loss of a few subpopulations within an ecosystem might have only a small effect on overall genetic diversity, the effect on phenotypic diversity and, potentially, overall population viability could be substantial. This concept of preserving variation in phenotypic traits that is determined by both genetic and environmental (i.e., local habitat) factors has also been identified by Hard (1995) as an important component in maintaining intraspecific adaptability (i.e., phenotypic plasticity) and ecological diversity within a genotype. He argues that adaptive processes are not entirely encompassed by the interpretation of molecular genetic data; in other words, phenotypic and genetic variation in adaptive traits may exist without detectable variation at the molecular genetic level, particularly for neutral genetic markers. Therefore, the effective conservation of genetic diversity necessarily involves consideration of the conservation of biological units smaller than taxonomic species (or DPSs). Reflecting this theme, the maintenance of local subpopulations has been specifically emphasized as a mechanism for the conservation of bull trout (Rieman and McIntyre 1993).

Based on this information, the Service concludes that each bull trout subpopulation is an important phenotypic, genetic, and distributional component of its respective DPS. Therefore, adverse effects that compromise the functional integrity of a bull trout subpopulation will be considered an appreciable reduction in the likelihood of survival and recovery of the DPS by reducing its distribution and potential ecological and genetic diversity.

Literature Cited

Frissel, C., W. Liss, and D. Bayles. 1993. An integrated, biopohysical strategy for ecological restoration of large watersheds. American Water Resources Association. June 1993.

Gilpin, M. 1996. Analysis towards a PVA for the bull trout in western Montana: a progress report for the Montana Bull Trout Science Group. Draft. Bozeman, MT.

Hard, J. 1995. A quantitative genetic perspective on the conservation of intraspecific diversity. American Fisheries Society Symposium 17:304-326, 1995.

Healy, M.C. and A. Prince. 1995. Scales of variation in life history tactics of Pacific salmon and the conservation of phenotype and genotype. American Fisheries Society Symposium 17:176-

184, 1995.
Leary, R.F. and F.W. Allendorf. 1997. Genetic confirmation of sympatric bull trout and Dolly Varden in western Washington. Transactions of the American Fisheries Society 126:715-720.

Montana Bull Trout Scientific Group. 1998. The relationship of land management activities and habitat requirements of bull trout.

Rieman, B. and J. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. USDA Intermountain Research Station General Technical Report INT-302.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout within the Columbia River and Klamath River basins. North Amer. J. of Fisheries Management 17:1111-1125.

Weaver, T.M. and J.J. Fraley. 1991. Factors affecting the distribution and abundance of bull trout: an investigation at hierarchical scales. North Amer. J. Fisheries Management. 17:237-252.

(This discussion would appear as a standard appendix to BOs addressing effects to bull trout during the interim period before finalization of a recovery plan; as recovery plans are developed for the respective DPS', this approach would be superseded)

The Columbia River and Klamath River bull trout DPS' have been severely reduced in terms of geographic distribution, abundance, and reproductive capacity, which led to their listing as threatened species in June, 1998. Factors contributing to the decline of bull trout populations are identified in the listing rule (FR 31647-31674) and include restriction of migratory routes by dams and other unnatural barriers, forest management practices, grazing practices, agricultural practices, road construction, mining, introduction of non-native species, and residential development resulting in adverse habitat modification, overharvest, and poaching.

Bull trout have been extirpated from several streams in the Klamath River basin and, although migratory forms were present historically, currently occur only as resident forms in headwater streams. The risk of extinction for this DPS over the next 100 years has been estimated at 70% to 90% (K. Schroeder and H. Weeks, OCAFS, *in litt.* 1997 *in* FR 31647-31674), and the Service considers six of the seven subpopulations in the Klamath River basin at risk of extirpation from naturally occurring events due to their depressed status (FR 31647-31674).

Bull trout have been extirpated from approximately 55% of their historical habitat in the Columbia River Basin (Quigley and Arbelbide 1997 *in* FR 31647-31674) and the Service considers 71 of the 141 subpopulations in this DPS at risk of extirpation from naturally occurring events due to their depressed status (FR 31647-31674). The listing rule characterizes the Columbia River DPS as having some strongholds, but generally occurring as isolated subpopulations, without a migratory life form to maintain the biological cohesiveness of the subpopulations, and with trends in abundance declining or of unknown status. Extensive habitat loss and fragmentation of populations have been documented for bull trout rangewide (Rieman and McIntyre 1993). As emphasized by Frissel et al. 1993, this degree of habitat degradation and the associated reduction in population and reproduction potential emphasizes the need to identify, protect, and restore the last patches of the landscape that continue to function in support of remnant bull trout populations

Adverse effects in the form of habitat degradation and other factors may be exacerbated for bull trout relative to other salmonids because (1) they are top carnivores that are more vulnerable to environmental disturbances and more prone to extinction than species at lower trophic levels (M.Gilpin *in litt.* 1996); (2) their delayed sexual maturity (5-7 years; Rieman and McIntyre 1993) is likely to prolong recovery time from the effects of adverse actions; (3) unlike anadromous salmon, bull trout display little or no anadromy (i.e., none for the Columbia River and Klamath River DPS') and, therefore, spend their entire life cycle in freshwater habitat, making them especially vulnerable to habitat disturbance; (4) bull trout require a long incubation and nursery period of time (220+ days) prior to fry emergence, making them especially vulnerable to water temperature changes, sediment deposition, and bedload movement; (5) bull trout juveniles are strongly associated with cover, including the interstitial spaces in the substrate, which makes them especially vulnerable to effects of sediment deposition, bedload movement, and changes in channel morphology (Weaver and Fraley 1991); (6) bull trout are vulnerable to hybridization with brook trout, a widely introduced species, as well as competition with other introduced exotics (e.g., lake trout) that can displace native bull trout; and (7) bull trout require colder water temperature than other native salmonids (Rieman and McIntyre 1993), thus restricting the available habitat compared to other salmonids and making them especially vulnerable to habitat alterations that affect stream temperatures. Accordingly, actions that affect bull trout habitat have a particular potential to result in severe adverse effects more readily than a similar action might, for instance, affect anadromous salmonids that spend the majority of their life cycle away from freshwater habitat.

Given the severely degraded status of bull trout DPS', the maintenance of remnant bull trout subpopulations within these DPS' is critical to the long-term survival of the respective DPS'. Because there is evidence of genetic divergence among bull trout subpopulations, indicating relatively little genetic exchange between bull trout subpopulations (Leary and Allendorf 1997), and because recolonization of habitat where isolated subpopulations have been lost is either unlikely to occur (Rieman and McIntyre 1993) or will only occur over extremely lengthy time periods, maintenance of the component subpopulations is critical to ensuring the continued survival and potential recovery of the DPS'. Additionally, because remnant or regional populations without the connectivity to refound or support local populations have a greater likelihood of extinction (Rieman and McIntyre 1993; Rieman et al. 1997), continued erosion of the baseline (i.e., the "snapshot of the species' condition) relative to isolated/individual subpopulations is likely to contribute toward the possible extinction of these subpopulations. This was recognized by the Montana Bull Trout Scientific Group in their stated goal of "establishing a baseline of existing conditions and monitoring to ensure those conditions are maintained or improved" (MBTSG 1998).

Healy and Prince (1995) observe that, because phenotypic diversity is a consequence of the genotype interacting with the habitat, the conservation of phenotypic diversity is achieved through conservation of the subpopulation within its habitat. They further note that adaptive variation among salmonids has been observed to occur under relatively short time frames (e.g., changes in genetic composition of salmonids raised in hatcheries; rapid emergence of divergent phenotypes for salmonids introduced to new environments). These observations support the notion that each subpopulation is a valuable biological component of its respective DPS. Healy and Prince (1995) conclude that while the loss of a few subpopulations within an ecosystem might have only a small effect on overall genetic diversity, the effect on phenotypic diversity and, potentially, overall population viability could be substantial. This concept of preserving variation in phenotypic traits that is determined by both genetic and environmental (i.e., local habitat) factors has also been identified by Hard (1995) as an important component in maintaining intraspecific adaptability (i.e., phenotypic plasticity) and ecological diversity within a genotype. He argues that adaptive processes are not entirely encompassed by the interpretation of molecular genetic data (i.e., phenotypic and genetic variation in adaptive traits may exist without detectable variation at the molecular genetic level, particularly for neutral genetic markers). Therefore, the effective conservation of genetic diversity necessarily involves consideration of the conservation of biological units smaller than taxonomic species or DPS's.

The intuitively obvious conclusion that individual subpopulation baseline improvements are the building blocks of overall DPS baseline improvement (and that baseline improvement is necessary) is bolstered by the generally depressed and fragmented status of bull trout DPS', the species' particular sensitivity to habitat disturbance, the lack of genetic exchange between subpopulations, probable phenotypic diversity resulting from response to different isolated environments, and the vulnerability of component subpopulations within a DPS to anthropogenic an natural extinction risks. Therefore, adverse effects that would tend to threaten the existence of a subpopulation constitute an unacceptable risk to the DPS because the action can be considered as also threatening the integrity of the DPS as a whole. Ongoing and new activities that proceed without regard to adverse effects to bull trout will continue to erode the baseline, preserve conditions that led to the listing, and threaten the continued existence of the DPS. Therefore, actions resulting in adverse effects must be designed so as to contribute to the improvement of the overall baseline in the intermediate to longer term, even if short term adverse effects are not entirely eliminated. The risk of short term impacts must still be thoroughly evaluated to ensure that a subpopulation is not lost and the DPS jeopardized.

In order to provide for the survival and recovery of the species, there is a need to apply these conclusions to ongoing and future actions that affect bull trout. Simply put, specific actions and categories of actions must be designed, as described above, so as to contribute to the improvement of the baseline relative to bull trout at both the individual subpopulation and DPS-wide scales. This does not necessarily mean that no timber harvest, grazing operations, road building, mines, etc. will occur. These and other categories of actions are ongoing and comprise the current baseline. It does mean that implementation of specific activities should be designed to reduce the adverse effects (i.e., both direct [take of individuals] and indirect [habitat degradation]) so that the overall action category's adverse effects are reduced. Actions that incorporate measures to reduce adverse effects (potential baseline improvement) at one scale but retain a significant potential of severe adverse effects (potential baseline detriment) to bull trout subpopulations at another scale because of their geographical location should be considered for relocation or otherwise further modified in order to avoid jeopardizing the species.