Fisheries Stream Scientist's Response to J.G. Williams Comments to Reports Submitted to the Water Board

The Stream Scientists submitted four reports to the Water Board on August 3, 2009. These reports were:

1. Rush and Lee Vining Creeks - Instream Flow Study.

2. Radio Telemetry-Movement Study of Brown Trout in Rush Creek

3. Pool and Habitat Studies on Rush and Lee Vining Creeks

4. The Effects of Flow, Reservoir Storage and Water Temperatures on Trout in lower Rush and Lee Vining Creeks.

John G. Williams, PhD. submitted comments on August 27, 2009. Prior to responding, we must confess that we were somewhat surprised that Dr. Williams had "*…not reviewed and so did not comment on the details of the studies…*" This lack of detailed review and comprehension of these studies detailing the relevant biology and habitat needs of brown trout on Rush and Lee Vining creeks probably accounted for some of the misunderstandings expressed in his comments.

<u>Stream Scientists' Response to Dr. Williams' comments regarding Brown Trout Habitat Criteria Development and citation of Heggenes (2002) paper</u>

We direct Dr. Williams to our response to CDFG's comments, in which we address several of his comments pertaining to the IFS report, habitat criteria based on Movement Study results, and our citation of the Heggenes (2002) paper. In one example, Dr. Williams used Figure 3B from Heggenes (2002) when commenting on our studies. However, Figure 3B presents the frequency of brown trout observations versus mean water velocity. As we fully describe in our CDFG response, after 12 years of studying brown trout in Rush and Lee Vining creeks, we concluded that mean water column velocities are poor physical descriptors of brown trout habitat. We found that focal velocities, taken nearer to the stream bottom, are a much better measurement of this habitat requirement. Figure 2A from Heggenes (2002) (which depicts the frequency brown trout observations versus focal water velocities) is more relevant to our studies, since it depicts the velocities at the locations actually occupied by the observed fish.

Dr. Williams is correct that previous studies have shown that habitats selected by salmonids as measured by location, water depth, and mean column velocities, will change with changing stream discharge (Vondracek and Longanekcer 1993; Shirvell 1994; Pert and Erman 1994; Greenberg 1994; McMahon and Hartman 1988; Holm et al. 2001; Kemp et al. 2003). However, focal point velocities and association with either the bottom or cover by larger brown trout remains relatively consistent over a range of flows. These larger brown trout either move to different locations to find suitable low velocity focal points or their focal point velocities at a particular location remain suitable over a wide range of flows, but the water depths and mean water column velocities at these locations change over the range of flows. Also, the range of test flows we mapped to evaluate winter holding habitat was a relatively narrow range of flows because during the fall and winter, streamflows in eastern Sierra streams are low, thus one would not expect a wide range of flow conditions during this baseflow period in which brown trout could theoretically "*move into deeper, faster water*" as described by Dr. Williams.

We remain confident that the methodology we employed for the IFS that concentrated on measuring focal point velocities for larger brown trout over a range of flows provides a better measure of how their habitat needs would be met over a range of flows than would other methodologies that measure mean water column velocities.

Stream Scientists' Response to Dr. Williams' question – "What is the relevant question?"

We are pleased that Dr. Williams was able to *"infer that the overarching question is, what kind of flow regimes will support brown trout populations that meet the size criteria set by Order 98-05"* from the Taylor et al. (2009a) report, as this was indeed the overarching question we were addressing with these studies. Dr. Williams comment indicates that we should probably place this objective more explicitly in each of the above reports. This objective is more prominently described in the Synthesis Report.

Stream Scientists' Response to Dr. Williams' question – "Whether other flow regimes exist that will meet the criteria set by Order 98-05, and also allow for the diversion of useful amounts of water?"

This question was deferred, by design, to be addressed in the Synthesis Report. We made that clear in each of these reports (e.g., Shepard et al. 2009a, Executive Summary, page iv and on page 60 of the main text). Dr. Williams also suggested that evaluating past flows released into Rush and Lee Vining creeks through the Shepard et al. (2009a) study did not address the above question although he acknowledged that our studies showed that "*…we now know that the current flow regime is very unlikely to meet the criteria.*" We believe that discovering whether the current flow regimes did, or did not meet, the criteria set by Order 98-05 was an objective given to the Stream Scientists by the SWRCB and, as Dr. Williams points out, we discovered that the current flow regime did not meet these criteria. This was an important finding and sets the stage for discovering why the current flow regime could not meet these criteria, or as Dr. Williams states we were able to "*…learn about what does not work.*"

In recommending flow regimes that will support brown trout populations that meet the size criteria set by Order 98-05; Dr. Williams says we should have asked ourselves, *"What were the pre-regulation flow regimes that produced the pre-1941 trout fisheries?"* He further states that "*One obvious answer based on the evidence behind Order 98-05, is the pre-regulation flow regimes*". As has been stated in many of our past reports, the Fisheries Stream Scientists (past and current) and their sub-consultants have always contended that there was never quantifiable data presented at past Water Board hearings to support the claim that brown trout "averaged 13-14 inches" in lower Rush Creek and that the creek "fairly consistently produced trout weighing ¾ to 2 pounds". This position is supported by language directly out of Decision-1631 and the Mono Basin EIR:

"Published and unpublished scientific information is scarce, and definitive information is unavailable to quantitatively describe historic pre-diversion fish habitats or populations."

There is also the thorny issue of what is meant by “pre-1941 or pre-diversion conditions” because in the decade prior to the start of LADWP’s diversions (the 1930s) the stream channels, riparian corridors, flow regimes, and non-native trout fisheries had been highly manipulated by approximately 60 years of human activities. In Rush Creek during the 1930s and into the early 1940s, CDFG reported that the overall catch of trout had increased but the catch per angler-hour effort had decreased, including 40% to 60% of anglers reporting “zero catch” angling days (CDFG 1943). In response, the Department recommended increased development of hatchery production of primarily “catchable” trout to maintain the quality of the fishery due to heavy fishing pressure (CDFG 1943). This information does not support the contention that a high-quality, self-sustaining, trophy trout fishery was present in lower Rush Creek prior to LADWP’s activities; at least in the 1930s.

The test flows identified in the IFS report as providing the highest availability of winter holding habitat in Rush and Lee Vining creeks are much closer to the estimated unimpaired (pre-regulation) winter baseflows on these creeks than the baseflows currently prescribed by Order 98-05 and the baseflows as altered by Southern Cal Edison’s upstream power generation activities. We delve further into these analyses in the Synthesis Report.

<u>Stream Scientists’ Response to Dr. Williams’ comment concerning – “the studies fail to consider what controls brown trout life-history trajectories”</u>

Dr. Williams correctly identifies that salmonids have a wide flexibility in their life-history trajectories and can adopt various life-history strategies. Our Rush and Lee Vining creeks’ investigations cover 12 years of research and monitoring and this entire body of work has been used to arrive at our understanding of the trout populations in these streams (Hunter et al. 2000-2008). We highlight the following findings made during our work. Few large brown trout inhabit Rush Creek below the Mono Gate One Return Ditch (MGORD) year-round, but some large brown trout from the MGORD reach use Rush Creek downstream of the MGORD seasonally, particularly for spawning (Taylor et al. 2009b). Annual recruitment of age-0 brown trout in Rush Creek below the MGORD has always been more than adequate to fully seed this portion of the stream with age-1 brown trout (Hunter et al. 2000-2008). Numerous large brown trout that are likely piscivorous inhabit the MGORD and abundances of age-0 brown trout within the MGORD are very low, likely as a result of both poor spawning habitat and predation by large brown trout in the MGORD (Hunter et al. 2004). Longevity of brown trout in the MGORD is longer than for brown trout in Rush Creek below the MGORD. Most brown trout in Rush Creek below the MGORD die before reaching age-4, while many more brown trout within the MGORD live longer than four years, including several otolith-aged males in excess of 10 years old (Hunter et al. 2004 and 2005).

Based on these findings we have inferred that two life histories are present within Rush Creek below Grant Lake Reservoir. One is a migratory life-history where brown trout migrate to the MGORD to take advantage of temperatures and flows that are more stable and ideal for growth, similar to environments found in many dam tail-water habitats, where they survive longer and grow faster and ultimately reach sizes where they become piscivorous. These migratory brown trout then emigrate from the MGORD to lower Rush Creek after reaching maturity to spawn and then move back into the MGORD after spawning. The other is a more resident life-history adopted by brown trout within lower Rush Creek. These resident brown trout appear to have shorter life-spans and spawn in lower Rush Creek, probably relatively close to where they reside.

We have speculated that lower Rush Creek either is incapable of supporting resident large brown trout that Order 98-05 desires, or that this portion of Rush Creek is capable of supporting large resident brown trout, but current flow regimes do not provide conditions compatible for fast enough growth and better survival for these resident trout to attain large size. The abundance of age-0 brown trout indicates that a prey base is available for cannibalistic brown trout to shift to piscivory, if they reach sizes large enough to switch to a diet of fish (about 250 to 300 mm; Moyle 2002). We have opted to test the second hypothesis in an attempt to meet the intent of Order 98-05. We believe that brown trout biomasses estimated during the past 12 years represent a population of brown trout near carrying capacity for the flow regime and physical habitat currently present in lower Rush Creek. Our rationale for believing that this population is fluctuating around a carrying capacity is that there is no legal harvest of fish allowed from this population (CDFG regulations), angler use is much lower than "put-and-take" sections of Rush Creek above Grant Lake Reservoir (CDFG creel surveys) and that changes in biomass could be related to changes in flows (Shepard et al. 2009a and 2009b). Thus, we suggest that the best way to produce more large trout in this population is to shift the current size distribution from one dominated by younger, smaller trout to one dominated by larger trout, which will mean fewer trout in the population.

<u>Stream Scientists' Response to Dr. Williams' question – "what should be done now?"</u>

Dr. Williams suggests that no changes be made in the flow regime of Rush and Lee Vining creeks, even though he concedes that the current flow regime is not providing conditions that allow for meeting the criteria of Order 98-05 to provide larger brown trout. Similar to our CDFG response, we believe that the effect of postponing instream flow revisions is to continue to subject the trout populations to artificially high winter baseflows until some later date when habitat recovers, after which it would then be appropriate to consider re-evaluating the instream flows. We feel this is a poor management strategy because our data indicate that revising summer, fall, and winter instream flows would likely increase growth and survival of brown trout in these streams.

Dr. Williams also contends that the IFS fails to provide the SWRCB with useful guidance regarding instream flow needs and will also discourage the SWRCB from taking an adaptive management approach in the future. Viewed outside the context of the Synthesis Report, Dr. Williams' contention may be understandable. However, the Mono Basin Restoration program is an ongoing adaptive management process. The Stream Scientists are evaluating the initial flow regimes specified in Order 98-05 and recommending streamflow and operational changes based on the information collected during the past 12 years. This process of reviewing the initial flow regimes is a specific directive to the Stream Scientists in Order 98-05. The Synthesis Report submitted to the SWRCB will include a monitoring plan so that any flow recommendations made by the Stream Scientists are evaluated, and appropriate changes are made based on monitoring results in an adaptive management framework. We strongly support the use of a true adaptive management process whereby hypotheses are translated to management actions and these management actions are monitored to test whether the original hypotheses were reasonable.

Literature Cited

CDFG. 1943. Fish and Game Commission – thirty-seventh biennial report for the years 1940-1942.

Greenberg, L. A. 1994. Effects of predation, trout density and discharge on habitat use by brown trout, *Salmo trutta*, in artificial streams. Freshwater Biology 32:1-11.

Heggenes, J. 2002. Flexible summer habitat selection by wild, allopatric brown trout in lotic environments. Transactions of the American Fisheries Society 131:287-298.

Holm, C. F., J. D. Armstrong, and D. J. Gilvear. 2001. Investigating a major assumption of predictive instream habitat models: is water velocity preference of juvenile Atlantic salmon independent of discharge? Journal of Fish Biology 59:1653-1666.

Hunter, C., B. Shepard, D. Mierau, K. Knudson, and R. Taylor. 2000. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 1999. Annual Report prepared for Los Angeles Department of Water and Power. 32 p.

Hunter, C., B. Shepard, K. Knudson, R. Taylor. 2001. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 2000. Annual Report prepared for LADWP. 32 p.

Hunter, C., B. Shepard, K. Knudson, R. Taylor, M. Sloat and A. Knoche. 2002. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 2001. Annual Report prepared for LADWP. 42 p.

Hunter, C., B. Shepard, K. Knudson, R. Taylor and M. Sloat. 2003. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 2002. Annual Report prepared for LADWP. 43 p.

Hunter, C., B. Shepard, K. Knudson, R. Taylor and M. Sloat. 2004. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 2003. Annual Report prepared for LADWP. 62 p.

Hunter, C., R. Taylor, K. Knudson, B. Shepard, and M. Sloat. 2005. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 2004. Annual Report prepared for LADWP. 54 p.

Hunter, C., R. Taylor, K. Knudson and B. Shepard. 2006. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 2005. Annual Report prepared for LADWP. 64 p.

Hunter, C., R. Taylor, K. Knudson and B. Shepard. 2007. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 2006. Annual Report prepared for LADWP. 74 p.

Hunter, C., R. Taylor, K. Knudson and B. Shepard. 2008. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 2007. Annual Report prepared for LADWP. 49 p.

Hunter, C., R. Taylor, K. Knudson and B. Shepard. 2009. Fisheries Monitoring Report for Rush, Lee Vining, Parker and Walker Creeks 2008. Annual Report prepared for LADWP. 74 p.

Kemp, P. S., D. J. Gilvear, and J. D. Armstrong. 2003. Do juvenile Atlantic salmon parr track local changes in water velocity? River Research and Applications 19:569-575.

Knudson, K., R. Taylor, B. Shepard and C. Hunter 2009. Pool and habitat on Rush and Lee Vining creeks. Report to LADWP, Los Angeles, CA. 18p.

McMahon, T. E. and G. F. Hartman. 1989. Influence of cover complexity and current velocity on winter habitat use by juvenile coho salmon (*Oncorhynchus kisutch*). Canadian Journal of Fisheries and Aquatic Sciences 46:1551-1557.

Moyle, P. B. 2002. Inland Fishes of California. University of California Press, Berkeley, California.

Pert, E. J. and D. C. Erman. 1994. Habitat use by adult rainbow trout under moderate artificial fluctuations in flow. Transactions of the American Fisheries Society 123:913-923.

Shepard, B., R. Taylor, K. Knudson, and C. Hunter. 2009a. Effects of flow, reservoir storage, and water temperatures on trout in lower Rush and Lee Vining creeks, Mono County, California. Report to Los Angeles Department of Water Power, Los Angeles, California. 64 p.

Shepard, B., R. Taylor, K. Knudson, and C. Hunter. 2009b. Addendum (September 1, 2009): Effects of flow, reservoir storage, and water temperatures on trout in lower Rush and Lee Vining creeks, Mono County, California. Report to Los Angeles Department of Water Power, Los Angeles, California. 3 p.

Shirvell, C. S. 1994. Effect of changes in streamflow on the microhabitat use and movements of sympatric juvenile coho salmon (*Oncorhynchus kisutch*) and chinook salmon (*O. tshawytscha*) in a natural stream. Canadian Journal of Fisheries and Aquatic Sciences 51:1644-1652.

Taylor, R., D. Mierau, B. Trush, K. Knudson, B. Shepard, and C. Hunter. 2009a. Rush and Lee Vining Creeks - Instream Flow Study. Report to Los Angeles Department of Water Power, Los Angeles, California. 79 p.

Taylor, R., K. Knudson, B. Shepard and C. Hunter. 2009b. Radio-telemetry-movement study of brown trout in Rush Creek. Report to LADWP, Los Angeles, CA. 55p.

Vondracek, B and D. R. Longanekcer. 1993. Habitat selection by rainbow trout *Oncorhynchus mykiss* in a California stream: implications for the Instream Flow Incremental Methodology. Ecology of Freshwater Fish 2:137-186.