Fisheries Stream Scientist's Response to CDFG 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.

We appreciate the effort that reviewers have put into commenting on these reports. The California Department of Fish and Game's Water Branch submitted comments, signed by Carl Wilcox, on October 5, 2009. We offer the following response to these comments:

Stream Scientist General Response to CDFG's Comments

1. Throughout their comments, CDFG repeatedly states that we made "flow recommendations" and "flow requests" in the IFS report. This is incorrect; we specifically stated that the purpose of this report was to identify "flow needs" and that recommendations would be made later within the Synthesis Report. Future flow recommendations will incorporate information from other Mono Basin fisheries reports such as the radio telemetry-movement study and the SNTEMP water temperature model, as well as recommendations from the Stream Scientist in charge of the geomorphic and riparian vegetation studies.

2. CDFG contends that "it is premature to alter the current instream flows before stream habitats are restored". From this statement we infer that CDFG feels that the instream flow recommendations made from observations and measurements within the Rush and Lee Vining creek channels in the late 1980's still has relevancy as applied to the current channels. We contend that the channels changed significantly in response to twenty years of flows released down these channels, making the current flow regime somewhat outdated. Our pool and habitat-typing surveys support this contention (Knudson et al. 2009). 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, whereas our data indicate that revising summer, fall, and winter instream flows would likely increase growth and survival of brown trout in these streams. As part of the upcoming Synthesis Report, continued long-term monitoring of the trout populations will be recommended to assist in evaluating revisions made to instream flows in Rush and Lee Vining creeks.

3. CDFG states that our IFS report was not consistent with Order 98-05. We disagree, the IFS and other studies, will be used to generate flow recommendations as the Stream Scientists are directed to do within Order 98-05. SWRCB's Order 98-05 revised the flow recommendations initially set by Decision-1631 and established minimum baseflow requirements and "Stream Restoration Flows" (SRFs) for each of the four streams (Rush, Lee Vining, Parker and Walker). Order 98-05 also initiated a stream monitoring program under the supervision of two SWRCB-appointed Stream Scientists, Dr. William Trush and Chris Hunter. The monitoring program's principle mandate was to (1) **"evaluate and make recommendations, based on the results of the monitoring program, regarding the magnitude, duration and frequency of the SRFs necessary for the restoration of Rush Creek**; and the need for a Grant Lake bypass to reliably achieve the flows needed for restoration of Rush Creek below its confluence with the Rush Creek Return Ditch", and (2) "evaluate the effect on Lee Vining Creek of augmenting Rush Creek flows with up to 150 cubic feet per second (cfs) of water from Lee Vining Creek in order to provide SRFs." This evaluation was to take place **"after two data gathering cycles (as defined in the stream monitoring plan), but at no less than 8 years nor more than 10 years after the monitoring program begins."** The Stream Scientists have been conducting extensive monitoring activities during the past 12 years to examine the efficacy of the SRF flows and baseflows in restoring and maintaining desired ecological conditions and trout populations in the four Mono Lake tributary streams.

4. CDFG questions the validity of our movement study data and the relevancy of Heggenes's (2002) study. CDFG suggests using regional-specific criteria such as Smith and Aceituno (1987). Our movement study data shows similar winter habitat use for several size classes of brown trout and winter and non-winter habitat use by our radio-tagged fish were compared to previous habitat use studies. We used our stream-specific habitat suitability data to develop our mapping criteria, we did not "apply" Heggenes (2002) data to Rush and Lee Vining creeks. This peer reviewed paper was simply cited to show that we had developed reasonable criteria based on measurements made at the focal locations actually occupied by brown trout. We also found short-comings of the Smith and Aceituno (1987) habitat suitability criteria report. We detail these findings later in this response.

5. CDFG contends that we used an untested methodology (direct habitat mapping) that lacks reproducibility and that we failed to include QA/QC procedures. CDFG also says there is no peer-reviewed protocol that outlines the procedures. We modified the original demonstration flow assessment approach proposed by Railsback and Kadvany (2008) by actually measuring water depths and velocities to define the perimeters of each habitat polygon and located each perimeter point by triangulation of distance measurements as recommended by Gard (2009). We detailed this methodology in our report and believe by measuring depths and velocities we addressed the problems identified by Gard (2009) about reproducibility. While we did not replicate the mapping effort, we did apply QA/QC measures. Depth and velocity measurements were usually double-checked by measuring these parameters until a polygon boundary was located and then re-measuring along that boundary. In addition, during and after each polygon was delineated the data recorder and person who was measuring depths and velocities

conferred to ensure that each polygon's boundaries were correctly displayed. For each polygon boundary point, the distance from the previous point was recorded and triangulation with at least one other point or mapped reference point was done by measuring two distances. Thus, the location of these boundary points were not subjective, they were quantifiable and easily measured with a stadia rod, current meter, and measuring tape. The boundaries between suitable and unsuitable focal velocities were usually quite obvious (i.e., clear velocity "break-points" occurred when the flow meter was moved a matter of inches, not feet); and measurements of depths (being either deeper or shallower than one-foot) were also very straight-forward. We clearly described the field methods for measuring polygon points and boundaries within the IFS report. We are confident that the measurements we made in the field were accurate representations of the holding and foraging habitats utilized by brown trout in Rush and Lee Vining creeks. We agree with CDFG that replicated mapping would provide a better way to quantify this reproducibility and the Fisheries Stream Scientist will consider conducting this type of study if the Water Board believes it is necessary and if funding becomes available to conduct this type of assessment. Perhaps CDFG would consider assisting with this study either by providing funding and/or personnel to do some of the field mapping. Additionally, we are aware that that CDFG has since received from McBain and Trush a draft protocol describing the Direct Habitat Mapping methodology and that the Department is in support of its utilization on other watersheds in California (e.g., Alameda Creek, McCloud River, Shasta River). Finally, we are unaware of a document describing CDFG QA/QC procedures in the original instream flow study reports for Rush and Lee Vining creeks.

6. CDFG requests that the Department be a participant in any future work conducted by the Stream Scientists to assure consistency with Order 98-05 and Department goals for protecting fishery resources in Rush and Lee Vining creeks. Our response is the Department has been involved in the Mono Basin restoration process for at least the last twelve years via Steve Parmenter in the Bishop Office. We were surprised at the apparent lack of communication between CDFG's Water Division and Mr. Parmenter during the preparation of CDFG's comments. Mr. Parmenter participated in nearly every bi-annual Mono Basin restoration meeting for the past four years as the instream flow studies for Rush and Lee Vining creeks were discussed. He was there for discussions regarding methodology; he reviewed several draft study plans for each creek, and even observed several hours of direct habitat mapping in the field on Rush Creek. While in the field with the Fish Team as we delineated and measured polygons on Rush Creek, Mr. Parmenter clarified his understanding of the field methods and offered excellent advice during this process. Our perspective was that Mr. Parmenter believed the methodology that we used had merit. Finally, during study plan development we utilized input from Mr. Parmenter, as well as comments and suggestions made by other stakeholders.

Stream Scientists Review of Previous Instream Flow Studies

We evaluated the currently prescribed flows for Rush and Lee Vining creeks as determined by studies conducted by CDFG and other experts in the late 1980s and early 1990s (Smith and Aceituno 1987; CDFG 1991; CDFG 1993). While these older studies were probably conducted with the best available information and methodologies at the time and have provided the streams adequate flow regimes to start the recovery process; we contend these studies and resulting flow recommendations currently have limited value primarily due to significant changes to the stream channels and also because newer methodologies allow for better quantification of changes in preferred habitats over a range of potential flows. We also point out that our IFS targeted a specific brown trout life-stage objective of larger adults. The fisheries termination criteria (as defined in Order 98-05) based on "size and structure of fish populations" was defined as "fairly consistently produced brown trout weighing 0.75 to two pounds (0.34 to 0.91 kg). Trout averaging 13 to 14 inches (330 to 355 mm) were also allegedly observed on a regular basis prior to the 1941 diversion of this stream". For Lee Vining Creek, the fisheries termination criteria of "size and structure of fish populations" was defined as "to sustain a fishery for naturally-produced brown trout that average eight to 10 inches (200 to 250 mm) in length with some trout reaching 13 to 15 inches (330 to 380 mm)".

Concerns about applying instream flow recommendations in the face of significant channel changes and limited habitat availability measurements were also raised as far back as the 1993 Water Board hearings. First, the stream channels have evolved so much that the original flow recommendations for trout habitat are no longer relevant. At the 1993 hearing, Jim Canaday asked Dr. Thomas Hardy to elaborate on an IFIM premise that the stream channel must be stable, and if a channel had undergone measureable changes how would this affect flow recommendations. After Dr. Hardy agreed that the Rush Creek channel had changed as a result of increased flows between 1987 and 1993, Canaday specifically asked Hardy, "Would that affect the applicability of the recommendations from either one of those studies if the stream is significantly different today than it was when those studies were put on?" Dr. Hardy responded, "It definitely has that potential, sir." Dr. Hardy was also questioned about applying WUA curves derived from a wide, shallow channel to a narrower, deeper channel more indicative of pre-1941 conditions. Dr. Hardy responded that the amount of habitat would be quite different. Habitat typing and pool surveys conducted between 1991 and 2008 (Trihey and Associates 1994; Knudson et al 2009) support our contention that significant riparian and channel evolution has occurred over the past 17 years, and that the present channels are not representative of channel conditions used in developing the currently prescribed instream flows for trout. Figure 4 from Knudson et al. (2009) documents the more than five-fold increase in pools with residual depths greater than three-feet deep in Rush Creek between 1991 and 2008 (Figure 1).

The second issue discussed during the 1993 Water Board hearing was development of habitat criteria curves. Dr. Hardy was again asked to comment on the issue. Mr. Birmingham asked, "If you were to develop onsite criteria curves, would you take all your data at a flow lower than the zero percentile flow for that stream?" Dr Hardy responded, "No. I would want to collect observations from a wider range of flows as I could physically collect the data in the stream." Mr. Birmingham then asked, "So would you then have a criticism of the E.A. study based on the fact that they took all of their observations at 19 cfs?" Hardy responded, "From that viewpoint, it would be a criticism." When cross-examined by Bruce Dodge, Dr. Hardy was asked why he would want a broader range of flows. Dr. Hardy responded, "Primarily, the fundamental problem with suitability curves is that they are surrogate for what we know to be true fish behavior on selection of stream locations. They really select energetically favorable positions." This response echoes the concluding sentence of a journal article that critiqued WUA estimates derived from PHABSIM studies (Williams 1995).

"It seems wiser to put effort into learning the basic biology of the species of concern, which alone can provide a firm foundation for valid applied methods and sound water management decisions"

We concur with Dr. Hardy's responses and have delved further into the issue of habitat criteria curves by examining the habitat preference criteria study used in developing the CDFG flow recommendations. Smith and Aceituno (1987) readily admitted that all of their brown trout observations were made during the daytime and also during the spring, summer, and fall. They cautioned against using these data for making either night time or winter flow recommendations; yet CDFG used these data for generating instream flow recommendations for all seasons, including winter months. Smith and Aceituno (1987) also made very few direct observations of brown trout utilizing habitat deeper than 2 ft, probably because at that time there were few pools with depths greater than 2 ft, yet CDFG still used these preference criteria to prescribe instream flows to address juvenile and adult brown trout pool habitat.

Smith and Aceituno (1987) alluded to measuring focal point velocities of observed brown trout. However; all of the habitat preference criteria utilized by CDFG to develop instream flows were based on mean water column velocities measured at $6/10^{th}$ total water column depth, rather than being based on focal velocities taken near the stream bottom in locations actually occupied by the observed brown trout (CDFG 1991; 1993). During our 12 years of studying brown trout in Rush and Lee Vining creeks, including extensive day and night snorkeling and three years of relocating radio-tagged fish, we came to the conclusion that mean water column velocities are poor physical descriptors of brown trout habitat. This is because more than 80% of the brown trout we observed during our studies were either directly on, or within 0.5 ft, of the stream bottom. Thus, we contend that focal velocities taken at 0.5 ft (or even closer to the stream bottom) more accurately describe the velocity preferences of brown trout in their holding positions compared to velocities taken higher in the water column in locations that brown trout are rarely, if ever, observed utilizing as holding habitat. Our findings are consistent with those reported by Raleigh et al (1986); Clapp et al (1992); Meyers et al (1992); and Heggenes (2002).

Our fall and winter baseflow recommendations were developed with data generated from relocations of our radio-tagged brown trout during both winter (December-March) and non-winter (April-November) periods. We used site-specific habitat measurements, taken at each relocation site, to develop holding habitat criteria for brown trout on Rush Creek. Consequently, we did not need to extrapolate non-winter observations to winter conditions, like many other IFS recommendations, including CDFG's studies on Rush and Lee Vining creeks (CDFG 1991; 1993).

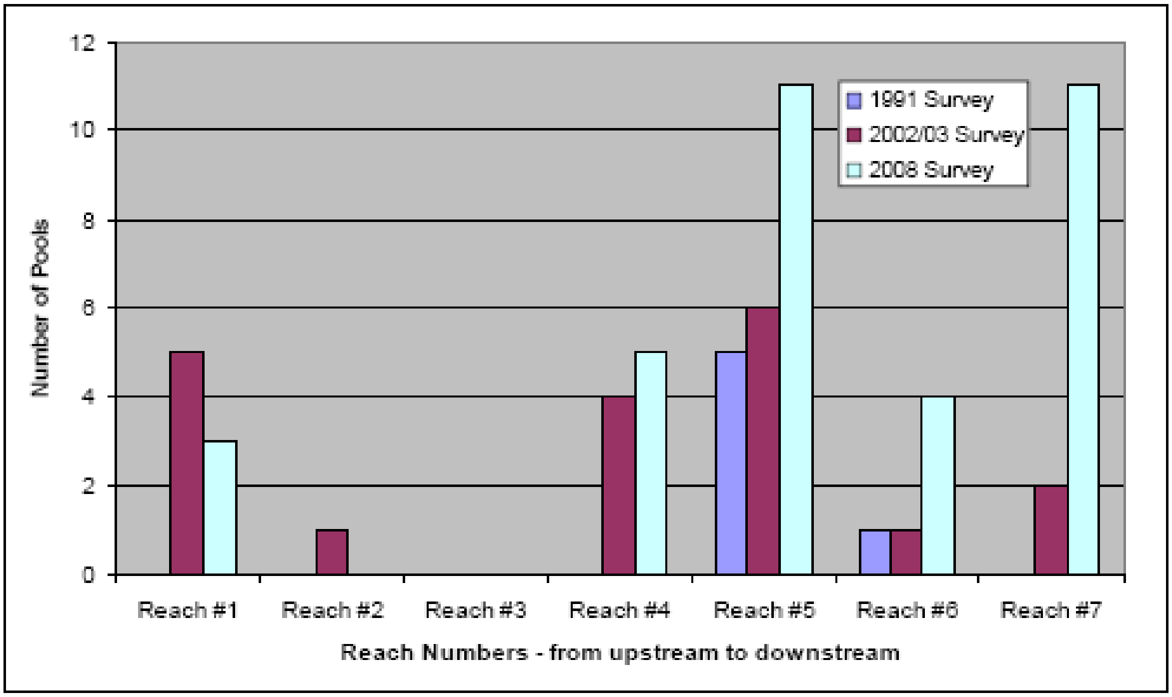

Figure 4. Total Numbers of Pools with Residual Depths Greater than 3.0 ft within seven stream reaches on Rush Creek during the 1991 Trihey survey, the initial 2002/03 pool survey and the follow up 2008 pool survey.

Figure 1. Figure 4 from Pool and Habitat Studies report (Knudson et al. 2009).

Development of Brown Trout Holding Habitat Criteria

Prior to developing brown trout holding habitat criteria for the IFS, we focused on studying the relevant biology and habitat of brown trout in Rush and Lee Vining creeks, which we felt would provide the most valid foundation for the methods needed to support sound water management decisions for this species in the Mono Lake Basin. Annual fish population estimate surveys conducted from 1999-2009 evaluated changes that occurred to the numbers, biomass, age-class structure and condition of the populations during different water-year types (Hunter et al. 2000 – 2009). The analysis of Rush Creek water temperature data in concert with fish population data identified statistical relationships between Grant Lake Reservoir storage levels, water temperatures, and brown trout abundance and condition factor (Shepard et al. 2009a-b). The extent of potential adult brown trout holding habitat was documented by measuring the frequency and distribution of high-quality pools (Platts et al. 1987) throughout the length of Rush Creek during 2002 and 2003 (Knudson et al. 2009). The evolution of the Rush Creek channel towards more high-quality pools as a result of large SRF flow releases in 2005 and 2006 was evaluated by repeating the pool survey in 2008 (Knudson et al. 2009).

The Platts et al. (1987) methodology rated pools based on their depth, surface area and amount of hiding cover, but did not factor water velocities into the ratings. While conducting day and night snorkel surveys in 2000 and 2002, we noticed that there were often relatively low numbers of brown trout in some of the high-quality pools identified during the pool survey. It appeared that brown trout largely avoided pools with relatively high water column velocities near the stream bottom, even when good to excellent hiding cover was present. This apparent preference by brown trout for low velocity holding areas was confirmed during our three-year study of the movement and habitat preferences of radio-tagged juvenile and adult fish in Rush Creek (Taylor et al. 2009). During this study, measured habitat parameters included the amounts and types of hiding cover, total water depths, and water column velocity measurements at 6/10th and 9/10th of total stream depth for each tagged fish that was relocated during winter (December-March) and non-winter (April-November) months. Habitat measurements were made for 132 relocated radio-tagged brown trout, including 45 juveniles (197-206 mm) that were tagged in Rush Creek; 56 adults (244-304 mm) tagged in Rush Creek; and 31 adults (314-518 mm) tagged in the Mono Gate One Return Ditch (MGORD aka "the ditch") that were subsequently relocated in Rush Creek downstream of the MGORD.

During winter months, all (100%) of the MGORD adults that were relocated downstream in Rush Creek proper, were holding in locations where water column velocities near the stream bottom ranged from 0.1 to 0.7 feet per second (fps), as were 91% of the brown trout adults tagged in Rush Creek, and even 85% of the Rush Creek juveniles (Figure 2). This demonstrated that all sizes of brown trout, not just the large MGORD adults, preferred low-velocity holding habitats and would benefit from increases in areas where stream bottom velocities are 0.0 to 0.7 fps. Thus, while our habitat depth and velocity criteria for delineating foraging and winter habitat was based on larger adults, polygons mapped under these criteria should also provide habitat for juveniles.

During the non-winter months, a somewhat higher proportion of all sizes of brown trout were relocated at sites where focal velocities were >0.7 fps, but 82% of all the adult fish and 81% of the juveniles were still found at locations with focal velocities ranging from 0.0 to 0.7 fps (Figure 3). There does, however, seem to be a slight preference for lower focal velocities during the winter months, since mean stream bottom velocity for all brown trout relocated during winter (0.36 fps) was lower than the non-winter mean (0.53 fps) (Table 1). For the large MGORD fish this difference was even greater: 0.33 fps during winter vs. 0.59 fps during non-winter (Table 1).

The winter graph (Figure 2) was the basis for why we used stream bottom velocities of 0.0 to 0.7 fps, measured 0.5 ft off the stream bottom, as the velocity criteria for delineating adult brown trout winter holding habitat during the IFS. Comparing mean column water velocities measured at 6/10th total depth to velocities measured at 9/10th total depth supports our contention that mean water column velocities are poor descriptors of brown trout habitat (Table 2). For the 123 instances where a relocated fish occupied a location with a focal point velocity less than 0.7 fps, 33% of the time the mean column water velocities exceeded 0.7 fps; and mean water column velocities were higher than focal velocities during 117 of 132 (or 89%) of our observations (Table 2).

Our water column depth criteria of >1.0 ft was based on the fact that 87% of the adult brown trout relocated during winter months were found where water column depths exceeded 1.0 ft (Figure 4). Brown trout relocated in non-winter months also showed a strong preference for locations with water column depths greater than 1.0 ft (Figure 5). Direct cover was the third criterion used to delineate winter holding habitat during the IFS and was also derived directly from Movement Study results. Our cover criterion was very straight-forward; there had to be enough direct hiding cover to provide at least 12 ft^2 of protection from surface detection.

The developed focal velocity, depth and cover criteria were utilized to measure the surface areas of adult brown trout holding habitat polygons during the IFS on Rush and Lee Vining creeks (Taylor et al. 2009). During the IFS mapping, water depths were measured to the nearest 0.1 ft and focal velocities to the nearest 0.1 fps. The study reaches for this mapping effort were based, in part, on habitat typing surveys conducted on these streams just prior to the IFS, where we measured the lengths and locations of all the pool, riffle and glide/run habitats (Knudson et al. 2009). In Rush Creek, much of the IFS direct habitat mapping effort was directed to the reach downstream of the Narrows because of the clusters of high-quality pools present and also because of this reach's documented geomorphic response to high runoff flows (Knudson et al. 2009). The Fish Scientists suggest that this reach best represents the likely future condition of the stream channel in lower Rush Creek and chose to concentrate our IFS in this reach to better analyze flow affects for this likely future channel condition. Finally, because our habitat measurements were collected during all seasons, we did not need to extrapolate non-winter observations to winter conditions like many other IFS recommendations, such as CDFG (1991; 1993) did with the habitat preference criteria developed by Smith and Aceituno (1987).

We believe that our stream and species-specific approach for determining holding habitat criteria for adult brown trout provided a sound foundation for our IFS recommendations. The extensive data set generated from the Movement Study clearly demonstrated that holding habitat, as defined by our IFS mapping criteria, was utilized by several size classes of juvenile and adult brown trout during <u>both</u> winter and non-winter months. Management decisions that expand the area of winter habitat defined by these criteria should enhance the survival and condition of adult brown trout in Rush and Lee Vining creeks.

Finally, 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. We welcome a testing of our IFS hypotheses through monitoring.

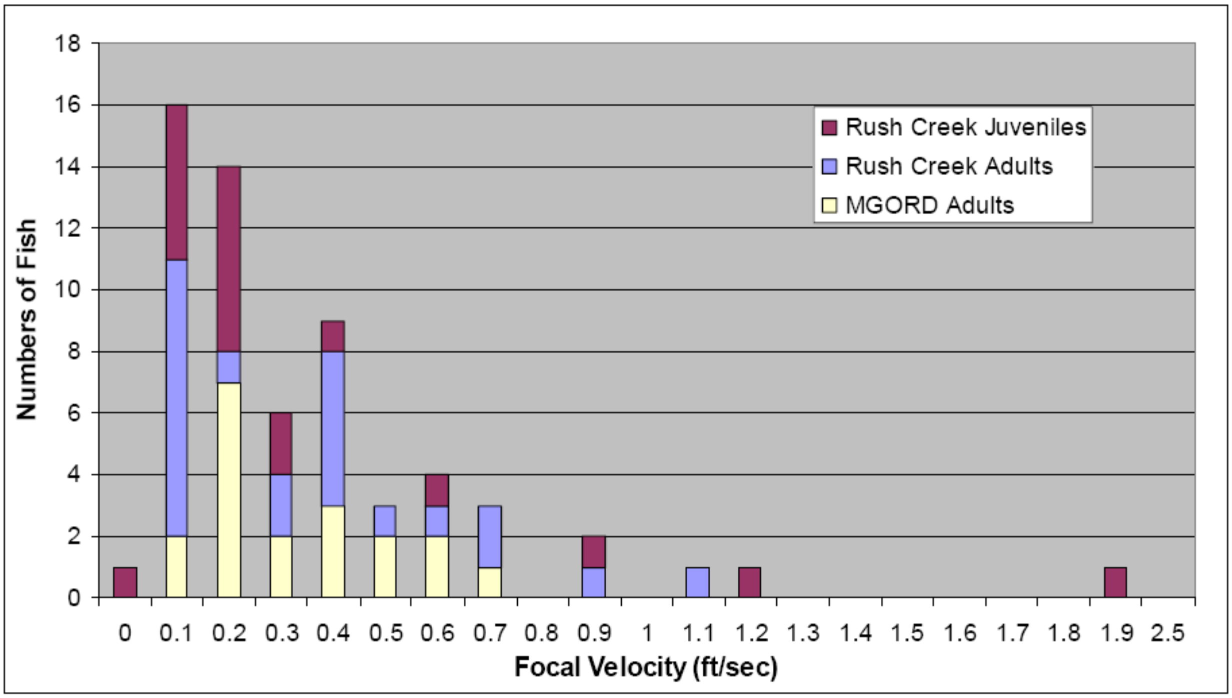

Figure 2. Distribution of focal velocities for brown trout relocated during winter months (December-March) in Rush Creek.

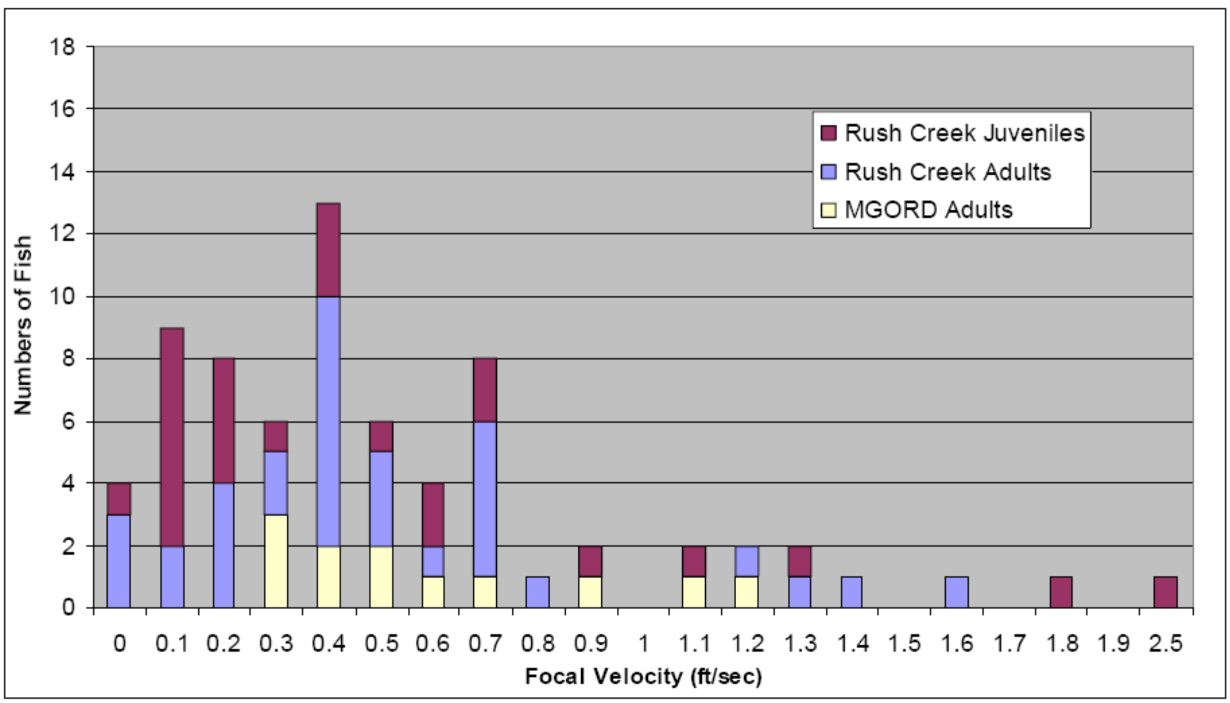

Figure 3. Distribution of focal velocities for brown trout relocated during non-winter months (April-November) in Rush Creek.

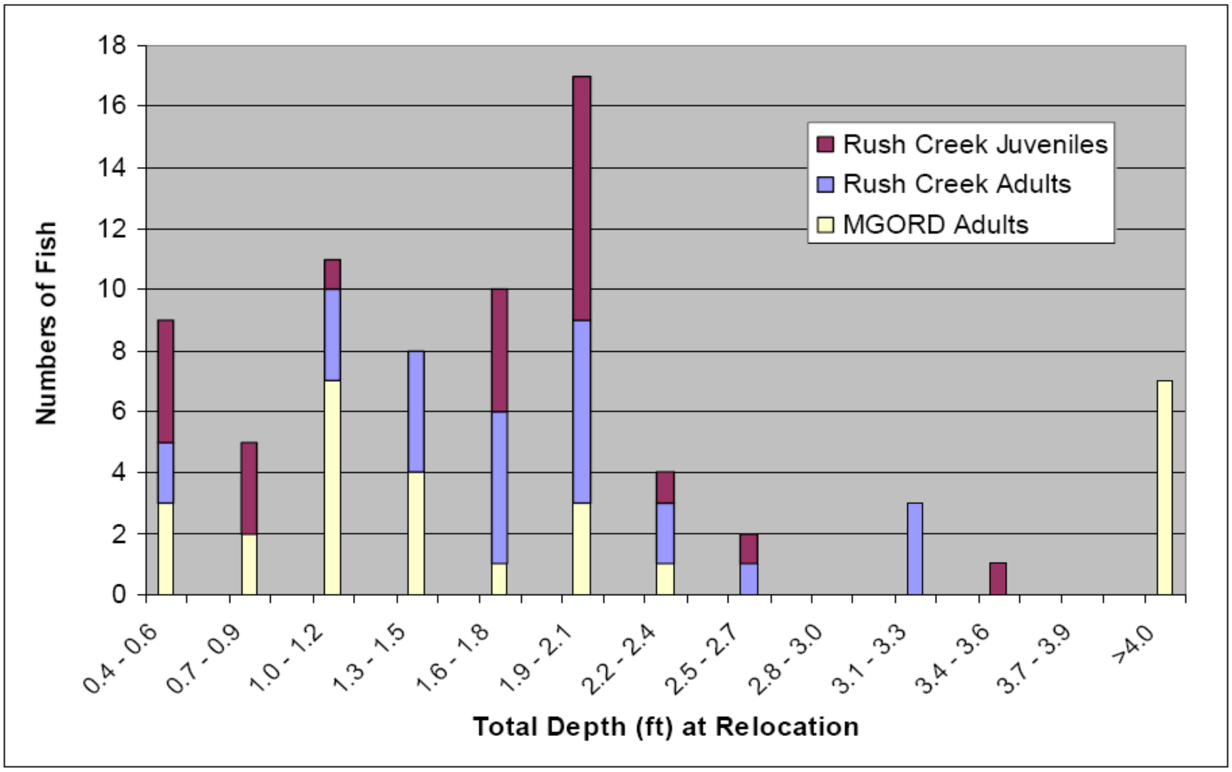

Figure 4. Total depths measured at locations of brown trout relocated during winter months (December-March) in Rush Creek.

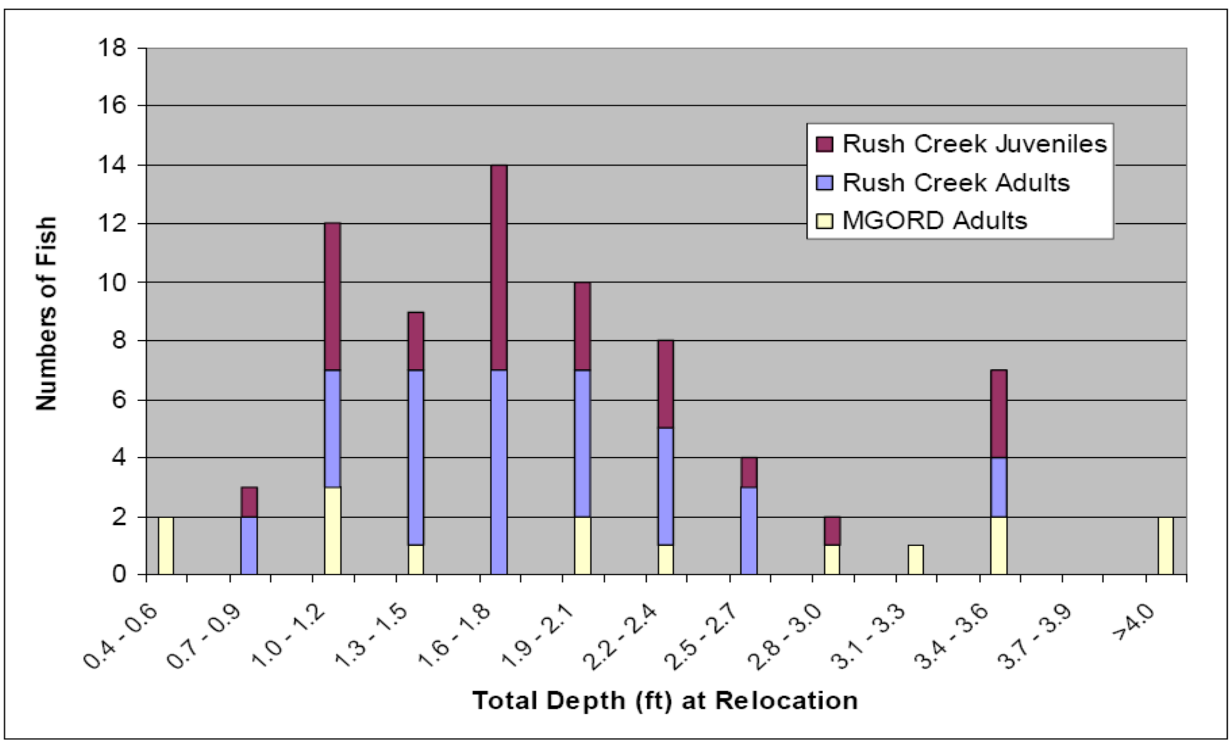

Figure 5. Total depths measured at locations of brown trout relocated during non-winter months (April-November) in Rush Creek.

Table 1. Measured focal velocities for three size groups of brown trout on Rush Creek during winter and non-winter periods, using the higher of the 6/10th versus 9/10th water column depths' velocity measurements for 43 observations with total depths ranging from 0.4-1.3 ft; and the 9/10th water column depths' velocity measurements for the remaining 89 observations (total depths 1.4-4.1 ft).

Winter Period (November – March)					Non-winter Period (April – October)				
Focal Velocity (fps)	Number of Rush Ck Juveniles	Number of Rush Ck Adults	Number of MGORD Adults	Total No. Relocated Fish	Focal Velocity (fps)	Number of Rush Ck Juveniles	Number of Rush Ck Adults	Number of MGORD Adults	Total No. Relocated Fish
0	1	0	0	1	0	1	3	0	4
0.1	5	9	2	16	0.1	7	2	0	9
0.2	6	1	7	14	0.2	4	4	0	8
0.3	2	2	2	6	0.3	1	2	3	6
0.4	1	5	3	9	0.4	3	8	2	13
0.5	0	1	2	3	0.5	1	3	2	6
0.6	1	1	2	4	0.6	2	1	1	4
0.7	0	2	1	3	0.7	2	5	1	8
0.8	0	0	0	0	0.8	0	1	0	1
0.9	1	1	0	2	0.9	1	0	1	2
1.0	0	0	0	0	1.0	0	0	0	0
1.1	0	1	0	1	1.1	1	0	1	2
1.2	1	0	0	1	1.2	0	1	1	2
1.3	0	0	0	0	1.3	1	1	0	2
1.4	0	0	0	0	1.4	0	1	0	1
1.5	0	0	0	0	1.5	0	0	0	0
1.6	0	0	0	0	1.6	0	1	0	1
1.7	0	0	0	0	1.7	0	0	0	0
1.8	0	0	0	0	1.8	1	0	0	1
1.9	1	0	0	1	1.9	0	0	0	0
2.5	0	0	0	0	2.5	1	0	0	1
TOTALS	**19**	**23**	**19**	**61**	TOTALS	**26**	**33**	**12**	**71**
Average Velocities (fps)	**0.38**	**0.36**	**0.33**	**0.36**	Average Velocities (fps)	**0.53**	**0.51**	**0.59**	**0.53**

Table 2. Total depths and water column velocities measured at 6/10th and 9/10th of total stream depth associated with relocated brown trout on Rush Creek.

Rush Creek Section	Date	Fish Code Number	Fish Length (mm)	Fish Weight (g)	Velocity at 0.6 total depth (fps)	Velocity at 0.9 total depth (fps)	Total Depth at Relocation (ft)
Upper Rush Creek Sampling Section	10/18/2005	31	194	78	0.8	0.6	2.2
	10/18/2005	32	197	77	2.5	0.2	1.0
	10/18/2005	33	201	88	0.6	0.4	1.8
	10/18/2005	35	204	83	0.9	0.1	1.7
	10/18/2005	36	199	76	0.2	0.1	1.7
	10/18/2005	37	197	82	0.7	0.7	1.2
	10/18/2005	51	304	297	1.3	1.4	1.6
	10/18/2005	53	291	250	1.3	1.2	1.7
	10/18/2005	54	266	205	0.9	0.3	2.7
	10/18/2005	55	291	262	0.7	0.6	0.9
	10/18/2005	57	294	298	1.1	0.7	2.3
Lower Rush Creek Sampling Section	10/19/2005	29	475	1220	0.0	0.3	3.4
	10/19/2005	42	196	75	0.0	0.2	1.9
	10/19/2005	48	201	95	1.9	0.7	1.8
	10/19/2005	50	200	82	0.8	0.5	2.5
	10/19/2005	58	276	221	0.2	0.0	1.4
	10/19/2005	59	244	165	0.3	0.2	2.6
	10/19/2005	65	250	151	0.8	0.5	2.2
	10/19/2005	67	291	223	1.9	0.7	1.8
	10/19/2005	68	274	208	0.8	0.5	2.2
	10/19/2005	69	266	186	0.4	0.3	1.2
Rush Creek Co. Road Sampling Section	10/20/2005	40	194	75	0.1	0.9	2.0
	10/20/2005	43	202	80	1.8	1.3	0.8
	10/20/2005	45	195	72	0.8	0.1	1.6
	10/20/2005	46	206	88	0.4	0.4	1.1
	10/20/2005	61	257	170	0.1	0.2	0.9
	10/20/2005	62	265	185	0.9	0.0	2.0
	10/20/2005	66	272	209	0.2	0.0	1.1
	10/20/2005	70	257	179	1.8	0.7	1.4
Upper Rush Creek Sampling Section	11/16/2005	21	518	1311	1.1	0.5	1.1
	11/16/2005	23	338	392	1.2	0.5	3.5
	11/16/2005	33	201	88	0.4	1.1	2.2
	11/16/2005	35	204	83	0.4	0.1	1
	11/16/2005	37	197	82	0.5	0.2	1.5
	11/16/2005	54	266	205	1.2	0.5	3.5
	11/16/2005	55	291	262	0.9	0.8	1.7
	11/16/2005	57	294	298	1.2	0.2	1.5

Table 2 (continued).

Rush Creek Section	Date	Fish Code Number	Fish Length (mm)	Fish Weight (g)	Velocity at 0.6 total depth (fps)	Velocity at 0.9 total depth (fps)	Total Depth at Relocation (ft)
Narrows down through Upper Rush Creek Sampling Section	11/17/2005	28	513	1110	0.6	0.5	1.1
	11/17/2005	29	475	1220	1.2	0.5	0.6
	11/17/2005	42	196	75	0.4	0.1	3.5
	11/17/2005	44	201	79	0.4	0.1	3.5
	11/17/2005	49	197	80	1.3	0.8	1.2
	11/17/2005	50	200	82	0.7	0.6	2.3
	11/17/2005	58	276	221	0.2	0.2	1.4
	11/17/2005	59	244	165	0.1	0.1	2.2
	11/17/2005	64	254	151	0.4	0.1	3.5
	11/17/2005	65	250	151	0.6	0.4	2.0
	11/17/2005	67	291	223	0.7	0.3	1.4
	11/17/2005	68	274	208	0.6	0.4	2.0
	11/17/2005	69	266	186	0.3	0.7	1.6
Ford down to County Road Culvert	11/15/2005	43	202	80	0.4	0.3	3.6
	11/15/2005	45	195	72	0	0.2	1.7
	11/15/2005	46	206	88	0.1	0.0	1.9
	11/15/2005	47	200	84	0.3	0.1	1.8
	11/15/2005	61	257	170	0.9	0.4	1.7
	11/15/2005	62	265	185	0.7	0.4	2.0
	11/15/2005	63	254	160	0.6	0.4	1.2
	11/15/2005	66	272	209	1.3	0.4	1.1
	11/15/2005	70	257	179	0.1	0.0	1.9
Gorge down to Highway 395	12/16/2005	25	362	510	0.3	0.1	0.7
	12/16/2005	35	204	83	1.8	0.6	1.8
	12/16/2005	37	197	82	0.2	0.1	0.7
	12/16/2005	53	291	250	0.1	0.1	1.0
	12/16/2005	54	266	205	1.1	0.5	1.1
	12/16/2005	55	291	262	0.9	0.6	1.1
	12/16/2005	57	294	298	0.2	0.1	2.2
Highway 395 down through Lower Sampling Section	12/17/2005	14	465	925	0.3	0.2	1.4
	12/17/2005	42	196	75	1.1	1.2	2.2
	12/17/2005	44	201	79	0.6	0.1	1.6
	12/17/2005	48	201	95	0.4	0	2.1
	12/17/2005	49	197	80	0.2	0.2	0.4
	12/17/2005	58	276	221	0.6	0.1	1.6
	12/17/2005	59	244	165	1.3	0.5	3.3
	12/17/2005	65	250	151	0.7	0.4	2.2
	12/17/2005	67	291	223	0.2	0.4	2.1
	12/17/2005	68	274	208	0.9	0.7	2
	12/17/2005	69	266	186	0.2	0.1	1.4

Table 2 (continued).

Rush Creek Section	Date	Fish Code Number	Fish Length (mm)	Fish Weight (g)	Velocity at 0.6 total depth (fps)	Velocity at 0.9 total depth (fps)	Total Depth at Relocation (ft)
MGORD to Highway 395	1/28/2006	25	362	510	0.4	0.3	1.0
	1/28/2006	37	197	82	0.2	0.1	0.7
	1/28/2006	53	291	250	0.2	0.1	1.5
	1/28/2006	57	294	298	0.1	0.3	0.4
Lower Rush Creek Sampling Section	1/27/2006	44	201	79	0.6	0.1	1.6
	1/27/2006	48	201	95	0.1	0.1	1.8
	1/27/2006	49	197	80	0.2	0.2	0.4
	1/27/2006	58	276	221	0.6	0.1	1.6
	1/27/2006	59	244	165	0.1	0.1	2.7
	1/27/2006	67	291	223	0.1	0.1	1.8
	1/27/2006	68	274	208	0.9	0.7	2.0
Co. Road Section	1/26/2006	40	194	75	0.3	0.1	0.9
	1/26/2006	47	200	84	0.1	0.1	2.1
MGORD to Hwy 395	3/15/2006	25	362	510	0.4	0.3	1.1
	3/15/2006	37	197	82	0.2	0.1	0.6
	3/15/2006	57	294	298	0.1	0.3	0.4
Hwy 395 to Narrows	3/13/2006	14	465	925	0.9	0.2	1.9
	3/13/2006	54	266	205	0.8	0.6	1.6
	3/13/2006	65	250	151	0.4	0.1	1.3
Lower Rush Creek Sampling Section	3/12/2006	39	187	80	1.9	0.2	1.2
	3/12/2006	42	196	75	0.1	0.3	2.1
	3/12/2006	44	201	79	0.5	0.4	1.9
	3/12/2006	48	201	95	0.1	0.1	1.9
	3/12/2006	58	276	221	0.5	0.4	1.9
	3/12/2006	59	244	165	0.8	0.2	3.2
	3/12/2006	67	291	223	0.2	0.1	3.2
	3/12/2006	68	274	208	0.7	0.4	2.0
Co. Road Section	3/13/2006	43	202	80	0.9	0.9	2.6
	3/13/2006	45	195	72	0.2	0.1	0.5
MGORD to Hwy 395	5/13/2006	35	204	83	1.6	0.4	3
	5/13/2006	53	291	250	1.1	0.4	1.8
	5/14/2006	54	266	205	1.6	0.7	1.3
Hwy 395 Narrows	5/16/2006	14	465	925	0.1	0.6	1.2
Lower Rush	5/14/2006	58	276	221	3.1	0.4	2.7
Co. Road Section	5/15/2006	45	192	72	0.1	0.1	1.3

Table 2 (continued).

Rush Creek Section	Date	Fish Code Number	Fish Length (mm)	Fish Weight (g)	Velocity at 0.6 total depth (fps)	Velocity at 0.9 total depth (fps)	Total Depth at Relocation (ft)
MGORD to Hwy 395	12/5/2006	12	508	1118	1.2	0.3	1.4
	12/5/2006	26	357	461	0.2	0.6	1.5
	12/5/2006	73	382	607	0.5	0.2	1.2
	12/5/2006	74	378	593	0.6	0.4	0.6
	12/5/2006	75	387	662	0.1	0.2	1.4
	12/5/2006	100	314	317	0.2	0.2	0.6
	12/5/2006	107	331	395	0.3	0.2	1.7
Hwy 395 to Ford	12/6/2006	28	513	1110	1.5	0.2	4.1
	12/6/2006	80	457	1056	0.5	0.1	2.0
MGORD to Hwy 395	2/17/2007	72	410	695	0.2	0.1	1.2
	2/17/2007	74	378	593	0.7	0.1	1
	2/17/2007	101	342	414	0.3	0.4	2.1
	2/17/2007	103	338	427	0.5	0.2	0.9
MGORD Hwy 395	5/1/2007	26	357	461	1.2	0.4	3.3
	5/1/2007	105	341	462	0.7	0.3	2.1
Hwy395 to Ford	5/2/2007	104	340	450	0.4	0.1	0.5
	5/2/2007	80	457	1056	0.9	0.5	2.9
MGORD to Hwy 395	9/14/2007	12	508	1118	0.7	0.3	2.3
	9/15/2007	103	338	427	0.9	0.4	1.3
	3/19/2008	89	518	1728	0.1	0.1	2.4

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