Results of Fine Sediment Monitoring in Rusch Creek Using Volunteers

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Abstract: Levels of fine sediment in pools were measured and amphibians surveyed in Rusch Creek, tributary to Hayfork Creek in the South Fork Trinity River Basin. Survey crews included students from Hayfork High School, members of the California Conservation Corp, U.S. Forest Service and staff of Pacific Watershed Associates. Fines in pools were measured using the V* technique and ranged from .033 to .182. V*w for Rusch Creek was .086, which compares favorably with other tributaries of the Trinity River. A total of 59 Pacific giant salamanders of varying age classes were found in Rusch Creek along with many adult yellow-legged frogs and one adult western toad.

Introduction

Rusch Creek is a second order tributary of Hayfork Creek in the South Fork Trinity River Basin. It flows into Hayfork Creek from the south just below Hayfork Valley. The area of the Rusch Creek watershed is 3955 acres (6.18 sq. mi.) and the basin is largely in U. S. Forest Service (USFS) ownership. Although the watershed is heavily forested, less than 20% of it has been logged. In recent years, the stream has been treated with numerous fish habitat improvement structures installed by the California Conservation Corp and the USFS.

Gary Flosi, California Department of Fish and Game habitat restoration specialist, had inspected Rusch Creek instream structures and found that considerable sand had built up around some of them (personal communication). Although the Hayfork Creek watershed is generally composed of resistant rock types, Rusch Creek has some outcrops of deeply weathered diorite which is highly erodible. The USFS habitat typing report on Rusch Creek (Mayo, 1992) also noted elevated levels of fine sediment and suggested the source might be related to roads adjacent to the stream.

On July 19-20, 1994, fine sediment in Rusch Creek was measured using the V* method that was devised at the USFS research station in Arcata, California (Hilton and Lisle, 1993). Amphibians are also know to be impacted by fine sediment (Welsh and Ollivier, 1992); therefore, amphibians were also assessed during this monitoring activity.

The South Fork Trinity River basin is currently the focus of restoration activity through a Cooperative Resource Management Planning (CRMP) group. The information gathered by this study is to help the CRMP understand the nature and degree of sediment related problems for fisheries in Rusch Creek. The exercise was also carried out to discover the degree to which volunteers from Hayfork High School could be used to help collect monitoring information. Shasta Trinity National Forest supported this activity, providing transportation, staff and insurance coverage for volunteers. Three members of the California Conservation Corp also assisted in this activity. Funding for this project was provided through the U.S. Bureau of Reclamation in Weaverville under the Trinity River Restoration Program.

Methods

Fine sediment in streams is known to negatively impact salmon, steelhead and trout (Reiser and Bjornn, 1979) as well as amphibian species (Welsh and Ollivier, 1992). For the purpose of this activity, fine sediment was considered to be of sand size or smaller (< 6.4 mm). Fine sediment in Rusch Creek was measured using the V* method as described in Hilton and Lisle (1993). The V* statistic is a ratio of the amount of fine sediment in pools relative to the volume of water and fine sediments combined.

To assess fine sediment in pools, a half inch diameter stainless steel probe, marked off at increments of .1 meter was used. Tape measures were run up the center of each pool unit and perpendicularly off this transect at defined intervals. Sediment depths along the perpendicular transects were measured and recorded and each pool mapped for reference. Depths of the water at the pool tail crest were measured to help calculate residual pool volume. This latter calculation helps to equalize results of V* tests regardless of stream height at the time of the survey. An illustration of the use of this technique taken from Hilton and Lisle (1993) is shown as Figure 1.

The lowest eleven pools in Rusch Creek above its convergence with Hayfork Creek were measured. The lowest reach was chosen because its B-2 channel type (Rosgen, 1985) and relatively mild gradient (<4%) allow for deposition of fine sediments. A short distance upstream of the reach surveyed, the channel type changes to an A-3 which is too confined to be compatible with the use of V*.

Data sheets (Appendix A) were provided by the U.S. Forest Service Redwood Sciences Lab in Arcata as was the Lotus 123 program into which data was entered. Although Hilton and Lisle (1993) suggest that placement of transects and points of measurement be made randomly, measurements were taken at fixed intervals. There was a concern that introduction of random number selection might introduce some confusion with inexperienced personnel. If the choice of transects or points of measurement seemed to be missing fine sediment deposits, then transects intervals or places where measurements were taken along transects were increased. The random number function within the program was removed to make it compatible with the methods used in this survey.

Each pool was mapped to show its configuration and the location of fine sediment deposits (Appendix A). Each pool measured was also photographed and representative photographs can be found in Appendix B.

Standard aquatic kick nets were used to sample amphibians. Riffle habitats were intensively sampled by turning over rocks and placing the kick net down stream. Riffles are primary habitat for tailed frog tadpoles (Aeschaphus truei) which were a primary target of the search. Pacific giant salamanders (Dicamptodon ensatus) were also sampled in pools with nets. Adult frogs and toads along the bank were captured by hand or with use of the nets. The amphibian survey was not intended to be quantitative.

Results and Discussion

The V* statistic is the percent of the residual pool volume that is filled by fine sediment. Lower V* values signify less volume of fine sediment in transport in a stream. If fine sediment levels are low, survival of salmon and steelhead eggs and alevin are increased. Low levels of fine sediment in transport also are associated with higher invertebrate productivity because of increased interstitial spaces in stream cobbles and gravels. Thus, V* can be used as a surrogate for aquatic health of salmonid streams with regard to fine sediment. Values for V* in Rusch Creek ranged from .033 to .362 which suggests low levels of fine sediment in transport. Most values centered around .05 which suggests that less than 5% of each residual pool volume is filled with fine sediment (Figure 2).

Figure 2. Various V* values for eleven pools measured in Rusch Creek in July 1994.

All V* values for Rusch Creek may be averaged to provide a statistic that can be compared across watersheds V*w (Lisle and Hilton, 1992). Caution must be exercised when different drainages are contrasted using V* because of varying geology and other factors. However, comparison of the V*w for Rusch Creek with other tributaries of the Trinity River basin measured by Redwood Sciences Lab is interesting (Figure 3). The V*w value for Rusch Creek was .086, which is in the lower tier of values for other sub-basins measured. Bear Creek and Big French Creek had lower measured V*w than Rusch Creek. The Big French Creek watershed lies mostly within the Trinity Alps Wilderness Area and is mostly undisturbed. Bear Creek, which joins Hayfork Creek from the north just downstream of Rusch Creek, flows from a USFS Roadless Area. Horse Linto Creek, which is recognized as being in advanced recovery from past watershed problems (Buck, 1994), had a V*w value of 0.12 which is slightly higher than Rusch Creek. Rattlesnake Creek and North Fork Rattlesnake Creek both have recognized problems with cumulative watershed effects (PWA, 1994) and had approximately 14% and 18% fine sediment of residual pool volume. Grouse Creek and Grass Valley Creek are known to have problems with high levels of fine sediment production and transport as reflected by V*w, values of .25 and .50, respectively (Lisle and Hilton, 1992).

Figure 3. Comparison of V*w in Rusch Creek with various other Trinity River tributaries as measured by USFS Redwood Sciences Lab (Lisle and Hilton, 1992).

The tailed frog inhabits forested streams and is often reduced or eliminated by land management activity, such as logging (Bury, 1983; Bury and Corn, 1988). Adult tailed frogs live near the edge of streams and may attain an age of 14 years. They respire through their skin; therefore, any change in the microclimate of stream side zones can cause problems for respiration of this species. Tailed frog larvae or tadpoles have a suction cup mouth to maintain position in the stream and scrape algae off rocks. If high levels of sediment are in transport, tailed frog larvae have a low survival rate. One primary reason for the survey of amphibians was to discover presence or absence of this indicator species of aquatic ecosystem health. No tailed frogs or tailed frog tadpoles were found. Various possible reasons for absence of this species are discussed in the conclusion.

Adult and juvenile Pacific giant salamanders and adult foothill yellow-legged (Rana boylei) frogs were found in abundance. One adult western toad (Bufo boreas) was also captured. Several different year classes of Pacific giant salamanders were represented in Rusch Creek samples. Estimates of life stage were made using lengths as put forth in Nussbaum et al. (1983) with specimens 34-47 mm categorized as young of the year, 48-84 mm as older age larvae and those greater than 85 mm as adults. Many adult Pacific giant salamanders remained in the aquatic environment and retained their gills with 32 adults counted, 17 older juveniles and 10 young of the year. Figure 4 shows the break down of size classes found. This age structure may not reflect that of the population as a whole as larger specimens were often concentrated in pools where sampling effort may have been greater.

Adult foothill yellow-legged frogs were numerous along the margins of the stream. Only ten individuals were captured but numerous others eluded capture. No yellow-legged frog tadpoles were seen during the survey, although some eggs masses were found.

Figure 4. Numbers of Pacific giant salamanders by size class collected during the survey of Rusch Creek.

Conclusion

The results of the July 1994 V* survey of Rusch Creek did not confirm the hypothesis that high levels of fine sediment in the stream are limiting fisheries values or hindering the performance of instream habitat improvement structures. The comparison of V*w values of other Trinity River tributaries suggests that Rusch Creek is not highly impaired as a result of excessive sedimentation.

However, the July 1994 survey represents only a snapshot of sediment conditions in Rusch Creek and additional fine sediment was noted in storage in terraces out of the active summer low flow channel. At one point a deposit of sand over one meter deep was measured upstream of a large, downed Douglas fir tree that spanned the channel. It is possible that the flow regime in recent years was sufficient to flush the fines and sand from the active channel but below thresholds that would release a new supply from hillside sources. No gullies or obvious major sediment sources were noted on the road that parallels Rusch Creek. A significant natural source of sand are several long (>100 yds.) vertical cut banks that Rusch Creek formed while cutting a new course around old debris jams.

Some of the configurations of structures may actually be functioning as "sand traps" and, therefore, contributing to the perception that sand is a problem. In particular, there are two sites where boulder clusters were placed immediately downstream of wing deflectors formed from trimmed gabion weirs. The flow is focused by the gabions on the boulders but creates a virtual dead spot from current immediately downstream of the boulder clusters. Some of the deepest deposits of fine sediment (. 2 meters) in the active channel were found at these sites. The USFS habitat typing survey (Mayo, 1992) may have noted shallow deposits of fines within pools that were only thin layers overlying bedrock. Pacific Watershed Associates (1994), in the *South Fork Trinity River Watershed and Fisheries Restoration Action Plan,* noted that in most South Fork Trinity sub-basins there was an inverse relationship between fine sediment and sand in pools and the densities of juvenile steelhead. Rusch Creek had one of the higher densities of juvenile steelhead yet was also noted as having very high amounts of fine sediment and sand in pools. The findings of this study explain this apparent anomaly.

Pacific giant salamanders appear to be the dominant vertebrate fauna in Rusch Creek possibly constituting more biomass than salmonids. Distribution of adults and juveniles were similar to those described by Welsh and Ollivier (1992) with young of the year and juveniles preferring riffle habitats and adults found predominantly in pools. While a few older age steelhead juveniles were sighted incidentally in pools during the V* survey, adult Pacific giant salamanders may be competing for space in pools with steelhead. Predation by Pacific giant salamanders on steelhead trout juveniles may also have some impact on salmonid standing crops.

The absence of tailed frogs is a puzzle for which there are several plausible answers. Only the lowest reach of Rusch Creek was surveyed for amphibians, so it is possible that tailed frogs may inhabit areas further upstream. High densities of Pacific giant salamanders in the lower reach may prevent distribution of tailed frogs in the reach surveyed. It is not likely that tailed frogs have been eliminated by the relatively minor human disturbance in the Rusch Creek watershed to date. Since adult tailed frogs live to be 14 years of age, even if there are some years of poor recruitment of juveniles due to sediment transport populations can persist because of this long life span.

While tailed frogs were absent from the lowest reach of Rusch Creek, recent disturbance to riparian areas related to timber harvest might have posed problems for the species. Changes in ambient air temperature next to the stream were very noticeable in areas adjacent to recent timber harvests. In 1990, clear cuts occurred down to the edge of the road which is about 100 feet away from the stream. This buffer does not seem to be sufficient to maintain a cool microclimate that is required by species such as tailed frogs or Olympic salamanders. The streamside buffer left on Rusch Creek is less than would be allowed in under FEMAT (1993) guidelines. Since Rusch Creek harbors steelhead, a riparian zone of two site potential tree heights (approximately 400 feet) would now be required.

No tadpoles of yellow-legged frogs were found in Rusch Creek during the survey but some egg masses were found on the underside of rocks. During the period of the survey, advanced larval stages of yellow-legged frog tadpoles were seen in abundance in Hayfork Creek near the convergence with Rusch Creek. It would seem that the warmer temperatures in the mainstem of Hayfork Creek are leading to more rapid development of eggs and larvae than in Rusch Creek.

Volunteers from Hayfork High School and CCC members were able to collect good data with little advanced training for this monitoring activity. After data had been entered, any values that seemed to be possible anomalies were checked in the field. Fewer than 10 data errors were discovered out of the 700 data points recorded for an accuracy rate of 99%. Using volunteers to help with monitoring can help reduce costs for restoration evaluation and water quality monitoring as well as increase community involvement and education. Any volunteer monitoring program, however, needs to have built in mechanisms for quality assurance and quality control of data.

Recommendations

Classes at Hayfork High School should use the data from this exercise for academic activities and data could be collected in future years to confirm the findings of this study.

Surveys might be conducted higher in the watershed for tailed frogs.

A related study should be conducted on changes in riparian microclimate relative to clear cuts away from stream but less than those recommended by FEMAT.

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References

Bury, R.B. 1983. Differences in Amphibian Populations in Logged and Old Growth Redwood Forests. Northwest Science 57:167-178.

Bury, R.B. and P.S. Corn. 1988. Response of aquatic systems to timber harvest: a review. Pages 165-181 in K.J. Raedeke (ed.): Streamside management, riparian wildlife and forestry interactions. Contribution No. 59, Institute of Forest Resources, University of Washington, Seattle, WA.

FEMAT. 1993. Forest Ecosystem Management: An Ecological, Economic and Social Assessment. USDA Forest Service, BLM, USFWS, NOAA, EPA and National Park Service. Portland, OR.

Flosi, Gary. Personal Communication. California Department of Fish and Game fish habitat restoration specialist. Fortuna, CA.

Hilton, S. and T.E. Lisle. 1993. Measuring the Fraction of Pool Volume Filled with Fine Sediment. USDA Forest Service, Pacific Southwest Research Station, Albany, CA. PSW-RN-414. 11 p.

Knopp, C. 1993. Testing indices of cold water fish habitat. Final Report to the North Coast Regional Water Quality Control Board, Santa Rosa, CA. 56 p.

Lisle, T.E. and S. Hilton. 1992. The volume of fine sediment in pools: An index of supply of mobile sediment in stream channels. Water Resources Bull. 28 (2): 371-383.

Mayo, T.M., 1992. Trinity River Basin restoration program, Rusch Creek habitat typing report, 1991. Prepared for USDI Bureau of Reclamation, Interagency Agreement No. 9-AA-20-08530, USDA Forest Service, Shasta-Trinity National Forests, Hayfork, CA.

Nussbaum, R.A., E.D. Brodie and R.M. Storm. 1983. Amphibians and reptiles of the Northwest. University of Idaho Press, Moscow, Id. 332 p.

Pacific Watershed Associates. 1994. Action Plan for Restortation of the South Fork Trinity River Watershed and Its Fisheries. Prepared under contract to USDI Bur. Reclamation, Weaverville, CA.

Reiser, D.W. and T.C. Bjornn. 1979. Habitat Requirements of Anadromous Salmonids. In: Influence of Forest and Rangeland Management on Anadromous Fish Habitat in the Western United States. USDA USFS, Gen. Tech. Pub. PNW-96.

Rosgen, D.L. 1985. A stream classification system. In Riparian Ecosystems and Their Management: Reconciling Conflicting Uses. First Annual North American Riparian Conference, Tuscon, Ariz.

Welsh, H.H. and L.M. Ollivier. 1992. Effects of Sediments from the Redwood National Park Bypass Project (Caltrans) on the Amphibian Communities in Streams in Prairie Creek State Park. USFS Redwood Sciences Lab, Arcata, CA.