Instream and Channel Restoration Projects

The riffle-pool sites have low biological effectiveness ratings, but the mean biological effectiveness ratings of the other six structures are all 3.0 ± 0.3, that is, the six structure types have equal biological effectiveness ratings. Examination of site-specific case studies also did not yield evidence to suggest that particular variations of LWD placements induce greater biological effectiveness. All treated reaches with LWD structures are going through only the second or third year of high flow conditions. Scouring at these structures has the potential to further increase residual pool depth and improve fish habitat.

Geomorphic effectiveness ratings are high in the rock-based structures (boulder clusters and riffle-pool sites) but low at the LWD structures. It is likely that the LWD structures require flood events of a greater return period to induce bed scour compared to the rock structures. It is also possible that residual pool depths measured at rock structures have not been formed naturally, but were anthropogenically excavated during rock placement.

- As with the biological effectiveness ratings, there was little difference in geomorphic effectiveness rating between the six LWD structures; all are 2.0 ± 0.4. The geomorphic effectiveness ratings were generally lower than the biological effectiveness ratings because of an apparent lack of a significant post-construction flood event to induce bed scour.
- Time dependency is required for high effectiveness class ratings of some geomorphic parameters. For example, when an alteration in the hydraulic geometry or a reduced width:depth ratio is targeted, it may take several years for the bank erosion rates or width:depth ratios to reflect the impact of the instream prescriptions.

Geomorphic effectiveness ratings will probably show a general increase in the next few years, assuming that the prescriptions perform adequately.

Lessons Learned

- Site selection should be based on the presence of pre-restoration data.
- Summer fish sampling may give the structures a higher class ranking.
- Particular configurations of LWD placements did not induce greater biological effectiveness ratings.
- Location of structures in the channel together with site-specific conditions were responsible for effectiveness, regardless of the structure type, its orientation to thalweg, or channel confinement.
- Selection of class boundaries has a significant effect on ratings.
- This methodology is a useful technique for evaluating projects that may not have a reference site pre-established. ▲

Based on: Aquaterra Environmental Services and Babakaiff and Associates Geoscience Inc. 1999. Intensive Monitoring of Instream Works: Methodology and Year 1 Results. Prepared for Ministry of Environment, Lands, and Parks.

Development of Techniques to Rehabilitate Oregon's Wild Salmonids

M.F. Solazzi., T.E.Nickelson, S.L.Johnson, and J.D.Rodgers

Project Descriptions

Various types of habitat restoration techniques aimed at increasing rearing density of salmonids have been tried in Oregon coastal streams. These techniques have included placing structures made of wood, boulder, or concrete across the stream channel, excavating off-channel alcoves, and placing wood and boulders in various configurations into coastal streams. Most of the instances where habitat improvements were evaluated relied on data collected only during summer months.

During the first phase of the research an extensive sampling program was established on many Oregon coastal streams to evaluate the effectiveness of existing instream restoration projects. The purposes of this sampling were to:

- examine the types of rearing habitat created by habitat improvement techniques
- compare the relative effectiveness of the habitat created by these techniques to support juvenile coho salmon during the summer and winter, and
- compare the density of juvenile coho salmon in

Instream and Channel Restoration Projects

constructed habitats with that of juvenile coho salmon in natural habitats of the same type. This work was published in Nickelson et al. (1992), see above.

In this research a number of studies are summarized and it is shown that juvenile salmon use different types of habitat at different times of the year. The availability of winter habitat may limit coho salmon smolt production in many Oregon coastal streams. Habitat restoration projects that do not create good winter habitat will fail to increase the production of coho salmon smolts. The work summarized in this paper involved two treatment streams and two reference streams (Alsea/Nestucca Winter Habitat Study). The habitat modification project increased the amount of dammed pool and alcove surface area and decreased the amount of rapid, riffle and glide surface area in both treatment streams during winter. The addition of large amounts of woody debris to the main channel dammed pools helped to reduce velocities in those habitats. It was designed to examine the effects of increasing winter habitat on the production of downstream migrant salmonids, particularly coho salmon. Another study (Tenmile Watershed Restoration Study) was initiated in 1991 on Tenmile Creek and Cummins Creek, both ocean tributary streams on the central coast of Oregon. This study examined the effects of watershed restoration on the production of downstream migrant salmonids, particularly steelhead and cutthroat trout. The post-restoration sampling is ongoing.

During the second phase of this research an intensive sampling effort concentrated on a few streams before and after restoration work to determine if the habitat modification resulted in significant changes in total smolt production. A portion of this work has been submitted for publication.

Criteria for Restoration Evaluation: pools created by construction of structures placed across the full width of stream channel, constructed alcoves, and pools created by log deflectors.

Population sizes of juvenile coho were measured by blocking of the pool with seines and conducting a mark-recapture estimate using electrofishing equipment and seines.

Restoration Responses

In the first phase of the research, it was clearly demonstrated that instream restoration involving full-width log structures resulted in an increase of summer juvenile coho three times greater than the reference streams (Figure 1).

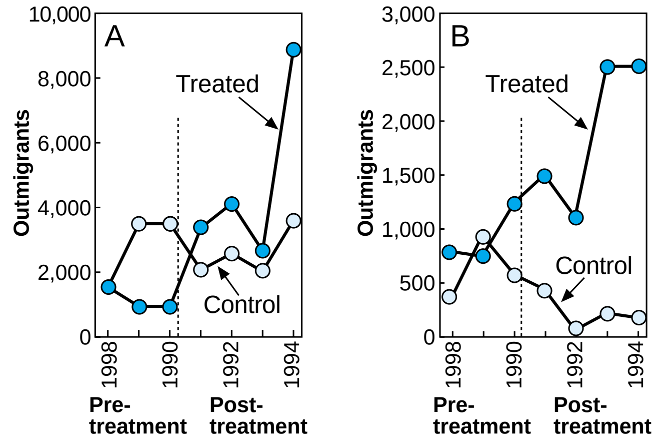

Figure 1: Increases in numbers of out-migrant coho salmon smolt after experimental addition of large woody debris to debris-poor streams in the Alsea/Nestucca streams in western Oregon (after Fig.8-1a, Tech Circ.9)

During the second phase of research, Nickelson, et al. (1992) found that adding bundles of small trees to dammed pools resulted in significant (ANOVA) increases in coho densities during winter. Habitat modification was designed to improve winter habitat for coho salmon, but the increased slow-water habitat and stream complexity also benefitted juvenile steelhead and cutthroat trout. Upper age class steelhead and cutthroat trout migrant populations did increase. This suggests that winter habitat was limiting their abundance and that the habitat modifications increased the capacity of the streams to produce steelhead and cutthroat trout.

Lessons Learned

- Construction of full-width log structures in small streams increases summer juvenile coho survival.
- Habitat modification was designed to improve winter habitat for coho salmon, but the increased slow-water habitat and stream complexity also benefitted juvenile steelhead and cutthroat trout.
- The results suggest that constructed dam pools should contain scour logs or boulders to maintain depth in a portion of the pool if it is to be used for winter rearing.
- By adding bundles of small trees to constructed dammed pools the density of coho salmon increased in the pools during the winter. ▲