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A New Method of Relating Size of Spawning Gravel to Salmonid Embryo Survival

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ABSTRACT

A new method for describing the size composition of salmonid spawning gravel was developed. For gravel samples from Idaho and Washington streams, cumulative distributions of particle sizes for gravel smaller than 25.4 mm were consistently plotted as straight lines on log-probability paper. Because of the lognormal distribution of the particle sizes in this range, the size composition of material smaller than 25.4 mm was closely approximated by two points on a regression of cumulative particle size distribution. The two size classes that best reflected the composition of the spawning gravel size were the percentage of the substrate smaller than 9.50 mm and the percentage smaller than 0.85 mm. Salmonid embryo survival was related to these two groups of particle size in laboratory tests. In these tests, 90-93% of the variability in embryo survival was correlated with changes in substrate size composition. Equations were developed to describe the effect of spawning gravel size composition on chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Salmo gairdneri*) survival to emergence in a wide range of spawning gravel mixtures. Gravel mixtures containing high percentages of fine sediment produced slightly smaller steelhead fry than gravels containing low percentages of fine sediment, but the difference was not significant ($P = 0.05$). There was no relationship between changes in gravel size composition and the size of chinook salmon emergents. In gravels containing large amounts of fine sediment, many of the steelhead and chinook salmon fry emerged before yolk sac absorption was complete.