Evaluation of spatial designs to estimate steelhead abundance using redd surveys –

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Redd surveys are used extensively to estimate spawner population size for Pacific Salmon (*Onchorynchus* spp.).  While surveying all potential spawning grounds is ideal, estimates are generally based on counts from a subset of reaches (i.e. sample) which can reduce cost substantially while meeting accuracy goals.  Here were use known redd location for three populations over several years to compare five different probability sampling designs through simulation. We interpret the results in the context of other redd sampling research and well-established sampling theory to provide recommendations for those designing redd surveys. Redd distributions tend to be very patchy, as was the case here. This results in estimators with high variance if this spatial structure is not accounted for. The coefficient of variation (CV) for estimates based on simple random sampling was high with values well over 15%. Moving to a more evenly spaced (i.e. spatially balanced) sampling design (generalized random tessellation stratified, GRTS) produced modest improvements in two of the three watersheds where spatial autocorrelation was strong. Estimates based on a stratified design and a design that included a census of all reaches during the peak count had much higher accuracy with approximate CV of generally one half to a third of GRTS alone.  We show how these improvements are predicted by theory and under which conditions the different approaches are likely to perform well.