

EVALUATION OF ALTERNATE METHODS FOR ESTIMATING NUMBERS OF OUTMIGRATING STEELHEAD SMOLTS

Abstract

The annual juvenile (smolt) migration to the lake by Great Lakes salmonids provides an opportunity for fishery managers to estimate the abundance of the smolting cohort. This information is valuable for modeling recruitment potential to the fishery and for estimates of the returning broodstock. The purpose of this study was to compare several techniques for estimating the number of steelhead *Oncorhynchus mykiss* smolts emigrating from the Betsie River in northwestern Michigan. We also compared the production of steelhead smolts from this river with other rivers in the state. In May and June, 1993-1996, we monitored emigrating smolts by use of visual observations, time-lapse videography and mark-recapture to estimate the number of steelhead smolts migrating past a lamprey weir located 18 km upstream of the river mouth. In 1993 and 1994, two observers counted smolts passing over the weir for 20 minutes out of each hour from 21:00 to 05:00 hours. In 1995 and 1996, black and white video cameras and time lapse videocassette recorders continuously monitored the passing smolts through the night. We reviewed each videotape and counts of the number of smolts passing over the weir from 21:00 to 05:00 for each night. We also collected 20 minute samples from the videotapes following the same schedules as was used for visual observations. A subsample of videotapes were reviewed a second time to measure variation of the counts. In all four years, a constriction weir was constructed every 5th night during the smolt run to capture emigrating fish and to quantify species composition and the origin of

steelhead (hatchery or wild). Steelhead smolts comprised 30-61% of all the salmonid juveniles sampled. Other species present were brown trout *Salmo trutta*, coho salmon *Oncorhynchus kisutch*, and chinook salmon *Oncorhynchus tshawytscha*. Wild steelhead comprised 12-52% of the steelhead smolts. Mark-recapture estimates and 95% confidence intervals for hatchery and wild steelhead smolts ranged from 13,837 (12,583-15,215) in 1985 to 56,661 (46,036-69,703) in 1993 and were 2-9 times greater than the estimates from direct observation and videography. The results from time-lapse videography and visual observation were similar and gave the most reliable estimates for steelhead smolts produced from the watershed. Estimates of steelhead smolt numbers from observation methods ranged from 2,198 (\pm 512) in 1996 to 9,645 (\pm 1,111) in 1994. The Betsie River produces fewer wild steelhead smolts (12-22/ha) than other streams studied in Michigan.