Abstract

The accuracy and precision of the widely used transportation-to-inriver (T/I) ratio estimator are investigated using analytical and Monte Carlo methods. The T/I ratio is the ratio for smolt-to-adult (SAR) rates for transported and untransported salmonid smolts. Repeated simulations of a binomial likelihood model under varying values of adult return rate, sample size, and true T/I ratio to examine the distributional properties of alternative T/I ratios. A bias-corrected version of the T/I estimator was found to be less biased and to have smaller variance than the traditional estimator, under all possible values of adult return rate, sample size, and true T/I ratio. Although the bias of the original estimator is positive, the bias of the corrected estimator is slightly negative. Consequently, the traditional T/I ratio estimator has a greater chance of falsely identifying a transportation benefit effect from the bias-corrected estimator. An asymptotic lognormal $100\ (1-\alpha)$ confidence interval, constructed using the log of the bias-corrected estimator, is shown to have optimal coverage properties, compared to the asymptotic normal confidence interval, and has comparatively shorter interval length. An example using the bias-corrected estimator with an asymptotic lognormal confidence interval is provided, using PIT-tag release and return data from the 1995 and 1996 transportation experiments.

Relationships between precision of the bias-corrected estimator and sample size are investigated under different values of true T/I, adult return rate, and α -level. The variance of the T/I estimator under the scenario of the size of the inriver group estimated was also derived. Sample size requirements for precision of this estimator is are generally exorbitant.