Depletion Estimators of Survey Catchability: Theory and Field Experiments

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Quantitative assessment of sessile invertebrate populations has become increasingly important in view of their high economic value and vulnerability to localized overexploitation. Survey-based indices of abundance can be scaled to absolute abundance if capture efficiency can be quantified. In recent years numerous attempts to apply the Leslie-Davis depletion estimator have been reported in the literature. Fortunately this trend has coincided with rapid advances in underlying theory. Maximum likelihood estimation (MLE) methods are sufficiently flexible to allow development of complex models. We apply MLE methods to six separate depletion experiments of surfclams (*Spisula solidissima*) conducted in the May 1997 off the coast of New Jersey. One depletion study was conducted by the R/V Delaware II; the other five were performed by commercial fishing vessels. Capture probability of a hydraulic dredge on the Delaware II was estimated at 0.59; comparable values for commercial vessels ranged from 0.38 to 1.0.

A key ingredient in the application of the depletion estimators to sessile organisms is knowledge of the position of sampling gear. Sessile organisms do not randomly mix after each tow so it is important to estimate the number of times that each patch of substrate has been covered. If this component is ignored and the sampling gear has a greater tendency to sample some areas more than others (e.g., near the center line of the depletion area) then the capture probability will be overestimated and population size will be underestimated. The magnitude of these biases depends on the pattern of sampling within the experimental area. We compare and contrast the estimates of population size and gear efficiency using traditional models and a new model in which the spatial position of the dredge is incorporated into the estimator.