Maximum likelihood estimation of stock composition

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Stock composition can be a significant issue in the management of mixed-stock fisheries of highly migratory or transboundary resources. Stock composition analysis, the determination of the contributions of constituent stocks to a mixed-stock fishery, uses differences in the frequency distributions of population characteristics among stocks to estimate the composition of a mixture of stocks. Two maximum likelihood estimators for stock composition analysis are developed, beginning with the formulation of a likelihood model for sampling population characteristics from a mixed-stock fishery. Maximum likelihood estimators of stock composition and computational methods are given for a standard likelihood model based on inherent population characteristics and an extended model that incorporates population characteristics and unique identifiers. Simulation experiments using allozyme frequency data for chinook salmon show that the standard model produces accurate estimates of stock composition. Simulation experiments also show that the extended model can improve estimation accuracy when constituent stocks have similar population characteristics.

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