

Robustified Asymmetric Logistic Regression Model for Global Fish Stock Assessment

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Abstract : The long time-series data on population assessments are essential for global ecosystem assessment because the temporal change of biomass in such a database reflects the status of global ecosystem properly. However, the available assessment data usually have limited sample sizes and the ratio of populations with low abundance of biomass (collapsed) to those with high abundance (non-collapsed) is highly imbalanced. To allow for the imbalance and uncertainty involved in the ecological data, we propose a binary regression model with mixed effects for inferring ecosystem status through an asymmetric logistic model. In the estimation equation, we observe that the weights for the non-collapsed populations are relatively reduced, which in turn puts more importance on the small number of observations of collapsed populations. Moreover, we extend the asymmetric logistic regression model using propensity score to allow for the sample biases observed in the labeled and unlabeled datasets. It robustified the estimation procedure and improved the model fitting.

Keywords : double robust estimation, ecological binary data, mixed effect logistic regression model, propensity score

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