

Standardized CPUE from small-scale squid jigging fisheries up to 2020

Summary

Data	Sales slips data
Definition of CPUE	Daily number of squid catch per boat
Duration of data available	July to December from 1970 to 2020
Duration of data used	Whole data
Number of records used	1399 records of monthly catch and effort data by landing ports
Statistical software package applied	R(3.5.2) was applied for statistical analyses. The following R function were applied through CPUE Standardization process: dredge function of the MuMIn package for model selection; glmer of the lme4 packages for modeling.
Statistical model	Generalized linear mixed model where $\ln(\text{CPUE} + \text{const.})$ was used as response variable and normal distribution error was applied. A constant value was added to CPUE because of two zero-catch observations.
Explanatory variables for model candidates	Categorical variables of year, month, landing port and those interaction terms were incorporated. Because of data missing, two interaction terms related to landing port worked as random effect.
Model selection	Final model was selected from all combinations of the explanatory variables based on BIC.
Explanatory variables in final model	Year, month, landing port, interaction terms of year:landing port and month:landing port
Estimation of year trend of CPUE	Least squares mean (lsmean)
Estimation of confidence intervals	1000 bootstrap samples were applied to the final model, estimating confidence intervals standardized CPUE.
Remarks	Standardized CPUE showed, in general, a similar year trend with nominal one, remaining below nominal one after 2010.

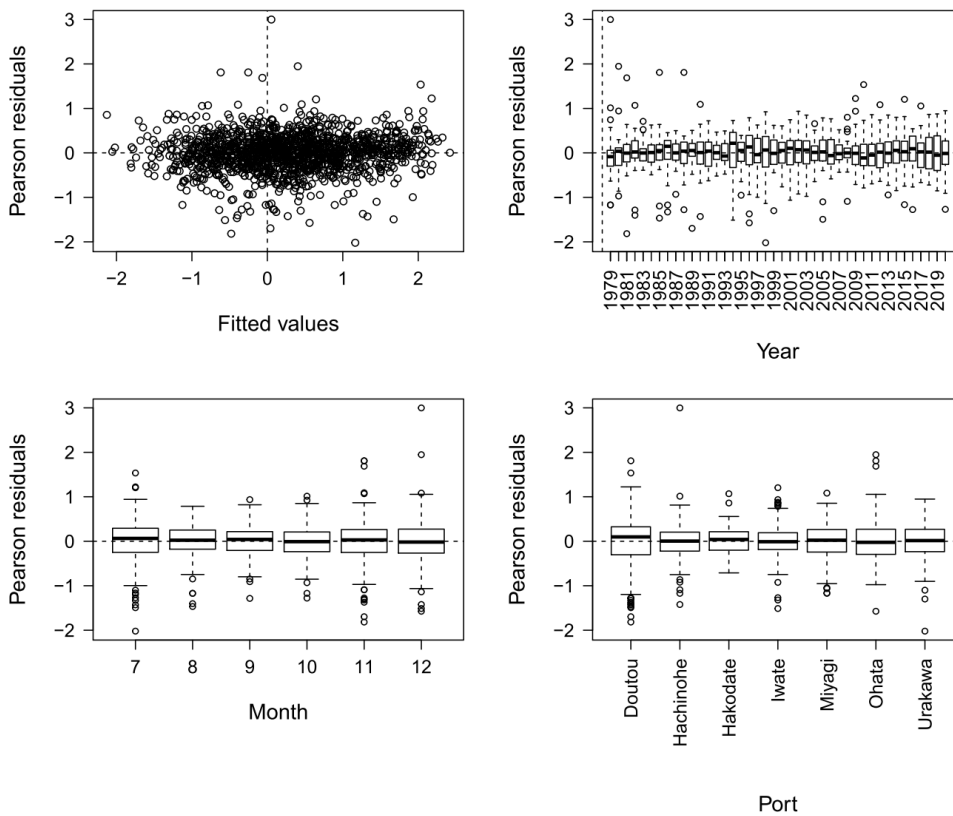


Fig. 1 Scatterplot of the Pearson residuals versus fitted values for the selected model (upper left), and boxplots of the Pearson residuals versus the covariates Year (upper right), Month (bottom left) and Port (bottom right). The lower and upper whiskers of the boxplots indicate 1.5 times the interquartile range below the lower quartile and above the upper quartile, respectively. The circles of the boxplots indicate outliers.

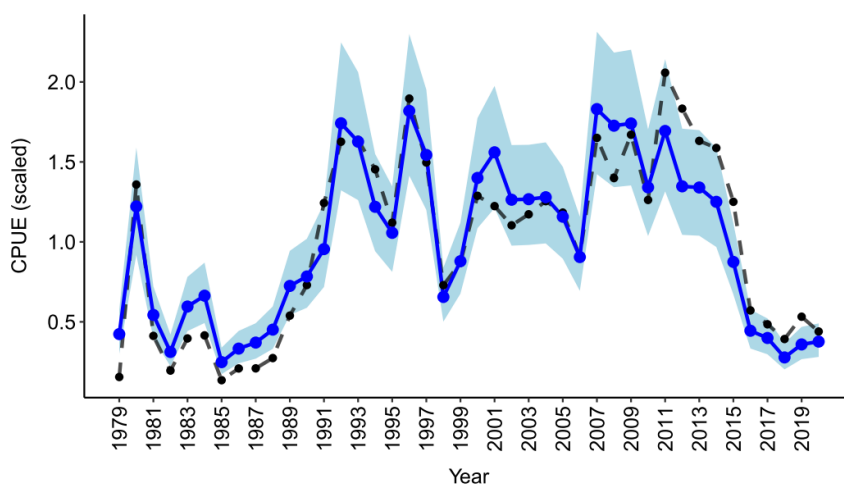


Fig. 2 Annual variation in the nominal CPUE (black line) and standardized CPUE (blue line). Light blue area indicates the 95% confidence interval for the standardized CPUE.