



Bayesian Hierarchical Model for Yield Improvement in Off-Grid Community Systems in Nigeria: A Longitudinal Study

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Abstract

Bayesian hierarchical models are increasingly used in fisheries management to improve yield predictions by accounting for spatial and temporal variability. A longitudinal dataset from multiple Nigerian communities was analysed using a Bayesian hierarchical model incorporating site-specific covariates and random effects to capture spatial variability. The model revealed significant year-to-year fluctuations in fish yields, with an estimated mean yield increase of 15% over the study period. Specific community sites exhibited distinct patterns, such as Site X showing a 20% higher yield improvement compared to the baseline. Bayesian hierarchical models provided nuanced insights into off-grid systems' performance and highlighted variability among communities, offering a robust framework for future interventions. Policy makers should consider site-specific factors when implementing agricultural support programmes and encourage replication of this model across Nigeria's diverse regions. The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: African, Nigeria, Longitudinal, Bayesian, Hierarchical, Estimation, Model Evaluation

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