Data-filtering-based or model-based methods: comparison for a data-limited-stock abundance indicator. Case study on a striped red mullet stock.

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Development of **abundance indicators** is important for the sustainable monitoring of exploited resource stocks. International Council for the Exploitation of the Sea (ICES) classifies the western stock of north Atlantic striped red mullet (*Mullus surmuletus*) as a Data Limited Stock- category 5 . Only Landings Per Unit Effort (LPUE) data are currently available. One of the most used method to study LPUE data relies on **Generalized Additive Mixed Models (GAMMs)**. We decided to study LPUE as an **abundance indicator** of red mullet stock using GAMM with three different data pre-processing. Spatio-temporal scale of the study is ICES Subarea 8 (including Bay of Biscay) and 2000-2023 period.

How much performance of GAMM modeling and abundance indicator prevision vary according to the data pre-processing?

GAMM model reminder:

$$E(LPUE)_i = \beta_{0r} + f(Var)_{ir} + \varepsilon_{ir}$$

- $E(LPUE)_i$: Mean LPUE
- β_{0r}: Intercept
- $f(Var)_{ir}$: Function of explicative variable
- ε_{ir}: Residuals: non-explained LPUE variability
- r is a random effect across some groups

SACROIS data
Fishing sequences of all otter bottom trawls (OTB) which have ever caught red mullet in ICES Subarea 8

Data pre-processing	First method: without data pre-processing	Second method: light data pre-processing	Third method: hard data pre-processing
Data cleaning: Focus on the meaningful information			
filter	At least 1 sequence of red mullet by vessel × year		
Activity filter	Fishing time is maximum 1 hour*	Fishing time is maximum 1 hour* Vessel must be present more than 4 years*	At least 24 fishing sequences by year*
Fishing filter	LPUE is more than 0.4 kg* (1 fish)	Vessel must land more than 500 kg by year* Mesh size between 20 and 320 mm*	Mesh size between 20 and 320 mm*
Anormal data	Not considered		Research and discussions with professionals to keep or remove suspicious data
Spatio-temporal aggregation (year × 15 days duration period × ICES rectangle × vessel): Selection of the useful statistical unit			
Other filters	Not considered		More than 2 sequences in a new statistical unit
Data pre-analysis	Not considered	Cut into 2 periods following a change in LPUE declarations*	Creation of vessels typologies according to selected technical characteristics: Regression tree and Hierarchical Ascendant Classification

Best GAMM model selection (based on AIC) for each method
Analysis of goodness-of-fit and GAMMs residuals

Best pre-processing method to create a red-mullet abundance indicator

Discussed with and approved by professional fishermen during working groups “Reference fleets”.

This is an ongoing work, please feel free to ask us for more information or to share ideas of improvement!

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