

# 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 (1 explanatory variable X):

$$g(LPUE_i) = \beta_0 + f(X_i) + \varepsilon_i$$

Link function of LPUE

Model the variability of the mean (or level) of LPUE due to explanatory variables

Contains the residual variability

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!