

Marginal increment analysis of fish otoliths: new insights across a range of species

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Almost 1 000 000 calcified pieces, primarily otoliths, are sampled annually worldwide and used for fish stock assessment. Individuals' age is estimated by interpreting growth structures recorded in the calcified pieces. Age readings require therefore validation to limit errors and their impacts on stock assessment. The most common semi-direct validation method is marginal increments (MI) analysis which verifies the period and periodicity of growth increments identified by reading. This study investigated the variability of estimated age and the MI according to several potential explanatory factors (geographical area, sampling year, sex, weight, total length, otolith radius...). 54 087 interpreted otoliths (*Gadus morhua*, n=3 804; *Melanogrammus aeglefinus*, n=3 267; *Merlangius merlangus*, n=15 245; *Pollachius virens*, n=3 329; *Solea solea*, n=13 010; *Pleuronectes platessa*, n=11 076; *Lepidorhombus whiffiagonis*, n= 4 356) sampled between 2010 and 2015 from the Bay of Biscay to the North Sea were used in this study. Using generalized linear mixed effect models, we showed that the influence of sex, sampling year and area on the relationship between age and total length depends on the species. However, for all species, the otolith length measured by the *radius* has a significant effect on the relationship between age and total length. MI analysis showed an annual periodicity of increment formation. Generalized additive mixed effect models showed that the annual pattern of MI could be influenced by sampling year and area and the observed age group depending on the species, but also that the interpretation scheme remains the most significant factor.

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