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Title:

Using δ^{13}C and δ^{15}N of present and past otoliths to monitor the effects of climate change and fishing activities on the marine food web of Faroe Islands

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Abstract:

It is widely accepted that climate change and fishing activities can modify the structure of marine food webs due to their effects on species assemblages, phenologies and life history traits. On the contrary, changes in trophic functions, i.e. prey-predator interactions, created by these perturbations remain largely unexplored. However, monitoring these changes is crucial for understanding marine population dynamics and enabling sustainable stock management. So far, this monitoring has been a challenging task, primarily due to the complexity of assessing trophic relationships over time in a natural habitat. Recent findings suggest that these limitations can now be overcome by using δ^{13}C and δ^{15}N from otolith organic matter to reconstruct diet characteristics. In this study, we take advantage of this new method to understand the effects of climate change and fishing activities on food web structures and functions. Towards this goal, we used otoliths from three co-occurring gadoids experiencing different degrees of fishing pressure and belonging to different trophic niches (the saithe, the cod and, the haddock). For each species, we assessed the annual δ^{13}C and δ^{15}N of otoliths from individuals caught in Faroe Islands between 1955-2014 and modeled the temporal variations of these signatures according to fishing pressures, environmental parameters, and climate indices. The results of this study, the first one investigating the long term changes in marine trophic functioning, will allow for a better understanding and better predictions of the impacts of climate change and fishing activities on marine ecosystems.

Keywords:

Climatic change, fishing activities, trophic structure and function, cod, haddock, saithe, stable isotopes, δ^{13}C and δ^{15}N, Faroe Islands

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