EGU21-3114
https://doi.org/10.5194/egusphere-egu21-3114
EGU General Assembly 2021

A century of otolith-derived temperature exposure of Icelandic and Norwegian cod (*Gadus morhua*)

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Increasing water temperatures are predicted around the globe with high amplitudes of warming in Subarctic and Arctic regions where Atlantic cod (*Gadus morhua*) populations currently flourish. We reconstructed population abundance, oxygen isotope and temperature chronologies from otoliths of the two largest cod populations in the world - the Icelandic and the Northeast Arctic (NEA) cod - to determine if their temperature selectivity over the last 100 years was driven by rising water temperatures and/ or changes in abundance. For $\delta^{18}O_{otolith}$ analysis, individual annual growth increments from immature and mature life history stages of cod collected in southern Iceland and the Lofoten area (Norway) were micromilled from adult otoliths. Ambient temperatures of Icelandic and Norwegian cod were reconstructed using otolith $\delta^{18}O$. Linear mixed effect models were applied to identify and quantify the density-dependent temperature selectivity of both cod populations. The results indicated that Icelandic cod migrated into warmer waters with increasing abundance ($p < 0.05$), whereas NEA cod moved into colder waters ($p < 0.001$). The temperature selectivity of NEA cod was also significantly correlated with water temperatures at 0-200 m depth ($p < 0.001$), indicating that NEA cod were at least partially exposed to increasing ocean temperatures due to global warming. Stable oxygen isotope and ambient temperature chronologies can be an important tool for sustainable management plans in terms of future global warming as it can be used to predict re-distribution as oceans warm.