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Optimizing otolith $\delta^{18}O$ values for shelf-scale determination of provenance in a migratory flatfish.

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The oxygen isotope ratio $\delta^{18}O$ in the otoliths of marine fishes is increasingly used to back-calculate their temperature experience and to discriminate among stocks. The impact of salinity induced variability in water $\delta^{18}O$ on sea temperature estimation from otolith $\delta^{18}O$ has previously been tested using the reconstructed movements of the flatfish plaice, *Pleuronectes platessa* L., calculated from archived data collected while the fish were at liberty, in the comprehensively modelled North Sea. This study demonstrated that otolith $\delta^{18}O$ of mature free-swimming plaice largely reflected environmental temperature and salinity at the time of deposition, and annual $\delta^{18}O$ signatures allowed accurate broad-scale sub-stock identification. Drawing on the same dataset, we here examine the potential utility of otolith $\delta^{18}O$ to geolocate fish at a finer resolution during their annual migration cycle. In plaice from 3 geographically discrete summer feeding zones, we compared predicted and measured otolith $\delta^{18}O$ values by month and by group to optimize quarterly groupings to best predict group membership. Although measured $\delta^{18}O$ values sometimes fell outside the expected ranges, observed seasonal $\delta^{18}O$ mainly corresponded with predicted values. Even in seasons where the two did not fully match, differences in observed $\delta^{18}O$ were sufficient to allow good discrimination among groups. Observed $\delta^{18}O$ was further used to probe feeding and spawning site fidelity of several mature females. Our results demonstrate how informed interpretation of otolith $\delta^{18}O$ values can provide independent fisheries-relevant data on fish stock characteristics not readily obtained by conventional means.

Keywords: Fish migration, Oxygen, Stable Isotopes, Natural Tag, Plaice, North Sea.

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