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Reconstructing Holocene seasonal hydrographic variability in the eastern North Atlantic using bivalve shells from St Kilda, Scotland

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Bivalve shells like Arctica islandica and Glycymeris glycymeris can be used as highly resolved archives of past marine climate and long-term biomonitors. The annual growth patterns of the shell reflect the environment the animals live in and by cross-matching these growth patterns it is possible to construct multi-centennial, annually resolved chronologies that form a temporal template for isotope sampling. The aim of this study is to detect a signal of Atlantic hydrographic variability in Scottish Shelf Seas that is as far as possible uncontaminated by other influences. In May 2014, we collected dead valves and young live specimens of G. glycymeris from St Kilda, Outer Hebrides, Scotland, and in April 2016, live specimens of A. islandica were collected at the same location. This area is of particular interest as it is close to the Scottish shelf margin, has negligible freshwater input, and is thought to represent open-ocean North Atlantic signals well. We here present two floating chronologies, each spanning >180 years, built from dead-collected G. glycymeris shells from St Kilda. All the shells in these chronologies were assigned radiocarbon ages between 3700-3300 cal yr BP. By combining the radiocarbon dates and the chronological data derived from cross-matching annual bands in the shells, one of the floating chronologies could be further constrained to 3750-3500 cal yr BP (95% range). Sub-annual δ18O data from the floating chronologies and from the modern specimens show a strong seasonal signal and multi-year trends. We calibrate the δ18O results from the modern specimens with instrumental data, which enables us (subject to the assumption that there has been no change in δ18Owater) to compare mean and seasonal seawater temperatures between the present day and the fourth millennium BP.