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Oceanographic conditions govern shell growth of *Arctica islandica* (Bivalvia) in surface waters off Northeast Iceland

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Shells of the long-lived bivalve *Arctica islandica* provide absolutely dated, highly resolved archives of environmental variability in the extratropical realm. Shell growth rates of contemporaneous *A. islandica* specimens are synchronized by one or several environmental factor(s), such as seawater temperature, food supply etc. Based on the growth synchrony, increment width records can be combined to composite chronologies. However, according to existing studies, *A. islandica* specimens from shallow waters do not show synchronous changes in shell growth and may thus not provide information about environmental conditions such as sea surface temperature.

Here, we present the first statistically robust composite chronology of *A. islandica* from unpolluted surface waters (8-23 m) off Northeast Iceland. The complete record spans the time interval of 1835 to 2012. Times of enhanced shell growth coincide with periods of higher temperature and elevated food supply. Instrumental sea surface temperature (SST) during the growing season explains up to 43% of the variation in relative shell growth. However, the correlation strength varies over time.

When the environmental conditions at the sampling site were stable over many consecutive years, i.e. one of the two major surface currents (the warm, nutrient-rich Irminger Current or the cold, nutrient-deficient East Icelandic Current) predominated the area over longer time intervals, the growth synchrony among coeval *A. islandica* weakened and the correlation between shell growth and SSTs was markedly reduced. Conversely, if the habitat was under the alternating influence of both ocean currents, shell growth was stronger correlated to each other and to SST. Thus, environmental variability is required to synchronize shell growth rates within an *A. islandica* population. This study further enlightens the relationship between bivalve shell growth and environmental variables.