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Reef-building oysters record seasonal variations in water mass-properties of tidal basins from the Central Wadden Sea (North Sea)

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Before proxy records can be reliably employed in palaeoclimate research, calibration studies have to be conducted to assess the confidence intervals of the respective proxies. Here, we use shells of the fast growing Pacific oyster *Magallana gigas* from the Central Wadden Sea, North Sea, a temperate barrier island-backbarrier tidal flat-salt marsh system with large seasonal changes of water mass-properties, for the calibration of geochemical proxies. *M. gigas* represents a non-native invasive species that rapidly develops oyster reefs. Calcite shells of two specimens from the intertidal and subtidal zones were sampled in high resolution yielding sub-monthly data sets. The time period represented in the shell, based on $\delta^{18}O$ age modelling, was estimated at 8-10 years and the growth of the shells was restricted from (late) spring to (early) autumn of each year. Mg/Ca, Mn/Ca and Sr/Ca ratios of the intertidal and subtidal specimens show similar seasonal patterns. Mg/Ca and Sr/Ca ratios are investigated as high-resolution sea surface temperature (SST) proxies. Important ontogenetic effects (i.e., increasing time-averaging with increasing age) as well as intra-species variability are discussed as limiting factors for the proxy development. Intertidal Mg/Ca ratios show only a significant correlation to the high-resolution SST record of the Central Wadden Sea when the early ontogenetic stage is considered. Sr/Ca ratios were comparable in terms of absolute values and amplitudes to those of *M. gigas* in the Northern Wadden Sea, but amplitudes were decreasing with increasing ontogeny. These findings seriously hamper the application of Mg/Ca and Sr/Ca for reliable palaeotemperature reconstructions regardless of ontogenetic stage. The Mn/Ca ratios were investigated as proxy for Mn cycling in tidal basins, where it is interrelated with seasonal changes in primary production. In addition to the generally observed seasonal variability of the Mn/Ca records, the subtidal Mn/Ca is significantly elevated compared to intertidal Mn/Ca. The subtidal Mn/Ca offset likely reflects differences in Mn cycling in tidal settings and could, therefore, serve in the palaeorecord as indicator to differentiate inter- and subtidal habitats in the same embedding sedimentary facies. This habitat effect has to be considered as an important factor besides environmental change when interpreting the high-resolution proxy record of fossil oysters.