Geophysical Research Abstracts,
Vol. 11, EGU2009-13597, 2009
EGU General Assembly 2009

Environmental regulation of bivalve growth in the southern Barents Sea: A combined ecological and geochemical approach

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Ecological and geochemical analyses of bivalve shells provide potentially complimentary information on patterns and drivers of natural variability in Arctic marine populations, yet are rarely considered together. We analyzed growth rates and shell geochemistry of the Greenland Smooth Cockle (Serripes groenlandicus) from the southern Barents Sea between 1882 and 1968. Growth, stable isotope (oxygen and carbon), and trace elemental (Mg, Sr, Ba, Mn) patterns were linked to environmental variations on weekly to decadal scales. Standardized growth rates exhibited multi-year periodicity inversely related to the North Atlantic Oscillation Index (NAO) and positively related to river discharge. Up to 60% of the interannual variability in Ba/Ca could be explained by variations in river discharge at stations closest to the rivers, but the relationship disappeared at a more distant location. Stable isotope data (18O, 13C), and Sr/Ca patterns suggest that bivalve growth ceases at elevated temperatures during the fall and recommences at the coldest temperatures in the early spring, implying that food, rather than temperature, is the primary driver of the annual growth cycle. Combining annually-integrated growth results and higher resolution geochemical results thus elucidated the annual growth cycle of an Arctic bivalve and mechanisms of biophysical coupling over a range of temporal and spatial scales.