Current sea ice retreat in the Pacific Arctic is associated with significant changes in benthic ecosystems. Sea ice extent and concentration affects benthic communities by moderating water mass boundaries, and carbon delivery. However, benthic ecosystem data are typically collected when the Arctic is clear of sea ice and only consistently since the 1990’s, while records of sea ice concentration extend back to the 1960’s and earlier. To examine the responses of benthic ecosystems to changing sea ice regimes, this study compares existing records of sea ice concentration using the stable isotope sclerochronology of bivalve shells. We focus on the 5 to 15-year record proxy isotopic record associated with suspension feeding *Serripes groenlandicus* and *Astarte borealis*, collected live from the northern Bering and Chukchi seas. Each water mass has a documented mean $\delta^{18}O_{H_2O}$ value, ranging from heavy isotope depleted Alaskan Coastal Waters ($<-1 \, \delta^{18}O$ VSMOW) to water that has comparatively higher ratios of the heavy isotope $^{18}O (>0 \, \delta^{18}O$ VSMOW). The related $\delta^{13}C$ values of shell carbonate are associated with different inorganic and organic carbon sources, as well as to region wide variations in the carbon/nitrogen ratios of organic matter, and the concentration of sediment chlorophyll-$a$, and total organic carbon in surface sediments. In addition, $\delta^{13}C$ values vary in the summer and are homogenized in the winter, potentially preserving a signal of sub-ice circulation. When combined, $\delta^{18}O$ and $\delta^{13}C$ values of bivalve carbonates have the potential to track changes in water mass location, carbon sources, and sub-ice water circulation, and these proxy indications can be extracted from the growth rings of well-preserved bivalve aragonite.