Estimating the Season of Harvest of the Eastern Oyster (*Crassostrea virginica*) from the St. Catherines Island Shell Ring (9Li231)

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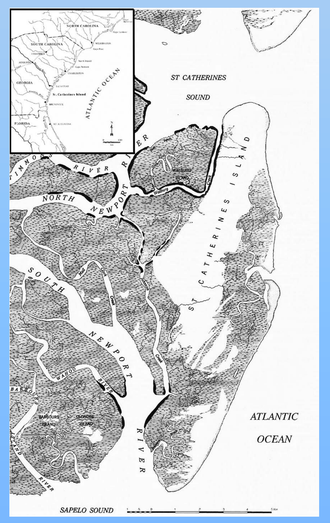
Introduction: St. Catherines Island is a barrier island located off the coast of Georgia (Liberty County), 50 miles south of Savannah (Figure 1). Recent excavations on St. Catherines Island have revealed a Late Archaic period shell ring that dates to 4500-3000 BP (Figure 2). Shell rings are circular shaped midden structures composed primarily of oyster shell but also contain the remains of other invertebrates, vertebrate species and artifacts. The primary interests in the study of shell rings include processes of construction and/or accumulation, composition, and seasonal use and/or occupation patterns. Evidence for seasonal resource procurement on St. Catherines Island comes primarily from analysis of vertebrate remains and hard clams (*Mercenaria mercenaria*). Determining seasonality of use of the fauna excavated from the shell ring is an important step toward understanding the settlement and subsistence strategies of the people who inhabited the island.



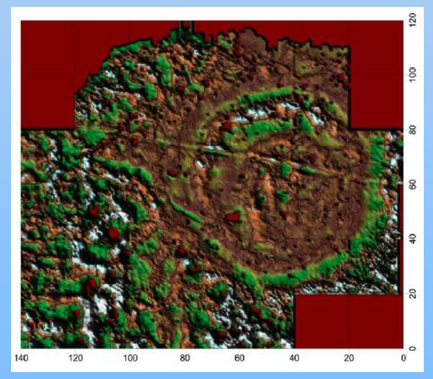


Figure 1. (Left) Map showing location of St. Catherines Island, Georgia.

Figure 2. (Above) Resistivity map of the St. Catherines Island Shell Ring.

One of the primary ways in which the question of seasonal settlement of coastal shell bearing sites in the Southeast has been addressed is through sclerochronology: the study of annual growth increments contained in the hard parts of mollusks. Bivalves deposit carbonate in concentric rings along their shell margin. The oxygen isotopic composition of skeletal carbonate is primarily influenced by the water temperature at the time of precipitation while dissolved inorganic carbon in the source water influences the carbon isotopic composition. Therefore, carbonate samples taken from the dorsal to ventral margins of the umbo provide a record of environmental conditions and growth of that organism. Oysters are often the most numerous component in southeastern coastal shell middens, but have not been considered suitable proxies for seasonality studies due to various environmental factors that may distort the growth record. This research uses stable isotope geochemistry to determine whether oysters on St. Catherines Island accurately record ambient environmental conditions.

Materials and Methods: Approximately 30 oysters were hand collected at low tide from three sites: Kings New Ground Marsh North, Goat Point Marsh, and Cemetery Road Marsh during the middle of each month from July 2006 to July 2008 to establish a modern analogue for comparison (Figures 3 and 4).

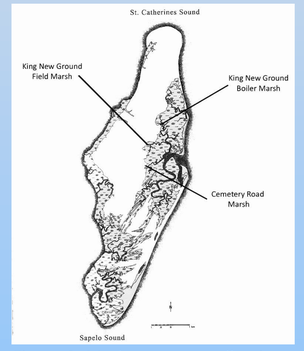


Figure 3. Modern oyster collection sites.

Figure 4. Nicole Cannarozzi collecting oysters.

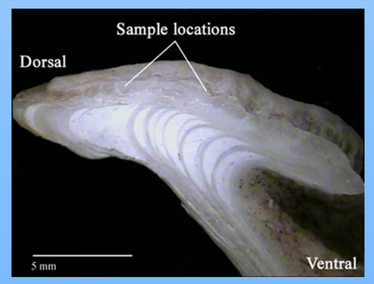


Figure 5. Radial cross-section through the umbo showing sample locations.

Specimens were immediately frozen and then transported to the Florida Museum of Natural History for processing and storage. They were then cleaned and separated into singles, soft tissue was removed manually and shells were dried in a dessicator. Measurements of water temperature and salinity were recorded and water samples taken at the collection site. Salinity levels were measured using a refractometer and water temperature was recorded using a digital thermometer. Only modern samples from Cemetery Road Marsh were analyzed to control for possible environmental variations among sites. Two well-preserved archaeological samples were selected from column samples excavated from the St. Catherines Island Shell Ring. Prior to sampling for isotopic analysis, the left valve of each specimen was radially cross- sectioned and mounted on glass slides with JB® KWIK Weld™ and fixed to the sample stage of a Merchantek EO Micromill at the Florida Museum of Natural History Stable Isotope Laboratory. Carbonate samples were drilled in ontogenetic sequence from the calcitic, foliated layers of the bisected surface of the umbo only (Figure 5). The isotopic analyses were conducted in the Light Stable Isotope Mass Spectrometry Laboratory, Department of Geological Sciences, University of Florida. All samples were analyzed according to standard techniques (Jones and Quitmyer 1996). All values are reported in standard notation where:

$\delta\,^{18}O = [\,(^{18}O/^{16}O)_{sample} / (^{18}O/^{16}O)_{standard}{}^{-1}] \times 10^{3}$ permil(‰).

Results and Discussion: Figure 6 (A-D) shows the $\delta^{18}O$ and $\delta^{13}C$ values of the modern and archeological shell samples. Modern oysters have $\delta^{18}0$ values between -1.97 to 1.38‰, and archaeological oysters have values between -2.32 to 1.30‰. Higher oxygen isotope values indicate warmer temperatures while lower values indicate cooler temperatures. A seasonal pattern of shell formation is shown in the four shells. Based on the range of temperatures in all profiles, the archaeological oysters were collected during the spring. The carbon isotope profiles show a more complex pattern. In the archaeological samples $\delta^{13}C$ values track sinusoidally with $\delta^{18}O$ values while carbon values in the modern samples are essentially flat. This could be attributed to a difference in the water chemistry on the coastal and mainland sides of the island. Modern oysters were collected from the eastern side of the island where other than precipitation there is little to no freshwater input. The shell ring is located on the western side of the island so it is likely that these oysters were collected from marshes closer to the ring. Marshes on the western side of the island experience different tidal cycles and may experience more freshwater mixing or increased evaporation than marshes on the eastern side of the island. Future studies will focus on indentifying morphological indicators of seasonal growth and understanding differences in water chemistry between the eastern and western side of the island.

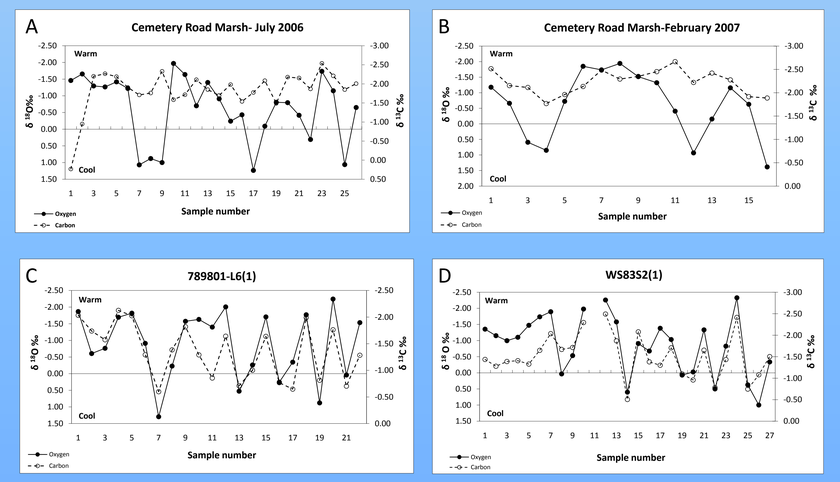


Figure 6. Oxygen and carbon isotope profiles from the oyster umbo. (A) and (B) Modern *C. virginica* from the Cemetery Road Marsh site- July 2006 and February 2007 collections. (C) and (D) Archaic *C. virginica* from the St. Catherines Island Shell Ring excavation units WS83S2 and 789N801E.

References:

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