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# Life history traits of the bivalve mollusk \textit{Saxidomus gigantea} from the coast of British Columbia: Insights for paleoclimate and archaeological applications

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The bivalve *Saxidomus gigantea* (butter clam) is the shellfish species most commonly recovered from archaeological midden deposits on the coast of British Columbia (BC). Shell middens have traditionally been used to interpret paleo-diet and the utilization of shellfish resources in this region. However, the potential for identifying the season of shellfish collection, and by proxy the season of site occupation, as well as paleotemperature has been limited by (1) the uncertainty of the timing of growth band formation; (2) the ability to reliably identify annual increments; and (3) an understanding of the influences of freshwater sources from rivers and precipitation on growth increment and growth line formation. Modern shells were collected alive on a monthly basis for a period of one year from Pender Island, southern BC. These shells were then analyzed to determine the life history traits of this species, such as season of growth line formation, growing season and growth rate. It is still unclear whether this species precipitates its shell in isotopic equilibrium with ambient seawater. Oxygen isotope analysis confirms a seasonal variation in growth increment formation, with the most positive $\delta^{18}$O values of -0.48 ‰ associated with winter line formation (annual growth lines), and the most negative values (on average, -3.60 ‰) with more rapid warm-temperature growth. The range of $\delta^{18}$O-derived temperatures is ca. 9˚C larger than the annual range of satellite temperatures indicating a freshwater influx. Intra-annual increments show clear seasonal oscillations with the broadest increments (age 4: 137 $\mu$m) in the summer and very narrow increments (age 4: 6 $\mu$m) or a growth cessation during the winter months. Butter clams grow from approximately February/March through to October/November. A fortnightly pattern of micro-increment width as identified by frequency analysis suggests a diurnal periodicity in the formation of intra-annual increments. Collection circumstances, such as low or high tide, springs or neaps, day or night and the relative position in the intertidal zone can be precisely estimated by analyzing the lunar daily growth increments. A combined approach (sclerochronology and stable isotope analysis) helps to distinguish between annual growth lines and disturbance breaks to refine estimates for the season of shell collection. This research provides new insights into the biology and seasonal growth cycles of the butter clam, which is crucial information for interpreting the season of shellfish collection and paleoenvironment. Biological and local environmental factors must be taken into consideration when using this species to determine patterns of seasonal shellfish collection in the archaeological record and to understand the gathering strategies of coastal communities.