Anti-predation strategy, growth rate and extinction amongst Pliocene scallops of the US eastern seaboard

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Placopecten, *Chesapecten* and *Carolinapecten* are scallop (pectinid bivalve) genera occurring in the Pliocene of the US eastern seaboard. The first, present in the area today, is a smooth, streamlined form, adept at escaping predators by swimming ('flight' strategy). The other two, which are extinct, are plicate ('ribbed') forms. Plication facilitates a 'resistance' strategy towards predators which is benefited by large size and high shell thickness - maximally so if these states are achieved early in life. Oxygen isotope profiles show that early ontogenetic extensional growth in Pliocene *Placopecten* was at the same moderate rate as in modern *Placopecten*. By contrast, in *Chesapecten* it was as fast as in the fastest-growing modern scallop (*c.* 80 mm/annum), and accompanied by development of an unusually thick shell, while in *Carolinapecten* it was substantially faster still (<150 mm/annum). Rapid growth in *Chesapecten* and *Carolinapecten* was probably enabled by high primary productivity, for which there is evidence from sediment composition and the associated biota. The extinction of *Chesapecten* and *Carolinapecten*, and the survival of *Placopecten*, can be attributed to a decline in primary productivity which prevented a maximally effective 'resistance' strategy towards predators but had no deleterious impact on a 'flight' strategy.