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Growth of Pisidium casertanum (Poli) in West Central Ohio

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BRIEF NOTE

GROWTH OF *PISIDIUM CASERTANUM* (POLI) IN WEST CENTRAL OHIO[1]

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Clams of the family Sphaeriidae are found in most freshwater habitats. They are hermaphroditic and ovoviviparous (Mackie 1978), brooding their young in marsupial sacs formed as outgrowths of the gill filaments. In the genera *Sphaerium* and *Musculium*, several distinct larval stages can be present within a single adult, whereas in *Pisidium* only a single ontogenetic stage is present in a given adult (Heard 1977). Consequently, individuals of *Sphaerium* and *Musculium* produce a number of broods over a short period of time while in *Pisidium* more time is presumably required between successive series of broods.

Several life-history studies of sphaeriid clams are known: *Musculium* (Thomas 1963, Gale 1977, Mackie *et al* 1976, Mackie 1979), *Sphaerium* (Avolizi 1976, Mackie 1979) and *Pisidium* (Heard 1965, Ladle and Baron 1969, Holopainen 1979, Meier-Brook 1970, Thut 1969, Mackie 1979). Only the studies of Mackie (1979) and Thut (1969) present a full seasonal pattern of growth for North American species of *Pisidium*.

Clarke (1973) states that *Pisidium casertanum* (Poli) is perhaps the most common species of *Pisidium* and is truly cosmopolitan, occurring throughout Eurasia, Africa, Australia, and South, Central and North America. Populations of these clams are reported in habitats ranging from ephemeral ponds to benthic zones of deep lakes. Our study describes aspects of the life-cycle of *P. casertanum* in a spring-fed stream with a relatively small annual temperature range.

Clams were collected monthly during the winter and bimonthly or weekly during the summer of 1974 and less regularly during 1975 from the west branch of Cedar Run at Cedar Bog, near Urbana, Ohio (USGS) map quadrangle Urbana West, Champaign County, Ohio: 40° 03.42'N 83°47.98'W). At certain times (see fig. 1) physical and chemical characteristics of the stream were recorded, including temperature and oxygen concentration (YSI Model 54 oxygen meter), conductivity (YSI Model 33 conductivity meter) and hardness (EDTA method, American Public Health Association 1976).

Usually more than 50 clams were removed from the stream sediment with a sieve (mesh opening = 0.5 mm) and fixed in the field with 12% neutral formalin. Shell length (greatest anterior-posterior dimension) was measured to the nearest 0.1 mm on a stage micrometer under a dissecting microscope. Samples collected within one week of each other were combined for a mean date. Samples were separated according to generation (adult *vs* juvenile) by the visual examination of frequency distributions of shell lengths. Generation samples with overlapping size distributions were separated by plotting cumulative frequency distributions on probability paper (Harding 1949, Cassie 1950, 1954).

Monthly variation in temperature and dissolved oxygen showed that in 1974 water temperature varied from 5.8 °C to 15 °C since the stream is fed from an underground source (Richard 1974), while

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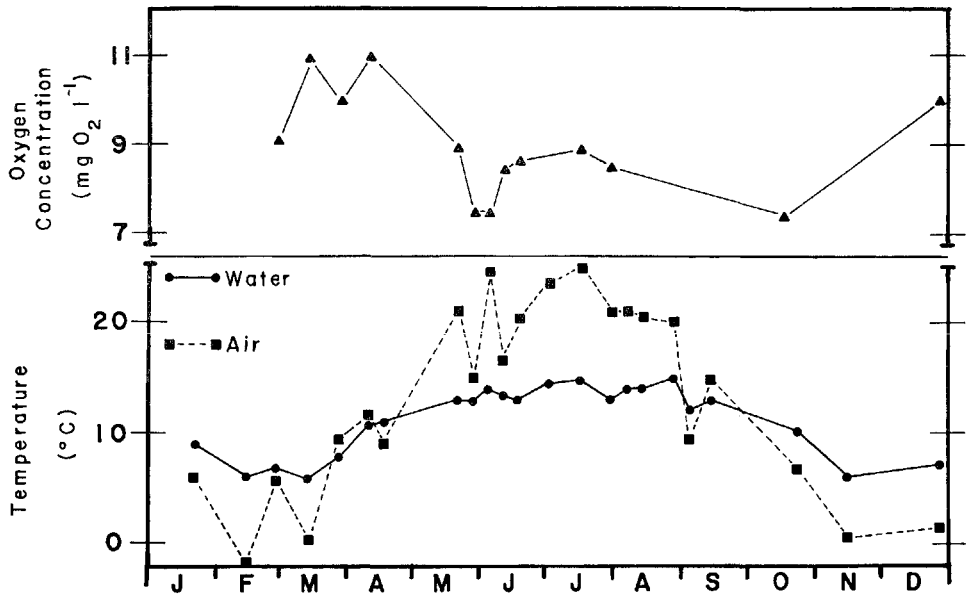

FIGURE 1. Dissolved oxygen and water and air temperature in relation to months for the west branch of Cedar Run.

as expected, air temperature had a much greater range (fig. 1). Gilbert and Hennen (1974) have shown that air temperature in the bog area fluctuates much less than that in the surrounding areas. The oxygen content, although decreasing in summer and fall, was relatively high throughout the year, ranging from about 65% to 98% saturation. Mean annual conductivity was 564 μmhos (range: 460–650 μmhos), total hardness was 410–564 mg/ℓ as $CaCO_3$, Ca hardness was 310–414 mg/ℓ as $CaCO_3$ and Mg hardness was 160–310 mg/ℓ as $CaCO_3$. The pH was usually > 7.2 (6.7–8.0), indicating that the stream, like the rest of the bog, is alkaline and not acidic. Bogs are by definition acidic; this habitat is actually a fen and alkaline in its water characteristics.

Size distributions of *P. casertanum* samples studied in 1974 revealed that there was one generation born per year with recruitment during April-August (fig. 2). The 1974 newborns were produced by clams born in 1972. Only *P. castertanum* with shell lengths of at least 3.0 mm are expected to contain extramarsupial larvae (those larvae ready to be born, Mackie 1979); therefore, these clams take about 24 months to reach shell lengths of 3.0 mm, have one period of reproductive contribution and have a potential maximum life span of 30 to 33 months.

The life-cycle pattern of *P. casertanum* from Cedar Run is the only report with a complete sequence of samples over a full year for a stream population. The only other report we found of a stream population of *P. casertanum* is by Heard (1965). Although Heard (1965) didn't follow this population over an entire year, he reports one reproductive period during spring-summer. Holopainen (1979) found a 3 year life span for a littoral population in Lake Pääjärvi, Finland, with a single period of summer reproduction. He also reports a 3 year life span with 2 periods of reproduction for a population in Lake Esrom, Denmark. Thut (1969) reports a one year life span with one period of reproduction in early summer in Lake Washington. Mackie (1979) has examined 2 populations from ephemeral habitats with one population showing a single annual life-cycle with one period of reproduction while the other has 2 generations per year with complete summer replacement.

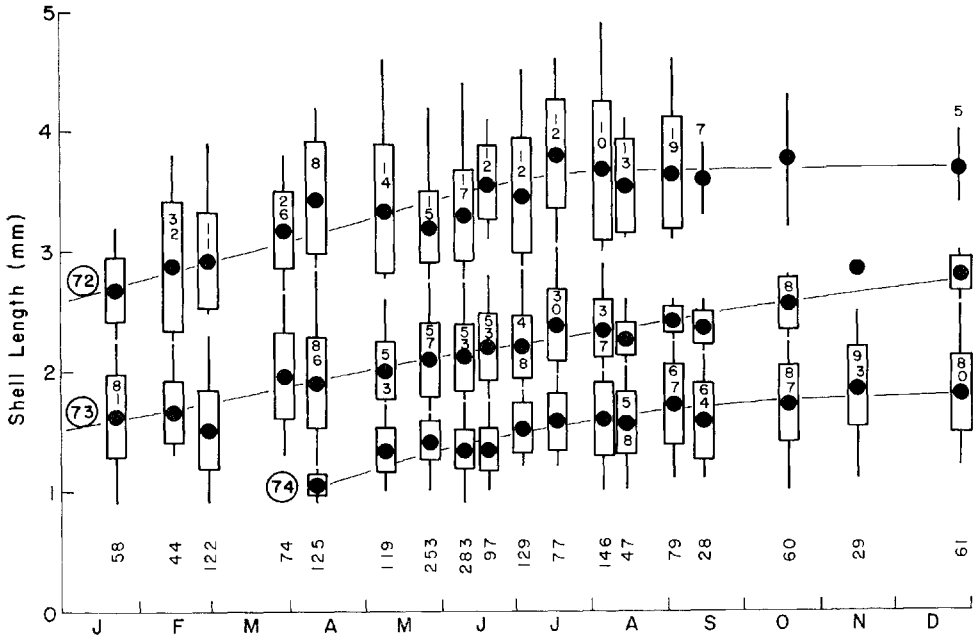

FIGURE 2. Mean shell length (solid black dot) in relation to months for generation samples of *Pisidium casertanum* for 1974. Vertical bars indicate the range and rectangles represent ± standard deviation. The 3 generations were born in April-August of 1972, 1973 and 1974 (indicated in open circles) for the largest to smallest size distributions respectively. The number of clams represented on each date is given at the bottom of the figure with the percentage of animals for generations indicated in or near the rectangles.

The life cycle of *P. casertanum* ranges from 2 generations per year with complete replacement (Mackie 1979) to the simple annual (Thut 1969, Mackie 1979) to three year life spans with one or two periods of reproduction (Holopainen 1979). *Pisidium casertanum* at Cedar Run (fig. 2) is well within this range with a maximum life span of 30 to 33 months with a single period of reproductive contribution after 24 months of growth and maturation.

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