Reoccurrence of *Cyclonaias tuberculata* in the Huron River, Michigan

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In 1935, mussels virtually paved the bottom of shoal-like niches of the Huron River in southeastern Michigan. Characteristic assemblages existed in the small, medium, and large-river zones, as well as in creeks and river-lakes (Van der Schalie, 1970). Since then, human activities have brought about serious depletion among the 25 species of mussels that occupied long stretches of the Huron. One of those species, *Cyclonaias tuberculata* (Rafinesque, 1820), was abundant between the cities of Dexter and Ann Arbor in the 1930's but was designated as a rare and endangered species by Michigan's 1975 Natural Features Inventory.

Water quality in this river segment was improved in recent years (Gannon & Meier, 1986) and currently supports a top quality, warm water fishery. In this note we report findings of a survey conducted between Ann Arbor and Dexter during the summer of 1986 to determine if *Cyclonaias tuberculata* had reestablished itself in this portion of the Huron River.

The study area is a 16-km reach, between river miles 60 and 70. In this river segment, width ranges between 12 and 45 m and depth between 0.9 and 9.0 m (Say & Jansson, 1976), except for low flow conditions when depths of 0.15 m were recorded. The 24-year annual mean discharge ranges between 3.96 m^3/sec and 16.7 m^3/sec.

Six sampling locations were identified as having suitable substrate for *Cyclonaias tuberculata*. Preliminary collecting established the presence of living or dead *Cyclonaias* at each of the sites. Where site conditions permitted, 76 randomly sampled 1-m^2 plots were surveyed, 36 on each side of the river, six times between June and August. Shells were hand-picked from the shallows, digging several inches below the surface. Dead valves deposited as middens by muskrats and raccoons were included. The length of each shell was recorded, as well as whether the specimen was live or dead. Living specimens were returned to the river.

Of the 370 specimens of *Cyclonaias tuberculata* found, 23.5% were live animals. The three upriver stations yielded 70% of the live specimens. Other genera found in this reach of the river were *Lampsilis*, *Villosa*, *Anodonta*, *Elliptio*, *Ligumia*, and *Pisidium*. The age of *Cyclonaias*, approximated by the length of the shell, ranged from about 3 to 20 years (2.6 to 11.0 cm); the average age for both live animals and dead shells was approximately 13–15 years (7.3 cm).

While the species has managed to recolonize this area since its decimation some 50 years ago, its numbers remain well below prior population levels (Van der Schalie, 1970). A greater number of living specimens were located in upriver sampling sites compared to downriver sites; this may correlate with improved water quality. In recent surveys the water quality of those upper reaches was rated as very good (Gannon & Meier, 1986). The lower rated downriver area is impacted by Mill Creek, the largest source of agricultural non-point pollution to this river reach. During our study, plumes of silt and suspended sediment were observed entering the river from Mill Creek, possibly suffocating organisms. This deleterious effect may also be exacerbated by the effluent of the Dexter Sewage Treatment Plant.

Theoretical life history data suggest that a healthy population would contain greater numbers of young valves relative to older valves than were found in this survey. Three hypotheses may explain the deviation between the size frequency distribution found in this survey (figure 1) and the expected theoretical distribution. (1) Annual recruitment may be low compared to 13 to 15 years ago. (2) Greater selective mortality of young, relative to older valves, may be occurring now with small dead shells being washed to the nearest impoundment where current is slowed. (3) Sample methodology used may not be sensitive to the smallest mussels. Because young mussels are approximately 0.32 cm long at age 1 year (Neves, 1985), hand sampling is likely to miss this group. In addition, the juvenile state may occupy habitats other than those of the adult that we sampled (D'Eliscu, 1972).

The latter hypotheses were tested in the summer of 1987 when the 1986 sample sites were revisited and

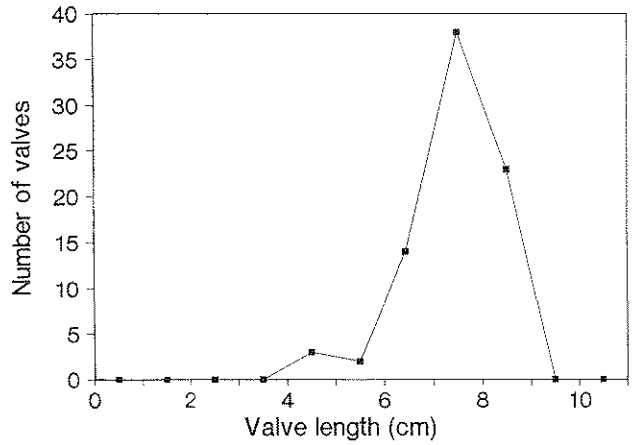

Figure 1. Size-frequency distribution of live and dead *Cyclonaias tuberculata* found in the Huron River study area.

sampled using a 2-mm mesh sieve. Three non-adult habitat types were also sampled: macrophytes, loose substrate downstream of boulders, and deep pool areas. Sampling with sieves allowed a higher percentage of live adults (53%) to be found compared to 23% in the 1986 survey. However, only one early juvenile (less than 17 mm) and four late juveniles (greater than 17 mm but less than 4 years old) were found in 450 0.25-m^2 samples. An abundance of Sphaeriidae of the desired size category were found, ruling out inefficient sampling as the problem but raising the additional concern of species competition. It has been postulated (Neves & Widlak, 1987) that the juvenile stage of Unionidae is probably the most susceptible stage to competitive interactions for food or space. Because Sphaeriidae has a competitive advantage in terms of adaptability, young Unionidae may suffer as Sphaeriidae prosper.

This survey has determined that *Cyclonaias tuberculata* has been reestablished in the Huron River between Ann Arbor and Dexter. However, the population size-frequency distribution suggests there may be a reason for additional concern. More information is needed to assess if annual recruitment of *Cyclonaias tuberculata* is sufficient to maintain a healthy mussel assemblage.

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