

Temperature Preference of the New River Shiner

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Abstract

New River shiners *Notropis scabriceps* (Cope) from the East Fork of Greenbrier River, West Virginia were acclimated to temperatures of 6, 12, 18, 24, 30, and 33 C and exposed to a 16–18 C horizontal gradient. Fish preferred temperatures higher than their acclimation temperatures of 6, 12, or 18 C, but lower than their acclimation temperatures of 24, 30, or 33 C. Preferred (P) and acclimation (A) temperatures were related by $P = 1.12A - 0.018A^2 + 4.28$. The final preferendum was calculated to be 19.3 C.

Temperature is one of the most important single factors governing the distribution and behavior of aquatic organisms (Gunter 1957; Stauffer et al. 1976). We report here on the temperature preference of the New River shiner *Notropis scabriceps* (Cope) and postulate that temperature selection is an important factor that governs the distribution of this species. The New River shiner is endemic to the upper Kanawha River drainage above Kanawha Falls in North Carolina, Virginia, and West Virginia (Hocutt et al. 1978; Jenkins 1980).

Methods

All specimens of New River shiner were collected from the East Fork of Greenbrier River at Thornwood, West Virginia during the spring of 1980, at an ambient temperature of 12 C. They were placed in a 76-liter plastic container partially filled with water from the collection site and transported to the laboratory within 3 hours of capture. Temperature in the container remained within ± 1 C of collection temperature.

Approximately 12 fish were placed in 38-liter aquaria and held at their capture temperature for 1 day, after which they were acclimated to 6, 12, 18, 24, 30, or 33 C at a rate that did not exceed 1 C/day. When the desired acclimation temperature was reached, fish were held an additional 5 days at acclimation temperatures (range ± 0.5 C).

Water temperatures in the aquaria were controlled by aquarium heaters and refrigeration units. Constant aeration maintained oxygen concentrations above 90% saturation. Vita-lites illuminated the holding and testing areas and were controlled by electric timers to simulate natural wave lengths and photoperiod.

Fish were fed crushed trout chow daily except the day of testing. Aquaria were filtered constantly and excess food was removed daily. Water in aquaria warmer than 18 C was changed weekly. Dead fish were removed immediately after they were found. Sick fish were treated with tetracycline and sulfa drugs and subsequently removed if they did not improve in one day.

Preference tests were conducted in a horizontal trough similar to that of Meldrim and Gift (1971). The trough was aluminum-coated inside with a nontoxic paint and outside with black paint to facilitate heating. It was 3.6 m long, 20 cm wide, and 25 cm deep. Twelve heat lamps beneath the trough created the temperature gradient. Water 4–8 C below the acclimation temperature was introduced at one end of the trough. Low flow and varying lamp intensities gave gradients of 16–18 C which were monitored by thermistors placed every 19 cm along the trough. The sides of the trough were enclosed to minimize external stimuli.

Eight fish acclimated to each temperature regime were tested individually. Each specimen was placed in the trough at its acclimation temperature and allowed 40 minutes to adjust to the trough. Then, each fish was observed via overhead mirrors for 20 minutes at 15-second intervals. The position of the fish with respect to the nearest thermistor was noted and the temperature recorded.

Results and Discussion

New River shiners acclimated to 6, 12, or 18 C preferred temperatures above acclimation; those acclimated to 24, 30, or 33 C preferred temperatures below acclimation (Fig. 1).

By stepwise regression analysis, the data were best fit by the equation $P = 1.12A - 0.018A^2 + 4.28$ ($R^2 = 0.57$), where P is preferred temperature and A is acclimation temperature. The calculated final temperature preferendum (Fry 1947), the point where $P = A$, was 19.3 C.

New River shiners could not be acclimated to

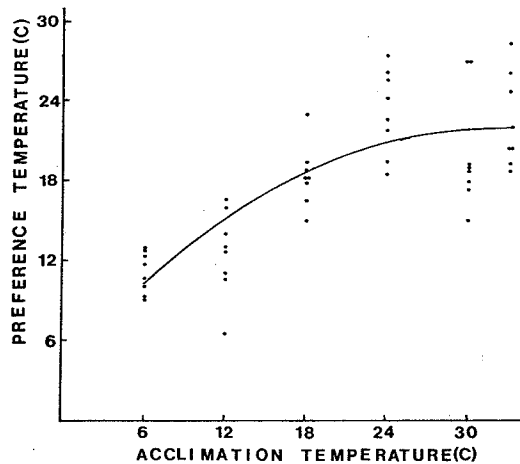


FIGURE 1.—Relationship between temperature preference and acclimation temperature for the New River shiner, $P = 1.12A - 0.018A^2 + 4.28$; P = preference temperature; A = acclimation temperature.

temperatures above 33 C even at a rate of 0.5 C/day. Several attempts were made, including some in which sick fish were treated with tetracycline and sulfa drugs. All attempts to acclimate fish to higher temperatures killed them. Treatment with drugs at lower temperatures was not necessary.

New River shiners have a restricted distribution in the higher-altitude streams of West Virginia or in streams fed primarily by springs in limestone areas (Hocutt et al. 1978). We have collected them in shaded areas of slow runs, fast-moving pools and around overhanging banks. Throughout its range, the species is restricted to the headwater areas of the New River in Virginia and North Carolina and to tributary systems in the lower reaches of the New River.

Cherry et al. (1977) reported the final temperature preferenda of several cyprinids from New River, Virginia, some of which also occur in the Greenbrier drainage: stoneroller *Camptostoma anomalum*, 26.6 C; fathead minnow *Pimephales promelas*, 26.2 C; bluntnose minnow *Pimephales notatus*, 28.4 C; rosy shiner *Notropis rubellus*, 26.1 C; spotfin shiner *N. spilopterus*,

31.0 C; and the telescope shiner *N. telescopus*, 21 C. The New River shiner has the lowest final preferendum of the cyprinids tested to date from the New River drainage.

Based on its restriction to cooler headwater and tributary areas throughout its range, and a comparison of data presented herein with other preference studies, it is hypothesized that temperature is an important factor governing the distribution of the New River shiner.

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