AQUARIUM SPAWNING OF THE NORTHERN REDBELLY DACE AND FINESCALE DACE WITH HYBRIDS OF THESE SPECIES

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My interest in Phoxinus eos (Northern Redbelly Dace) and Phoxinus neogaeus (Finescale Dace) is centered on the hybrids which occur between these two species. Therefore, I have bred the hybrids with both parent species. I have not observed mating between individuals of the same species, but I believe it is similar to what I have observed.

The fish are maintained in a greenhouse in 10 30-gallon aquaria with filtration. The water temperature in the greenhouse ranges from 70°F in the winter to around 85°F on a sunny summer day. They can tolerate the latter temperature if the aquarium is aerated vigorously. Other individuals are kept in an office with natural light, in which the temperature range is about 65 to 70°F throughout the year--about what one would expect at home. They are fed twice daily on conditioning flakes, alternated with Daphnia, baby trout chow, frozen brine shrimp, tiny baby topminnows, and baby brine shrimp. Up to 12 individuals can be kept comfortably in a 10-gallon tank. I provide several rocks for cover, and plenty of filamentous algae and underwater plants as well. They nibble on the algae frequently; probably they gain some nutrition from the microscopic fauna, but Northern Redbellies are known to feed on "much plant material, including diatoms and filamentous algae, as well as zooplankton, insects, and occasionally fish," as C.L. Smith summarizes.

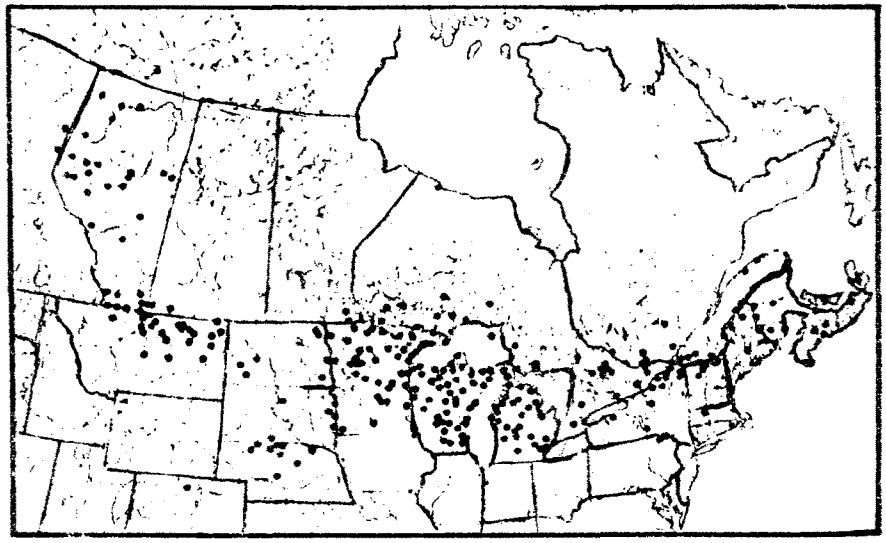
To induce breeding, several males and females are placed in a refrigerated room. I lower the temperature to about 35°F over a period of about three weeks. The day length is decreased from 14 hours of light to seven hours of light, and the light is dimmed by covering the light or the tank with black plastic. One could provide a similar treatment by putting the fish on the porch or in the garage in the fall and leaving them there until spring. I feed these fish only once a week, as they remain robust at this temperature with little food. Their metabolic rates must slow down considerably.

After two to three months of the "winter treatment," the temperature and the day length are increased slowly over several weeks. I have the idea from some of the early authors who observed spawning in minnows that these fish are impressed by rapid change, so I remove the plastic all at once, and rapidly bring the temperature up the rest of the way to room temperature (about 70°F). I move them back to the office or to the greenhouse to a tank of fresh water. This somewhat simulates what they would encounter in the spring when the ice melts and allows the bright sunlight to shine into the water, and the spring rains flush the pond. The water change

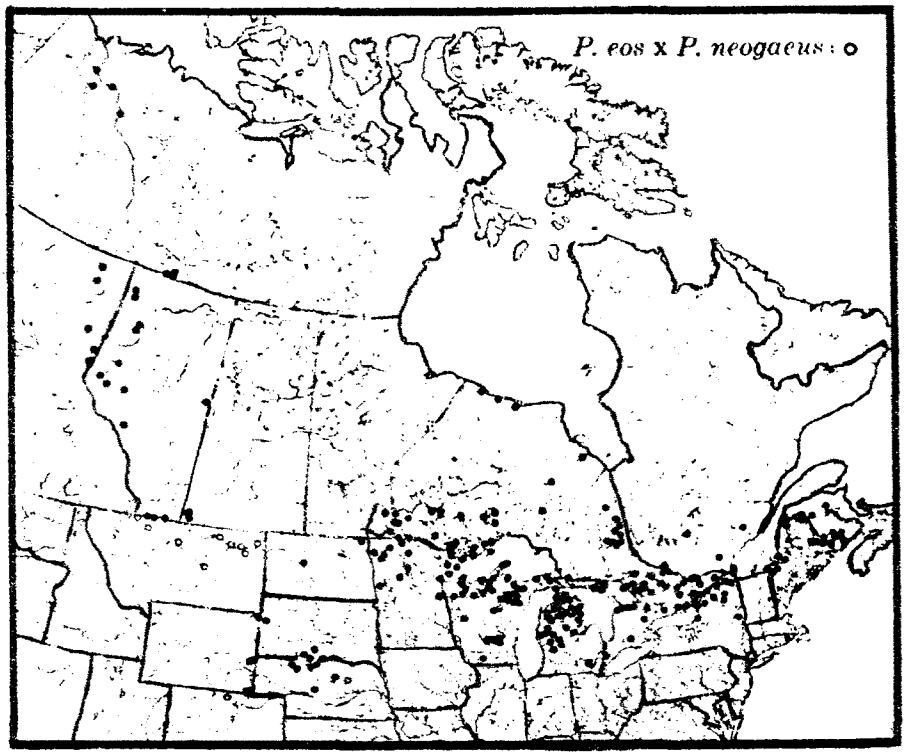
seems important; some fish develop their breeding colors in the middle of the winter for a few days in response to a water change. Frequent water changes and live food seem to be the keys to inducing these fish to breed in the aquarium. I exchange about one-half the tank at least twice with fresh water which has been aged for 24 to 48 hours.

The fish subjected to this treatment begin to breed in February, and groups will continue to spawn up until September. Fish spawn in the office and the greenhouse, so it does not seem important that they have natural light. I have read that spermatogenesis is inhibited in coldwater minnows at high temperatures, and indeed, the greenhouse residents did not spawn through July and August. Fish which were not "winter-treated" also spawned, at about the same time as the breeding season in the field, which is early June at the New Hampshire sites where these fish were collected. Perhaps all my manipulations were unnecessary, though it was clear that some were induced to breed long before they would have naturally. It seems that their innate calendar will guide them if the aquarium conditions are appropriate.

I put one female and one to five males in the same tank. After a week or so, the males start to develop their breeding coloration. Northern Redbelly Dace collected from northeastern states and southeastern Canada develop



Northern Redbelly Dace range map from Atlas.



Finescale Dace range map from Atlas. Note open circles in Montana, where hybrids--and only hybrids--are said to occur naturally.

an orange, yellow, or blood-red belly. All three color patterns are beautiful, and each male attains only one of those colors. There are no phases of color development, and males in each group are equally fertile. The male Finescale Dace develops an orange belly.

The males are distinguished from the females by the curvature of the pectoral fins which they develop as they reach sexual maturity, at about one year of age. The fin curvature seems to develop most rapidly during the breeding season, such that an older fish will have very distorted pectoral fins. This is most clearly seen when looking down on the fish from above. The fins of the males, particularly the pectoral fins, become bright yellow. Females may develop yellow fins and a light yellow coloration on the belly, but

fish without these colors have spawned. Very old, large females also develop the fin curvature.

The Northern Redbelly Dace is reported to spawn in filamentous algae (Phillips, 1969), while the Finescale Dace spawns under rocks (Stasiak, 1972). It appears that the female initiates the courtship which culminates in egglaying, and the hybrid females prefer the algae. The males of either species seem to accept that.

The males start to chase the female as her belly begins to swell with eggs. A male pushes his snout against her vent repeatedly while swimming along beside her. He interrupts this behavior to wriggle next to her, throwing his whole body into a vibrating motion. A male alternates these behaviors for several minutes, and finally gives up. Sometimes more than one male will participate. The behavior is repeated many times a day, and may go on for weeks. When this behavior begins, the proportion of live food in the diet is increased, and the half-water changes are made every other day.

About one month after the fish are removed from the cold room, the eggs are laid. When the female is ready, she will swim over to a male, apparently to attract his attention. She does not wriggle or chase him, but pushes her way into the filamentous algae nearby to lay the eggs. One or more males will follow her path through the algae to fertilize the eggs. If they do not follow her into the algae, the female repeats the behavior again and again, sometimes for two or three days, until she has successfully spawned. If they do not respond to her after several days, the female will begin to chase the males and wriggle a bit next to one of them. Some females spawn again two to four weeks later.

The young hatch in less than a week, but it is hard to know they are there! They are black, incredibly slim, and about eight millimeters long. The first day after they hatch, they just hang in the algae, motionless. This is probably a good way to hide, because they look like little sticks. It seems as if they are attached somehow, because they can hang vertically, adhering even to the film on the aquarium wall. After one day, they can swim in short bursts if disturbed, but immediately settle back down to the algae. They rise to school at the surface at about four days after hatching. At this time, they can eat powdered baby fish food. After about two weeks, they are large enough to eat baby brine shrimp, on which they really thrive and grow quickly. I have never observed the parents to eat the babies, or even notice them, but I carefully remove the babies to a new tank filled with water from the parents' aquarium. I scoop them out in a plastic cup. The males do eat the eggs, which are a little over a millimeter in diameter, and have a light golden yolk. Young born in the aquarium are large enough to spawn in the following spring.

References

Phillips, G.L. 1969. Chrosomus erythrogaster and C. eos (Osteichthyses; cyprinidae): taxonomy, distribution and ecology. PhD. dissertation, University of Minnesota.

Smith, C.L. 1986. The Inland Fishes of New York State. Albany: N.Y. Dept. of Environmental Conservation, p. 200.

Stasiak, R.H. 1972. The morphology and life history of the finescale dace, Pfrille neogaea, in Ithasca Park, Minnesota. PhD. dissertation, University of Minnesota.