Fine Fare for Native Fishes: The Fairy Shrimp, *Streptocephalus seali*

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During our free time recently, we have been studying the animals that live in and around floodplain pools of the Mississippi River in Warren County, Mississippi. On 23 May 2004, while searching for alligator gar, we made a surprising discovery of some very different kinds of animals. With seines and dip nets, we checked out eight pools that we had sampled the previous year for fish. Because of unusually low water in the Mississippi River, most were fishless, but in two of the pools we collected dozens of small crustaceans: a clam shrimp, *Eulimnadia* sp., and a fairy shrimp, *Streptocephalus seali*. Neither species, we quickly learned, was well studied in the Mississippi River floodplain, so we immediately went back for collecting gear and began our own study that same evening. The fairy shrimp is particularly interesting to aquarists who collect and cultivate "natural" foods for their fishes.

S. seali is a very widely distributed species. It occurs in Canada, the United States, and México; in the U.S. it has been recorded from 24 states ranging from New Jersey to Oregon and from Minnesota to Louisiana (Moore, 1951; Anderson, 1984). Like other fairy shrimp, it usually appears in temporary pools in which there are no fish or salamander larvae. It swims upside-down, using its legs to filter detritus and microscopic organisms out of the water for its food. *S. seali* live as long as three months (one captive male lived five months), and females may produce as many as 1500 eggs in their lifetime. Although this fairy shrimp has been studied for more than 50 years, some basic aspects of its biology have not been determined. It is unknown, for example, if *S. seali* produces both summer eggs (which hatch almost immediately) or just their winter eggs or cysts (which tolerate drying and freezing before hatching). Mating has been observed, but it is unclear if mating is necessary for the females to produce fertile cysts since some populations of other fairy shrimp species are known to be parthenogenic (all females).

Fairy shrimp are closely related to the brine shrimp, *Artemia salina*, which has long been used in the pet trade as a source of food for tropical and marine fishes. As a group, they are an excellent source of food for aquarium fishes. *S. seali*, in particular, is slow moving, colorful, and large, typically reaching sizes of 30 mm, and as much as 42 mm (Moore, 1951). Unlike its famous relative the brine shrimp, *S. seali* is a true freshwater animal and will stay alive in a freshwater fish tank until it is eaten. We have fed them to bluegill, green sunfish and bantam sunfish, all of which eagerly fed on them, but almost all aquarium fishes will eat these animals either live or frozen (Anderson, 1984).

Our populations of fairy shrimp appeared in May shortly after pools formed, disappeared during the summer when predatory invertebrates (backswimmers and dragonflies) were abundant, and appeared again during October-December when floodplain pools reformed after drying out at the end of summer. The pools where we collected fairy shrimp were completely isolated from the river and other fish habitats. Pools were sometimes as large as 10,000 m^2, but most ranged from 2500 m^2 down to 450 m^2. Average depths were usually less than 25 cm. Most pools had abundant emergent vegetation and some canopy. Bottoms consisted of hard packed mud with overlying silt. The water quality in these pools was variable depending on location and time of year. Afternoon water temperature ranged from 11-33°C and turbidity from clear (<4 NTU) to moderately opaque (>80 NTU). Water was slightly acidic (morning pH=6.5) to neutral (morning pH=7.0). Our observations were similar to those made by

Fig. 1.
Processing light traps. Photo by Dena Dickerson/Jan Hoover.

Walter Moore in Louisiana. He found fairy shrimp from August through April in tree-lined ponds and roadside ditches (Moore, 1951). Water temperature ranged from 13.5-29.5°C and turbidity from fairly clear (25 ppm) to murky (3000 ppm). Water, however, was more acidic (pH= 5.2-6.1). Our own data suggested that dissolved oxygen was not an important factor in distribution of the fairy shrimp; morning dissolved oxygen ranged from hypoxic (<2 mg/l) to normoxic (>9 mg/l).

Collecting fairy shrimp is easy and can be done in different ways. We used Plexiglas light traps like those used to collect small fish (Killgore, 2003). The light traps we use have small, removable pans on the bottom that make it possible to place them in very shallow water. The traps are set out during late afternoon, baited with a yellow chemical light stick, and recovered the following morning (Fig.1). Pans are removed and the animals can be poured out and preserved for scientific study or kept alive for fish food. Fairy shrimp are strongly phototactic and abundance in light traps can be very high. One trap in October had so many fairy shrimp in it that we were able to fill two pint jars (Fig. 2). If you use light traps, it requires some planning (not to mention the traps themselves) and two separate trips (one to set the traps, another to pick them up), but one person can do it alone. You can also use a seine, which requires virtually no planning and very little time, but you need a partner to help. The easiest method of collecting fairy shrimp is probably the dip net, which requires nothing else but a little elbow grease.

Once fairy shrimp are collected, they can be transported just like fish—in water-filled buckets or coolers—avoiding overcrowding, temperature shocks, and drastic water changes (Anderson, 1984). They can be maintained alive for long periods in unfiltered, gently aerated aquaria of any size. Airstones, however, should be barely bubbling or suspended just beneath the surface of the water. Shrimp can be fed yeast or a combination of yeast with some other food, like algae, protozoa, or flake food (Moore, 1957; Kaczynski, 1971). Yeast is considered critical for long-term maintenance, fast growth, and egg-production, but we have also kept fairy shrimp for several weeks by feeding them nothing but a variety of finely ground flake foods.

Cultivation from eggs is also fairly simple and can be done either indoors in jars or aquaria, or outdoors in ponds or in children's wading pools (Moore, 1957; Anderson, 1984; Anderson and Hsu, 1990). Fairy shrimp eggs are best hatched if the eggs are preserved in a moist environment (wet mud) for short periods of time instead of being allowed to dry completely. Most fairy shrimp larvae hatch within 24-48 hours and continue hatching for several days. Shrimp can be maintained at room temperatures (21-27°C). These shrimp will reach a length of 12 mm in approximately 8-12 days, at which time they will be able to produce eggs. High summer temperatures (>30°C) usually reduce the productivity of a fairy shrimp culture, but growth is higher in warmer water

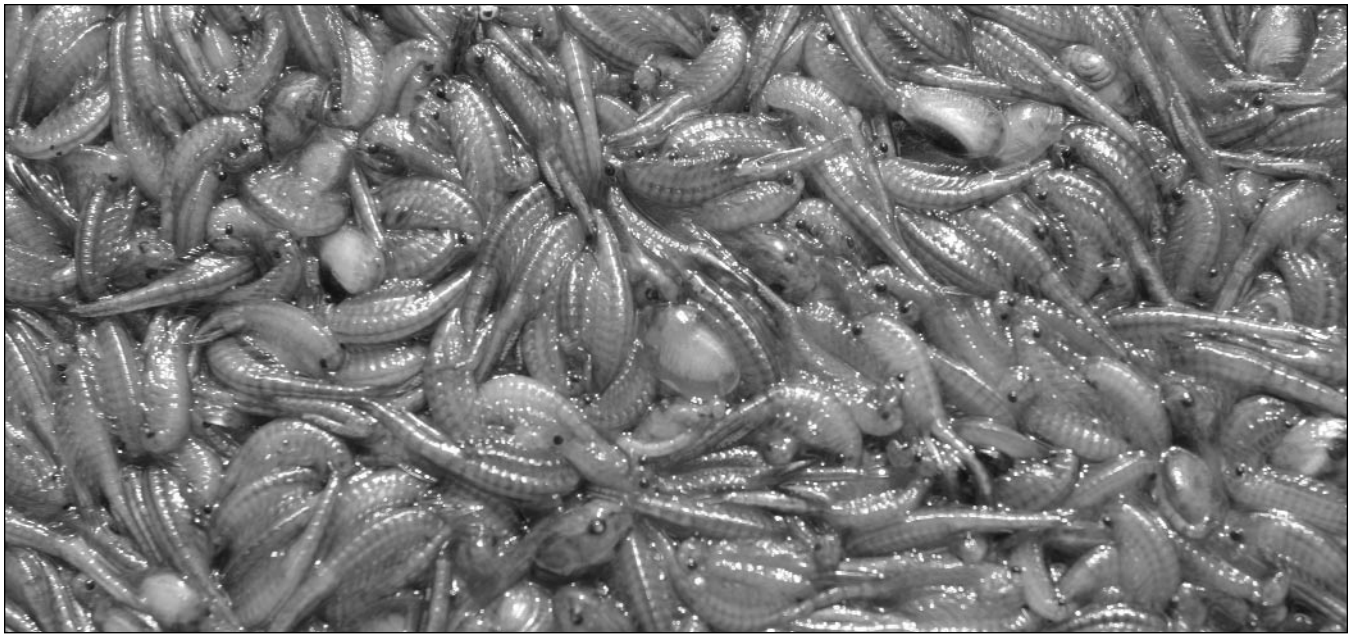

Fig. 2.
Fairy shrimp catch from a single light trap. Clam shrimp are also present. Photo by Dena Dickerson/Jan Hoover.

(25°C) than in water of variable temperature (21-27°C) or cooler water (18°C). *S. seali* can be maintained at a wide range of water hardness ranging from 60-130 $CaCO_3 l^{-1}$. It has been seen that lighting does not play a significant role in the survival or growth rates of fairy shrimp. Shrimp that have been maintained in "normal" photoperiods (approximately 12 hours light/dark) and shrimp that have been maintained in complete darkness have shown no differences in growth rates or survival.

Sometimes, though, successful cultivation is accidental. Walter Moore discovered this in the 1950s (Moore, 1957). He would sometimes set aside jars that once contained fairy shrimp before throwing them away. In many cases, a new hatch of fairy shrimp would appear 1-20 days after all of the adult shrimp had died or had been removed. We had a similar experience. After taking about 30 fairy shrimp home in a five-gallon bucket and removing them with a small net, the empty bucket was placed outside where it remained dry for several days. After some rain, we observed in the bucket, partially filled with rainwater, a thriving population of fairy shrimp.

We believe that the fairy shrimp, *Streptocephalus seali*, is a perfect natural food for the native fish aquarist. It is readily available, occurring throughout most of North America and in a wide range of habitat conditions. It is easy to collect and cultivate. And, when added to a fish tank, it will remain alive until eaten, which for most native fish aquaria will not be a very long time.

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