

Survey of the Freshwater Mussel Fauna of Unsurveyed Streams of the Tennessee River Drainage, Virginia

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INTRODUCTION

The freshwater mussel fauna of the upper Tennessee River drainage in southwest Virginia has been surveyed extensively over the last 25 years (Neves et al., 1980). Most of these surveys have occurred in mainstem rivers of the drainage: Clinch River (Stansbery, 1973; Bates & Dennis, 1978; Ahlstedt, 1991); Powell River (Ahlstedt & Brown, 1979; Dennis, 1981; Wolcott & Neves, 1994); North Fork Holston River (Stansbery, 1972; Stansbery & Clench, 1974a); Middle Fork Holston River (Stansbery & Clench, 1974b); and South Fork Holston River (Stansbery, 1977). Except for three major tributaries to these rivers; Copper Creek (Ahlstedt, 1981), Little River (Church, 1991), and Big Moccasin Creek (Neves & Zale, 1982), most other tributaries have received little if any survey effort. Ferguson (1992) conducted spot checks in 55 tributary streams of southwest Virginia, and reported mussels in ten of those tributaries. He recommended more thorough surveys in those ten streams and several other tributaries seemingly suitable for mussels.

Because several federally endangered species and other species of concern were known to occur in headwater habitats of southwest Virginia, a thorough examination of unsurveyed and under-surveyed streams was warranted. The objective of this project was to seek new populations of species under federal protection and to assess the general status of those populations. This report summarizes efforts, collections, and conclusions from the surveys.

METHODS

A tentative list of streams for survey was compiled based on information and experience gathered over the last 15 years by the second author (Neves) and from

Ferguson's (1992) recommendations. During the summers of 1995 and 1996, 24 streams were surveyed for freshwater mussels (Fig. 1). Survey methods consisted of a two-person team walking stream banks at various access points to locate suitable mussel habitat. At suitable sites, the survey team snorkeled each stream reach to locate live mussels and shells. Effort expended in surveying upstream or downstream from each access point varied depending on apparent suitability of a reach as habitat for mussels, to include substrate, water quality, stream size, and presence and density of live mussels and shells. All live and fresh-dead mussels and relic shells were recorded, as were the specific locations of high densities of mussels and individuals of rare species. Time spent surveying was recorded as a measure of effort (man-h). All common and scientific nomenclature is according to Turgeon et al. (1988).

RESULTS

Survey effort ranged from 1.5 to 113.0 man-hours total for each stream (Fig. 2). In general, more time was spent snorkeling in streams with more species. Streams with notable species richness (7 to 18 species), as determined by the presence of live individuals or shells, were as follows: Clinch River headwaters, North Fork Clinch River, Blackwater Creek, Indian Creek at Cedar Bluff, Possum Creek, and Laurel Creek (Fig. 2). These streams contained the species of potential federal interest (Table 1).

In particular, live individuals of the tan riffleshell (*Epioblasma florentina walkeri*), a federally endangered species, were found in the Clinch River headwaters and in Indian Creek at Cedar Bluff. The population in Indian Creek was previously unreported and seemed to be in higher densities than in the Clinch River

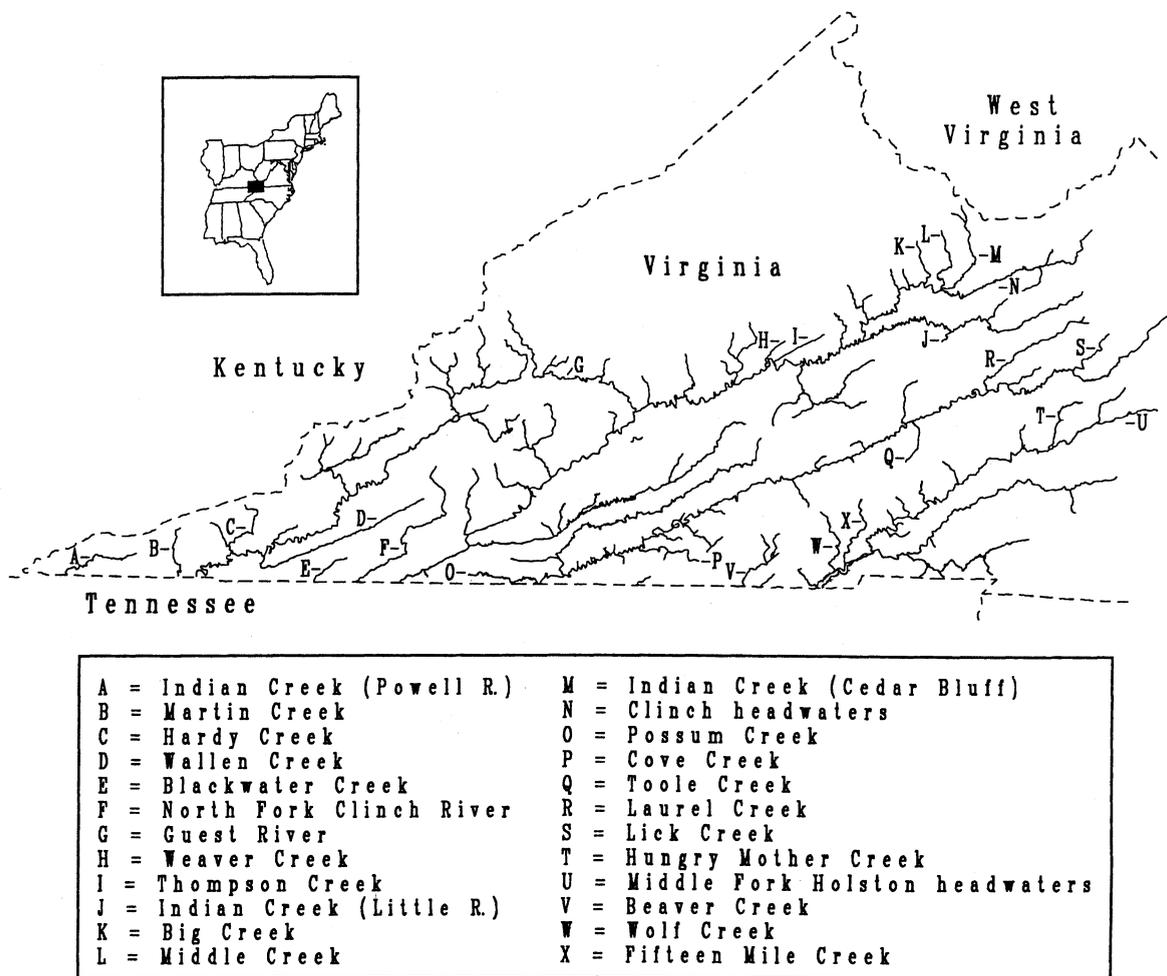


Fig. 1. Third-order and larger streams of the upper Tennessee River system in Virginia. Tributaries and headwaters surveyed for mussels in 1995 and 1996 are labeled beginning with A for the downstream-most stream in the Powell system and ending with X for the upstream-most stream in the South Fork Holston system.

headwaters. A very small (13 mm), live individual was found in Indian Creek, indicating successful reproduction by this species. Two fresh-dead tan riffleshells were found in a large riffle about 1 km downstream of the known population in the Clinch River headwaters, and one relic shell was found about 1 km upstream of the known population. Subsequent to our survey, more intensive sampling has been conducted to delineate the range of the tan riffleshell in Indian Creek (Brian Watson, pers. comm.).

One fresh-dead individual and many relic shells of the fine-rayed pigtoe (*Fusconaia cuneolus*), a federally endangered species, were found in Possum Creek, as well as a variety of species now known to occur only in the North Fork Holston system above Saltville. The shells identified as fine-rayed pigtoes were atypical in color and

unusually slow growing, but the tooth and beak structure was similar to other specimens of similar age. Our identification of these shells as fine-rayed pigtoes was confirmed by D. H. Stansbery of Ohio State University.

Shells of three other federally endangered species also were found. The purple bean (*Villosa perpurpurea*), recently listed as federally endangered, was known only from the Clinch River mainstem and lower Copper Creek (Neves 1991). Four relic shells were found in Indian Creek at Cedar Bluff. Relic shells of the purple bean, the federally endangered shiny pigtoe (*Fusconaia cor*), and the recently listed rough rabbitsfoot (*Quadrula cylindrica strigillata*) were found in the Clinch headwaters in a large riffle about 1 km below the confluence with Indian Creek at Cedar Bluff. A shell of the rough rabbitsfoot was also found in Possum Creek.

The Tennessee pigtoe (*Fusconaia barnesiana*), a state protected species, was collected in 11 of the 18 streams surveyed, making it among the most common species collected. It and the Tennessee clubshell (*Pleurobema oviforme*) were particularly widespread in the Clinch

was found in Laurel Creek. This species is extremely rare in the Tennessee River system and is perhaps a distinct subspecies from its otherwise widespread distribution in Atlantic-drainage basins.

Specific locations and numbers of individuals

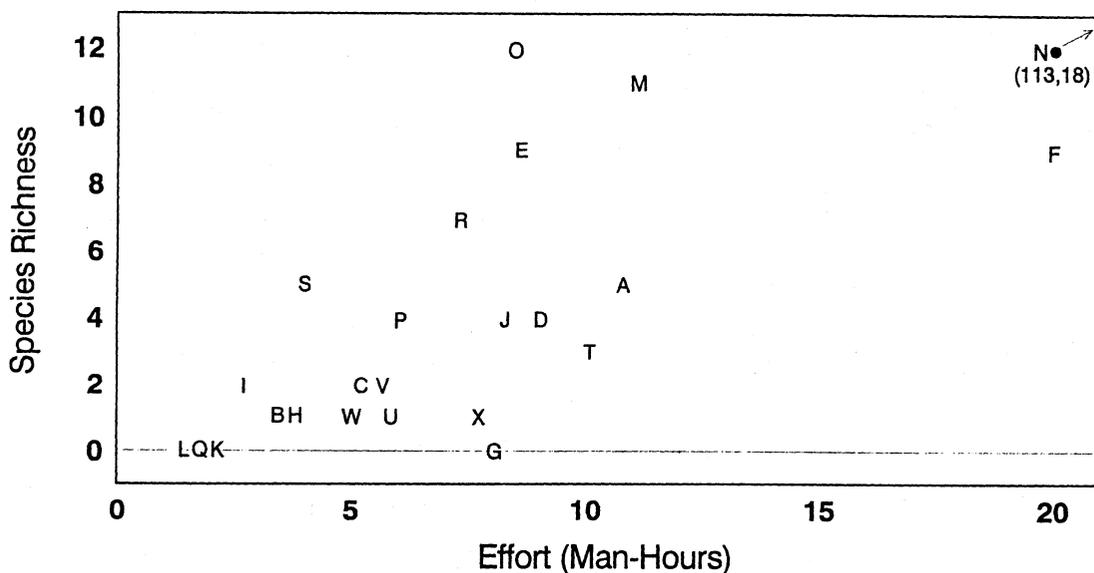


Fig. 2. Total sampling effort (man-hours) versus species richness in each stream. Species richness includes live individuals, and fresh-dead and relic shells of all species. Streams in the upper left quadrant merit further survey effort. Labels are defined in Fig. 1.

River headwaters, being found in 12 and 8 reaches, respectively, of the 13 reaches surveyed. The Tennessee pigtoe was the only species found in Fifteen Mile Creek; 179 live individuals were counted and relic shells were abundant. The Tennessee clubshell was the only amblemine found in Lick Creek, where 24 live individuals and six shells were found; and in Cove Creek, where two live individuals and 12 shells were found. These streams might be good locations for glochidial studies of these species. What was probably two live slabside pearlymussels (*Lexingtonia dolabelloides*) were found in the Clinch River headwaters in the large riffle adjacent to the residential area along Route 707 in Cedar Bluff; however, identification was uncertain. The state protected Tennessee heelsplitter (*Lasmigona holstonia*), recommended for endangered status by Neves (1991), was found in a previously unknown location: 16 live individuals were found in East Fork Blackwater Creek in a long, shallow pool about 50 m above the Route 600 bridge. We also confirmed known population occurrences in the headwaters of Middle Fork Holston River and Clinch River (Neves, 1991) and North Fork Clinch River. A relic squawfoot (*Strophitus undulatus*)

collected of the federally endangered species are provided in Table 2. For all other species, detailed descriptions of locations of survey sites within streams, mussels found at each survey site, and habitat descriptions are included in Winston & Neves (1996).

DISCUSSION

Those streams showing high richness despite relatively low survey effort (Blackwater Creek, Indian Creek at Cedar Bluff, Possum Creek, and Laurel Creek) are the most likely to have as yet undiscovered populations of rare species. Further efforts at finding rare species should be concentrated in these streams. Streams showing high richness with higher survey effort (North Fork Clinch River below Duffield and Clinch headwaters above Richlands) may also contain populations of rare species since even the recorded effort may have been insufficient to find extremely rare species. The slippershell mussel (*Alasmidonta viridis*) and the little-wing pearlymussel (*Pegias fabula*) are particularly difficult to locate, not only because of their rarity, but also because of their small body sizes. Both species are known to occur in smaller streams and, although we

never found it, the little-wing pearlymussel had been found previously in the Clinch headwaters in an area that we surveyed (Church 1991).

In Possum Creek, fresh-dead and relic specimens of the fine-rayed pigtoe and the rough rabbitsfoot were found both at the mouth and 7 km upstream. The entire stream reach between these sites likely contains mussels and is in need of a thorough survey. Indian Creek and Possum Creek, which contain federally endangered species, flow through residential areas. This suggests that residential development can be compatible with mussel populations as opposed to the concentrated sewage outfall resulting from urban areas (Church 1991; Goudreau et al. 1993). This observation was further exemplified by two streams that we surveyed flowing through Abingdon. Fifteen Mile Creek supported a fairly dense population of Tennessee pigtoes along most of its length downstream of Abingdon. Conversely Wolf Creek, which had extensive reaches of seemingly good substrate for mussels, was devoid of mussels except in the higher gradient reach in mid-town above the wastewater treatment plant.

Goudreau et al. (1993) reported that mussels were absent from the Clinch River for 3.75 km below the Tazewell wastewater treatment plant in a 1985 survey. We also surveyed this reach and, despite the abundance of seemingly suitable substrate for mussels, found only one adult Tennessee pigtoe and two rainbow mussels (*Villosa iris*). We noted many muskrat middens with large numbers of shells of asian clams (*Corbicula fluminea*) but with no mussel shells. Given that the three mussels we found could easily have washed down from the sizeable populations in Plum Creek and above the Tazewell wastewater treatment plant, we concluded that there was no evidence of colonization of mussel populations in this reach.

The population of the state-protected Tennessee heelsplitter in the North Fork Clinch River was downstream of the wastewater outfall from Duffield. Live rainbows, mountain creekshells (*Villosa vanuxemensis*) and wavy-rayed lampmussels (*Lampsilis fasciola*) also were found there. The Duffield area likely will continue to experience economic development, especially because Highway 58 is being upgraded to 4-lane across all of southwest Virginia. The resultant increase in treated wastewater will jeopardize these populations of mussels unless effective dechlorination or ultraviolet treatment is used at the wastewater treatment plant.

The lower reaches of Blackwater Creek and North Fork Clinch River were atypical for streams of the Tennessee River in Virginia. Channel gradient was low, substrate was composed mostly of sand and silt, and stream banks were high and incised. The water was

turbid even though tributaries and upper reaches were clear. We found no evidence of high densities of mussels or the presence of rare species in these lower reaches, although survey conditions (turbidity) were not optimal. Although most species were found in the middle reaches, both the lower and middle reaches of these streams merit further survey effort.

Physical habitat of Laurel Creek was very different from that of Blackwater Creek and North Fork Clinch River. It was higher in gradient, substrate was coarser, and water was very clear. We surveyed this stream in late October when the water was cold and high; thus, further survey effort in summer may locate additional species.

In summary, this mussel survey recorded possible new populations of five federally endangered species, one federal species of concern, and three state-protected species. One state-protected species was found to be quite common in tributaries to the main river channels. Further survey effort in tributaries of the Powell, Clinch, and Holston rivers in Tennessee, in addition to more intensive surveys of Blackwater Creek, North Fork Clinch River, the Clinch River headwaters, Possum Creek, and Laurel Creek, may discover additional populations of endangered species of freshwater mussels.

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Table 1. Mussel species collected (live, fresh-dead, or relic) in the 24 streams surveyed in southwest Virginia, 1995-1996. Stream labels are defined in Fig. 1.

Common Name	Scientific Name	Streams Where Collected
Cumberland moccasinshell	<i>Medionidus conradicus</i> (Lea)	A,D,E,F,J,M,N,O,R,S,T
fine-rayed pigtoe ¹	<i>Fusconaia cuneolus</i> (Lea)	O
fluted kidneyshell	<i>Ptychobranchnus subtentum</i> (Say)	N
fluted-shell	<i>Lasmigona costata</i> (Rafinesque)	M,N,O
kidneyshell	<i>Ptychobranchnus fasciolaris</i> (Rafinesque)	M,N,O
mountain creekshell	<i>Villosa vanuxemensis vanuxemensis</i> (Lea)	A,B,C,D,E,F,J,M,N,O,P,S,T,V,W
pheasantshell	<i>Actinonaias pectorosa</i> (Conrad)	M,N
pink heelsplitter	<i>Potamilus alatus</i> (Rafinesque)	F
pocketbook	<i>Lampsilis ovata</i> (Say)	E,M,N,O

purple bean ¹	<i>Villosa perpurpurea</i> (Lea)	M,N
rainbow	<i>Villosa iris</i> (Lea)	A,C,D,E,F,H,I,J,M,N,O,P,R,S,T
rough rabbitsfoot ¹	<i>Quadrula cylindrica strigillata</i> (Wright)	N,O
shiny pigtoe ¹	<i>Fusconaia cor</i> (Conrad)	N
slabside pearlymussel ³	<i>Lexingtonia dolabelloides</i> (Lea)	N
spike	<i>Elliptio dilatata</i> (Rafinesque)	F
squawfoot ⁴	<i>Strophitus undulatus</i> (Say)	R
tan riffleshell ¹	<i>Epioblasma florentina walkeri</i> (Wilson & Clark)	M,N
Tennessee clubshell ²	<i>Pleurobema oviforme</i> (Conrad)	E,F,N,P,R,S
Tennessee heelsplitter ³	<i>Lasmigona holstonia</i> (Lea)	E,F,N,U
Tennessee pigtoe ³	<i>Fusconaia barnesiana</i> (Lea)	A,D,E,F,I,J,M,N,O,R,V,X
threeridge	<i>Amblema plicata plicata</i> (Say)	E,O
wavy-rayed lampmussel	<i>Lampsilis fasciola</i> (Rafinesque)	A,E,F,M,N,O,P,R,S

¹ Federally endangered

² Federal species of concern

³ State protected

⁴ Extremely rare in the Tennessee River system

Table 2. Locations and numbers of five federally endangered species collected during this survey.

Species	Location
fine-rayed pigtoe	<p>Possum Creek, North Fork Holston drainage, Scott County, Kingsport Quadrangle, Latitude: 363548, Longitude: 823608. Upstream of confluence with North Fork Holston River (creek mile 0.0). Nine relic shells found.</p> <p>Possum Creek, North Fork Holston drainage, Scott County, Kingsport Quadrangle, Latitude: 363606, Longitude: 823708. Upstream of Rte. 639 bridge (creek mile 3.7+). One fresh-dead and two relic shells found.</p>
purple bean	<p>Indian Creek (at Cedar Bluff), Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370518, Longitude: 814558. From confluence with Clinch River upstream to private bridge (downstream of first Rte. 631 crossing). Four relic shells found.</p> <p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370453, Longitude: 814637. Large riffle adjacent to residential area along Rte. 707. One relic shell found.</p>
rough rabbitsfoot	<p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370453, Longitude: 814637. Large riffle adjacent to residential area along Rte. 707. One relic shell found.</p> <p>Possum Creek, North Fork Holston drainage, Scott County, Kingsport Quadrangle, Latitude: 363606, Longitude: 823708. Upstream of Rte. 639 bridge (creek mile 3.7+). One relic shell found.</p>
shiny pigtoe	<p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370453, Longitude: 814637. Large riffle adjacent to residential area along Rte. 707. One relic shell found.</p>
tan riffleshell	<p>Indian Creek (at Cedar Bluff), Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370518, Longitude: 814558. From confluence with Clinch River upstream to private bridge (downstream of first Rte. 631 crossing). Two live, seven fresh-dead, and 17 relic shells found.</p> <p>Indian Creek (at Cedar Bluff), Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370522, Longitude: 814550. From first private bridge to next private bridge (upstream of first Rte. 631 crossing). Two relic shells found.</p> <p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370453, Longitude: 814637. Large riffle adjacent to residential area along Rte. 707. Two fresh-dead, one relic shell found.</p> <p>Clinch River headwaters, Clinch drainage, Tazewell County, Richlands Quadrangle, Latitude: 370503, Longitude: 814519. Just above bridge going to racetrack just upstream of Cedar Bluff. One relic shell found.</p>