

counties, Tennessee, and Lee County, Virginia; Clinch River, Hancock County, Tennessee, and Scott, Russell, and Tazewell Counties, Virginia; Big South Fork, Scott County, Tennessee and McCreary County, Kentucky; and Buck Creek, Pulaski County, Kentucky (Isom and Yokely 1968; Schuster *et al.* 1989; Ahlstedt 1991; Bakaletz 1991; Gordon 1991; Ahlstedt and Tuberville 1997; Hagman 2000; Ahlstedt, pers. comm. 2002; B. Jones, Mississippi Museum of Natural Science, pers. comm. 2002; Cicerello, pers. comm. 2003; Garner and McGregor, in press).

*Purple Bean (Villosa perpurpurea (Lea 1861))*

Adult purple beans are typically 2.5 to 7.5 cm (1.0 to 3.0 in) in length (R. Tawes, personal observation, 2003). Gravid females have been observed in January and February (Ahlstedt, 1991; Bob Butler, Service, pers. comm. 2003). Glochidia of the purple bean have been identified on the fantail darter (*Etheostoma flabellare*), greenside darter, and mottled sculpin (Watson and Neves 1996). This species inhabits small creeks to medium-sized rivers and can be found in a variety of substrates (Gordon 1991; Parmalee and Bogan 1998).

The purple bean is endemic to the upper Tennessee River drainage in Tennessee and Virginia. Its historical range included the Powell River, Lee County, Virginia; Clinch River system, Claiborne, Grainger, and Hancock Counties, Tennessee, and Russell, Scott, Tazewell, and Wise Counties, Virginia; Emory and Obed Rivers, Morgan and Cumberland counties, Tennessee; and Holston River System, Hawkins and Sullivan Counties, Tennessee, and Scott and Washington Counties, Virginia. It has apparently been extirpated from the Powell River, Emory River, North Fork Beech Creek (Holston River System) and North Fork Holston River (Service 2003). The purple bean persists in portions of the Clinch River mainstem, Hancock County, Tennessee, and Scott, Russell, and Tazewell Counties, Virginia; Copper Creek (a Clinch River tributary), in Scott County, Virginia; Indian Creek (a Clinch River tributary), in Tazewell County, Virginia; in the Obed River, Morgan and Cumberland Counties, Tennessee; and in Beech Creek, a tributary of the Holston River, Hawkins County, Tennessee (Ahlstedt 1991; Gordon 1991; Winston and Neves 1997; Watson and Neves 1998; Ahlstedt and Tuberville 1997; S.A. Ahlstedt, pers. comm. 2000, 2002, 2003; Fraley and Ahlstedt 2001).

*Rough Rabbitsfoot (Quadrula cylindrica strigillata (Wright, 1898))*

The rough rabbitsfoot is the largest of the five mussels, with adult specimens sometimes reaching 12 cm (5 in) in length (Parmalee and Bogan, 1998). Spawning in this species apparently occurs from May through June (Yeager and Neves 1986). Glochidia of rough rabbitsfoot have been identified on the whitetail shiner (*Cyprinella galactura*), spotfin shiner (*Cyprinella spiloptera*), and bigeye chub (*Hybopsis amblops*) (Yeager and Neves 1986). This species prefers clean sand and gravel substrate in streams ranging from medium-sized creeks to medium-sized rivers (Parmalee and Bogan 1998).

Like the purple bean, the rough rabbitsfoot is endemic to the upper Tennessee River system. The rough rabbitsfoot historically occupied the Powell River, Hancock and Claiborne Counties, Tennessee, and Lee County, Virginia; Clinch River system, Hancock and Claiborne Counties, Tennessee, and Russell, Scott, and Tazewell Counties, Virginia; and Holston River System, Hawkins and Sullivan Counties, Tennessee, and Scott and Washington Counties, Virginia. It is apparently extirpated from the entire Holston River system (Service, 2003). It currently persists in portions of the Powell River, Claiborne and Hancock Counties, Tennessee and Lee County, Virginia; Clinch River, Hancock County, Tennessee and Scott, Russell, and Tazewell Counties, Virginia; and in Indian Creek, Tazewell County, Virginia (Ahlstedt 1981; Gordon 1991; Ahlstedt and Tuberville 1997; Winston and Neves 1997; Watson and Neves 1998; S.A. Ahlstedt, pers. comm. 2000, 2002, 2003; Fraley and Ahlstedt 2001).

The summary of these five mussels presented above represents our current understanding of their historical and current range and distribution. Research is ongoing regarding identification of some species. For example, varying mantle coloration, microattractant configuration, size differential, and spawning cycles may indicate that the oyster mussel is actually a species complex (more than one species represented). Researchers from Virginia Tech are in the process of formally describing the Duck River variety (J.W. Jones, Virginia Tech, in press), and some malacologists, molluscs biologists, believe that the Big South Fork variety is actually a distinct, undescribed species, or possibly a variant of the tan riffleshell (*Epioblasma florentina walkeri*), a closely related species (S.A. Ahlstedt, USGS, pers. comm. 2002). A recent genetic investigation on the

genus *Epioblasma* using mitochondrial DNA markers suggested that the tan riffleshell and the oyster mussel may be the same species (Buhay *et al.* 2002). Because these observations have not yet been published or peer reviewed and/or are not conclusive, we believe for the purposes of this proposed rule that the Duck River and Big South Fork populations are true *E. capsaeformis*. The distributions presented above are based upon shell morphology as described and currently recognized in the scientific literature. Therefore, we will consider these species' current ranges as outlined above, until presented with new information.

**Summary of Decline and Threats to Surviving Populations**

These five mussels, like many other Cumberlandian Region mussel taxa, have undergone significant reductions in total range and population density (Layzer *et al.* 1993; Williams *et al.* 1993; Neves *et al.* 1997; Fraley and Ahlstedt 2000; Cicerello and Laudermilk 2001; Service 2003), primarily resulting from human-induced changes in stream and river channels, including channel modifications (e.g., dams, dredging, mining) and historic or episodic water pollution events (Schuster *et al.* 1989; Gordon 1991; Neves *et al.* 1997; Parmalee and Bogan 1998; Cicerello and Laudermilk 2001). The entire length of the main stems of the Tennessee and Cumberland Rivers and many of their largest tributaries are now impounded or greatly modified by the discharge of tailwaters (Service 2003). For example, more than 3,700 rkm (2,300 rmi) (about 20 percent) of the Tennessee River and its tributaries were impounded by the Tennessee Valley Authority by 1971 (Service 2003). Dams permanently alter the free-flowing aquatic habitat required by many mussels and their host fish. None of the five mussels are known to survive in impounded waters. Riverine mussels are killed during construction of dams; they may be suffocated by sediments that accumulate behind the dams and the reduced water flow behind dams limits food and oxygen available to mussels. Mussel populations in free-flowing river sections below dams can be adversely affected or extirpated from reduced dissolved oxygen levels, unnatural flow regimes, and colder temperatures, or greatly modified by the dams or their tailwater releases (Neves *et al.* 1997). Many fish species that serve as hosts to mussel larvae are also eliminated by dams and impounded waters.

Other forms of habitat modification, such as channelization, channel clearing and de-snagging (woody debris