The Mussel Fauna of the Glover River, Oklahoma

Caryn C. Vaughn, Oklahoma Biological Survey and Department of Zoology, University of Oklahoma, Norman, OK 73019

The Glover River is a pristine, unimpounded tributary of the Little River in the Ouachita Highlands of southeastern Oklahoma. The upper 40 km of this river were systematically surveyed for mussels in July 1996. Mussel species richness and abundance increased in a downstream direction as stream gradient decreased and mussel habitat became more available. Twenty-two species of unionid mussels occur in the river. The fauna is dominated by the threeridge *(Amblema plicata*) and the pigtoe (*Fusconaia flava)*. Healthy populations of two regional endemic species, the Ouachita kidneyshell (*Ptychobranchus occidentalis)* and the Ouachita creekshell (*Villosa arkansasensis*) occur in the river, as do a small population of the rabbitsfoot mussel (*Ouadrula cylindrica*), a national species of concern. The Glover River contains a diverse, healthy mussel fauna that can be protected well into the future through sound land management practices.

INTRODUCTION

The Little River system drains a large portion of the southern Ouachita Mountains in southeastern Oklahoma and southwestern Arkansas, an area of east-west trending ridges and valleys (Honess 1923, Vaughn and Taylor 1999). The Glover River is the only remaining unimpounded tributary of the Little River. This highly pristine river is 48 km long, has a drainage area of 876 km^2 (Oklahoma Water Resources Board 1990), and is known for its scenic value (Rafferty and Catau 1991, Vaught 1997) and fish biodiversity (Taylor and Lienesch 1995). The river contains the largest known population of the federally threatened leopard darter *(Percina pantherina*) (Jones et al 1994, Williams et al 1999). The upper two thirds of the river is high gradient (average slope 19 m/km) and is characterized by low bedrock and boulder falls, chutes, and riffles. Below the fall line, the gradient decreases to 1 m/km as the river flows through the Gulf Coastal Plain before entering the Little River. Here stream habitat is characterized by deep, long pools separated by shallow riffles (Jones et al 1994). Riparian areas are mixed pine and oak forest historically harvested for timber by private companies. Since 1996, much of the watershed has come under the management of the US Forest Service and timber harvest has decreased.

The objective of this study was to describe the distribution and abundance of freshwater mussels (Unionidae) in the Glover River. Because the river is remote and crossed by very few roads, large stretches of the river are only accessible by canoe, and surveys have been limited. Until this study, the mussel fauna of the river was described for only one site where the river crosses a state highway (Fig. 1, site 22; Valentine and Stansbery 1971).

METHODS

The upper 40 km of the Glover River were traversed by canoe in July 1996 (Fig. 1). The lower section of the river, below Highway 3 (Fig. 1), is degraded, and was not included in this study. Reconnaissance snorkel searches were conducted in areas where shells were observed and in areas where habitat looked appropriate for mussels. When live mussels were observed, I sampled the site by using a timed search. A timed search is the most common technique for collecting information on mussel abun-

dance and is the only technique that can reliably be used to obtain estimates of total species richness and to locate rare species (Vaughn et al 1997, Strayer et al. 1997). Timed surveys were conducted by searching the entire site for a minimum of 1 h by at least 3 experienced surveyors. Surveyors, wearing a mask and snorkel, systematically swam over the area and picked up mussels by hand. Mussels with either part of the shell or their siphon exposed at the surface were located by both sight and feel; when a patch of mussels was located, the surveyor also dug in the substrate for buried mussels. SCUBA was used in deeper areas (>75 cm). Mussels were placed in a canvas bag underwater and removed to shore. Individual mussels were identified (Table 1) and returned to the stream alive after all sampling was completed Vaughn et al. (1997). Data from all surveyors were pooled, and abundance was standardized as the number of mussels collected per hour of search effort (Vaughn and Taylor 1999). Limited voucher specimens were taken and deposited in the mollusk collection of the Oklahoma Biological Survey (www.biosurvey.ou.edu).

RESULTS and DISCUSSION

Twenty-two sites were systematically searched for mussels in 1996, and live mussels were found at 19 of these sites (Fig. 1). In addition, Site 22 was resurveyed in 1999. Mussel abundance per site (as mussels observed/hour) ranged from 0 to 228, with a mean of 56 ± 75 (Fig. 2). Mussel species richness per site ranged from 0 to 13, with a mean of 5 ± 3 (Fig. 2). Overall, mussel species richness and abundance are lower in the Glover River than in larger, lower

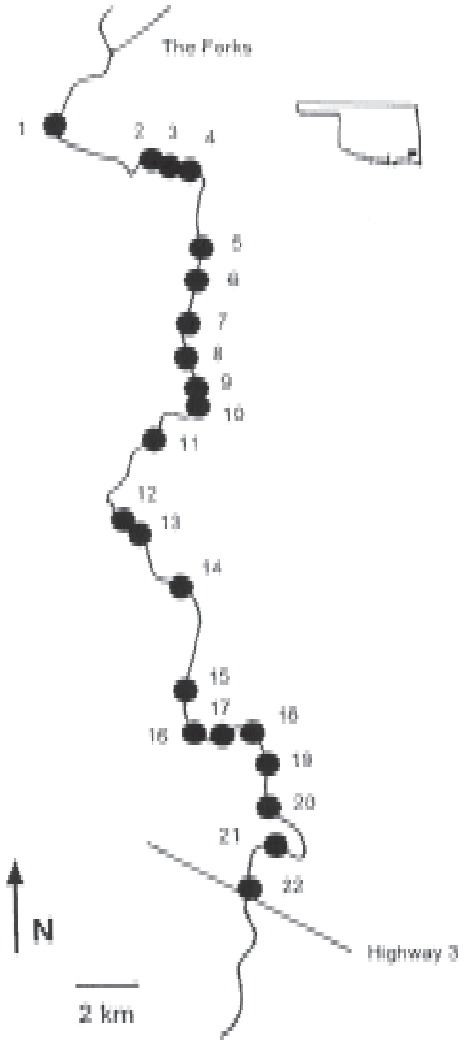

Figure 1. Location of sample sites on the Glover River.

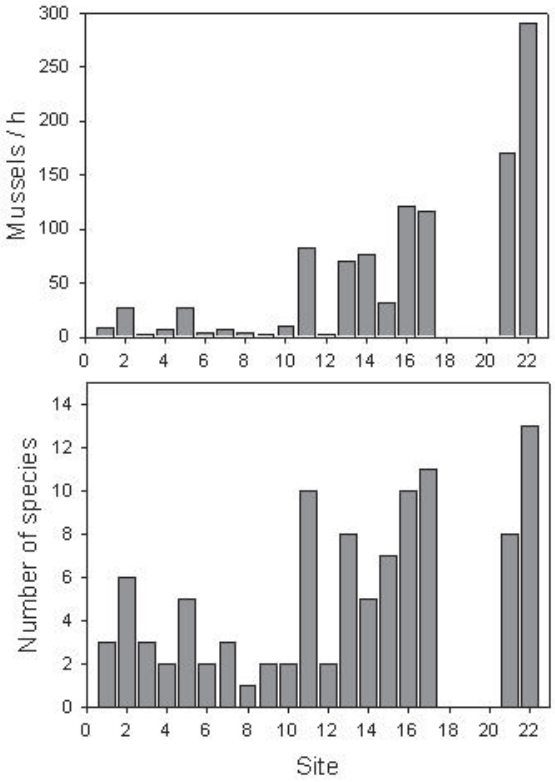

Figure 2. Abundance (as mussels found per hour of samplling effort) and species richness of mussels by site in the Glover River.

TABLE 1. Standardized abundance (individual found per hour) for the 22 sites. No live mussels were found at sites 18-20.

	Site																		
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**21**	**22**
Actinonaias ligamentina															1.0	26.7	5.5	4.5	3.0
Amblema plicata plicata	2.4	14.4	1.0	4.8	18.4		1.5			4.5	44.8		28.0	9.3	5.0	18.7	50.5	25.5	168.0
Ellipsaria lineolata																		1.5	
Fusconaia flava		4.8			3.2	3.0	4.5	4.0	1.2	6.0	24.0	1.5	18.7	36.0	7.0	54.0	45.5	121.5	78.0
Lampsilis cardium		1.6	1.0								3.2			0.7		0.7	0.5	1.5	2.0
L. siliquoidea		0.8			1.6						4.0						0.5	1.5	
Lasmigona costata											0.8		1.3			1.3	3.0		4.0
Leptodea fragilis																			1.0
Plectomerus dombeyanus																0.7			10.0
Potamilus purpuratus																			1.0
Ptychobranchus occidentalis	4.8	4.0	1.0			1.5			1.2			1.5	14.7	28.7	15.0	1.3	5.0	1.5	6.0
Quadrula cylindrica cylindrica																0.7			3.0
Q. pustulosa pustulosa															2.0	16.0	4.5	13.5	9.0
Strophitus undulatus											0.8		1.3	2.0			1.0		1.0
Tritogonia verrucosa	2.4				2.4						2.4				1.0	1.3	0.5		3.0
Villosa arkansasensis		1.6		2.4	1.6		1.5				1.6		2.7		1.0				2.0
Villosa iris													1.3						
V. lienosa											1.6		2.7				1.0		

gradient rivers in the region, such as the Kiamichi River (Vaughn et al. 1996) or the lower Little River (Vaughn and Taylor 1999), and this is a reflection of habitat availability. In the Glover River, both mussel species richness and abundance generally increase from upstream to downstream as the river decreases in gradient and as mussel habitat becomes more available. In the upper reaches of the river, mussels are generally confined to pockets of sand and gravel on the downstream side of large boulders. In the lower stretches of the river, more extensive areas of sand and gravel are available for mussels to colonize.

Eighteen living mussel species were found in the Glover River (Table 1), and no species were found as shell material that were not also found alive. The mussel fauna in the river is dominated by the three-ridge (*Amblema plicata)* and the pigtoe (*Fusconaia flava)*. These two species are also abundant in other streams in southeastern Oklahoma (Vaughn et al. 1996, Vaughn and Taylor 1999) and throughout the Mississippi drainage (Parmalee and Bogan 1998).

The Ouachita kidneyshell (*Ptychobranchus occidentalis*) is an Interior Highlands endemic (Oesch 1984) that appears to be thriving in the Glover River. The incidence and abundance of this species in the Glover River are much higher than in other rivers in the region, including the upper Little River, which has a similar fauna to the Glover (Vaughn and Taylor 1999). The Ouachita creekshell (*Villosa arkansasensis)* is a Ouachita Mountains endemic species that also is doing well in the Glover River, occurring at eight sites. This species is classified as a species of special concern by the American Fisheries Society because of its narrow range (Williams et al 1993). The rabbitsfoot mussel (*Quadrula cylindrica*) was found at two sites. This species, a former C2 candidate for federal listing, is classified as threatened by the American Fisheries Society (Williams et al 1993).

The abundance of the fluted shell (*Lasmigona costata*) is higher in the Glover River than other rivers in Oklahoma that have been surveyed to date. This species is at the western edge of its range in eastern Oklahoma (Parmalee and Bogan 1998). The rainbow mussel *(Villosa iris),* also at the edge of its range in Oklahoma (Branson 1984), occurred at only one site.

I surveyed Site 22 (Fig. 1), directly upstream from where a state highway crosses the river, in both 1996 and 1999, and this site also was surveyed by Valentine and Stansbery during the summer of 1969 (Valentine and Stansbery 1971). I found one species at this site in 1999 that I did not find in 1996, a single individual fragile papershell (*Leptodea fragilis*) (Table 1). Valentine and Stansbery report five species from this site that I did not find in either year, the yellow sandshell (*Lampsilis teres*), threehorn wartyback *(Obliquaria reflexa*), southern hickorynut *(Obovaria jacksoniana*), lilliput *(Toxolasma parvus*), and deertoe (*Truncilla truncata*). I did not find either live or shell material of *L. teres*, *O. reflexa*, *T. truncata*, or *T. parvus* at any of the Glover River sites that I surveyed, although I have found these species in the mainstem of the Little River (Vaughn and Taylor 1999). I found two species at Site 22 not reported by Valentine and Stansbery, *Quadrula cylindrica* and *Villosa arkansasensis*. *Obovaria jacksoniana* and *V. arkansasensis* can only be reliably separated by using tissue morphology and it may be that what I have identified as *V. arkansasensis*, Valentine and Stansbery called *O. jacksoniana*. *Quadrula cylindrica* may have spread into the Glover from the mainstem of the Little River (Vaughn and Taylor 1999).

Charles M. Mather (pers. com.) has recorded four mussel species from the Glover River that I did not find during this study. These species are the bleufer (*Potamilus purpuratus)*, the southern mapleleaf (*Quadrula apiculata*), the giant floater (*Pyganodoan grandis*) and the pondmussel (*Ligumia substrostrata*). These specimens are deposited in the mollusk collection at the University of Sciences and Arts of Oklahoma, Chickasha, OK.

Mussel populations are declining in many river systems in North America, including the Little River drainage (Vaughn 2000), primarily as a result of habitat degradation and fragmentation (Bogan 1993, Vaughn 1997). The main threats to mussels in the Glover River are siltation

resulting from timber harvest and gravel mining. Siltation resulting from logging activities is expected to decrease under Forest Service management. Gravel mining currently occurs within 30 m of the richest mussel site in the river (Site 22) and poses a serious threat to the continued existence of this bed. The Glover River contains a diverse, healthy mussel fauna that can be protected well into the future through sound land management practices.

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