

## Survey and Status of Mussels and Mussel Habitat in the Poteau River Buck Ray, Don Groom, Curtis Tackett **Oklahoma Department of Wildlife Conservation**



## Need:

Freshwater mussels are one of the most threatened faunas globally (Strayer et al. 2004). The Ouachita Region of Oklahoma, including the Ouachita Uplands and Gulf Coastal Plain, contains five small rivers identified by the Oklahoma Comprehensive Wildlife Conservation Strategy that are a Very High Priority Conservation Landscape with 19 freshwater mussels species identified as Species in Greatest Conservation Need (OCWCS: ODWC 2005 p. 209). These rivers are the Poteau River, the Kiamichi River, and the Little River with its major tributaries, the Mountain Fork River and the Glover River. These rivers contain a high proportion of species identified in the OCWCS as Species in Greatest Conservation Need (OCWCS pp. 211-212), particularly freshwater mussels.

The Poteau River, impounded near Wister in 1949, is a tributary to the Arkansas River. It has a shoreline of approximately 115 miles, 7,333 acres with a capacity of 62,360 acre-ft. The Poteau River is one of the three major tributaries of the Arkansas River originating in the Ouachita uplands. The Poteau is 4<sup>th</sup> order, 228 m longs, drains 4840 km<sup>2</sup> and is impounded by Wister Lake 116m upstream from the mouth. Above Wister the river is high gradient as it flows through the Ouachita Mountains. Below Wister the river makes an abrupt transition to low-gradient turbid conditions as it flows across the Arkansas River floodplain (Matthews et al. 2005).

The Poteau has been harvested for mussels, both historically and continually until 2007. In 1947-48 several thousand mussel shells and fragments were collected from a Caddo Indian midden (ca. 3500-1000 B.P.) along Fourche Maline Creek, a major tributary of the Poteau (Bell 1953, Wyckoff 1976, White 1977). More recently, from 1912 – 1923 a semi-quarterly survey was conducted of a site near the city of Poteau, which is now directly above Wister Lake (Isley, 1924). In 1976 a survey was completed on a tributary to the Poteau, 100m upstream from the Caddoan midden (White, 1977), and in 1994 a survey by Harris was also conducted on 23 sites in the upper Poteau River primarily in Arkansas. Most recently, Vaughn conducted a survey in 2003 of the Poteau identified as suitable mussel habitat above Wister Lake in Arkansas and below Wister from the dam to just past Poteau (Vaughn, 2004). The Poteau River contains over 30 species of mussels (Vaughn 2004) of which there are 11 species identified as species of Greatest Conservation Need including 5 Tier I species: Ouachita kidneyshell (Ptychobranchus occidentalis), Ouachita Creekshell (Villosa arkansasensis), Butterfly (Ellipsaria lineolata), Southern Hickorynut (Obovaria jacksonia, and Purple Lilliput (Toxolasma lividum); 2 Tier II species: Louisiana fatmucket (Lampsilis hydiana), and Plain pocketbook (Lampsilis cardium); and 4 Tier III species: Threeridge Mussel (Amblema plicata), Washboard (Megalonaias nervosa), Bluefer (Potamilus purpuratus), and Wartyback Mussel (Quadrula nodulata) (OCWCS pp. 211-212).

In 1999 and 2000, 306,004 and 108,871 pounds of mussels were taken from Oklahoma rivers. In 1999 over 150,000 pounds of M. nervosa were harvested from the Poteau and nearby Clear and Muddy Boggy Rivers. Concerns over this increase in harvest prompted the Oklahoma Department of Wildlife Conservation to create a mussel sanctuary in July of 2000 in the lower Poteau River. Examination of size distribution data of both *M nervosa* and *A. plicata* indicate that recruitment is very low in Poteau River populations (Vaughn, 2004). Additionally, the majority of *M. nervosa* sampled by Vaughn (2004) exceeded the size limit and is therefore not protected by these regulations and smaller individuals occurred at only one site.

The primary uses for Wister Lake are flood control, water supply, low flow regulation and conservation. Since the time of its construction, normal pool has been raised several times and flooded existing wetlands in the western reaches of Wister Lake. This has greatly impaired the littoral and riparian zones and their ability to properly filter sediment and protect shoreline. Water quality issues have become an increasing problem in Wister as land use practices change and sediment accumulation increases. Federal, state and municipal stakeholders have been working towards solutions to improve the overall water quality within the lake.

The most recent proposal is to extend a sluice tube in the lake and "siphon" water out the sluice gate into the tail race. This will interrupt the stratification of the lake and discharge anoxic water through the sluice gate. The anticipated results of this action is to improve the dissolved oxygen concentration and reduce algae blooms within the lake, which would improve fish habitat and improve water quality before entering municipal treatment plants. To date the draft Environmental Assessment conducted by the USACE has addressed little about the overall operation of the "siphon" and contains few test models. The lack of information has been commented on by multiple organizations and more information will not be available until publication of the final draft. No impact study is scheduled or anticipated for this action.

Since continued mussel harvest and alterations to the water quality in the Poteau River below Wister Reservoir have the potential to negatively affect downstream water quality, habitat, and diversity of mussel and fish populations in state designated mussel sanctuaries research is needed to collect updated distribution and status data of these sensitive species.

## **Objectives:**

1) To conduct an intensive one-year survey of the freshwater mussel species in the Poteau River.

2) To systematically survey fish assemblages to determine health of the Poteau river and presence of larval mussel hosts.

3) To determine the baseline concentration of dissolved oxygen, pH, temperature, and conductivity both in Wister Reservoir and in the Poteau River below Wister Dam.

4) To determine the concentration of ammonia, organic nitrogen, nitrite, nitrate, orthophosphate, and total phosphorus in water samples from Wister Lake and the Poteau River.

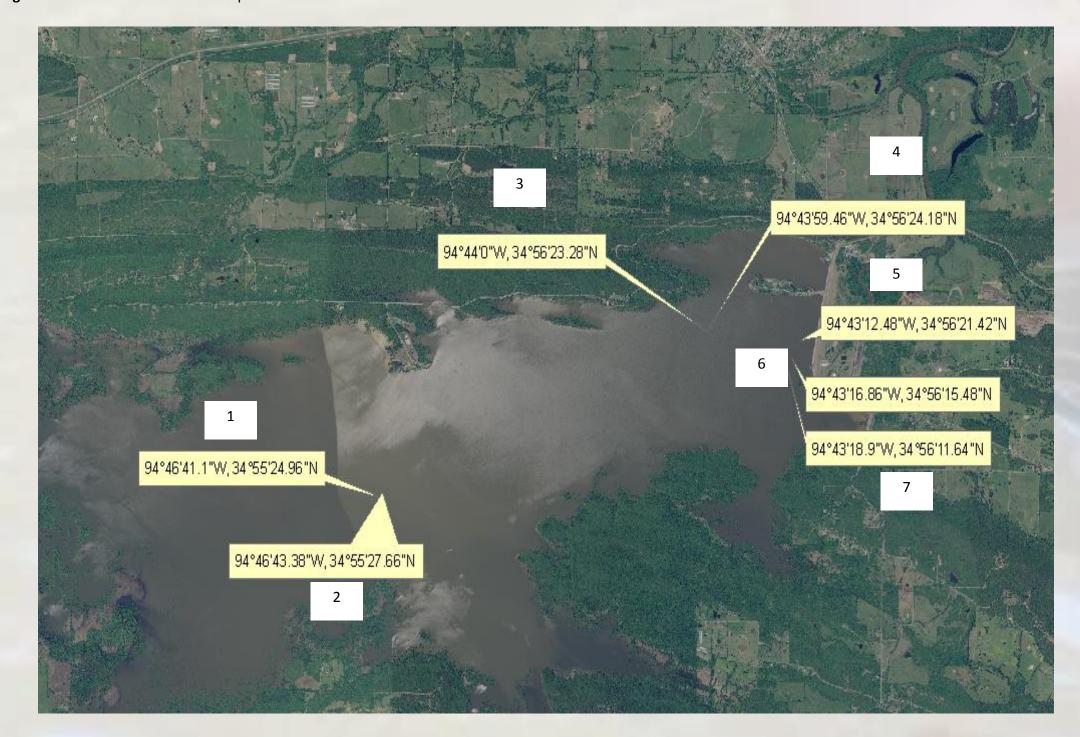
5) To determine the sediment concentrations of total organic carbon and total metals including mercury, arsenic.

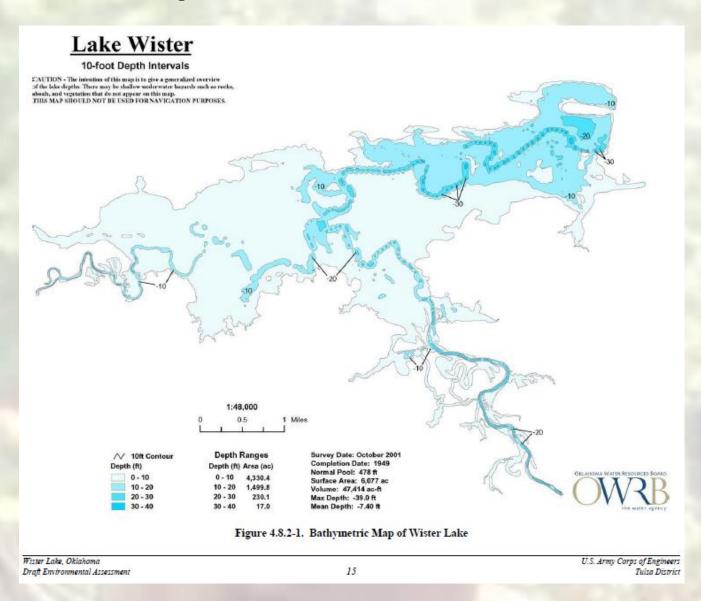
## Methods:

Mussel surveys were conducted in sites determined to be suitable mussel habitat, from the upstream border with Wister Lake Dam to the downstream crossing of Highway 112 (approximately 27 km) and timed snorkeling and scuba searches based on Vaughn (1998) and USFWS (2005) (figure 2). Once located, mussels were carefully removed from the substrate and enumerated. All individuals collected were identified to species using keys by Oesch (1995) and Mather (2005). Basic water chemistry data (temperature, dissolved oxygen, pH, conductivity, alkalinity and hardness) were collected at each sampling site. A fish survey was also completed at mussel sampling sites. A variety of gears, including boat and backpack electrofishing and seines, were utilized depending on the water depth. All sampling locations and their corresponding fish and mussel community data were georeferenced with global positioning system (GPS) receivers.

Sediment chemistry was be collected using a stainless steel Ekman dredge sampler (6 x 6 x 6 inches), targeting no more than the approximate top 10 cm of sediment. Five samples were collected in Wister Lake and two samples were collected from the Poteau (figure 1). At each sampling station, the sampler was deployed, gently extracted from the sediment, and slowly and carefully raised through the water column to minimize sample disruption during retrieval. This material was transferred into a stainless steel sample collection container using a stainless steel spoon and homogenized and used to fill a 4 oz. glass jar and stored at 4°C until analysis.

Figure 1: Locations of Sediment Samples From Wister Lake





During August of 2010, a survey of mussels was conducted in the Poteau River from Wister Dam downstream to Hwy 59. Individual mussels were released immediately prior to identification. Additionally, relic shells were collected from each site for future examination. For each of the 6 identified sites (figure 2), mussels and fish were surveyed. As a result of sampling, 16 species of mussels (table 1) and 25 species of fish (table 2) were identified.



Mussels were identified at each of the survey sites although mussel abundance varied greatly ranging from a 13 species at site 6 to a single species at site 4. Catch per unit effort (mussels per survey minute) was .347 (table 4). For the majority of the site, SCUBA gear had to be used to locate mussels. There visibility was so poor that all SCUBA surveys were done strictly by feel likely contributing to the low CPUE. Of the 17 total species collected in our study, 4 species are considered species of greatest conservation need (OCWCS, 2005). We identified one Tier II species the wartyback mussel (Quadrula nodulata) at sites 5 and 6; and three Tier II species: bluefer (*Potamilus pupuratus*) at site 3, three ridge (*Amblema plicata*) at sites 1 and 5, and the washboard (Megalonaias nervosa) at all 6 sites. The species collected in this study reflect a similar mussel community as has been previously known to occur within this stretch of the Poteau River. We collected 15 of the 23 species identified by Vaughn and Spooner (2004) and 11 of the 18 species identified by Isley (1925).

Species	Common Name	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Obliquaria reflexa	Threehorn Wartyback		2	6		13	79
Corbicula fluminea	Asian Clam		8	1		2	1
Potamilus purpuratus	Bluefer			1			
Truncilla truncata	Deer Toe		1				1
Pyganodon grandis	Floater						7
Pluerobema sintoxia	Round Pigtoe	3				2	25
Quadrula quadrula	Maple Leaf		1			4	21
Lampsilis siliquoidea	Fat Mucket		1	2		10	22
Quadrula pustulosa	Pimpleback						1
Tritogonia verrucosa	Pistolgrip					1	
Amblema plicata	Three Ridge	11				5	
Fusconaia flava	Wabash Pigtoe		9	10		12	7
Quadrula nodulata	Wartyback					1	3
Megalonaias nervosa	Washboard	8	20	8	3	50	13
Lasmigona complanata	White Healsplitter	5	8	4		13	8
Lampsilis teres	Yellow Sandshell	3					1

Table 1: Summary of Mussels Found in the Poteau River By Site

**Results and Discussion** 

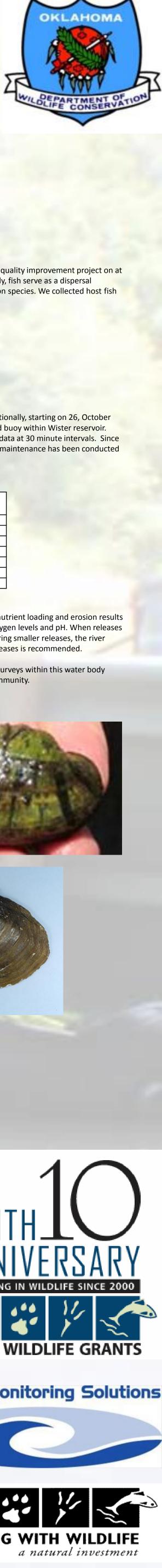
Fish were identified and enumerated for each survey location and released on site and listed in table 4 with the red shiner (*Notropis lutrensis*), longear sunfish (Lepomis megalotis), and bluegill sunfish (Lepomis macrochirus) being the most abundant species with an overall CPUE of 2.41 (table 2). It should be noted that although the red shiner was species with the greatest total abundance, all but 1 individual of this species was collected at only 1 site, site 5. The largemouth bass and spotted bass largely represent the piscivorus feeding guild within this section of the Poteau River. Channel catfish were also present in small numbers at all but 1 site. The harlequin darter (*Etheostoma histrio*), identified as a Tier III species (ODWC, 2005), was the only fish species collected that was identified as a species of greatest conservation need.

Table 2: Summary for Fish Found in the Poteau River By Site

				Si	ite		
Species	Comon Name	1	2	3	4	5	6
Fundulus notatus	Blackstripe Topminnow					1	
Ictalurus furcatus	Blue Catfish			1			2
Lepomis macrochirus	Bluegill	18	5	5	5	9	9
Ictalurus punctatus	Channel Catfish	4	1	1		1	1
Percina copelandi	Channel Darter					1	
Cyprinus carpio	Common Carp			1			2
Aplodinotus grunniens	Freshwater Drum	3	7	2	3	1	1
Pylodictis olivaris	Flathead Catfish					7	
Lepisosteus oculatus	Spotted Gar			1	1		
Lepisosteus platostomus	Shortnose Gar				2		
Etheostoma blenniodes	Greenside Darter					1	
Lepomis cyanellus	Green Sunfish	2				1	1
Etheostoma histrio	Harlequin Darter						
Micropterus salmoides	Largemouth Bass	3	3	1	3	1	5
Percina caprodes	Logperch		2			1	
Lepomis megalotis	Longear Sunfish	7				36	
Lepomis humilis	Orangespot Sunfish				2	1	1
Cyprinella lutrensis	Red Shiner		1			70	
Noturus exilis	Slender Madtom					10	
Ictiobus bubalus	Smallmouth buffalo			1	1		3
Micropterus punctulatus	Spotted Bass	3	3	2	2	8	
Campostoma anomalum	Central Stoneroller					8	
Marone chrysops	White Bass				2		
Proximis annularis	White Crappie						2
Gambusiia affinis	Western Mosquitofish						4







Fish were included in this study for two reasons. First, we were interested in a baseline assessment of the health of this section of the Poteau River prior to any water quality improvement project on at Wister Lake. Second, fish play a critical role in the life cycle of mussel species when the glochidia parasitize fish briefly before the glochidia metamorphose. Additionally, fish serve as a dispersal mechanism for mussel. Mussels vary in their specificity to glochidial hosts. Some mussels are species specific and others being capable of parasitizing multiple common species. We collected host fish species for all of the mussel species collected that were identified as species of greatest conservation need. Table 6 lists the mussels and their known hosts.

Table 3: Summary of Biological Collections

Taxonomic Group	Total abundance	Richness	CPUE
Mussels	350	16	2.413793103
Fish	184	25	0.347621252

At each mussel survey location, basic water quality parameters (dissolved oxygen, pH, conductivity, salinity, temperature) were collected using handheld probes. Additionally, starting on 26, October 2010, ODWC staff worked with Water Monitoring Solutions (Consultant) in placing two YSI 6920v2 sondes in the study area. One sonde was suspended from a marked buoy within Wister reservoir. The second sonde was placed in the Poteau River, suspended within a PVC pipe fixed to the shoreline approximately 1.8 miles below Wister Dam. The sondes record data at 30 minute intervals. Since their deployment, the units have been monitored on a monthly basis. Data was downloaded from the units, calibrations and calibration logs maintained, and regular maintenance has been conducted as needed/required.

Table 4: Sediment Analysis (values in mg/kg)

Sample	Arsenic	Mercury	Nitrogen, Total	Notrogen, Kjeldahl	Nitrate-Nitrite	Phosphorus
1	12	<.025	942	942	<1	308
2	4.9	<.026	531	531	<1	178
3	2	<.027	283	283	<1	92
4	11.6	<.028	864	864	<1	313
5	10.2	<.029	685	685	<1	357
6	9.3	<.030	673	673	<1	219
7	8.1	<.031	683	683	<1	208

It is important to note that the Wister area experienced a drought and extreme summer temperatures in 2011. The combination of shallow bathymetry, orientation, nutrient loading and erosion results in heating of the reservoir to extreme temperatures during the summer and re-suspension of nutrients/sediments that drive algal blooms that negatively influence oxygen levels and pH. When releases were compared to water quality parameters, it was noted that the lake de-stratifies during extended releases and stratifies relatively quickly when releases cease. During smaller releases, the river does not sufficiently aerate to improve water quality, specifically as it pertains to low pH values in the river. Further evaluation of pH, dissolved oxygen and various releases is recommended

No mussels identified as tier I or tier II species of greatest conservation need were collected during this project. This is concerning due to the presence on previous surveys within this water body (table 5). This could indicate a decline in mussel density and or abundance. Therefore, additional survey work is needed to determine current status of the mussel community.

 Table 5: Mussels Previously Collected Within the Poteau River Identified as Species of Greatest Conservation Need in the CWCS.

Oachita Kidneyshell ychobranchus occidentalis)SGCN Tier IGreenside Darter
Oachita Creekshell (Villosa arkansasensis),SGCN Tier ICreole Darter, Greenside Darter, shadow bass
Butterfly SGCN Tier I Freshwater Drum, Green (Ellipsaria lineolata) Sunfish
Southern Hickorynut (Obovaria jacksonia)SGCN Tier IUnknown
Purple Lilliiput (Toxolasma lividum)SGCN Tier IGreen Sunfish, Longeared Sunfish
Louisiana fatmucket (Lampsilis hydiana)SGCN Tier IILargemouth Bass, Orangethroat Darter
Plain pocketbook (Lampsilis cardium);SGCN Tier IIbluegill, largemouth and smallmouth bass, sauger, walleye, white crappie and yellow perch.
References: Mather (2005)

