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SIGNIFICANT RECENT RECORDS OF UNIONID MUSSELS IN NORTHEAST TEXAS RIVERS

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ABSTRACT

Five rivers in northeastern Texas, U.S.A. were surveyed for Unionid mussels from 2010 to 2012. We sampled 165 sites in the North and South Sulphur rivers, the Little Cypress Bayou, Black and Big Cypress creeks, the upper Sabine River, the Neches River, the Angelina River, the Attoyac Bayou, and the upper Trinity River. Each location was accessed by kayak and timed tactile surveys of 50 to 300 m of the river were conducted. We recorded a total of 20,134 mussels of 35 species, of which 16,714 were live. State listed species were found in all the rivers. The Neches River was the most speciose of all the large rivers of northeastern Texas and should be of prime conservation concern. The Sulphur River contained a few species that extended in from Oklahoma. The Trinity River, which runs through the Dallas/Fort Worth metroplex, surprisingly had two threatened species.

KEY WORDS Freshwater mussels, Unionidae, Northeastern Texas, Surveys, Conservation

INTRODUCTION

Freshwater mussels of the family Unionidae have been impacted by anthropogenic factors for many decades and both the number of species and their abundances have declined throughout North America (Bogan, 2008; Downing et al., 2010). In the early 1990s, Texas Parks and Wildlife Department (TPWD) began systematic surveys in the state to determine the status of unionid mussels (Howells, 1997) and in 2009, 15 of the 51 species found in the state were listed as threatened: <http://www.tpwd.state.tx.us/newsmedia/releases/?req=20091105c> accessed June 5/2013.

This legal designation sparked interest in generating accurate current distribution records for those species. East Texas is a center for mussel diversity for the state because it contains both species exhibiting their westernmost distribution, other species that are either Texas endemics or only occur just eastward into western Louisiana or Arkansas (Neck, 1982; Howells et al., 1996; Burlakova et al., 2011) and some whose distribution extends south from Oklahoma. Northeast Texas has five drainage basins with rivers that start within the state and flow independently to either the Red River on the Louisiana border or to the Gulf of Mexico (Fig. 1).

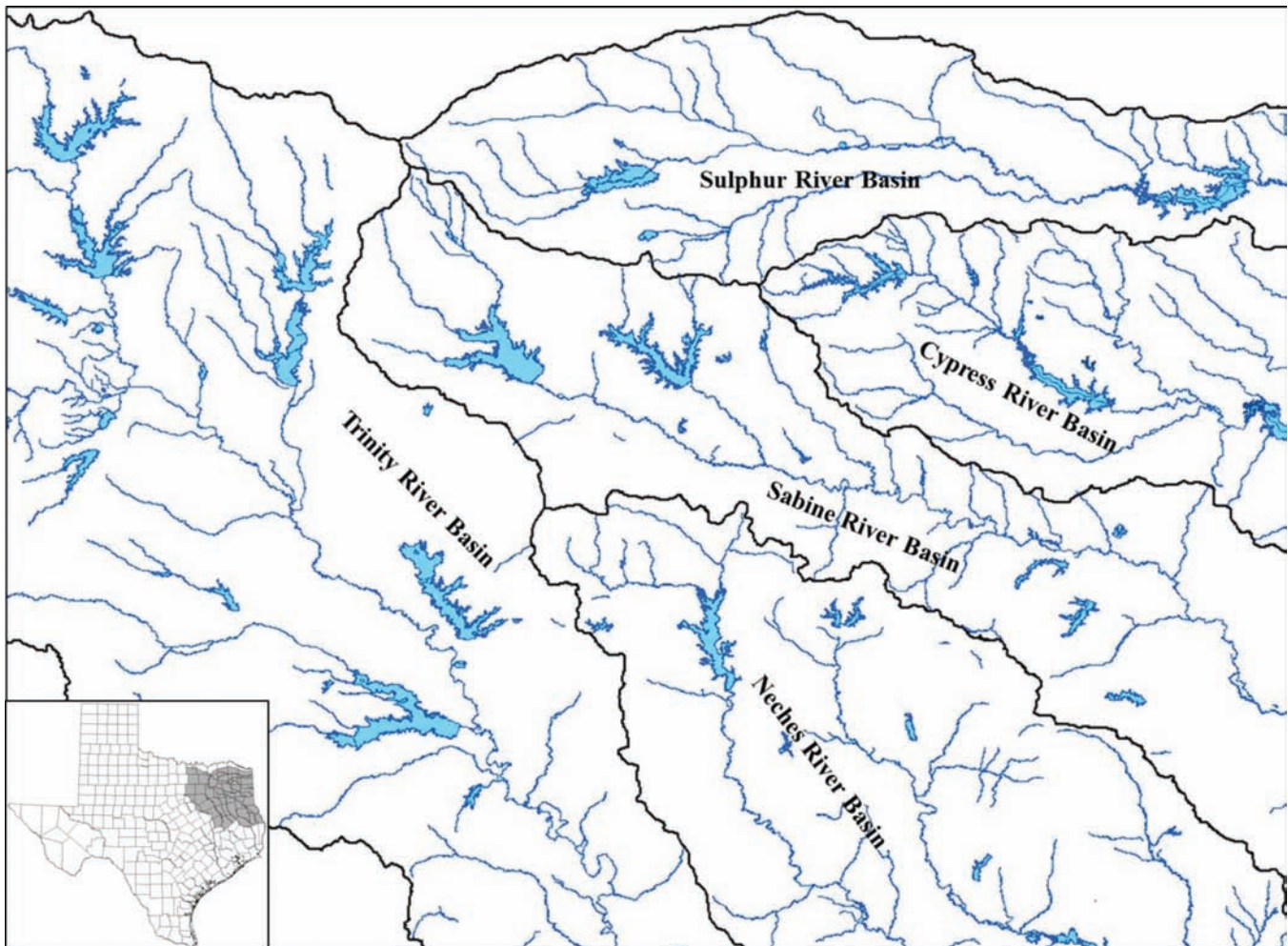


FIGURE 1

Map of the Northeast Texas River basins containing the rivers where mussels were collected.

Because of these substantial water resources, northeast Texas has been a prime area for reservoir development and over 30 large dams have been constructed (Graf, 1999; www.twdb.state.tx.us/waterplanning/swp/2012/ accessed June 5/2013). The rapid human population increases in the nearby Dallas/Fort Worth area have produced intense pressure to continue to build dams for their increased water needs. Northeast Texas also has a number of commercial interests that impact its water resources, including oil and gas drilling, intensive ranching, poultry operations and timber harvesting (Burlakova et al., 2011). These stressors led the writers of the 2005-2010 Texas Comprehensive Wildlife Conservation Strategy Plan (Bender et al., 2005) to identify “evaluating how instream flows and water quality impact rare and endangered species” as a high priority for northeast Texas.

Northeast Texas historically contained 42 species of unionid mussels (Park & Bachtal, 1940; Howells, 1997; Ford & Nicholson, 2006; Ford et al., 2009) and this represents the highest diversity in the state. Six of those species are listed as state threatened: Southern Hickorynut (*Obovaria jacksoniana*), Louisiana Pigtoe (*Pleurobema riddellii*), Texas Pigtoe (*Fusconaia askewi*), Triangle Pigtoe (*Fusconaia lananensis*), Sandbank Pocketbook (*Lampsilis satura*), and Texas Heelsplitter (*Potamilus amphichaenus*). Although *F. askewi* is considered to be a valid species, Burlakova et. (2012) considered *F. lananensis* to be a synonym of that species. Howells et al. (2012) disagreed and considered that *F. lananensis* should be recognized as distinct. In addition some north Texas *Fusconaia* have a similar morphology to *F. flava* (Howells, pers. comm.) such that all distributions of *Fusconaia* in Texas are of interest. Northeast

Texas also has records for other problematic species, such as Mapleleaf (*Quadrula quadrula*), Pimpleback (*Quadrula pustulosa*) and White Heelsplitter (*Lasmigona complanata*), which are at the southern or western extent of their distribution, and so are poorly known in the state (Table 1; Vidrine, 1993). Four other species,

TABLE 1

State threatened and rare unionid mussels recorded in the river basins during this study. Numbers of live and recent dead are shown (Live/Dead).

Species	Common name	Status in Texas	Trinity	Neches	Sabine	Cypress Creek	Sulphur
<i>Arcidens confragosus</i>	Rock Pocketbook	Species of concern	4/0	55/1	21/9	1/0	5/2
<i>Fusconaia askewi</i>	Texas Pigtoe	Threatened	15/16	886/80	282/214	2/3	2/10
<i>Fusconaia flava</i>	Wabash Pigtoe	No status	0/0	0/0	0/0	1/0	1/0
<i>Fusconaia lananensis</i>	Triangle Pigtoe	Threatened	0/0	148/16	0/0	0/0	0/0
<i>Lampsilis satura</i>	Sandbank Pocketbook	Threatened	0/1?	86/13	14/13	0/0	0/0
<i>Lasmigona complanata</i>	White Heelsplitter	Restricted distribution	0/0	0/0	0/0	0/0	1/0
<i>Obovaria jacksoniana</i>	Southern Hickorynut	Threatened;	0/0	24/2	0/0	0/0	0/0
<i>Pleurobema riddellii</i>	Louisiana Pigtoe	Threatened	0/0	437/29	1/1	18/4	0/0
<i>Potamilus amphichaenus</i>	Texas Heelsplitter	Threatened	0/0	6/5	7/16	0/0	0/0
<i>Quadrula pustulosa</i>	Pimpleback	Restricted distribution	0/0	0/0	0/0	0/0	3/0
<i>Quadrula quadrula</i>	Mapleleaf	Restricted distribution	0/0	0/0	0/0	1/0	24/9
<i>Strophitus undulatus</i>	Creeper	Species of concern	0/0	11/1	0/0	6/17	0/0
<i>Truncilla donaciformis</i>	Fawnsfoot	Species of concern	0/0	35/10	0/0	0/0	3/0
<i>Villosa lienosa</i>	Little Spectaclecase	Poorly known	0/0	10/5	0/0	0/0	0/0

Rock pocketbook (*Arcidens confragosus*), Creeper (*Strophitus undulatus*), Fawnsfoot (*Truncilla donaciformis*), and Little Spectaclecase (*Villosa lienosa*) are widely distributed in northeast Texas but rarely found (Howells et al., 1996) and are included in this report. The first three of these are listed as Species of Concern by TPWD. Internal TPWD surveys from 1992 to 1998 produced more recent distributional records for the mussels of east Texas (Howells et al., 1996; Howells, 1997) and surveys of reservoirs and bridge crossings on four rivers and stream segments produced new locality records for some of these species (Karatayev & Burlakova, 2007). However, long reaches between bridges on large rivers were not surveyed in these studies and so our understanding of the overall distribution of these mussels was limited. In 2010 we began mussel surveys of the larger rivers in all five river basins; this involved kayaking upstream and downstream of bridge access points in an attempt to clarify the distribution of unionids in northeast Texas. Here we report information on some of the least common of those species.

METHODS

We surveyed 165 locations in the large rivers of five river drainages: the North and South Sulphur rivers in the Red River basin, the Little Cypress Bayou and the Black and Big Cypress Creeks in the Cypress River basin, the upper Sabine River in the Sabine River basin, the upper Neches River, the Angelina River and the Attoyac Bayou in the Neches River basin, and the upper Trinity in the Trinity River basin. The Trinity River was sampled using divers from Zara Environmental LLC and Half Associates Inc. In general, each river was surveyed from the upstream areas east of Dallas to downstream areas in northeast and eastern Texas. Surveys on the Sabine and Neches began in the summer of 2010 and the surveys on other rivers were started in 2011.

We traveled to each designated site by kayak and did initial reconnaissance of areas along the shore for shells. In appropriate locations we sampled using a timed hand search, or with SCUBA gear in deeper areas (Vaughn et al., 1997). Surveys were standardized on a per person-hour of searching (Strayer & Smith, 2003). Depending on the goals of the particular survey, multiple samples varying from 50 to 300 m of the river at that site were made.

All live unionids were collected, identified, counted and then returned to the river. Habitat data collected varied in association with goals of each particular survey but only general descriptions of the sites are used in this report. Vouchers were retained in the University of Texas at Tyler collection.

RESULTS

From the five River basins, we recorded a total of 20,134 mussels of 35 species, of which 16,714 were live. In the Angelina River (including the Attoyac Bayou) we found 1,853 live mussels and 243 recent dead of 22 species. Of the 28 species recorded in the Neches River, 10,122 were live and 972 were recent dead. In the three branches of the Cypress River drainage we recorded 460 live and 292 dead of 21 species. From the Sulphur River basin we collected 22 species with 940 live and 95 dead. A total of 1,124 live and 679 dead of 16 species were recorded in the Trinity River in the

Dallas Fort Worth area. Fourteen threatened, rare or poorly known species were found in some or all the rivers during the survey (Table 1).

State Threatened species

Five species listed as threatened by TPWD were found in this study (Table 1). Undetermined *Fusconaia* species were fairly common in many sites. The form matching the shell morphology of *F. askewi* was abundant in the Sabine, Neches and Angelina rivers, whereas *F. lananensis* morphs were identified in the Angelina River and Attoyac Bayou. *Fusconaia lananensis* was occasionally common with 56 individuals recorded at a single site in the Angelina River. *Fusconaia* species were rare in the Black and Little Cypress and also the Trinity and Sulphur rivers. In these water bodies very few live specimens were found but the morphology of the dead ones were usually similar to what is typically called the Wabash Pigtoe (*F. flava*) although some were comparable to *F. askewi*. Genetic analysis (mtDNA of the ND1



FIGURE 2

Wabash Pigtoe (*Fusconaia flava*) from the Sulphur River.

gene) of one individual from the Sulphur River (Fig. 2) that morphologically resembled *F. askewi* genetically matched *F. flava*, whereas one from Black Cypress Bayou (Fig. 3) that resembled *F. flava* genetically matched *F. askewi*, which suggested that both species may occur in these rivers. *Lampsilis satura* was uncommon in all

rivers with a maximum of six at a site, but a total of 100 live and 26 recently dead specimens were found in the Sabine, Neches and Angelina rivers. Recruitment was also evident as juveniles of this species were collected. One weathered dead specimen from the Trinity River was tentatively identified as *L. satura*. *Obovaria jack-*



Fusconaia flava
Black Cypress Bayou, TX

FIGURE 3

Wabash Pigtoe (*Fusconaia flava*) from the Black Cypress Creek.

soniana was very rare and only found in sites close to Texas Highway 84 on the Neches River. This area of the river is connected to the floodplain, which appears to be important for the species (Troia, 2010; Troia & Ford, 2010). *Pleurobema riddellii* was common in the Neches and Angelina rivers where most of the total 455 live and 33 dead were found. A few individuals of this species were found in the Big and Little Cypress rivers and one live and one dead were found in two sites on the Sabine River. Prior to this study no live *P. riddellii* had been recorded in the Sabine River in over 35 years. Recently live individuals have also been recorded in the upper Trinity River (J. Krejca, Zara Environmental LLC, pers. comm.). Additional surveys may reveal more localities for this species. *Potamilus amphichaenus* was one of the rarest overall species with only 13 live and 21 dead recorded in the Sabine and Neches rivers and only one or two individuals at a site. *Potamilus amphichaenus* was also one of the few mussels in which more dead individuals were found than live ones, which may indicate higher predation rates (Walters & Ford, in press).

Species of Concern

Arcidens confragosus is widely distributed in east Texas but is typically uncommon at each site (Howells et al., 2000). In this survey we found 76 live and 10 recently dead specimens in the Sabine, Neches, Angelina, Little Cypress and Sulphur rivers (Table 1). They generally were dispersed and no more than nine individuals were found at a single site. One *Lasmigona complanata* was found in the Sulphur River just downstream of the Wright-Patman Reservoir (Heffentrager & Ford, 2012). *Strophitus undulatus* was rare with 17 live and 18 dead specimens recorded from all three branches of the Cypress River and in the Neches River and Attoyac Bayou. *Truncilla donaciformis* was common in the Neches River at several sites just above the B. A. Steinhagen Reservoir with 38 live and 10 dead in total. Three were found live in two sites on the Sulphur River.

Rare or poorly known species

Quadrula pustulosa was confirmed (genetic analysis on two individuals) in the Sulphur River with three live

individuals collected (Fig. 4). *Quadrula quadrula* was also found at most sites on the Sulphur River (Fig. 5) and one was found in Big Cypress Bayou. *Villosa*

lienosa were found in several sites in the Neches River, one site on the Angelina River, often with two or three at a site although only 10 total live individuals were collected.



FIGURE 4
Pimpleback (*Quadrula pustulosa*) from the Sulphur River.

DISCUSSION

Our records suggest that many of the conclusions of Howell's 1997 report for east Texas mussels are still accurate. The Sulphur River basin has a few species that extend into Texas from Oklahoma (i.e., *L. complanata*, *Q. quadrula* and *Q. pustulosa*). The Cypress Creek Basin rivers have few rare species with the exception of *S. undulatus* and *P. riddellii*. *F. askewi* are still abundant in many sites in the upper Sabine River with evidence of abundant recruitment. That river also has the highest quantity of *P. amphichaenus* although individuals were scattered and most records were for recently dead individuals. *Potamilus amphichaenus* has a thin shell that

makes them vulnerable to terrestrial predators (Walters & Ford, in press). The occurrence of living *P. riddellii* in the Sabine River is important as it extends northward its known recent distribution. Even without its tributaries, the Angelina River and Attoyac Bayou, included the Neches River has the most speciose mussel fauna of the large rivers of northeast Texas. Besides an abundance of *Fusconaia* and *Pleurobema* species, *L. satura*, *T. donaciformis*, *O. jacksoniana*, *V. lienosa*, *P. amphichaenus*, *A. confragosus* and *S. undulatus*, are all found in the Neches River (Table 1). This river should be of prime conservation concern for mussels in the state.

**FIGURE 5**

Mapleleaf (*Quadrula quadrula*) from the Sulphur River.

Although this survey only included a very small portion of the Trinity River, results from there were significant in recording both *Fusconaia species* and *P. riddelli* in the upper reaches of the Elm Fork in Fort Worth. It had been expected that mussels were likely extirpated from the Trinity River in that highly populated area (Strecker, 1931) but other recent surveys in that metroplex found significant mussel populations (Krejca, pers. comm.). This may relate to improvements in water quality or just a paucity of data for that river. Additional surveys in that river are especially recommended.

Although most unionid mussel species are undoubtedly uncommon in northeast Texas it is important to note that these surveys still located live specimens of rare species and occasional significant mussel beds. This study suggests several avenues for additional work in northeast Texas on this fauna. First, continued research and additional protection is needed for all populations of riverine mussels but particularly the Neches River and areas in the middle reaches of the upper Sabine River where mussels were both diverse and abundant. We now have enough distributional data in these two rivers to begin to conduct population studies on some of the im-

portant species there, potentially protecting some of the largest populations of these threatened species. We also have sufficient information to indicate that some additional species, such as *O. jacksoniana* and *S. undulatus*, should be listed in the state. Second, improvement in current anthropogenic impacts is needed in all rivers but particularly in the Sulphur River, Cypress Creek basin and upper Trinity River. These rivers were more obviously modified by dams, agriculture and industries but have some important species, although in very low numbers. Additional distributional data are needed in these three river basins to help make appropriate decisions concerning protection of the rare species found in these drainages.

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