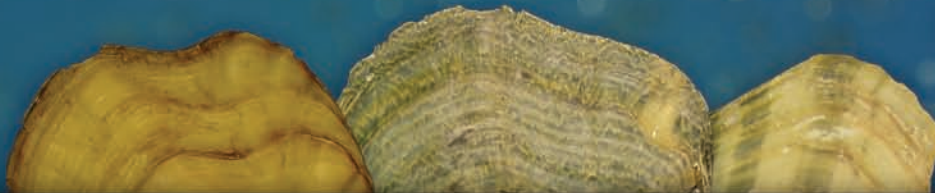


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# RECENT COLLECTION OF A FALSE SPIKE (*QUADRULA MITCHELLI*) IN THE SAN SABA RIVER, TEXAS, WITH COMMENTS ON HABITAT USE

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## ABSTRACT

Similar to other rare and endemic freshwater mussel species in Texas, the distribution and life history of the False Spike, *Quadrula mitchelli*, is poorly understood. Few recent locality records suggest that *Q. mitchelli* has been extirpated from much of its range and is declining in numbers at an alarming rate, which has led to it being petitioned for listing under the Endangered Species Act. We present our findings of the discovery of one live individual collected on the San Saba River, TX and provide information regarding the species' habitat use. The discovery represents the second known population in Texas and the only record of a live individual from the San Saba River. Knowledge of habitat use may help identify populations in other streams and allow managers to develop recovery plans for *Q. mitchelli*. However, given the rarity of this species, *Q. mitchelli* potentially faces extinction unless prompt conservation action is taken by state and federal agencies.

**KEY WORDS** Freshwater mussels, Unionids, Texas, False Spike, Rare Species

## INTRODUCTION

In Texas, the current status and life history of rare freshwater mussel (Bivalvia: Unionidae) species are poorly understood. False Spike, *Quadrula mitchelli* (Simpson, 1895), is a rare species of mussel endemic to Central Texas and the Rio Grande drainage. Strecker (1931) described the species as being common wherever it was found. Over the last 30 years, considerable effort has been spent trying to locate live individuals of this species in stream segments where it historically occurred, but to date contemporary accounts are largely based on weathered shell material (Howells, 2010). The only exceptions are the discovery of several live individuals of *Q. mitchelli* in the Guadalupe River and a fresh dead individual in the San Saba River (Randklev et al., 2012; Randklev et al., in press). These accounts indicate that *Q. mitchelli* is still extant, but the absence of this species in other parts of its range suggest *Q. mitchelli* is no longer common, an observation reported as early as the 1970s (Stansbery, 1971). The decline of this species in stream segments where it once occurred has been attributed to anthropogenic impacts to streams and rivers coupled with record droughts and floods in the late 1970s and early 1980s in Texas (Howells, 2003). As a result, *Q. mitchelli* was designated as state threatened in 2009 (Texas Register 35 2010) and is currently being reviewed for listing under the Endangered Species Act (ESA; Federal Register 76 2011).

Historically, the range of *Q. mitchelli* included the Rio Grande, San Antonio, Guadalupe, Colorado, and Brazos river basins (Howells et al., 1996; Howells, 2010). The species is likely extirpated from the Rio Grande drainage (Howells, 2003). In central Texas, a single subfossil valve was collected from Salado Creek (Howells, 2002), representing the only record of the species in the San Antonio River drainage. Within the Guadalupe River drainage, Strecker (1931) and Wurtz (1950) collected live individuals from the Guadalupe River in the early decades of the twentieth century. Valves of a recently dead individual (shells in good condition, but soft tissue absent; Howells, 2003) were collected in the San Marcos River, a major tributary of the Guadalupe River, in 2000 (Howells, 2001). *Quadrula mitchelli* has been historically collected from Pecan Bayou (R.G. Howells database), Johnson Fork Creek (R.G. Howells database), Pedernales (Howells, 1994), San Saba (Strecker, 1931; Howells, 1995), and Llano (Strecker 1931; Howells 1996) rivers within the Colorado River drainage and from the Brazos (R.G. Howells database), Lampasas (R.G. Howells database), and Leon rivers (Strecker, 1931; R.G. Howells database) within the Brazos River drainage. Until recently, however, the only evidence to suggest the species still exists in Texas was the discovery of a valve of a fresh-dead individual (soft tissue present) from the San Saba River (Randklev et al., in press) and seven live individuals col-

lected in the Guadalupe River in 2011 (Randklev et al., 2012).

## METHODS

In July 2012, we conducted multiple-pass-depletion surveys for state-threatened mussel species in the lower San Saba River as part of a larger, ongoing study in the river. While conducting timed searches, we collected one live *Q. mitchelli* (Fig. 1) at a site located

11.3 km east of San Saba, San Saba Co., Texas, approximately 200 m upstream from a fresh-dead specimen reported by Randklev et al. (in press). Gonadal fluid was extracted to determine sex and reproductive viability (Saha & Layzer, 2008).

To improve our understanding of *Q. mitchelli*'s habitat, we recorded physical measurements of habitat at the site. Six equidistant cross-section transects along the length of the site (76.5 m) were used to determine site-



**FIGURE 1**

Live individual of *Quadrula mitchelli* collected from the San Saba River, San Saba Co., Texas.

specific habitat characteristics. We measured depth (m) and velocity ( $\text{ms}^{-1}$ ) at 0.5 m increments along each transect to determine mean discharge ( $\text{m}^3\text{s}^{-1}$ ). Pebble counts (Wolman, 1954) were conducted along each transect to determine median substrate particle size (Gordon et al., 2004). Additionally, three 0.25- $\text{m}^2$  quadrats, placed on and directly adjacent to where the *Q. mitchelli* individual was collected, were used to determine microhabitat characteristics. We measured depth, velocity, and substrate characteristics (dominant, subdominant, and percentage fine sediment) for each of the quadrats mentioned above. We measured shear stress with FST hemispheres (Statzner

& Müller, 1989) and visually determined percentage of benthic algae within each quadrat. Canopy cover (%) was visually estimated by three observers standing over the middle quadrat.

## RESULTS

The individual collected was consistent with taxonomic descriptions provided by Howells (2010) and measured 68.4 mm in shell length, representing a large adult. The presence of eggs in gonadal fluid extracted from the visceral mass clearly indicated that the individual was a

viable female capable of reproducing, but the individual appeared not to be gravid at the time of sampling. Timed searches were conducted for a total of 70.6 person-hours (p-h) at the site, with an overall catch-per-unit-effort of 13.1 mussels collected per p-h of search effort (Table 1). Eight species were collected throughout the site during

our survey, including four species listed as state threatened (Table 1; Texas Register 35 2010). Of these, *Q. houstonensis*, *Q. petrina*, and *Truncilla macrodon* are listed as candidates for protection under the Endangered Species Act (Federal Register 76 2011).

**TABLE 1**

Freshwater mussel species collected from one site on the San Saba River, San Saba Co., Texas where one live individual of *Quadrula mitchelli* was observed. Total individuals collected and catch-per-unit-effort (CPUE) are provided.

Species	Common Name	Live Individuals Collected
<i>Amblyema plicata</i> (Say 1817)	Threeridge	8
<i>Cyrtornaias tampicoensis</i> (I. Lea 1838)	Tampico Pearlymussel	1
<i>Leptodea fragilis</i> (Rafinesque 1820)	Fragile Papershell	21
* <i>Quadrula houstonensis</i> (I. Lea 1859)	Smooth Pimpleback	390
* <i>Quadrula mitchelli</i> (Simpson 1859)	False Spike	1
* <i>Quadrula petrina</i> (Gould 1855)	Texas Pimpleback	247
<i>Quadrula verrucosa</i> (Rafinesque 1820)	Pistolgrip	251
* <i>Truncilla macrodon</i> (I. Lea 1859)	Texas Fawnsfoot	3
Total individuals collected		922
Total person-hours of effort		70.6
CPUE (mussels/p-h)		13.1

\*State-threatened species and species being reviewed for potential listing under the Endangered Species Act (ESA; Federal Register 76 2011).

The site inhabited by the *Q. mitchelli* individual was characterized by steep banks with extensive riparian vegetation and adjacent land uses comprised of pecan orchards and rangeland. The channel was relatively wide and shallow with gravel and cobble substrates and moderate to high water velocities (Table 2). The macrohabitat of the site consisted of a run-riffle-pool sequence. We collected the individual in a run, immediately upstream from where flow transitioned into a riffle, and *Q. mitchelli* was observed burrowed in very coarse gravel. Benthic algae were relatively abundant on gravel and cobbles and on the shells of live mussels.

## DISCUSSION

Limited information regarding habitat preferences for *Q. mitchelli* exists. Wurtz (1950) and Randklev et al. (2012) collected live specimens in the Guadalupe River at sites with relatively shallow depths (< 0.7 m) with gravel and cobble substrates, similar to habitat observed

in the present study. However, Wurtz (1950) noted water lilies at a site where *Q. mitchelli* was present but no other study reported macrophytic vegetation where the species was collected.

While only one individual was collected during our survey, the physical habitat measurements we recorded might be of use in locating similar habitat for *Q. mitchelli* in streams within the Colorado River basin. Also, if this species becomes listed under the ESA, our observations of habitat might assist resource managers with mapping of critical habitat. Finally, there is little information available on the effort needed to collect this species by using the timed-search method. Therefore, the amount of effort we invested to locate a live individual of *Q. mitchelli* can be used to guide surveys targeting this species, especially in streams where it is suspected to occur in low densities.

The status of *Quadrula mitchelli* in Texas, based on historical and contemporary surveys, is tenuous. The

**TABLE 2**

Site-specific habitat and microhabitat estimates collected from San Saba River, San Saba Co., Texas where one live individual of *Quadrula mitchelli* was collected. Microhabitat refers to habitat measured from quadrats on and adjacent to the area where *Q. mitchelli* was collected.

Habitat parameters	Estimate
<b>Site-specific habitat<sup>a</sup></b>	
Mean bankfull width	23.52 m ± 1.42 (SD)
Mean bankfull depth	0.73 m ± 0.04 (SD)
Mean wetted width	22.63 m ± 1.27 (SD)
Mean depth	0.20 m ± 0.04 (SD)
Discharge range	1.42 – 1.81 m <sup>3</sup> s <sup>-1</sup>
Median substrate particle size	36 – 67 mm
<b>Microhabitat<sup>b</sup></b>	
Mean current velocity	0.51 ± 0.02 m s <sup>-1</sup> (SD)
FST-hemisphere density	1.129 – 1.274 g cm <sup>-3</sup>
Mean dominant substrate	119.17 mm ± 24.18 (SD)
Mean subdominant substrate	58.60 mm ± 3.33 (SD)
Mean fine substrate	11.67% ± 6.24 (SD)
Mean benthic algae	46.67% ± 4.71 (SD)
Mean canopy cover	69% ± 5.66 (SD)

<sup>a</sup>n = 6 for all estimates. <sup>b</sup>n = 3 for all estimates.

species appears to have been extirpated from much of its range and until our discovery in the San Saba River has only been recently collected alive from the Guadalupe River (Randklev et al., 2012). Given the amount of time expended to collect this individual (70.6 p-h) and the fact that we observed this species at only one site, despite surveying other locations with similar effort, does not bode well for *Q. mitchelli* in the San Saba River. Thus, it appears that *Q. mitchelli* is on the brink of local extinction in this river, which is problematic because it is only known to persist at one other locality. Currently, there are no substantive plans to mitigate the decline of this species which indicates to us that the likelihood of recovering *Q. mitchelli* is low unless prompt conservation action is taken by Texas Parks and Wildlife Department and U.S. Fish & Wildlife Service.

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## **OUR PURPOSE**

The Freshwater Mollusk Conservation Society (FMCS) is dedicated to the conservation of and advocacy of freshwater mollusks, North America's most imperiled animals. Membership in the society is open to anyone interested in freshwater mollusks who supports the stated purposes of the Society which are as follows:

- 1) Advocate conservation of freshwater molluscan resources;
- 2) Serve as a conduit for information about freshwater mollusks;
- 3) Promote science-based management of freshwater mollusks;
- 4) Promote and facilitate education and awareness about freshwater mollusks and their function in freshwater ecosystems;
- 5) Assist with the facilitation of the National Strategy for the Conservation of Native Freshwater Mussels (Journal of Shellfish Research, 1999, Volume 17, Number 5), and a similar strategy under development for freshwater gastropods.

## **OUR HISTORY**

The FMCS traces its origins to 1992 when a symposium sponsored by the Upper Mississippi River Conservation Committee, USFWS, Mussel Mitigation Trust, and Tennessee Shell Company brought concerned people to St. Louis, Missouri to discuss the status, conservation, and management of freshwater mussels. This meeting resulted in the formation of a working group to develop the National Strategy for the Conservation of Native Freshwater Mussels and set the ground work for another freshwater mussel symposium. In 1995, the next symposium was also held in St. Louis, and both the 1992 and 1995 symposia had published proceedings. Then in March 1996, the Mississippi Interstate Cooperative Research Association (MICRA) formed a mussel committee. It was this committee (National Native Mussel Conservation Committee) whose function it was to implement the National Strategy for the Conservation of Native Freshwater Mussels by organizing a group of state, federal, and academic biologists, along with individuals from the commercial mussel industry. In March 1998, the NNMCC and attendees of the Conservation, Captive Care and Propagation of Freshwater Mussels Symposium held in Columbus, OH, voted to form the Freshwater Mollusk Conservation Society. In November 1998, the executive board drafted a society constitution and voted to incorporate the FMCS as a not-for-profit society. In March 1999, the FMCS held its first symposium "Musseling in on Biodiversity" in Chattanooga, Tennessee. The symposium attracted 280 attendees; proceedings from that meeting are available for purchase. The second symposium was held in March 2001 in Pittsburgh, Pennsylvania, the third in March 2003 in Raleigh, North Carolina, the fourth in St. Paul, Minnesota in May 2005, the fifth in Little Rock, Arkansas in March 2007, the sixth in Baltimore, Maryland in April 2009, the seventh in Louisville, Kentucky in 2011, and the eighth in Guntersville, Alabama in 2013. The society also holds workshops on alternating years, and produces a newsletter four times a year.

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