

PRELIMINARY SURVEY OF FRESHWATER MUSSELS OF THE BIG CYPRESS BAYOU SYSTEM, TEXAS

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INTRODUCTION

The Big Cypress Bayou system represents a unique ecosystem in northeastern Texas. It includes Caddo Lake on the Texas-Louisiana border (the only lake in Texas) as well as several other associated impoundments. Freshwater mussel fauna (Family Unionidae) first came to national attention here in 1909 when valuable gem-quality pearls were found in the area (Blakely 1988). A major pearl fishery developed which drew musselers and pearl buyers from around the country. However, this fishery lasted only from 1909 through 1912 when a dam constructed downstream elevated water levels and made mussel harvest very difficult (Shira 1913). In late 1912, the U.S. Fish Commission (Shira 1913) examined the area and documented unionid species found in shell mounds left by musselers around Caddo Lake. Limited scientific attention was directed to unionid mollusks in this region in subsequent years.

More recently, increased demand from freshwater mussel shells used to make cultured pearl implants prompted Texas Parks and Wildlife Department (TPWD) to survey mussel license holders about this fishery. Several reported commercial harvest of shells in the Caddo Lake area (Howells 1993). From 1981 through 1988, Mather and Bergmann (1994) surveyed sites from Caddo Lake upstream to just above Lake O'the Pines. In 1992, the U.S. Army Corps of Engineers (Shafer et al. 1992) also examined a similar region within the drainage basin of Texas. Attempts by TPWD to survey sites on Caddo Lake and the adjacent Big Cypress Bayou were thwarted in 1995 by high waters and flood conditions; however, in July 1996, 20 sites were examined by TPWD. Reported herein are the results of the July 1996 TPWD surveys and summaries of previous review of the Big Cypress Bayou system.

MATERIALS AND METHODS

In July 1996, TPWD Heart of the Hills Research Station (HOH) teams joined with TPWD Inland Fisheries Management and Resource Protection personnel to examine areas of the Big Cypress system. Additionally, the Franklin County Water District (FCWD) which manages Cypress Springs Reservoir on the upper reaches of Big Cypress Bayou had recently requested TPWD input on requests by commercial musselers to allow commercial harvest on that reservoir where commercial activity is prohibited. FCWD personnel accompanied the HOH staff in examining Cypress Springs Reservoir as well.

Survey efforts by the HOH staff included examination of both reservoir and riverine environments by wading, snorkeling, and examination of exposed bar and bank areas. Several bivalve samples were taken on reservoirs in the upper drainage basin. Sampling was generally non-quantitative due to limited unionid densities and restrictions on time and personnel available. Over 20 sites were examined on 8-10 July 1996 from Cypress Springs Reservoir downstream to Black and Little Cypress bayous. Surveys of lower Black and Little Cypress bayous, Big Cypress Bayou above Caddo Lake, and Caddo Lake were thwarted by rain and lightning storms. Representative unionids were returned to HOH for identification and examination.

RESULTS AND DISCUSSION

Collection Sites

Cypress Springs Reservoir

Collections here were dominated by mapleleaf (Quadrula quadrula), with Louisiana fatmucket (Lampsilis hydiana) and pond mussel (Ligumia subrostrata) also present. All mapleleaves taken were large adults; no juveniles were found to suggest significant recent reproduction. The only known fish host for mapleleaves is flathead catfish (Pylodictis olivaris). If flathead catfish populations in Cypress Springs Reservoir were reduced or eliminated, reproductive failure among mapleleaves would be expected.

Bob Sandlin Reservoir

Eight unionid taxa were found here, many in relative abundance. Species including floaters (Anodonta, Pyganodon, Utterbackia) and pond mussels typically associated with softer substrate and backwater situations were more abundant than heavy-shelled, slow-growing species more indicative of stable, undisturbed environments.

Big Cypress Bayou immediately below Bob Sandlin Reservoir

Eleven unionid taxa were found by TPWD, 10 of which were represented by living specimens. This area contained the only living threeridge (Amblema plicata) and washboards (Megaloniais nervosa) found during the July 1996 survey. Most specimens were large adults with little evidence of recent, successful reproduction among the heavy-shelled, slow-growing species.

Big Cypress Bayou at US Highway 271 and State Highway 11

No living bivalves were found in this area during the July 1996 survey. All mussels appear to have been eliminated by environmental degradation. A tributary stream entering just upstream from US 271 reportedly carries discharges from an upstream poultry plant which may be at least partially responsible for these losses. If fish populations (necessary hosts for larval mussels and successful mussel reproduction) are also reduced in this area, it could account for the apparent lack of juvenile mussels in the area upstream immediately downstream of Bob Sandlin Reservoir dam.

Big Cypress Bayou at FM 947 just upstream of Lake O' the Pines

Two mussel species were found here, but in limited numbers (four total specimens). Negative environmental conditions which are apparently impacting unionids upstream, likely continue to impact mussels at this location as well.

Lake O' the Pines

Seven unionid taxa were found in this reservoir (all alive); however, all but two were fast-growing species often associated with soft bottoms and eutrophic environments. Yellow sandshell (Lampsilis teres) often tolerates such conditions as well. Mapleleaf, which is much less tolerant of these conditions, was represented by only three living individuals.

Little Cypress Bayou at State Highway 3001

Six unionid taxa were found at this site. Mather and Bergmann (1994) found others in their 1981-1988 survey at downstream sites in this tributary.

Black Cypress Bayou, two upstream sites

Only a single dead pond mussel was found in this area by TPWD in July 1996. Mather and Bergmann (1994) found others in their 1981-1988 survey at downstream sites in this tributary. However, declining weather conditions and associated rain and lightning during the July 1996 survey precluded sampling other locations on Black, Little, and Big Cypress bayous and Caddo Lake.

Caddo Lake

This lake was not sampled by TPWD in July 1996; however, Shafer et al. (1992) reported several unionid taxa here in 1992 and musselers reported harvesting several taxa in the area in 1993 which were sent to HOH for examination.

Bivalve Species Table 1

Threeridge (Amblema plicata)

This commercial and pearl-producing species was relatively abundant only in Big Cypress Bayou immediately downstream of Bob Sandlin Reservoir but was otherwise lacking in TPWD samples. Mather and Bergmann (1994) found only a single specimen in their earlier samples further downstream. No juveniles were found.

Giant Floater (Pyganodon grandis) and Paper pondshell (Utterbackia imbecillis)

Both species occur statewide in soft-bottom waters and are often locally abundant. Both were present through Big Cypress Bayou and giant floater was abundant at several sites examined in July 1996.

Flat Floater (Anodonta imbecillis)

This species had not been reported in Texas through 1931 but was present very near the Texas state line in Louisiana (Strecker 1931). It now occurs at several locations in eastern Texas and is abundant at some sites (Mather et al. 1990; Howells et al. 1996). Construction of reservoirs (Texas had only one natural lake, Caddo Lake) has created many new habitats for flat floater in Texas.

Rock-pocketbook (Arcidens confragosus)

Found only by Shira (1913) in 1912, rock-pocketbook was not found by subsequent researchers. This species is widely distributed, but usually uncommon to rare. Failure to find it more recently may only reflect limited abundance locally.

Wabash Pigtoe (Fusconaia flava)

The taxonomic status of this and other fusconids in Texas is far from resolved. All forms have declined dramatically in Texas in recent decades. The greater abundance found by Mather and Bergmann (1994) in their 1981-1988 samples than found by TPWD in July 1996 reflects several higher-density sites not sampled by TPWD. The current status at the Mather and Bergmann sites remains to be determined. Shafer et al. (1992) referred to this species as F. cerina which is now generally believed to occur only east of the Mississippi River (Vidrine 1993).

Plain Pocketbook (Lampsilis cardium)

Shafer et al. (1992) reported L. ovata in their collections. However, Big Cypress Bayou specimens are more likely L. cardium, or possibly L. satura. Among these, L. cardium reaches its southwestern range limit in northeastern Texas (where it is rare) and L. satura has become extremely rare in Texas in recent years. No pocketbook lamproliids were taken by either Mather and Bergmann (1994) or TPWD.

Louisiana Fatmucket (Lampsilis lydiانا) and Yellow Sandshell (L. teres)

Both species were locally abundant at sites in Big Cypress Bayou. Louisiana fatmucket is common at many sites throughout eastern Texas and yellow sandshell is often very abundant throughout much of the state.

Fragile Papershell (Leptodea fragilis)

This species was found in limited numbers by previous researchers in Big Cypress Bayou but not by TPWD. Our failure to locate it likely represents only limited abundance within this system and fewer downstream sampling sites than other workers. Fragile papershell is often abundant elsewhere in Texas and is often tolerant of environmental alteration.

Washboard (Megaloniais nervosa)

This important commercial and pearl-producing species was found by all four surveys in Big Cypress Bayou. Shira (1914) reported higher percent composition for washboard in 1912 because his efforts centered on shell dumps left by mussel harvesters (strongly biased estimates). TPWD found no juveniles of this species. It may be more abundant than the 1996 samples indicated; diving deeper waters will be necessary to more-accurately assess its status locally.

Threehorn Wartyback (Obliquaria reflexa)

This small, but occasionally harvested, species was reported earlier by Shira (1913) but not by others since. It is sporadically abundant at some sites in eastern Texas and may have never been extremely abundant in the Big Cypress system. Its unique appearance suggests misidentification is unlikely.

Bankclimber (Plectomerus dombevanus)

Bankclimber is sometimes taken for pearls but rarely for commercial shell. Shira (1913) found it to be the most abundant species in shell dumps. Subsequent researchers found it but in reduced numbers. TPWD found it only at one location and no juveniles were taken.

Louisiana Pigtoe (Pleuroberna riddellii)

This is one of the rarest Texas unionids. Two living specimens found by Mather and Bergmann (1994) in their 1981-1988 survey are apparently the only living specimens documented in Texas in over 15 years. TPWD failed to find it in July 1996.

Bleufer (Potamilus purpuratus)

Bleufer is sometimes taken for pearls but only rarely for shell. Although it is often abundant at some locations in eastern Texas, it is apparently not common in the Big Cypress system; Shafer et al. (1992) failed to find it and others found only a small number of specimens.

Wartyback (Quadrula nodulata)

This species is not abundant anywhere in Texas. In Big Cypress Bayou, only Shira (1913) and TPWD (one specimen, alive) found it.

Pimpleback (Quadrula pustulosa, mortoni, or both)

The taxonomic status of many pimpleback populations in Texas is confused. Previous researchers have referred the Big Cypress Bayou specimens to pimpleback (Q. pustulosa). Those taken by TPWD in July 1996 appear more closely allied to western pimpleback (Q. mortoni) populations from the Sabine and Neches rivers. Somewhat greater abundance reported by Mather and Bergmann (1994) may reflect site-specific densities in areas not sampled by TPWD.

Mapleleaf (Quadrula quadrula)

This species, southern mapleleaf (Q. apiculata), and possibly Gulf mapleleaf (Q. nobilis) occur in Big Cypress Bayou. Specimens taken by TPWD in July 1996 appear to be mapleleaf; however, several poorly sculptured or badly eroded specimens may have apiculata affinities. Mapleleaves are commercially-important shell species and occasionally produce pearls. No juveniles were taken in July 1996.

Squawfoot (Strophitus undulatus)

Squawfoot is widely distributed but usually uncommon to rare. TPWD has not taken a single living specimen statewide since unionid studies began in 1992. Both Mather and Bergmann (1994) and Shafer et al. (1992) reported it from the Big Cypress drainage, but general rarity may account for absence in the July 1996 TPWD samples.

Texas Lilliput (Toxolasma texasensis)

Texas lilliput occurs within the Big Cypress system and may be locally abundant. Lilliput (T. parvus) probably occurs here as well but was not positively identified by TPWD in 1996.

Pistolgrip (Tritogonia verrucosa)

Although Shafer et al. (1992) failed to find this species, Shira (1913) and Mather and Bergmann (1994) found several individuals; TPWD found only a single living specimen in July 1996 and several shells. Pistolgrip still persists in limited abundance at sites in the Neches and Sabine rivers, but has declined dramatically for undetermined reasons in central Texas. It is rarely taken for shell, but does occasionally produce pearls.

Fawnsfoot (Truncilla donaciformis) and Deertoe (T. truncata)

Both species reach their southwestern range limit in eastern Texas and neither is typically abundant. Only Shira (1913) reported both species. Mather and Bergmann (1994) found deertoe, but Shafer et al. (1992) did not find it. TPWD found only a single living deertoe in July 1996.

Tapered Pondhorn (Unio merus declivis)

This species, typical of soft bottoms in backwater areas, was not found by Shafer et al. (1992) or Shira (1913). Greater percentage composition found by TPWD in July 1996 over that reported by Mather and Bergmann (1994) may reflect site-specific density differences or could suggest increasing eutrophication in the system which would benefit this species over some other unionid taxa.

Little Spectaclecase (Villosa lioussii)

Shafer et al. (1992) found this species present and Mather and Bergmann (1994) found it relatively common at some of the sites they examined in the Big Cypress Bayou drainage. Failure of TPWD to identify this species in its July 1996 collections could reflect declines in population levels seen throughout eastern Texas in recent years. However, some darkly-stained or badly-eroded specimens currently identified as pond mussel, may prove to be little spectaclecase when they are dissected in the near future. Poor specimens of both species can be confused in superficial examinations.

CONCLUSIONS AND RECOMMENDATIONS

Freshwater Mussel Population Status

Based upon current data, Big Cypress Bayou and its associated reservoirs still supports relatively abundant unionid populations at some locations. Some sites within this system also support relatively diverse populations. However, like virtually all drainage basins in Texas, habitat alteration and degradation appear to have reduced populations from previous levels.

Species associated with softer bottoms, eutrophic conditions, and impoundments were often represented by juveniles, multiple size classes of adults, or both. However, larger, heavy-shell species including mapleleaves, washboards, threeridges, bankclimbers, and others, were found alive only as older adults. Reasons for the apparent absence of recent successful reproduction are unclear, but pollutants and environmental degradation are possible explanations. It should be noted, however, some unionid populations may see many consecutive years without a successful year class and only periodic successful reproduction may be typical of some populations.

Commercial Musseling at Cypress Springs Reservoir

Just prior to the July 1996 TPWD survey of this system, the Franklin County Water District, which operates Cypress Springs Reservoir, queried TPWD-Marshall about requests by commercial musselers to open commercial harvest on the reservoir (currently prohibited by the water district). In the absence of prior, recent TPWD survey data on this area, it was difficult to provide a recommendation until the July 1996 survey. Now, based on these results, it appears the continued restriction on commercial mussel harvest on Cypress Springs Reservoir should be maintained. The primary commercial species present in the reservoir is mapleleaf. This species is also available for harvest in Bob Sandlin Reservoir, Lake O' the Pines, and Caddo Lake downstream. Protecting the population in one small impoundment will not eliminate or prevent commercial harvest in the drainage basin. Further, we failed to find evidence of successful reproduction among the mapleleaves in Cypress Springs Reservoir. It may be wise to retain the harvest prohibition on this water body until the reasons for this apparent reproductive failure can be better defined. Finally, mapleleaves are very long-lived species. If it becomes desirable to lift harvest restrictions in the future, many individuals in this population should still be available for harvest at that time.

Pollution Problems

Shira (1913) reported as early as 1913 that mussel losses had occurred in the Caddo Lake-Big Cypress Bayou area which were associated with oil well operations and it seems likely some such problems continue. It is difficult to clearly define every environmental problem in a system like Big Cypress Bayou in a brief,

preliminary survey. However, the complete absence of unionids and Asian clams (*Corbicula* spp.) in Big Cypress Bayou from just upstream of US Highway 271 downstream nearly to Lake O'the Pines (including an absence of dead shells) suggests major environmental problems which have been ongoing for some years. A poultry plant discharging effluent into a tributary stream in this area should be examined critically as a possible cause of these extirpations. Unionids are one of the most sensitive indicators of environmental problems and their complete absence from samples in this reach of river signals a major problem. Asian clams are also noted for their ability to endure in disturbed areas; their absence is also indicative of problems. Finally, large numbers of floaters and pond mussels could suggest accelerated eutrophication associated with increased nutrient input from a variety of human-related sources. Greater scrutiny is needed in this regard to ascertain if these changes are occurring naturally or are being avoidably hastened.

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Table 1. Freshwater mussels (Family Unionidae) found in the Big Cypress Bayou system by Shira (1913), Mather and Bergmann (1994), Shafer et al. (1992), and by Texas Parks and Wildlife Department (TPWD) in July 1996. Values represent percent composition among all collections. Numbers in parentheses under Shira (1913) represent mean percent composition found in shell dumps left by musselers for some of the more abundant taxa.

Source	Shira (1913)	Mather and Bergmann (1994)	Shafer et al. (1992)	TPWD Present
Survey date	1912	1981-1988	1992	1996
Sites examined	7	11	27	20
Species	shell	living	status?	living
Threeridge <i>Amblema plicata</i>	-	0.2	X	3.8
Giant floater <i>Pyganodon grandis</i>	X	1.2	X	4.7
Paper pondshell <i>Utterbackia imbecillis</i>	-	0.5	X	0.2
Flat floater <i>Anodonta suborbiculata</i>	-	-	X	4.5
Rock-pocketbook <i>Arcidens confragosus</i>	X	-	-	-
Wabash pigtoe <i>Fusconaia flava?</i>	X	25.8	X	0.2
Plain pocketbook <i>Lampsilis cardium</i>	-	-	X	-
Louisiana fatmucket <i>Lampsilis hydiana</i>	X	19.9	X	12.4
Yellow sandshell <i>Lampsilis teres</i>	X(6)	5.8	X	16.8
Fragile papershell <i>Leptodea fragilis</i>	X	0.7	X	-
Pond mussel <i>Ligumia subrostrata</i>	-	3.2	X	34.1
Washboard <i>Megaloniais nervosa</i>	X(7)	1.2	X	0.6
Threehorn wartyback <i>Obliquaria reflexa</i>	X	-	-	-
Bankclimber <i>Plectomerus dombeyanus</i>	X(55)	3.0	X	1.1
Louisiana pigtoe <i>Pleurobema riddellii</i>	-	0.4	-	-
Bleufer <i>Potamilus purpuratus</i>	X(5)	0.7	X	0.2
Wartyback <i>Quadrula nodulata</i>	X	-	-	0.2
Pimpleback <i>Quadrula pustulosa?</i>	X(6)	10.2	-	0.6
Mapleleaf <i>Quadrula quadrula</i>	X(4)	0.2	X	12.8
Squawfoot <i>Strophitus undulatus</i>	-	1.2	X	-
Texas lilliput <i>Toxolasma texasensis</i>	-	16.2	X	6.4
Pistolgrip <i>Tritogonia verrucosa</i>	X(3)	1.8	-	0.2
Fawnsfoot <i>Truncilla donaciformis</i>	X	-	-	-
Deertoe <i>Truncilla truncata</i>	X	1.1	-	0.2
Tapered pondhorn <i>Uniomereus declivis</i>	-	1.9	-	0.8
Little spectaclecase <i>Villosa lierosa</i>	-	4.9	X	-
Total number	?	569	?	469

Duplicate



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Attached is a preliminary report on the freshwater mussel species found and sites examined in July 1996 in the Big Cypress Bayou drainage by TPWD. The next mussel newsletter due out about 1 August 1996 will list species by site and an additional summary will appear in the 1996 mussel survey report which should be completed in December 1996 or January 1997 after this year's field work ends.

We still need to examine several sites on US 59 upstream of Caddo Lake and Caddo Lake itself.

If there are any questions, please let me know.

Sincerely,

Bob Howells