DISTRIBUTIONAL SURVEYS OF FRESHWATER BIVALVES IN TEXAS: PROGRESS REPORT FOR 2000

by
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ABSTRACT

During 2000, over 3,100 unionid specimens were documented among some of 121 locations (144 samples) statewide in Texas where specimens were either directly surveyed by the Heart of the Hills Research Station (HOH) staff or were sent to HOH by volunteers. Living specimens to relatively-recently-dead shells were found in 49% of the collections, 8% yielded only long-dead to subfossil shells, and 34% produced no unionids or their remains.

In conjunction with previous 1992-1999 field-survey work, unionids appear completely or almost extirpated from the Pedernales, Blanco, San Marcos, Llano, Medina, upper Guadalupe, upper Sulphur, areas of the San Jacinto, and much of the San Saba rivers. Sections of other river systems and many tributaries have also experienced major unionid population losses in recent years. However, relict individuals and small populations were found in the San Marcos River, a tributary of the lower Trinity River, and a stream in San Antonio in 2000. A drought that began in 1995 and continued through 2000 caused water-level declines statewide with subsequent negative impacts on freshwater mussel populations. Drought impacts were most significant in the western two-thirds of the state. Although drought conditions were briefly interrupted in some areas by heavy rains and damaging floods in 1996, 1997, and 1998, even these were lacking in 1999, but flood conditions developed again in late 2000 . Many water bodies experienced dramatic increases in water levels in 1997 and 1998 after being severely dewatered in late 1995 and most of 1996, but in 1999 and early 2000, levels fell even more dramatically. Some major rivers ceased flowing in summer and fall 1999 and spring and summer 2000. Although no sampling efforts were mounted to document impact on rare endemic unionids, species like golden orb, Texas pimpleback, Texas fatmucket, and Texas fawnsfoot were almost certainly reduced in numbers, especially at sites that dried completely.

CONTENTS

INTRODUCTION

Beginning in January 1992, Texas Parks and Wildlife Department's (TPWD) Heart of the Hills Research Station (HOH) began surveys of freshwater mussel populations within the state to better understand this resource and manage the fishery for them. A questionnaire survey of mussel license holders in 1992 was reported by Howells (1993). Field surveys of unionid populations also began in 1992 and have continued through the present. These have been reported on an annual basis (Howells 1994, 1995, 1996a, 1996b, 1997a, 1997b, 1998, 1999, 2000). Some of these data were ultimately used to compile Freshwater Mussels of Texas (Howells *et al.* 1996). Discussed here are findings from continuing surveys conducted in 2000, with comments relating to prior findings.

MATERIALS AND METHODS

Various habitats were sampled at each collection site. Collection methods and sampling effort varied between sites depending upon personnel, equipment, and time available as well as field conditions at the time of sampling. Minimal sampling efforts involved visual examination of shoreline and shallow-water habitats with hand collection. Where possible, sites were sampled by wading and snorkeling with hand collection. Previous annual reports discuss details of these methods (Howells 1994, 1995, 1996a, 1996b).

Results are presented in numbers collected (retained or released) and percent composition of the collection. Caution should be used in considering percentages calculated from small sample sizes, where mussel abundance and species composition may have been altered (e.g., after harvest by musselers), or where collection efforts focused on obtaining selected species (e.g., for laboratory work or reference specimens). Where a species at a given locality was represented only by fragments or definate numbers were not documented, they were excluded from percent-composition calculations.

Mussels taken were identified to species whenever possible. Some subfossil or badly weathered specimens could not be identified to species. Ill-defined taxonomic status of some "species" also sometimes precluded assigning specific identifications at this time. Other non-unionid bivalves were also documented when encountered. Where "no bivalves" including Asian clams (*Corbicula*) were found, this was indicated, but where unionids were absent and Asian clams were not documented as either present or absent at a particular site, it was reported as "no unionids present." Common and scientific names used generally follow Turgeon *et al.* (1988), Williams *et al.* (1993), and Howells *et al.* (1996), and are presented in Howells (1995, 1996a, 1996b) and Appendix I.

Varying environmental conditions can confound attempts to define how long a given specimen has been dead; however, a number of terms have been used herein to convey an approximation of this. While inherently imprecise, these attempts to characterize time since

death are useful in distinguishing between shells that have been dead for many years or decades from others which clearly died only days or weeks before collection. Terminology relating to condition of dead shells and shell counting methods are summarized in Howells (1996a, 1996b) and Appendix I.

RESULTS AND DISCUSSION

Red River Drainage

Bonham State Park Lake (Bois d'Arc Creek Drainage), southwest of Bonham, Fannin County, Texas, 6 June 2000.
A volunteer examined this lake, but reported finding only fingernail clams.

Hays Creek, near Mount Pleasant (Big Cypress Bayou Drainage), Titus County, Texas, 8 August 2000.
A volunteer reported finding the following specimen at this location:

Hays Creek, near Mount Pleasant Species	*N* alive	*N* shells	Condition	Percentage
Paper pondshell	0	1.0	relatively-recently dead	100.0

Sabine River Drainage

Sabine River, 1.6 km downstream of Lake Tawakoni, Rains and Van Zandt counties, Texas, 9 October 2000.
A volunteer reported finding a single, relatively-long dead bleufer shell here.

Blood's Pond (Sabine River Drainage), Sabine Pass, Jefferson County, Texas, September 2000:
A volunteer took specimens of three living paper pondshells to a local TPWD biologist for identification that had been collected in this pond. This appears to represent the southeastern-most record for unionids in Texas.

Neches River Drainage

B.A. Steinhagen Reservoir, east side and north from boat ramp at U.S 190, Jasper County, Texas 24 February 2000.
A volunteer reported the following species during a partial drawdown:

B.A. Steinhagen Reservoir, east side, north from U.S. 190 boat ramp

Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	2.0	very-recently dead	2.0
Flat floater	0	2.0	recently to very-recently dead	2.0
Louisiana fatmucket	0	18.0	recently to very-recently dead	18.2
Yellow sandshell	0	14.0	recently to very-recently dead	14.1
Fragile papershell	0	6.0	recently to very-recently dead	6.1
Bankclimber	0	10.0	recently to very-recently dead	10.1
Bleufer	0	7.0	relatively-recently - very-recently dead	7.1
Giant floater	0	11.0	recently to very-recently dead	11.1
Southern mapleleaf	0	1.0	relatively-recently dead	1.0
Western pimpleback	0	18.0	recently to very-recently dead	18.2
Gulf mapleleaf	0	2.0	very-recently dead	2.0
Texas lilliput	0	2.0	relatively-recently dead	2.0
Fawnsfoot	0	1.0	very-recently dead	1.0
Pondhorn	0	2.0	recently dead	2.0
Paper pondshell	0	3.0	relatively-recently dead	3.0
Asian clam (present)				
Fingernail clams (two species present)				

B.A. Steinhagen Reservoir, southwest side U.S 190, Tyler County, Texas 24 February 2000.

A volunteer reported the following species during a partial drawdown:

B.A. Steinhagen Reservoir, southwest side of U.S. 190 boat ramp

Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	1.0	very-recently dead	3.2
Flat floater	0	1.0	very-recently dead	3.2
Louisiana fatmucket	0	1.0	recently dead	3.2

Yellow sandshell	0	3.0	recently to very-recently dead	9.7
Fragile papershell	0	1.0	recently to very-recently dead	3.2
Threehorn wartyback	0	3.0	recently to very-recently dead	9.7
Bankclimber	0	7.0	recently to very-recently dead	22.6
Bleufer	0	10.0	relatively-recently to very-recently dead	32.3
Western pimpleback	0	1.0	very-recently dead	3.2
Gulf mapleleaf	0	2.0	recently dead	6.5
Paper pondshell	0	1.0	relatively-recently dead	3.2

Asian clam (present)
Fingernail clams (one species present)

B.A. Steinhagen Reservoir, east side and south from boat ramp at U.S 190, Jasper County, Texas 24 February 2000.
A volunteer reported the following species during a partial drawdown:

B.A. Steinhagen Reservoir, east side, south from U.S. 190 boat ramp

Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	0	1.0	recently dead	1.2
Rock-pocketbook	0	2.0	very-recently dead	2.4
Louisiana fatmucket	0	12.0	recently to very-recently dead	4.3
Yellow sandshell	0	8.0	recently to very-recently dead	9.5
Fragile papershell	0	11.0	recently to very-recently dead	13.1
Threehorn wartyback	0	12.0	recently to very-recently dead	14.3
Bankclimber	0	11.0	recently to very-recently dead	13.1
Bleufer	0	2.0	relatively-recently to very-recently dead	2.4
Giant floater	0	8.0	recently to very-recently dead	9.5
Southern mapleleaf	0	4.0	relatively-recently dead	4.8
Western pimpleback	0	11.0	recently to very-recently dead	13.1

Texas lilliput	0	1.0	relatively-recently dead	1.2
Paper pondshell	0	1.0	relatively-recently dead	1.2
Asian clam (present)				

Village Creek, location unstated, Hardin County, Texas, 3 June 2000.

A volunteer collecting for TPWD's Mussel Watch program sent shells of several specimens for identification. These included: Louisiana pigtoe, western pimpleback, Texas lilliput, and little spectaclecase.

Trinity River Drainage

Lake Ray Roberts, bridge at F.M. 3002, Cook County, Texas, 8 September 2000.

A volunteer examined this area during a low-water period and reported finding:

Lake Ray Roberts, bridge at F.M. 3002

Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	2	several	long dead – very-long dead	-
Louisiana fatmucket	0	many	unstated	-
Yellow sandshell	0	4.0	very-long dead	-
Fragile papershell	2	many	very-long dead	-
Bleufer	1	0.0	-	-
Giant floater	1	many	very-long dead	-
Southern mapleleaf	15	many	recently – very-long dead	-
Texas lilliput	0	0.5x6	very-long dead	-
Paper pondshell	1	0.0	-	-
Asian clam (abundant)				

Lake Ray Roberts, northeast of Sanger, east of boat ramp, Denton County, Texas, 8 September 2000.

A volunteer examined this site during low water and reported finding:

Lake Ray Roberts, northeast of Sanger				
Species	*N* alive	*N* shells	Condition	Percentage
Southern mapleleaf	25	many	recently – very-long dead	100.0

Lake Lewisville, Arrowhead Park, between boat ramp and highway U.S. 35, Denton County, Texas, 6 June 2000.
A volunteer examined this area (300-400 m shoreline, 30-35 minutes) and reported finding:

Lake Lewisville, north of Lake Dallas dam				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	10	12.0+0.5x9	recently to relatively-recently dead	27.7
Louisiana fatmucket	0	6.0+0.5x8	recently to relatively-recently dead	12.5
Yellow sandshell	0	4.0+0.5x3	relatively-recently dead	6.3
Bleufer	0	1.0	relatively-recently dead	0.9
Southern mapleleaf	17	21.0+0.5x11	recently to relatively-recently dead	43.8
Pimpleback spp.	4	0.5x2	relatively-recently dead	5.4
Lilliput	3	0.0	-	2.8
Deertoe	0	1.0	relatively-recently dead	0.9
Asian clam (abundant)				

Lake Lewisville, Arrowhead Park, east of U.S. 35, Denton County, Texas, 14 September 2000.
A volunteer examined this area and reported finding (20-minute search):

Lake Lewisville, Arrowhead Park, east of U.S. 35				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	12	many	recently – relatively-recently dead	-
Louisiana fatmucket	0	9.0+0.5x5	relatively-recently – very-long dead	-

Fragile papershell	0	3.0	long dead	-
Bleufer	0	2.0+0.5x1	long dead	-
Southern mapleleaf	15	many	relatively-recently dead	-
Pimpleback sp(p).	1	4.0	recently dead	-
Asian clam (abundant)				

Lake Lewisville, near U.S. 35, Denton County, Texas, 17 February 2000.
A volunteer examined this area and reported finding:

Lake Lewisville, near U.S. 35				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	2.0+0.5x8	recently to long dead	31.3
Louisiana fatmucket	0	4.0+0.5x5	long dead	28.1
Pink papershell	0	2.0+0.5x2	recently dead	12.5
Bleufer	0	2.0	relatively-recently dead	6.5
Giant floater	0	0.5x1	long dead	3.1
Southern mapleleaf	0	2.0+0.5x2	long dead	12.5
Pimpleback spp.	0	2.0	recently dead	6.3
Asian clam (present)				

Lake Lewisville, area adjacent to boat docks near U.S. 35, Denton County, Texas, 17 February 2000.
A volunteer examined this area and reported finding:

Lake Lewisville, adjacent to boat docks near U.S. 35				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	1	2.0+0.5x4	recently to long dead	38.9
Louisiana fatmucket	0	0.5x4	recently dead	22.2
Yellow sandshell	0	0.5x1	long dead	5.6
Fragile papershell	0	1.0	recently dead	5.6
Bleufer	0	0.5x1	long dead	5.6
Giant floater	0	0.5x2	long dead	11.1
Southern mapleleaf	0	0.5x1	long dead	5.6
Pimpleback spp.	0	1.0	recently dead	5.6
Asian clam (present)				

Lake Lewisville, Westlake Park, Denton County, Texas, 17 February 2000.
A volunteer examined this area and reported finding:

Lake Lewisville, Westlake Park near U.S. 35				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	2.0	recently dead	8.7
Rock-pocketbook	0	1.0	recently dead	4.3
Yellow sandshell	0	0.5x1	long dead	4.3
Fragile papershell	0	0.5x1	recently dead	4.3
Pink papershell	0	0.5x1	recently dead	4.3
Giant floater	0	2.0+0.5x1	long dead	13.0
Southern mapleleaf	0	9.0+0.5x2	long dead	47.8
Pimpleback spp.	0	0.5x3	recently dead	13.0
Asian clam (present)				

Lake Lewisville, Westlake Park, north of Old Dallas Dam, inlet to boat ramp, Denton County, Texas, 14 September 2000.
A volunteer examined this area and reported finding (20-minute search):

Lake Lewisville, Westlake Park, north of Old Dallas Dam				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	11	many	recently - long dead	-
Louisiana fatmucket	0	16.0+0.5x5	relatively-recently – very-long dead	-
Yellow sandshell	0	2.0	very-long dead	-
Fragile papershell	0	2.0	recently dead	-
Bleufer	0	3.0	long – very-long dead	-
Southern mapleleaf	27	many	recently – relatively-recently dead	-
Pimpleback spp.	6	4.0	recently dead	-
Deertoe	0	1.0	recently dead	-
Asian clam (few)				

Lake Lewisville, Westlake Park, inlet northwest of Old Lake Dallas Dam, Denton County, Texas, 6 June 2000.
A volunteer examined this area (250-300 m shoreline, 30 minutes) and reported finding:

Lake Lewisville, Westlake Park, northeast of Old Lake Dallas Dam				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	5	12.0	recently to relatively-recently dead	29.3
Louisiana fatmucket	0	2.0+0.5x3	relatively-recently dead	8.6
Yellow sandshell	0	1.0+0.5x2	relatively-recently	5.2
Southern mapleleaf	11	20.0	recently to relatively-recently dead	53.4
Deertoe	0	0.5x2	relatively-recently dead	3.4

Lake Lewisville, Westlake Park, south shore opposite Old Lake Dallas Dam, Denton County, Texas, 14 September 2000.

A volunteer examined this area (ca 3 km of shoreline) during low water and reported finding:

Lake Lewisville, Westlake Park, south shore opposite Old Lake Dallas Dam				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	> 100	many	very-recently - long dead	-
Rock-pocketbook	0	2.0+0.5x1	not stated	-
Louisiana fatmucket	0	many	relatively-recently – long dead	-
Yellow sandshell	0	9.0+0.5x7	long dead – very-long dead	-
Fragile papershell	0	7.0-0.5x3	long dead	-
Bleufer	0	21.0	long dead – very-long dead	-
Pink papershell or Texas heelsplitter	0	6.0+0.5x5	not stated	-
Giant floater	0	few	long – very-long dead	-
Southern mapleleaf	0	many	recently –very-long dead	-
Pimpleback spp.	5	4.0	recently dead	-
Asian clam (few)				

Lake Lewisville, Queens Point, Westlake Park, Denton County, Texas, two dates.

A volunteer examined this area and reported finding:

6 June 2000 (1.2 km, 75 minutes)

Lake Lewisville, Queens Point, Westlake Park Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	>30	>55.0	recently to relatively-recently dead	27.5+
Louisiana fatmucket	0	11.0+0.5x21	relatively-recently dead	10.4
Yellow sandshell	0	7.0+0.5x4	relatively-recently dead	3.6
Fragile papershell	1	1.0	relatively-recently dead	0.6
Bleufer	1	2.0	relatively-recently dead	1.0
Giant floater	0	1.0+0.5x1	relatively-recently dead	0.6
Southern mapleleaf	>50	>100	recently to relatively-recently dead	48.5+
Pimpleback spp.	17	5.0	recently dead	7.1
Lilliput	1	0.0	-	0.3
Deertoe	0	1.0	relatively-recently dead	0.3

14 September 2000 (ca 2 km of shoreline)

Lake Lewisville, Queens Point Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	> 50	many	relatively-recently - very-long dead	-
Louisiana fatmucket	0	many	relatively-recently – long dead	-
Yellow sandshell	0	few	long dead – very-long dead	-
Fragile papershell	0	6.0-0.5x2	long dead – very-long dead	-
Bleufer	0	few	long dead – very-long dead	-
Pink papershell or Texas Heelsplitter	0	21.0+0.5x2	very-recently – relatively-recently dead	-
Giant floater	0	few	long – very-long dead	-
Southern mapleleaf	> 75	many	recently –very-long	-

			dead	
Pimpleback spp.	4	3.0+0.5x7	recently dead	-
Asian clam (very few)				

Lake Lewisville, Westlake Park, north of Lake Dallas dam, Hickory Creek area, Denton County, Texas, 6 June 2000.
A volunteer documented the following specimens:
(200 m shoreline, 20 minutes)

Lake Lewisville, north of Lake Dallas dam				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	2	3.0	relatively-recently dead	87.5
Southern mapleleaf	10	16.0+0.5x9	relatively-recently dead	12.5

Elm Fork Trinity River, Jimmy Porter Park, Carrollton, Dallas County, Texas, two dates.
A volunteer collected:

7 May 2000

Elm Fork Trinity River, Jimmy Porter Park, Carrollton				
Species	*N* alive	*N* shells	Condition	Percentage
Tapered pondhorn	0	0.5x1	long dead	100.0
Asian clam (present)				

2 June 2000

Elm Fork Trinity River, Jimmy Porter Park, Carrollton				
Species	*N* alive	*N* shells	Condition	Percentage
Tapered pondhorn	0	0.5x4	long dead to subfossil	100.0
Asian clam (present)				

Elm Fork Trinity River, McInnish Park, Carrollton, Dallas County, Texas, two dates.
A volunteer reported the following specimens:

20 March 2000

Elm Fork Trinity River, McInnish, Carrollton				
Species	*N* alive	*N* shells	Condition	Percentage
Louisiana fatmucket	0	2.0	recently dead	9.1
Yellow sandshell	0	2.0	relatively-recently dead	9.1
Giant floater	0	6.0	recently dead	27.3
Southern mapleleaf	0	12.0	recently dead	54.5
Asian clam (present)				

14 October 2000.

McInnish Park Pond				
Species	*N* alive	*N* shells	Condition	Percentage
Yellow sandshell	0	3.0	relatively-recently dead	42.9
Giant floater	0	4.0	long dead	57.1

White Rock Creek, Addison, Dallas County, Texas, 16 March 2000.
A volunteer examined this area, but found only Asian clams (recently dead).

Trinity River, Green Island, Fort Worth Nature Center, Tarrant County, Texas, 22 April 2000.
A volunteer reported the following species:

Trinity River, Green Island, Fort Worth Nature Center				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	-	0.5x35	recently to long dead	97.2
Giant floater	-	0.5x1	long dead	2.8

West Parker Pond, Arbor Hills Nature Preserve, Plano, Collin County, Texas, 19 October 2000:
A volunteer documented the following specimens:

West Parker Pond, Plano				
Species	*N* alive	*N* shells	Condition	Percentage
Pondhorn	0	3.0	relatively-recently dead	100.0

Lake Livingston, unspecified locations, Trinity County, Texas, several dates.
Groups of volunteers examining the reservoir in this county reported:

7 March 2000

Lake Livingston Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	0	2.0+0.5x4	recently dead	18.2
Giant floater	0	2.0+0.5x25	recently dead	81.8

30 March 2000

Lake Livingston Species	*N* alive	*N* shells	Condition	Percentage
Southern mapleleaf	1	0.5x1	relatively-recently dead	100.0

5 April 2000

Lake Livingston Species	*N* alive	*N* shells	Condition	Percentage
Giant floater	0	0.5x5	recently to relatively-recently dead	55.6
Southern mapleleaf	0	0.5x1	long dead	11.1
Texas lilliput	0	0.5x3	relatively-recently to long dead	33.3

9 April 2000

Lake Livingston Species	*N* alive	*N* shells	Condition	Percentage
Giant floater	0	0.5x1	recently dead	50.0
Lilliput sp?	0	0.5x1	recently dead	50.0

10 May 2000

Lake Livingston Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	0	0.5x1	relatively-recently dead	3.8
Giant floater	0	0.5x7	recently to long dead	26.9
Southern mapleleaf	0	1.0+0.5x9	relatively-recently - very long dead	38.5
Lilliput spp.?	0	0.5x8	very recently - relatively-recently dead	30.8

Lake Livingston, Camp Olympia, Trinity County, Texas, five dates.
Volunteers reported the following species:

28 April 2000

Lake Livingston, Camp Olympia Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	0	2.0+0.5x13	recently to relatively-recently dead	37.5
Giant floater	0	12.0+0.5x7	very recently - relatively-recently dead	47.5
Southern mapleleaf	0	1.0+0.5x2	long dead	7.5
Lilliput spp.?	3	1.0+0.5x2	very recently dead	7.5

17 October 2000

Lake Livingston, Camp Olympia Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	1	0.0	-	16.7
Giant floater	0	0.5x1	relatively-recently dead	16.7
Southern mapleleaf	1	0.5x3	long dead	66.7
Asian clam (present)				

18 October 2000

Lake Livingston, Camp Olympia Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	0	1.0+0.5x1	relatively-recently dead	7.4
Giant floater	0	2.0+0.5x8	very-recently – long dead	37.0
Southern mapleleaf	0	8.0+0.5x7	relatively-recently – very-long dead	55.6
Asian clam (present)				

24 October 2000

Lake Livingston, Camp Olympia Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	0	3.0+0.5x7	relatively-recently dead	16.9
Giant floater	0	6.0+0.5x31	recently – long dead	62.7
Lilliput sp(p).	0	5.0+0.5x5	very-recently – relatively-recently dead	16.9
Paper pondshell	0	1.0+0.5x1	relatively-recently dead	3.4

December 2000 (day unstated)

Lake Livingston, Camp Olympia Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	0	0.5x5	very-recently dead	17.9
Giant floater	0	0.5x5	recently – long dead	17.9
Southern mapleleaf	0	0.5x10	long – very-long dead	35.7
Lilliput sp(p).	0	0.5x 8	recently – very-recently dead	28.6

Pond B at Camp Olympia, adjacent to Lake Livingston, Trinity County, Texas, two dates. Volunteers examined this site and reported:

28 September 2000

Pond B at Camp Olympia Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	0	6.0+0.5x25	recently – long dead	8.7
Yellow sandshell	0	0.5x1	long dead	0.3
Pink papershell	0	0.5x2	long dead	0.6
Giant floater	3	17.0+0.5x228	recently dead – subfossil	69.9
Southern mapleleaf	0	14.0+0.5x32	recently – very-long dead	13.0
Paper pondshell	0	4.0	recently dead	1.1
Lilliput sp(p).	0	10.0+0.5x13	very-recently – long dead	6.5
Asian clam (present)				

4 October 2000

Pond at Camp Olympia Species	*N* alive	*N* shells	Condition	Percentage
Flat floater	0	24.0+0.5x94	very-recently – relatively-recently dead	16.5
Giant floater	0	181.0+0.5 x396	very-recently - long dead	80.7
Southern mapleleaf	0	1.0+0.5x2	relatively-recently-long dead	0.4
Lilliput sp(p).	0	1.0+0.5x5	very-recently – long dead	0.8
Paper pondshell	0	5.0+0.5x6	very-recently – relatively-recently dead	1.5
Asian clam (present)				

Davis Bayou (Trinity River drainage), Liberty County, Texas, 5 October 2000.

A local park superintendent sent the following specimens to HOH for identification following collection during a low-water period:

Davis Bayou Species	*N* alive	*N* shells	Condition	Percentage
Rock-pocketbook	0	0.5x1	very-recently dead	3.3

Louisiana fatmucket	0	1.0+0.5x1	very- recently – relatively-recently dead	6.7
Yellow sandshell	0	3.0	very-recently dead	10.0
Fragile papershell	0	0.5x1	recently dead	3.3
Washboard	0	2.0	very-recently – long dead	6.7
Bankclimber	0	5.0	very-recently – recently dead	16.7
Giant floater	0	1.0	recently dead	3.3
Southern mapleleaf	0	7.0+0.5x1	long dead – relatively-long dead	26.7
Western pimpleback	0	4.0+0.5x2	very-recently – recently dead	20.0
Texas lilliput	0	1.0	relatively-recently dead	3.3

Much of the unionid fauna in the Trinity River and its tributaries downstream of Lake Livingston dam has been lost or reduced to a limited number of specimens. Davis Bayou appears to have supported an exceptional number of species for the region in recent times. Washboard and southern mapleleaf had not been reported for Liberty County and others (rock-pocketbook, Louisiana fatmucket, yellow sandshell, fragile papershell, bankclimber, giant floater, and western pimpleback) have been reported in Liberty County only in the San Jacinto River drainage.

Galveston Bay Drainage

Mustang Bayou, F.M. 521, northeast of Arcola, Fort Bend County, Texas, 4 December 2000.
Examination of this site produced only Asian clam valves.

Mustang Bayou, S.H. 288, Brazoria County, Texas, 5 December 2000.
Examination of this site produced:

Roadside ditch near Angleton Species	*N* alive	*N* shells	Condition	Percentage
Round pearlshell	0	1.0	relatively-recently dead	100.0
Asian clam (present)				

Mustang Bayou; seven sites: C.R. 48, first crossing east of S.H. 288, F.M. 1128, S.H. 35 south of S.H. 6 in Alvin, S.H. 35 Bypass southeast of Alvin, C.R. 169 northeast of Liverpool, and F.M. 2917; Brazoria County, Texas, 5 December 2000.
Examination of these sites produced only Asian clams and their shells and valves.

Mustang Bayou, C.R. 99, north of S.H. 6, Brazoria County, Texas, 5 December 2000.
Examination of this site produced:

Mustang Bayou, at C.R. 99 Species	*N* alive	*N* shells	Condition	Percentage
Round pearlshell	3	6.0	recently – long dead	100.0
Asian clam (present)				

Dickinson Bayou, at F.M. 528, north of Alvin, Galveston County, Texas, 5 December 2000.
Volunteers examining this area found only Asian clams and their shells and valves.

Dickinson Bayou, at S.H. 517, northeast of Alvin, Galveston County, Texas, 5 December 2000.
Volunteers examining this area found the following unionid:

Dickinson Bayou, at S.H. 517 Species	*N* alive	*N* shells	Condition	Percentage
Round pearlshell	0	1.0	recently dead	100.0

Dickinson Bayou, at McFarland Road, northeast of Alvin, Galveston County, Texas, 5 December 2000.
Volunteers examining this area collected the following specimens:

American Canal, S.H. 528 Species	*N* alive	*N* shells	Condition	Percentage
Round pearlshell	2	3.0	recently – relatively-recently dead	100.0

Galveston County Water Company Canal, two sites: S.H. 6 and Cemetery Road east of Alvin, Galveston County, Texas, 5 December 2000.
Volunteers examining these sites found only Asian clams and their shells and valves.

Brazos River Drainage

Stamford Reservoir (Brazos River drainage), Haskell County, Texas, 31 July 2000.

A volunteer examined this reservoir and reported living Tampico pearlymussel (large specimens noted), bleufer, and giant floater present.

Lake Trammel (Brazos River drainage), Nolan County, Texas, 8 April 2000.

A volunteer examined lake-bottom ditches and borrow pits exposed as reservoir levels declined due to existing drought conditions and found:

Lake Trammel Species	*N* alive	*N* shells	Condition	Percentage
Giant floater	0	1.0+0.5x5	recently dead	85.7
Pondhorn	0	0.5x1	recently dead	14.3

Brazos River, from Possum Kingdom Reservoir dam downstream about 16 km, Palo Pinto County, Texas, summer 2000:

K.E. Bickel (TPWD, Fort Worth; pers. comm.) reported an extensive Asian clam kill with particularly high levels of mortality between SH 4 and 1.9 km downstream. No cause for the die-off was determined.

Brazos River, at S.H. 340, N 31°32'10", W 97°24'06", McLennan County, Texas, 17 March 2000.

Brazos River Authority (BRA) personnel volunteers examined this site and reported finding:

Brazos River, at S.H. 340 Species	*N* alive	*N* shells	Condition	Percentage
Yellow sandshell	1	0.5x9	relatively-recently dead	84.6
Bleufer	0	0.5x2	relatively-recently dead	15.4

Lake Proctor, unspecified site (Leon Rive drainage), (N 31°59'21", W 98°28'52"), Comanche County, Texas, 2 March 2000.

BRA personnel reported finding two, relatively-recently dead southern mapleleafs in a random shoreline search.

Lake Limestone (Navasota River drainage), F.M. 3371 (N 30°25'97", W 96°22'60"), Limestone County, Texas, two dates.
A random-shoreline collection by BRA personnel included:

3 February 2000

Lake Limestone Species	*N* alive	*N* shells	Condition	Percentage
Southern mapleleaf	0	0.5x3	relatively-recently dead	100.0
Asian clam (abundant)				

12 February 2000

Lake Limestone Species	*N* alive	*N* shells	Condition	Percentage
Yellow sandshell	0	0.5x6	relatively-recently dead	75.0
Fragile papershell	0	0.5x2	relatively-recently dead	25.0

Lampasas River at F.M. 2670 west of Maxdale, Bell County, Texas, 21 November 2000:
During other work in the area, the HOH staff recovered a single Tampico pearlymussel valve (very long dead).

Lampasas River, several km upstream of Stillhouse Hollow Reservoir, Bell County, Texas, 1 May 2000.
A volunteer collected the following specimens:

Lampasas River Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	0.5x6	subfossil	40.0
Tampico pearlymussel	0	0.5x1	subfossil	6.7
Louisiana fatmucket	0	0.5x1	subfossil	6.7
Yellow sandshell	0	0.5x1	subfossil	6.7
Pistolgrip	0	0.5x6	subfossil	40.0

Belton Reservoir, White Flint Park, Bell County, Texas, 23 January 2000.
A volunteer collected the following specimens and sent them to HOH for identification:

Belton Reservoir, White Flint Park Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	3.0	recently to relatively-recently dead	7.9
Tampico pearlymussel	0	6.0	recently dead	15.8
Fragile papershell	0	8.0	recently to relatively-recently dead	21.1
Bleufer	0	7.0+0.5x2	recently to very-long dead	23.7
Giant floater	0	3.0+0.5x2	recently to very-long dead	13.2
Southern mapleleaf	0	2.0	recently dead	5.3
Smooth pimpleback	0	2.0	recently dead	5.3
Pistolgrip	0	2.0	recently dead	5.3
Paper pondshell	0	1.0	relatively-recently dead	2.6
Asian clam (present)				

Belton Reservoir, Leona Park Road, Bell County, Texas, 23 January 2000.
A volunteer collected the following specimens and sent them to HOH for identification:

Belton Reservoir, Leona Park Road Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	3.0+0.5x2	very-recently - very-long dead	12.5
Yellow sandshell	0	7.0	very-recently - relatively-recently dead	17.5
Fragile papershell	0	5.0	very-recently - relatively-recently dead	12.5
Bleufer	0	10.0	very-recently to very-long dead	25.0
Giant floater	0	5.0	very-recently to very-long dead	12.5
Southern mapleleaf	0	5.0+0.5x2	very-recently to very-long dead	17.5
Pistolgrip	0	1.0	recently dead	2.5
Paper pondshell	0		relatively-recently dead	
Asian clam (present)				

Brazos River, at S.H. 21, Burleson and Brazos counties, Texas, 25 March 2000.

In 1999, a volunteer documented a large number of very-recently dead Texas fawnsfoot shells at this location. TPWD's Mussel Watch Program used volunteers to examine thus site again in 2000. However, some volunteers reported seeing Texas fawnsfoot specimens but did not count or collect them and others discarded unionid specimens before identification and documentation. Additionally, some specimens from opposite sides of the river appeared to have been mixed. As a result, data from this effort have been discarded.

Little Brazos River, at S.H. 21, N 30°38'30", W 96°31'15", Brazos County, Texas, 8 February 2000.

BRA personnel volunteers examined this site and reported finding only Asian clam (abundant).

TPWD's Mussel Watch Program used volunteers to examine the above site on 25 March 2000 during collection efforts at the Brazos River – S.H. 21 sites above. However, because volunteers were moved east to the Little Brazos River prior to documentation of all Brazos River samples, some specimens between the two rivers appeared to be mixed. Further, some volunteers were observed collecting then discarding specimens without documenting them. As a result, data from this site is not presented herein.

Yegua Creek (Brazos River Drainage), at S.H. 50, N 30°22.10', W 96°20.54', Burleson County, Texas 5 January 2000,

BRA personnel volunteers examined this site and reported finding:

Yegua Creek, at S.H.50 Species	*N* alive	*N* shells	Condition	Percentage
Fragile papershell	0	0.5x1	long dead	50.0
Bleufer	0	0.5x1	long dead	50.0
Asian clam (present)				

Spring Creek (Little Brazos River Drainage), at S.H. 36, N 30°48.17', W 96°30.68, Robertson County, Texas, 8 January 2000.

BRA personnel volunteers examined this site and reported finding only Asian clam.

Duck Creek, at F.M. 979, N 31°11'42", W 96°27'01", Robertson County, Texas, two dates.

BRA personnel volunteers examined this site and reported finding:

3 February 2000

Duck Creek, at F.M. 979 Species	*N* alive	*N* shells	Condition	Percentage
Asian clam (abundant)	-	-	-	-

17 March 2000

Duck Creek, at F.M. 979 Species	*N* alive	*N* shells	Condition	Percentage
Yellow sandshell	0	0.5x2	relatively-recently dead	50.0
Bleufer	0	0.5x2	relatively-recently dead	50.0
Asian clam (present)				

Navasota River at S.H. 79, N 31°10'10", W 96°17'54", Leon County, Texas, three dates. Brazos River Authority (BRA) volunteers reported the following specimens:

3 February 2000

Navasota River at S.H. 79 Species	*N* alive	*N* shells	Condition	Percentage
Asian clam (abundant)	-	-	-	-

17 March 2000

Navasota River at S.H. 79 Species	*N* alive	*N* shells	Condition	Percentage
Smooth pimpleback	0	0.5x3	relatively-recently dead	100.0

3 May 2000

Navasota River at S.H. 79 Species	*N* alive	*N* shells	Condition	Percentage
Yellow sandshell	0	0.5x2	relatively-recently dead	100.0

Navasota River at S.H. 105, N 30°21'54", W 96°08'28", Washington and Grimes counties, Texas, two dates.

BRA volunteers reported the following specimens:

8 February 2000

Navasota River at S.H. 105 Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	0.5x7	relatively-recently - long dead	58.3
Yellow sandshell	0	0.5x2	relatively-recently - long dead	16.7
Southern mapleleaf	0	0.5x1	relatively-recently dead	8.3
Smooth pimpleback	0	0.5x2	relatively-recently dead	16.7

21 March 2000

Navasota River at S.H. 105 Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	0.5x2	recently dead	100.0

Jones Creek, at Bois d'Arc Road southeast of Fulshear, Fort Bend County, Texas, 4 December 2000.

Examination of this site during a low-water period produced:

Jones Creek, at Bois d'Arc Road Species	*N* alive	*N* shells	Condition	Percentage
Tampico pearlymussel	0	3.0	long dead – subfossil	42.9
Yellow sandshell	0	3.0	recently dead – subfossil	42.9
Fragile papershell	0	1.0	relatively-recently dead	14.3
Asian clam (extremely abundant)				

Jones Creek; three eastern sites: Winner Foster Road at Bella Vista, S.H. 359 west of S.H. 723, and S.H. 723; Fort Bend County, Texas, 4 December 2000.
Examination of shallow waters and banks at these locations produced only a limited number of Asian clam shells and valves.

Jones Creek, S.H. 359 east of S.H. 723, Fort Bend County, Texas, 4 December 2000.
Examination of this location found no bivalves or their shells. The stream appears intermittent at this site.

Oyster Creek: four sites: Farmer Road north of S.H. 359, S.H. 6, Alternate U.S. 90 at Sugar Land, and F.M. 1092 at Missouri City; Fort Bend County, Texas, 4 December 2000.
Examination of shorelines and shallow waters at these sites found only a small number of Asian clams, their shells and valves.

Oyster Creek, at F.M. 523, Brazoria County, Texas, 5 September 2000:
A volunteer examined this site but found only very-recently dead Atlantic rangia (12), but no unionids or Asian clams.

Oyster Creek tributary, at F.M. 3345, east of F.M. 1092, north of S.H. 6, Fort Bend County, Texas, 4 December 2000.
Examination of this site produced only a limited number of Asian clams and their shells and valves.

Kitty Hollow Park Lake, north of S.H. 6, northwest of Arcola, Fort Bend County, 4 December 2000.
Examination of shorelines and shallows here produced only a few Asian clam shells.

American Canal, F.M. 521, northeast of Arcola, Fort Bend County, Texas, 4 December 2000.
Examination of this site produced only Asian clams and their shells and valves.

American Canal: eight sites: C.R. 48, S.H. 288, Curry Street east of S.H. 288, F.M. 1128, C.R. 99, C.R. 296D, C.R. 296B, and S.H. 45; Brazoria County, Texas, 5 December 2000.

Examination of canal banks and shallows produced only a limited number of Asian clams and their shells and valves.

American Canal, at Mandale Road, east of S.H. 35, north of Alvin, Galveston County, Texas, 18 July 2000:

Wading an snorkeling this location during a survey for channeled applesnail (*Pomacea canaliculata*) produced subfossil valves from Tampico pearlymussel, yellow sandshell, and southern mapleleaf (Brazos River morph), as well as an abundance of Asian clams.

American Canal, at S.H. 528, north of Alvin, Galveston County, Texas, 5 December 2000.

Volunteers examining this site found the following specimens:

American Canal, S.H. 528 Species	*N* alive	*N* shells	Condition	Percentage
Tampico pearlymussel	0	2.0	subfossil	10.0
Round pearlshell	0	13.0	relatively-long – very-long dead	65.0
Yellow sandshell	0	0.5x2	very-long dead	10.0
Southern mapleleaf	0	2.0+0.5x1	very-long dead – subfossil	15.0
Asian clam (present)				

American Canal, at Algoa-Friendswood Road, northeast of Alvin, Galveston County, Texas, 5 December 2000.

Volunteers examining this site found the following specimens:

American Canal, Algoa-Friendswood Road Species	*N* alive	*N* shells	Condition	Percentage
Yellow sandshell	0	0.5x1	subfossil	100.0
Asian clam (present)				

Roadside ditch, south side of S.H. 36 near F.M. 1495, Brazoria County, Texas, 4 September 2000:

A volunteer examined this site but found only recently-dead shells (8) of Atlantic rangia, but no unionids or Asian clams.

Roadside ditch, about 0.4 km east of the S.H 35 and S.H. 288, Angleton, Brazoria County, Texas, 2 February 2000.

A volunteer examined this ditch and found:

Roadside ditch near Angleton				
Species	*N* alive	*N* shells	Condition	Percentage
Round pearlshell	0	2.0	recently dead (+other older shells)	100.0
Asian clam (present)				

Colorado River Drainage

Concho River, downstream of the low-water crossing at Paint Rock, Concho County, Texas, 21 April 2000.
The author and a volunteer examined this area during drought conditions and found:

Concho River, downstream of Paint Rock				
Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	1.0	recently dead	-
Tampico pearlymussel	2	present	very-recently dead	-
Yellow sandshell	0	0.5x1	subfossil	-
Fragile papershell	5	present	very-recently dead	-
Southern mapleleaf	0	present	very-recently dead	-
Texas pimpleback	0	present	very-recently dead	-
Bleufer	6	present	very-recently dead	-
Paper pondshell	0	3.0	very-recently dead	-
Asian clam (abundant)				

A pool of water was still present behind the dam upstream of the low-water crossing, as were two smaller pools downstream over a distance of about 2 km. However, the downstream pools were stagnant (dead fish were floating) and nearly all mussels in them had perished. This area once held the largest known remaining Texas pimpleback population. Unless survivors managed to persist in pools, it is doubtful most Texas pimplebacks and other unionids here could survive the observed conditions.

O.H. Ivie Reservoir (Colorado and Concho River confluence), southcentral shore park boat ramp, Concho County, Texas, 21 April 2000.
The author and a volunteer examined this site and found only:

O.H. Ivie Reservoir Species	*N* alive	*N* shells	Condition	Percentage
Tampico pearlymussel	0	1.0	recently dead	100.0
Asian clam (present)				

Brady Reservoir (Brady Creek – Colorado River drainage), north side of dam, McCulloch County, Texas, 21 April 2000.
The author and a volunteer examined this site and found:

Brady Reservoir Species	*N* alive	*N* shells	Condition	Percentage
Tampico pearlymussel	0	present	recently dead	-
Giant floater	0	present	recently dead	-
Southern mapleleaf	0	present	recently dead	-
Asian clam (present)				

Low-water conditions here caused extensive mortalities among unionids in shallow waters. Additionally, piles of opened Tampico pearlymussels indicated pearlers had been actively taking advantage of declining water levels to heavily harvest this species in search of pearls.

San Saba River, at the first F.M. 2092 crossing downstream of Menard, Menard County, Texas, two dates.
During other fisheries research in the area, the following specimens were collected:

13 November 2000

San Saba River, F.M. 2092, 13 November 2000 Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	0.5x1	subfossil	10.0
Tampico pearlymussel	0	1.0+0.5x2	long dead – subfossil	30.0
Fragile papershell	1	1.0+0.5x1	very-recently dead – relatively-recently dead	20.0
Bleufer	0	0.5x1	subfossil	10.0
Texas pimpleback	0	1.0	recently dead	10.0

Pistolgrip	0	1.0	relatively-recently dead	10.0

15 November 2000

San Saba River, F.M. 2092, 15 November 2000

Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	0.5x1	subfossil	11.1
Tampico pearlymussel	0	0.5x2	very-long dead	22.2
Fragile papershell	0	2.0	relatively-recently dead	22.2
Bleufer	0	0.5x1	subfossil	11.1
Southern mapleleaf	0	0.5x1	very-long dead	11.1
Texas pimpleback	0	1.0+0.5x1	recently dead – very-long dead	22.2

Prior to these collections, Texas pimpleback had been reduced to only four known populations, one of which was upstream of Menard in the San Saba River. Although these two collections suggest another population may occur downstream of Menard, extensive flooding and river bed scouring prior to these samples could have moved specimens from the area upstream of Menard to the F.M. 2092 site.

Lake Travis, at The Narrows, Burnet County, Texas, 30 July 2000.

Examination of this location found:

Lake Travis, The Narrows

Species	*N* alive	*N* shells	Condition	Percentage
Tampico pearlymussel	0	present	recently – long dead	-
Yellow sandshell	0	0.5x1	very-long dead	-
Fragile papershell	0	present	long dead	-
Bleufer	0	present	long dead	-
Southern mapleleaf	0	present	long dead	-
Tapered pondhorn	0	0.5x1	very-long dead	-
Asian clam (present)				

Although this location is the upper end of Lake Travis and much of this area is often covered with 3-6 m of water, the extended drought had reduced it to a minor trickle of water running down the old river channel. No living mussels were found and even when

water levels return to normal, it may require years for the unionid population to repopulate.

Lavaca-Navidad River Drainage

Cox Creek at SH 35, Calhoun County, Texas, 4 October 2000:
A volunteer documented the following specimens:

Cox Creek Species	*N* alive	*N* shells	Condition	Percentage
Texas lilliput	3	1.0	recently dead	100.0
Asian clam (present)				

Lake Texana, west side of S.H. 172, Jackson County, Texas, 23 February 2000:
A volunteer examined this area during a low-water period and found:

Lake Texana, west side at S.H. 172 Species	*N* alive	*N* shells	Condition	Percentage
Yellow sandshell	0	3.0	recently dead	6.8
Giant floater	1	0.0	-	2.3
Southern mapleleaf	25	8.0	recently dead	75.0
Texas lilliput	0	6.0+0.5x1	recently to relatively-recently dead	15.9
Asian clam (present)				

Lake Texana, boat ramp area near U.S. 59, Jackson County, Texas, 8 March 2000.
A volunteer examined this area during a low-water period and found:

Lake Texana, boat ramp near U.S. 59 Species	*N* alive	*N* shells	Condition	Percentage
Yellow sandshell	0	1.0+0.5x3	very-recently to relatively-recently dead	13.0
Giant floater	0	1.0+0.5x2	recently dead	13.0
Southern mapleleaf	0	1.0+0.5x3	recently dead	17.4
Texas lilliput	1	1.0+0.5x7	recently dead	39.1

Paper pondshell	0	1.0+0.5x3	recently dead	17.4
Asian clam (present)				

Lake Texana, east shore north side of S.H. 111, Jackson County, Texas, 8 March 2000.
A volunteer examined this area during a low-water period and found:

Lake Texana, east shore north side of S.H. 111				
Species	*N* alive	*N* shells	Condition	Percentage
Rock-pocketbook	0	1.0	recently dead	-
Round pearlshell	0	1.0	recently dead	-
Yellow sandshell	0	23.0	recently to long dead	-
Giant floater	3	22.0	recently dead	-
Southern mapleleaf	many	19.0	recently dead	-
Paper pondshell	0	3.0	recently dead	-
Asian clam (present)				

Lake Texana, west shore south of S.H. 111, Jackson County, Texas, 8 March 2000.
A volunteer examined this area during a low-water period and found:

Lake Texana, west shore south of S.H. 111				
Species	*N* alive	*N* shells	Condition	Percentage
Rock-pocketbook	0	1.0	recently dead	5.9
Yellow sandshell	0	7.0	very-recently - relatively-recently dead	41.2
Giant floater	2	4.0+	recently dead	35.3+
Southern mapleleaf	2+	1.0	recently dead	17.6+
Asian clam (present)				

Guadalupe River Drainage

North Fork Guadalupe River, upstream of Hunt at Mo-Ranch, Kerr County, Texas, 10 November 2000:
A single recently-dead shell of paper pondshell was found during casual examination of shallows at this site.

San Marcos River, at U.S. 90, Caldwell County, Texas, 22 March 2000.
A local school class reported finding:

San Marcos River, at U.S. 90 Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	0.5x3	very-long dead	100.0
Asian clam (present)				

San Marcos River, private property about 1.6 km downstream of U.S. 90, county unstated, Texas, 30 March 2000.

Although this site was examined by TPWD's Mussel Watch personnel and volunteers, no confirmation of written permission to enter private property was provided with the submitted data sheet. Subsequently, data obtained cannot be reported here.

San Marcos River, Palmetto State Park, Gonzales County, Texas, three dates.

TPWD's Mussel Watch personnel and volunteers examined this area and reported finding:

5 February 2000

San Marcos River, Palmetto State Park Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	0	3.0+0.5x30	very-long dead - subfossil	97.1
Yellow sandshell	0	1.0	very-long dead	2.9

A volunteer examined this area again on 23 April 2000 and reported finding:
23 April 2000

San Marcos River, Palmetto State Park Species	*N* alive	*N* shells	Condition	Percentage
Golden orb	5	-	-	71.4
False spike	0	0.5x2	recently dead	28.6

This collection is the only suggestion in some 20 years that false spike still survives any where.

The author examined this area again on 22 August 2000 prompted by the April 2000 report and found:

22 August 2000

San Marcos River, Palmetto State Park Species	*N* alive	*N* shells	Condition	Percentage
Threeridge	1	several	subfossil	-
Tampico pearlymussel	0	several	subfossil	-
Yellow sandshell	0	several	subfossil	-
Washboard	0	several	subfossil	-
Southern mapleleaf	0	several	subfossil	-
Golden orb	1	several	subfossil	-
False spike	0	several	subfossil	-

There is relatively little "good" mussel habitat in this section of the San Marcos River. Further surveys will be required to better evaluate any populations of golden orb, false spike, or other unionids and will need to include detailed examination of each side of the river for the limited number of pockets of microhabitat that can still support mussels.

Lake Wood, location unstated, Gonzales County, Texas, 22 March 2000.

This site was examined by TPWD's Mussel Watch personnel and volunteers. However, because of questionable specimen identifications reported (*e.g.*, mapleleaf does not occur in the Guadalupe River drainage and bleufer has not been confirmed there in many years), data were discarded.

Guadalupe River, U.S. 183 at Gonzales (city), Gonzales County, Texas, 8 March 2000:

A volunteer reported finding a single washboard that was relatively-recently dead.

Beitel Creek (San Antonio River drainage), adjacent to S.H. 410, San Antonio, Bexar County, Texas, 11 February 2000.

A volunteer examining bulldozed stream banks in this area found:

Beitel Creek at S.H. 410 Species	*N* alive	*N* shells	Condition	Percentage
Creeper (squawfoot)	0	0.5x1	recently dead	100.0
Asian clam (present)				
Fingernail clams (two species present)				

This specimen of creeper is the only confirmation that the species still exists in Texas since TPW initiated its mussel survey work in 1992.

Beitel Creek, (San Antonio River drainage), upstream of Weidner Road, northeast San Antonio, Bexar Count, Texas, 11 January 2000.
A volunteer examined this area, but found only recently dead Asian clam shells.

Beitel Creek (San Antonio River drainage), adjacent to commercial area on Perrin Creek Street, San Antonio, Bexar County, Texas, 11 February 2000.
A volunteer examined this area and found Asian clam (relatively-recently dead), but no unionids.

Beitel Creek (San Antonio River drainage), adjacent to the U.S. 35 and U.S. 410 intersection, San Antonio, Bexar County, Texas, 20 December 2000.
A volunteer examined this site and found several species of fingernail clams, but no unionids or Asian clams were present.

Baffin Bay – Laguna Madre Drainage

Unnamed pond, about 0.8 km south of Sarita on U.S. 77, Kenedy County, Texas, 30 December 2000.
A volunteer surveyed this site, but no bivalves were found.

Unnamed pond, adjacent to U.S. 77 right-of-way about 9.7 km north of Norias, Kenedy County, Texas, 30 December 2000.
A volunteer surveyed this site, but no bivalves were found.

Drainage ditch, adjacent to U.S. 77 about 4.8 km south of Raymondville, Willacy County, Texas, 13 December 2000.
A volunteer examined this site, but found no bivalves.

Rio Grande Drainage

Delaware River (Pecos River drainage), at S.H. 625 west of Orla (N 31°53'42.10", W 104°21'00.97"), Culberson County, Texas, 30 May 2000).
When examined this site was completely dry with little indication of recent water flow or aquatic mollusks. Local residents and game wardens indicated that permanent pools may be present on private lands downstream (to the northwest and into New Mexico), but this area was not surveyed.

Red Bluff Reservoir, southwest side (N 31°53'47.46", W 103°54'55.57"), Reeves County, Texas, 30 May 2000.
Neither unionids, Asian clams, or fragments of their shells were found here despite low-

water conditions. Although surface water salinity reading was 0.0 ppt, it is likely that significantly higher salinity waters invade this site during normal reservoir levels.

Red Bluff Reservoir, southwest side of the dam (N 31°53'47.46", W 103°54'55.57"), Reeves County, Texas, 30 May 2000.
Neither unionids, Asian clams, or fragments of their shells were found here despite low-water conditions. See above comments.

Pecos River, first crossing immediately downstream of Red Bluff Reservoir dam (N 31°53'50,45", W 103°54'06.87"), Reeves County, Texas, 30 May 2000.
Only two nearly subfossil unionid fragments were found at this location. River salinity was 1.5 ppt.

Pecos River, at S.H. 652 east of Orla (N 31°52'21.07", W 103°49'56.00"), Reeves County, Texas, 30 May 2000.
No bivalves or their remains were found at this site. River salinity was 2.5 ppt.

Pecos River, at S.H. 302 west of Mentone (N 31°40'07.90", W 103°37'35.17"), Loving County, Texas, 30 May 2000.
No bivalves or their remains were found at this site. River salinity was 2.5 ppt.

North Floodway Canal, at U.S. 77, just south of Sebastion, Cameron County, Texas, 13 December 2000.
A volunteer examined this site, but found no bivalves.

Water Body and Species Summary

The number of specimens examined was not documented in 1992, but from 1993 through 2000 was >2,500; >3,000; >1,700; >7,200; >1,500, >1,200, > 3,000, and >3,100, respectively. The number of specimens was somewhat inflated in 1999 and 2000 due to a reexamination of B.A. Steinhagen Reservoir, Jasper and Tyler counties, in January 1999 and February 2000 during drawdown periods. The number of locations examined each year from 1992 through 2000 was 56, 162, 202, 179, 232, 87, 118, 136, and 121, respectively. Although new data collected 1997 through 2000 were less than in some previous years and a high proportion of 1999-2000 data originated from volunteers, there was generally no particular suggestion of dramatic changes in abundance, distribution, or composition at most locations. However, dramatic declines in water levels in many rivers, streams, and reservoirs were clearly contributing to mortality by mid- to late 1999 and into mid-2000. Low-water levels occurred statewide by 2000, but were less dramatic in the eastern third of the state. Stranded mussel assemblages found or reported in 1999 and 2000 were typically similar to those observed under more-normal conditions. Nonetheless, except in a few cases reported by volunteers, the extent of these losses in 1999 and 2000 was not

monitored by HOH. Declines in both abundance and diversity can probably be anticipated in many areas for some time into the future.

In eastern Texas, B.A. Steinhagen Reservoir on the Neches River experienced a drawdown in 1999 associated with control of noxious aquatic macrophytes. Similar drawdowns also occurred in 1993-4 and 1996, with extremely cold weather in 1996 causing extensive mortalities among unionids. However, virtually all taxa documented previously were found surviving and most of those displayed signs of successful reproduction between February 1996 and January 1999. These prior drawdowns and the 1999 evaluation of survivors were described in Howells *et al.* (2000). An additional drawdown in this same reservoir was not monitored by HOH, but data were supplied by one volunteer during these conditions.

Seasonal Weather Patterns

Years from mid-1995 through mid-2000 continued to be an alternating series of drought-caused low-water conditions. Drought conditions in 1995 and 1996 lowered river and reservoir levels nearly statewide. In some areas, low-water situations were still problematic in mid-1998 and in 1999, waters were low nearly everywhere statewide. Even several storms that produced scouring floods in 1998 were absent in 1999, but occurred again in late 2000. Some smaller impoundments and streams were completely dewatered in 1999 and early 2000. Rivers like the Concho and Colorado rivers experienced no-flow conditions and dry, exposed bottoms for long stretches. Negative environmental impacts on local unionids were unavoidable. Impacts to unionids by scouring floods that caused environmental damage in 1997 and 1998 were not monitored in 1999 and no effort has been mounted to define the impact of flooding in late 2000.

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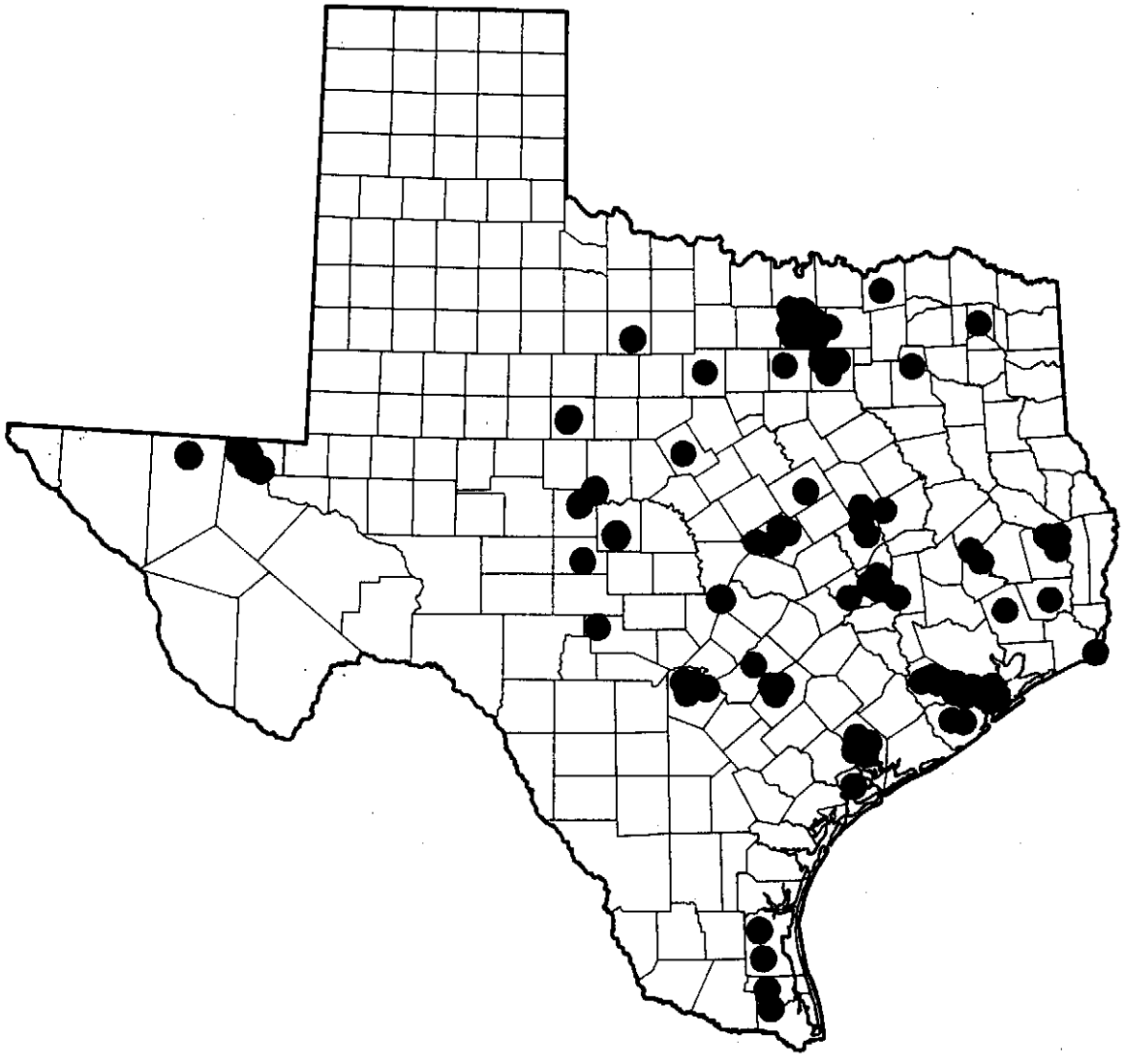
Figure 1. Locations surveyed for freshwater mussels (Family: Unionidae) and other bivalves in 2000 by Texas Parks and Wildlife Department personnel or by volunteers who subsequently provided data on these sites.



APPENDIX I.

Common and Scientific Names

Common names used in this and previous TPWD mussel-distribution reports and associated scientific names include:

Family: Unionidae

Threeridge *Amblema plicata*
Flat floater *Anodonta suborbiculata*
Floater sp. *Anodonta* sp. – Collections in B.A. Steinhagen Reservoir in 1993 produced specimens that appear intermediate between giant floater and flat floater. They have higher beaks and darker coloration than flat floater and are more inflated and less-deep bodied. Similar specimens have been found by P. Hartfield (U.S. Fish and Wildlife Service, Jackson, Mississippi; pers. com.) in Mississippi. Whether these represent an undescribed species, unusual ecophenotype of flat floater, or a hybrid remains unresolved.
Rock-pocketbook *Arcidens confragosus*
Ouachita rock-pocketbook *Arkansia wheeleri*
Tampico pearlymussel *Cyrtonaias tampicoensis*
Spike *Elliptio dilatata*
Texas pigtoe *Fusconaia askewi*
Wabash pigtoe *Fusconaia flava*
Triangle pigtoe *Fusconaia lananensis*
Round pearlshell *Glebula rotundata*
Texas fatmucket *Lampsilis bracteata*
Plain pocketbook *Lampsilis cardium*
Louisiana fatmucket *Lampsilis hydiana*
Sandbank pocketbook *Lampsilis satura*
Yellow sandshell *Lampsilis teres*
Pocketbook *Lampsilis ovata* – not present in Texas
Pocketbooks – collectively refers to plain pocketbook, sandbank pocketbook, or both
Fatmuckets – collectively refers to Texas fatmucket, Louisiana fatmucket, or both
White heelsplitter *Lasmigona complanata*
Fragile papershell *Leptodea fragilis*
Pond mussel *Ligumia subrostrata*
Washboard *Megalonaias nervosa*
Threehorn wartyback *Obliquaria reflexa*
Southern hickorynut *Obovaria jacksoniana*
Bankclimber *Plectomerus dombeyanus*
Louisiana pigtoe *Pleurobema riddellii*
Texas heelsplitter *Potamilus amphichaenus*
Pink papershell *Potamilus ohiensis*
Bleufer *Potamilus purpuratus*
Salina mucket *Potamilus salinasensis* – this species has also been called *Disconaias salinasensis* and *Potamilus metnecktayi*

Giant floater *Pygaonodon grandis*
Rio Grande monkeyface *Quadrula couchiana*
Southern mapleleaf *Quadrula apiculata*
Golden orb *Quadrula aurea*
Smooth pimpleback *Quadrula houstonensis*
Western pimpleback *Quadrula mortoni* – also known as *Quadrula pustulosa mortoni*
Gulf mapleleaf *Quadrula nobilis*
Wartyback *Quadrula nodulata*
Texas pimpleback *Quadrula petrina*
Pimpleback *Quadrula pustulosa*
Mapleleaf or common mapleleaf *Quadrula quadrula*
Pimpleback sp. or sp(p). – refers to golden orb, smooth pimpleback, western pimpleback, Texas pimpleback, pimpleback, or some combination of those species; identification of worn specimens and others from the Trinity River drainage can be difficult or impossible
False spike *Quincuncina mitchelli*
Creeper *Strophitus undulatus* – previously called squawfoot
Lilliput *Toxolasma parvus*
Texas lilliput *Toxolasma texasiensis* – western lilliput *Toxolasma mearnsi* is considered only a form of Texas lilliput herein
Pistolgrip *Tritogonia verrucosa*
Mexican fawnsfoot *Truncilla cognata*
Fawnsfoot *Truncilla donaciformis*
Texas fawnsfoot *Truncilla macrodon*
Deertoe *Truncilla truncata*
Tapered pondhorn *Uniomerus declivis*
Pondhorn *Uniomerus tetralasmus*
Paper pondshell *Utterbackia imbecillis*
Little spectaclecase *Villosa lienosa*

Family: Corbiculidae
Asian clam *Corbicula* sp(p). – Most recognize all American corbiculas as *Corbicula fluminea*; however, some genetic studies suggest a second species may be present in Texas; no efforts were made to define species in this study

Family: Dreissenidae
Zebra mussel *Dreissena polymorpha*
Quagga mussel *Dreissena bugensis*
Zebra mussels – collectively zebra mussel, quagga mussel, or both

Family : Mactridae
Atlantic rangia *Rangia cuneata*

Family: Sphaeriidae
Fingernail clams and their relatives – no effort was made to identify species herein

SHELL CONDITION TERMINOLOGY

It is not usually possible to determine exactly how long a freshwater mussel shell has been dead. Different conditions such as water and substrate pH, erosive or corrosive environments, and exposure to sun can impact specimen condition and rate of disintegration. None the less, some qualitative estimate of time-since-death can be very useful. The following terms are used in TPWD freshwater mussel surveys:

Very-recently dead: Soft tissue remains attached to the shell; shell in good condition, essentially as it would be in a living specimen; internal and external colors are not faded.

Recently dead: No soft tissue remains, but shell otherwise in good condition (looking like a living specimen that had been killed and cleaned); internally nacre is glossy and without evidence of algal staining, calcium deposition, or external erosive effects; internal and external colors are not faded.

Relatively-recently dead: Shell in good condition, but internally nacre is loosing its glossy nature; algal staining, calcium deposition, or external erosive effects (or some combination of these) is evident on the nacre; internal and external colors often faded somewhat.

Long dead: Shell shows early signs of internal and external erosion, staining, calcium deposition, or some combination of these; most or all of the internal coloration and glossy nature has faded (especially in species with colored nacre); shell epidermis with major sections absent, or , if present, clearly aged and flaking.

Very-long dead: Shell shows significant signs of erosion, staining, and calcium deposition more widely pronounced than above; coloration often faded white or nearly so; relatively little intact epidermis left; for specimens in erosive environments, internal features (*e.g.*, pseudocardinal teeth) and external features (*e.g.*, pustules) often weathered and smoothed, or otherwise exfoliated; shells often chalky, brittle, and crumbling.

Subfossil: Shells with little or no epidermis; nacre faded white and entire shell often white; sometimes with signs of erosion, staining, or calcium deposition; typically chalky and powdery to the touch; shells often brittle and crumbling.

SHELL COUNTING METHODS

0.5 x 1 = one valve (one half shell); counted as one specimen in some calculations.
1 = one living specimen with a complete shell (two matched valves);
1.0 = one complete shell consisting of two, matching valves.
0.5 x 2 = one valve from each of two individuals; counted as two specimens in some calculations.
3.0+ 0.5 x 2 = three complete shells (pairs of matched valves) and two additional unpaired valves from two additional individuals; counted as five specimens in some calculations.