

**DISTRIBUTIONAL SURVEYS OF  
FRESHWATER BIVALVES IN TEXAS:  
PROGRESS REPORT FOR 2004**

by  
Robert G. Howells

MANAGEMENT DATA SERIES

No. 233

2005

Texas Parks and Wildlife Department  
Inland Fisheries Division  
4200 Smith School Road  
Austin, Texas 78744

## ACKNOWLEDGMENTS

Many biologists and technicians with Texas Parks and Wildlife Department's (TPWD) Inland Fisheries Heart of the Hills Fisheries Science Center obtained freshwater mussels during other departmental field work and provided editorial review of this manuscript, as did individuals from other TPWD divisions. Volunteers and TPWD staff supplying specimens or data in 2004 included: Roe Davenport, Tom Miller, Tony Gallucci, Marvin Eisthen, James Dobie, Bill Lindemann, Paula Power, Matthew Chunchal, Daniel Spooner, Jane Crone, Marsha Reimer, Andy Tirpak, Alex Karatayev, Lyubov Burlakova, Jesse Todd, Tom Brandt, and Susan Martin.

## ABSTRACT

During 2004, over 460 unionid specimens were documented among 51 locations that were examined statewide in Texas where specimens were either directly surveyed by Heart of the Hills Fisheries Science Center (HOH) staff or were sent to HOH by volunteers or other Texas Parks and Wildlife Department personnel. Living and very recently and recently dead specimens were documented at 27% of the locations examined and 49% produced no unionids or their remains.

In general, too few specimens were obtained from too few sites to draw extensive conclusions about the status of freshwater mussels across Texas in 2004. Drought conditions that began in mid-1995 lessened somewhat in 2003 and 2004. Indeed, high waters at some locations precluded obtaining good estimates of species present. However, early losses associated with dewatering likely accounted for the reported failure to find unionids at locations previously known to support populations.

# CONTENTS

INTRODUCTION.....	1
MATERIALS AND METHODS.....	1
RESULTS AND DISCUSSION.....	2
Canadian River Drainage.....	2
Red River Drainage.....	2
Sulphur River Drainage.....	3
Sabine River Drainage.....	3
Neches River Drainage.....	3
Trinity River Drainage.....	4
San Jacinto River Drainage.....	5
Buffalo Bayou Drainage.....	5
Brazos River Drainage.....	6
Colorado River Drainage.....	6
Guadalupe River Drainage.....	10
Nueces – Frio River Drainage.....	19
Aransas Bay Drainage.....	11
Rio Grande Drainage.....	11
Water Body and Species Summary.....	13
LITERATURE CITED.....	13
FIGURE.....	15
APPENDIX I.....	16

## INTRODUCTION

Beginning in January 1992, Texas Parks and Wildlife Department's (TPWD) Heart of the Hills Fisheries Science Center (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, 2001a, 2001b, 2002, 2003, 2004). 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 2004, 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). Also, during 2004, personnel from HOH and Stephen F. Austin State University (SFASU) and several volunteers obtained information regarding the distribution of Asian clam in Texas to develop better information on the range of this invasive exotic species in Texas; a submitted manuscript is currently under review.

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 definite 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

### Canadian River Drainage

Lake Meredith, North Turkey Cove, Hutchinson County, Texas, 5 May 2004.

Biologists from Oklahoma working at this site reported finding giant floater, southern mapleleaf, and pondhorn at this site, but did not indicate numbers present or condition of the specimens. Although giant floaters had been documented here in previous surveys and there were upstream records of pondhorn, neither southern mapleleaf or pondhorn had been documented in Lake Meredith before.

### Red River Drainage

Lake Theo, shoreline, Briscoe County, Texas, 3 April 2004.

A volunteer examined this site and reported finding the following specimens and observing other pondhorns:

Lake Theo Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Pondhorn	-	1	recently dead	100.0
Asian clam (abundant)				

Dundee State Fish Hatchery, Archer County, Texas, 3 April 2004.

HOH personnel confirmed Asian clams were present in hatchery waterways.

Town Lake, Mount Pleasant, Titus County, Texas, 22 May 2004.

SFASU personnel confirmed the presence of Asian clams in this water body.

## Sulphur River Drainage

oper Reservoir, Delta County, Texas, 4 January 2004.

TPWD state park staff confirmed the presence of Asian clams in this water body, but did not conduct surveys of other bivalves.

## Sabine River Drainage

ine River, at Deweyville 1.6 km north of Smith's Fish Camp, Newton County, Texas, multiple historical collections.

A volunteer examined unionids taken in historic collections at this location now at the Brazosport Museum of Natural History. He reported the following species were represented there: southern mapleleaf, wartyback, western pimpleback (listed as "pimpleback"), gulf mapleleaf, threehorn wartyback, bleufer, fawnsfoot, lilliput (as *haleiana*), washboard, threeridge, Louisiana fatmucket, sandbank pocketbook, yellow sandshell, bankclimber, southern hickorynut, pistolgrip, and fragile papershell.

## Neches River Drainage

Steinhagen Reservoir (Neches River drainage), cove on northwest corner of U.S. 190, Tyler County, Texas, 27, August 2004.

Personnel ( $N = 3$ ) from Stephen F. Austin State University and HOH collected the following specimens in a 1-hour, random collection.

B.A. Steinhagen Reservoir, cove northeast of US 190

Species	$N$ alive	$N$ shells	Condition	Percentage
Louisiana fatmucket	0	0.5x1	long dead	4.3
Yellow sandshell	0	0.5x2	long dead	8.7
Bleufer	0	1.0	recently dead	4.3
Giant floater	6	5.0	long dead	47.8
Western pimpleback	0	0.5x1	long dead	4.3
Texas lilliput	7	0.0	-	30.4

s River, gravel bar on the west bank downstream of Town Bluff Dam, Tyler County, Texas, 27 August 2004.

Personnel ( $N = 3$ ) from Stephen F. Austin State University and HOH collected the following specimens at this site; numerous other unionids were present, but were not formally enumerated:

Neches River below Town Bluff Dam				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Rock-pocketbook	0	1.0	very recently dead	2.4
Threeridge	-	-	present	-
Yellow sandshell	0	2.0	very recently dead	4.9
Sandbank pocketbook	1	12.0	very recently dead	31.7
Washboard	-	-	present	-
Texas heelsplitter	0	5.0	very recently dead	12.2
Southern mapleleaf	1	1.0	very recently dead	4.9
Western pimpleback	1	0.0	-	2.4
Gulf mapleleaf	0	4.0	very recently dead	9.8
Wartyback	1	1.0	very recently dead	4.9
Pistolgrip	0	4.0	very recently dead	9.8
Fawnsfoot	0	5.0	very recently dead	12.2
Deertoe	2	0.0	-	4.9
Asian clam (present)				

Numbers listed above only indicate the number of specimens retained and not the numbers or proportions actually present at this site. Water levels were very low and appeared to have dropped very recently. Air temperatures were high and many specimens stranded above the water line or in shallows had died and were being lost to excessively warm temperatures. Many unionids found alive in shallows were relocated to deeper waters during this survey in an effort to save them. The discovery of numerous very recently dead and living Texas heelsplitters was encouraging. This endemic species has become quite rare and has never before been found in abundance in the Neches River downstream of Town Bluff Dam. This site is scheduled to be surveyed in greater detail before September 2005.

Lower Neches Valley Authority Canals, Jefferson County, Texas.

Dr. R. Harrell, Lamar University, reported Asian clams were present in these waters.

### Trinity River Drainage

Amon G. Carter Reservoir, Montague County, Texas, 12 June 2004.

A volunteer with the TPWD Mussel Watch program reported the presence of Asian clams in this water body.

Unnamed pond, near Frankford and the North Dallas Tollway, Dallas, Dallas County, Texas, two dates.

5 April 2004:



A volunteer examined this site and found one living and 26 recently to long dead paper pondshells.

25 October 2004:

A volunteer surveying this site found a single long dead paper pondshell 95 mm in length.

White Rock Reservoir, Sunset Bay, Dallas, Dallas County, Texas, 3 July 2004.

A volunteer examined this site and reported finding a single long dead lilliput.

Madisonville Reservoir, Madisonville, Madison County, Texas, 25 August 2004.

HOH staff documented the presence of Asian clams in this water body, but did not conduct surveys for other bivalves.

### San Jacinto River Drainage

Lake Creek, Montgomery County, Texas, 16, 2004.

A volunteer with the Texas Nature Trackers program found specimens of western pimpleback at a location in this stream (exact location, number, and condition unstated).

Kidfish Pond, off West Archer Road, Baytown, Chambers County, Texas, 25 May 2004.

HOH personnel confirmed the presence of Asian clams in this water body, but did not conduct surveys for other bivalves.

### Buffalo Bayou

Bear Creek, below Addicks Dam, north of I-10 and east of SH 6, Harris County, Texas, 30 October 2004.

Staff from Stephen F. Austin State University and TPWD used hand collections and timed searches (five people for 20 minutes) and 0.25 m<sup>2</sup> quadrats to survey this site. Timed search efforts produced:

Bear Creek, timed search Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Round pearlshell	10	4	recently to relatively recently dead	13.9
Giant floater	1	1	recently dead	1.9
Southern mapleleaf	88	3	recently dead	84.3
Western pimpleback	1	0	-	0.1

Among all mussel taxa combined, 64.8/man-hour were documented. Quantitative sample with 20, 0.25 m<sup>2</sup> quadrats produced a total of 9 southern mapleleafs (mean = 0.45;  $N/m^2 = 1.8$ ). This site was surveyed in July 1994 by a group from the American Malacological Union that was meeting in Houston at that time (Howells 1996a). Recent construction of buildings just west of this location raised concern that this mussel assemblage might have been lost due to area development. Nonetheless, unioids are still present.

### Brazos River Drainage

Pat Cleburne Reservoir, Johnson County, Texas, 6 February 2004.

Dr. R. McMahon, University of Texas at Arlington, reported finding Asian clams at this location prior to 1994.

Lake Whitney (reservoir), Hill County, Texas, 6 February 2004.

Dr. R. McMahon, University of Texas at Arlington, reported finding Asian clams at this location prior to 1994.

Brazos River, Hill County, Texas, 6 February 2004.

Dr. R. McMahon, University of Texas at Arlington, reported finding Asian clams at this location prior to 1994.

### Colorado River Drainage

Colorado River, north of boat ramp at US 35 near Bay City, Matagorda County, Texas, 2 February 2004.

A volunteer examined this site and reported the following species:

Colorado River at US 35				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Tampico pearlymussel	-	7.0	recently dead	17.9
Yellow sandshell	-	3.0	recently dead	7.7
Fragile papershell	-	2.0	recently dead	5.1
Lilliput	-	25.0	recently dead	64.1
Texas lilliput	-	1.0	recently dead	2.6
Asian clam (present, both white and purple forms)				

Threadgill Creek, ca 2.4 km downstream of Lang's Mill Road crossing, east of RR 783, northeast of Doss, Gillespie County, Texas, two dates.  
19 June 2004:

HOH personnel found one very recently dead Texas fatmucket specimen and a second living specimen that was subsequently released.

1 July 2004:

Upon returning to the area to conduct a more detailed survey, HOH staff found:

Threadgill Creek, downstream of Lang's Mill Road				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Texas fatmucket	3	7.0+0.5x4	very recently to very long dead	58.3
Texas lilliput	3	4.0+0.5x3	very recently to very long dead	41.7
Asian clam (present)				

Live Oak Creek below the lower-most dam (Pedernales River drainage), Lady Bird Johnson Park, Fredericksburg, Gillespie County, Texas, 30°14.310'N, 98°54.666'W, several dates.

TPWD, volunteers, or both examined this site and documented the following specimens: 6 April 2004

Live Oak Creek below the lower-most dam, Lady Bird Johnson Park				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Texas fatmucket	0	1.0+0.5x3	recently dead to relatively recently dead	7.1
Texas lilliput	0	1.0+0.5x3	recently dead to relatively recently dead	8.9
Paper pondshell	0	21.0+0.5	recently dead to relatively recently dead	83.9
Asian clam (present)				

10 April 2004

Live Oak Creek below the lower-most dam, Lady Bird Johnson Park				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Texas fatmucket	0	6.0+0.5x2	recently dead	16.7
Texas lilliput	0	1.0+0.5x1	recently dead	4.2
Paper pondshell	0	26.0+0.5x12	recently dead	79.2

29 April 2004

---

Live Oak Creek below the lower-most dam, Lady Bird Johnson Park

Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Texas fatmucket	0	4.0+0.5x1	recently dead	9.8
Texas lilliput	0	3.0	recently dead	5.9
Paper pondshell	0	15.0+0.5x28	recently dead	84.3
Asian clam (present)				

---

Johnson City Lake, on the Pedernales River north of Johnson City on US 281, Blanco County, Texas, 15 February 2004.

A volunteer examined this site, but found only Asian clams present.

Sandy Creek, at SH 71, Llano County, Texas, 15 February 2004.

A volunteer examined this site, but did not find any bivalves present.

Llano River, at FM 3404 north of Kingland, Llano County, Texas, 15 February 2004.

A volunteer examined this site, but found only Asian clams to be present.

Inks Lake, north shore on east side of FM 2900 at Kingsland, Llano County, Texas, 15 February 2004.

A volunteer examined this site, but found only Asian clams to be present.

Llano City Lake, on Llano River just upstream of SH 16, Llano County, Texas, 15 February 2004.

A volunteer examined this site, but found only Asian clams.

Llano River, downstream of Llano City Lake Dam, Llano County, Texas, 15 February 2004.

A volunteer examined this site, but found only Asian clams.

Willow Creek, at SH 29 east of Mason, Mason County, Texas, 16 February 2004.

A volunteer examined this site, but no bivalves were found.

San Saba River, at FM 1311 north of SH 29 and east of Menard, Menard County, Texas, 16 February 2004.

A volunteer attempted to examine this site, but found it fenced. Asian clams were present along the roadside.

San Saba River, at FM 2029 (north SH 29 east of Menard), Menard County, Texas, 16 February 2004.

A volunteer examined this site and found:

San Saba River at FM 2029				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Threeridge	0	0.5x3	relatively long dead	42.9
Tampico pearlymussel	0	0.5x2	relatively long dead	28.6
Bleufer	0	0.5x2	relatively long dead	28.6
Asian clam (present)				

San Saba River, at FM 2029 closer to Menard than the above site, Menard County, Texas, 16 February 2004.

A volunteer examined this site, but found only Asian clams.

San Saba River, at Menard between US 83 and Decker Street, Menard County, Texas, 16 February 2004.

A volunteer examined this site, but found only Asian clams.

Concho River, low-water crossing downstream of Paint Rock, Concho County, Texas, 16 February 2004.

A volunteer examined this site and reported:

Concho River at low-water crossing below Paint Rock				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Fragile papershell	0	0.5x5	recently dead	100.0
Asian clam (present)				

Brady Creek, county road opposite FM 2134 south of US 87, Concho County, Texas, 16 February 2004.

A volunteer examined this site, but no bivalves were found.

Brady Creek, south of site at county road opposite FM 2134 south of US 87, Concho County, Texas, 16 February 2004.

A volunteer examined this site, but no bivalves were found.

Brady Creek, east side in Melvin City Park, McCulloch County, Texas, 16 February 2004.

A volunteer examined this site, but no bivalves were found.

Brady Lake, park at northeast corner of dam (Brady Creek drainage), Brady, McCulloch County, Texas, 16 February 2004.

A volunteer examined this site and reported the following specimens:

Brady Lake, northeast corner of dam				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Tampico pearlymussel	0	5	recently dead	100.0
Asian clam (present)				

Lake Travis, Austin, Travis County, Texas, reported from an old collection made in the 1970s or 1980s.

A single recently dead bleufer was reported in the collection of M. Whitehead.

### Guadalupe River Drainage

Blanco River, at Wimberley, Hays County, Texas, reported from an old collection made in the 1970s or 1980s.

The following specimens were reported in the collection of M. Whitehead.

Blanco River, Wimberley				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Texas fatmucket	-	1	recently dead	25.0
Texas pimpleback	-	1	recently dead	25.0
Pistolgrip	-	1	recently dead	25.0
Unidentified unionid	-	1	recently dead	25.0

San Marcos River, adjacent to state fish hatchery and waste-water treatment plant, San Marcos, Hays County, Texas, 9 January 2004.

U.S. Fish and Wildlife Service personnel found a single, very long dead valve of Texas pimpleback during other work in the area.

San Marcos River, 45 m upstream of the San Marcos Waste Water Treatment Plant, adjacent to state fish hatchery and horse pasture, San Marcos, Hays County, Texas, 12 November 2004.

U.S. Fish and Wildlife Service personnel found a one living Texas pimpleback during other work in the area. This is the first record of this species being found alive in this system since 1977.

San Antonio River, in Brackenridge Park, San Antonio, Bexar County, Texas, reported from an old collection made in the 1970s or 1980s.

A single recently dead lilliput shell was reported in the private collection of M. Whitehead.

Woodlawn Lake, San Antonio, Bexar County, Texas, reported from an old collection made in the 1970s or 1980s.

Two recently dead paper pondshell specimens were reported in the private collection of M. Whitehead.

Coletto Creek Reservoir (San Antonio River drainage), Goliad County, Texas, 12 May 2004. HOH staff confirmed the presence of Asian clams in this water body, but did not conduct surveys for other bivalves.

### Aransas Bay Drainage

Poesta Creek, at SH 202, 4 km south of US 181 at Beeville, Bee County, Texas, 7 September 2004.

HOH staff confirmed the presence of Asian clams in this water body, but did not conduct surveys for other bivalves.

### Rio Grande Drainage

Rio Grande, between Black Gap Wildlife Management area downstream boundary and Reagan Canyon, Brewster County, Texas, 29.72272°N, 102.69052°W, 8 June 2004.

During other work in the area, HOH staff personnel collected the following specimens:

Rio Grande, between Black Gap WMA and Reagan Canyon				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Salina mucket	0	0.5x1	relatively-recently dead	100.0

Rio Grande, upstream of Palmas Canyon, Brewster County, Texas, 29.78025°N, 102.46979°W, 8 June 2004.

During other work in the area, HOH staff personnel collected the following specimens:

Rio Grande, upstream of Palmas Canyon				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Texas hornshell	0	1.0	recently dead	50.0
Salina mucket	0	0.5x1	relatively-recently dead	50.0

Rio Grande, near Palmas Canyon, Brewster County, Texas, 29.78365°N, 102.51716°W, 8 June 2004.

During other work in the area, HOH staff personnel collected the following specimens:

Rio Grande, near Palmas Canyon				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Texas hornshell	0	2.0	recently dead	40.0
Salina mucket	0	0.5x3	recently dead	60.0

Rio Grande, upstream of Panther Canyon (ca 11 km upstream of San Francisco Creek), Brewster County, Texas, 29.80974°N, 102.37227°W, 8 June 2004.

During other work in the area, HOH staff personnel collected the following specimens:

Rio Grande, upstream of Panther Canyon				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Tampico pearlymussel	0	0.5x2	long dead	40.0
Salina mucket	0	1.0+0.5x2	relatively-recently to relatively-long dead	60.0

Rio Grande, ca 3.6 km upstream of San Francisco Creek, Brewster County, Texas, 29.86498°N, 102.33235°W, 8 June 2004.

During other work in the area, HOH staff personnel collected the following specimens:

Rio Grande, upstream of San Francisco Creek				
Species	<i>N</i> alive	<i>N</i> shells	Condition	Percentage
Tampico pearlymussel	0	1.0	relatively-recently dead	50.0
Salina mucket	0	0.5x1	relatively-recently dead	50.0

\*\* During the above five collections in June 2004, volunteers with the field crew also collected a relatively-long dead valve of Tampico pearlymussel, but only recorded its collection site as "Lower Canyons Rio Grande".

Pinto Creek, upstream of US 90, Kinney County, Texas, 13 May 2004.

During other TPWD work in the area, 5, very long dead valves of Tampico pearlymussel were found.



## **Water Body and Species Summary**

The number of specimens examined annually was not documented in 1992, but from 1993 through 2003 was >2,500; >3,000; >1,700; >7,200; >1,500, >1,200; > 3,000; >3,100; <150; >1,900, >1,260, and >467, respectively. The number of locations examined each year from 1992 through 2004 was 56, 162, 202, 179, 232, 87, 118, 136, 121, 90, 103, 231, and 51, respectively. Among the locations examined in 2004, 27% yielded living specimens or very recently and recently dead shells and valves, but no unionids or their remains were found at 49% of these sites. Generally, too few specimens were documented and too few locations examined to allow conclusions about status of freshwater mussels at most locations in Texas in 2004. No unionids were found at a number of sites examined by volunteers that had previously supported mussel populations. Drought conditions since mid-1995 in many areas likely reduced or eliminated mussel assemblages at many of these sites.

## **LITERATURE CITED**

- Howells, R.G. 1993. Preliminary survey of freshwater mussel harvest in Texas. Texas Parks and Wildlife Department, Management Data Series 100, Austin.
- Howells, R.G. 1994. Preliminary distributional surveys of freshwater bivalves in Texas: progress report for 1992. Texas Parks and Wildlife Department, Management Data Series 105, Austin.
- Howells, R.G. 1995. Distributional surveys of freshwater bivalves in Texas: progress report for 1993. Texas Parks and Wildlife Department, Management Data Series 119, Austin.
- Howells, R.G. 1996a. Distributional surveys of freshwater bivalves in Texas: progress report for 1994. Texas Parks and Wildlife Department, Management Data Series 120, Austin.
- Howells, R.G. 1996b. Distributional surveys of freshwater bivalves in Texas: progress report for 1995. Texas Parks and Wildlife Department, Management Data Series 125, Austin.
- Howells, R.G. 1997a. Distributional surveys of freshwater bivalves in Texas: progress report for 1996. Texas Parks and Wildlife Department, Management Data Series 144, Austin.
- Howells, R.G. 1997b. Freshwater mussels of the Wichita River, Texas, with comments on the Little Wichita and Pease rivers. Texas Parks and Wildlife Department, Management Data Series 142, Austin.
- Howells, R.G. 1998. Distributional surveys of freshwater bivalves in Texas: progress report for 1997. Texas Parks and Wildlife Department, Management Data Series 147, Austin.

- Howells, R.G. 1999. Distributional surveys of freshwater bivalves in Texas: progress report for 1998. Texas Parks and Wildlife Department, Management Data Series 161, Austin.
- Howells, R.G. 2000. Distributional surveys of freshwater bivalves in Texas: progress report for 1999. Texas Parks and Wildlife Department, Management Data Series 170, Austin.
- Howells, R.G. 2001a. Distributional surveys of freshwater bivalves in Texas: progress report for 2000. Texas Parks and Wildlife Department, Management Data Series 187, Austin.
- Howells, R.G. 2001b. Status of freshwater mussels of the Rio Grande, with comments on other bivalves. Texas Parks and Wildlife Department, Summary Report, Austin.
- Howells, R.G. 2002. Distributional surveys of freshwater bivalves in Texas: progress report for 2001. Texas Parks and Wildlife Department, Management Data Series 200, Austin.
- Howells, R.G. 2003. Distributional surveys of freshwater bivalves in Texas: progress report for 2002. Texas Parks and Wildlife Department, Management Data Series 214, Austin.
- Howells, R.G. 2004. Distributional surveys of freshwater bivalves in Texas: progress report for 2003. Texas Parks and Wildlife Department, Management Data Series 222, Austin.
- Howells, R.G., R.W. Neck, and H.D. Murray. 1996. Freshwater mussels of Texas. Texas Parks and Wildlife Press, Austin.
- Turgeon, D.D., and nine coauthors. 1998. Common and scientific names of aquatic invertebrates of the United States and Canada: Mollusks. American Fisheries Society Special Publication 16, Bethesda, Maryland.
- Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of the freshwater mussels of the United States and Canada. Fisheries (Bethesda) 18(9):6-22.

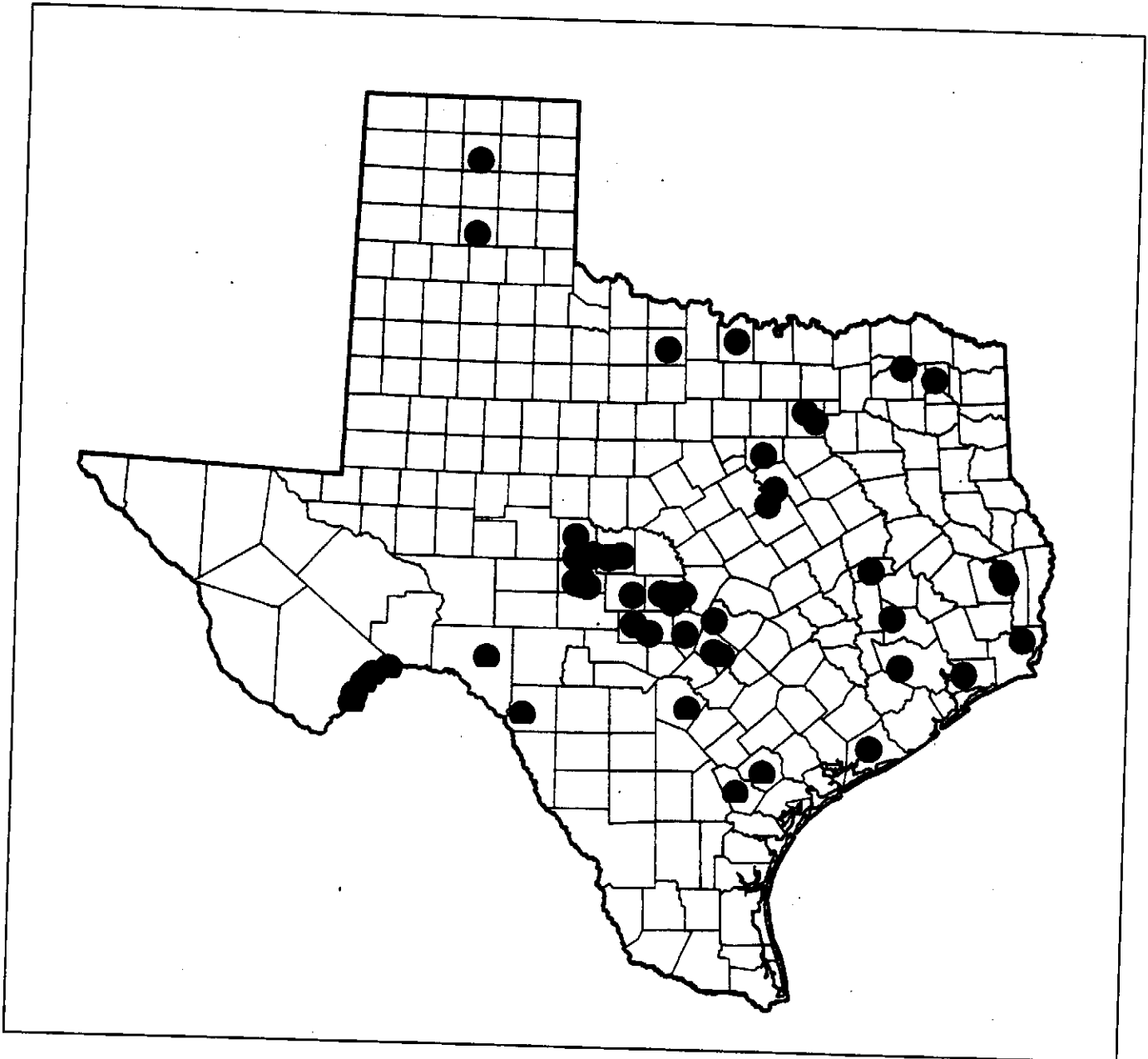


Figure 1. Locations surveyed for freshwater mussels (Family Unionidae) and other bivalves in 2004 by Texas Parks and Wildlife Department personnel or by volunteers who subsequently provided data on these sites.

## 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 (US 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 pearl mussel *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 hornshell *Popenaias popeii*

Texas heelsplitter *Potamilus amphichaenus*

Pink papershell *Potamilus ohiensis*

Bleufer *Potamilus purpuratus*

Salina mucket *Potamilus metnecktayi* – this species has also been called *Disconaias salinasensis* and *Potamilus salinasensis*

Giant floater *Pyganodon 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* - Serb et al. (2003 ) used DNA analysis to demonstrate this species should be moved to the genus *Quadrula*.

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 losing 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.