

**DISTRIBUTIONAL SURVEYS OF
FRESHWATER BIVALVES IN TEXAS:
PROGRESS REPORT FOR 1996**

by

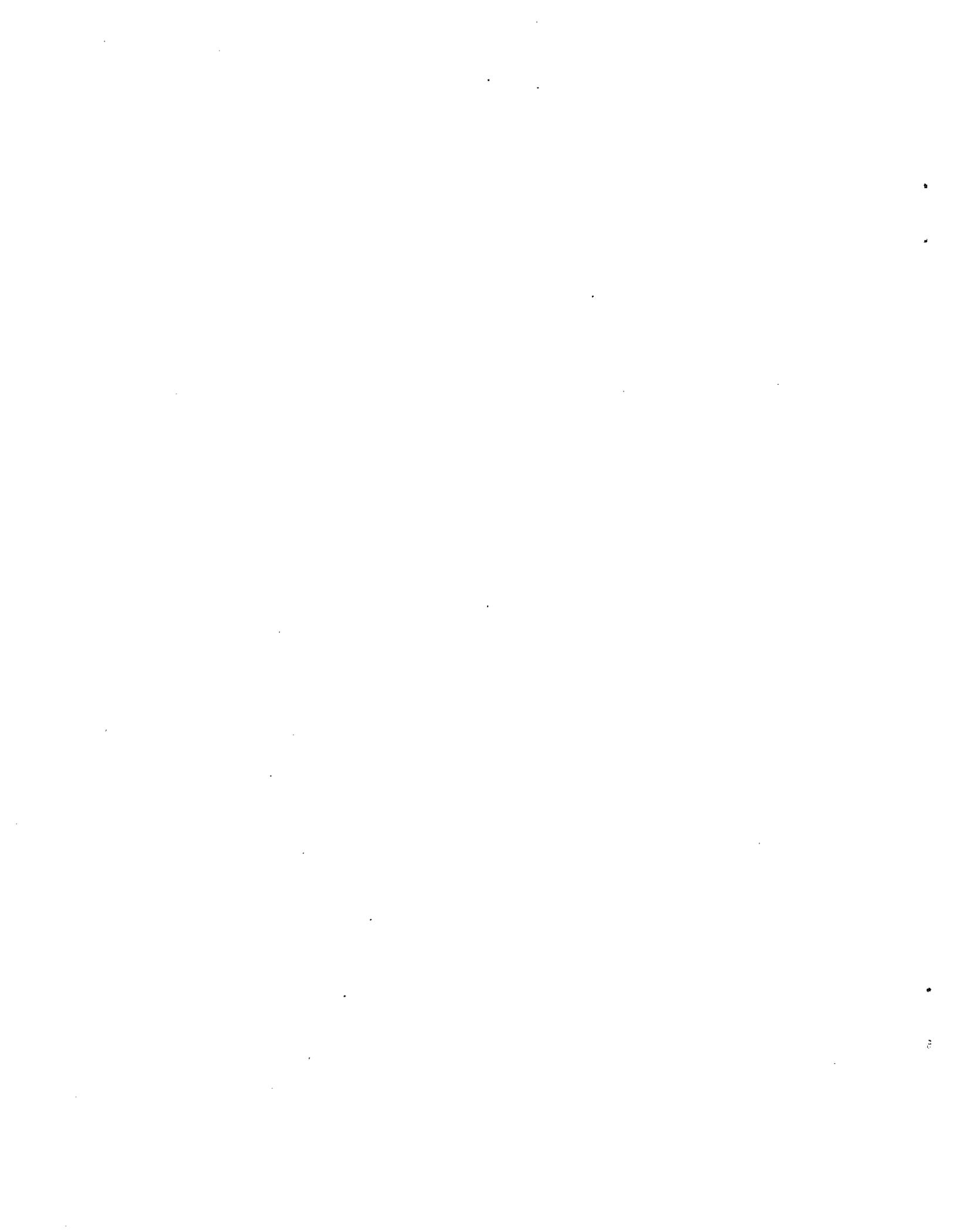
Robert G. Howells

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ABSTRACT

During 1996, over 7,200 unionid specimens were documented from 232 locations (300 sample sites) 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 or recently-dead shells were found at 45% of the locations, 16% yielded only long-dead or subfossil shells, 35% produced no unionids or their remains, and 4% could not be accessed due to private lands or other local site problems which precluded sampling.

In conjunction with previous field-survey work 1992-1995, unionids appear completely or almost completely 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. A drought which began in 1995 and continued through 1996 caused water-level declines statewide with subsequent negative impacts on freshwater mussel populations. Among the most dramatic examples occurred at reservoirs on the Rio Grande where levels at Falcon Reservoir were down approximately 15 m. Collections in 1995 found large numbers of mussels in shallow waters and on recently-exposed bottoms, but in 1996, only a single living specimen was found. Additionally, cold-kills associated with reservoir drawdowns in early 1996 resulted in mussel losses as well.

Primary sport and commercial species are still present in some waters in relative abundance. Many other species have declined in distribution and abundance in recent years due largely to wide-ranging environmental degradation and poor land management rather than to harvest. However, several rare species were discovered to have additional populations not previously recognized. Golden orb *Quadrula aurea* and Texas fatmucket *Lampsilis hydiana* were each only known to survive at one site each in Central Texas. In 1996, two additional populations of golden orb and one of Texas fatmucket were discovered in different drainage basins than the previously known survivors. Texas heelsplitter *Potamilus amphichaenus* had been known from only about 150 specimens since it was described in 1898, but in January 1996, another 11 living specimens and over 20 shells were found in the Neches River drainage and 40 living specimens were located in the Trinity River. Four living specimens of Texas fawnsfoot *Truncilla macrodon* and a number of recently dead shells were located in the Brazos River and two living Louisiana pigtoes *Pleuobema riddellii* found in the Neches River were among the first of their species to be seen in recent decades.

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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). These data were ultimately used to compile *Freshwater Mussels of Texas* (Howells et al. 1996). Discussed here are findings from continuing surveys conducted in 1996.

MATERIALS AND METHODS

Various habitats were sampled at each collection site examined. 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. On several occasions, SCUBA or hookah-pump diving were used to sample deeper waters. Brails and skimmer dredge were also used to sample deeper waters at several sites. Transects or quadrats were also employed in higher-density situations. 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 numbers were not documented, it may have been 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).

Varying environmental conditions can confound attempts to accurately define how long a given specimen has been dead, a number of terms have been used herein to convey an approximation of this. While inherently inaccurate, these attempts to characterize time since death are useful in distinguishing between shells which have been dead for many years or decades from others which clearly died only days or weeks before collection. Terminology relating to specimen condition was summarized in Howells (1996a, 1996b).

RESULTS AND DISCUSSION

Red River

Lake Arrowhead (Little Wichita River drainage), Clay County, 1 October 1996:

Wading and snorkeling were used to collect a limited number of specimens.

Lake Arrowhead Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Yellow sandshell	2	0.5 x 1	very long dead	21.4
Fragile papershell	0	2.0	relatively recent-very long dead	14.3
Pink papershell	1	3.0	relatively recent-recent	28.6
Mapleleaf sp.	5	0.0	-	35.7

Local park personnel indicated commercial musselers have been harvesting unionids in this reservoir and local law enforcement officials had been monitoring the activity by checking licenses and minimum harvest sizes. Mapleleaf specimens found here are suspected to be *Quadrula quadrula*, but may include *Q. apiculata* as well. Further genetic testing is required to clarify their taxonomic status.

Red River near confluence of Bois d'Arc Creek, Fannin County, 20 August 1996:

Brief sand- and gravel-bar examinations produced:

Red River near Bois d'Arc Creek Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Fragile papershell	0	1.0	recently dead	100.0

Red River about 1.5 km east of Wood Creek (33°50'36.9", 96°0'45.8"), Fannin County, 20 August 1996:

Brief sand and gravel bar examinations produced:

Red River about 1.5 km east of Wood Creek Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Bleufer	0	1.0	recently dead	100.0

Red River at Murphy Creek, Fannin County, 19 August 1996:

Brief sand and gravel bar collections produced:

Red River at Murphy Creek Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Yellow sandshell	0	1.0	very long dead	50.0
Pink papershell	0	1.0	relatively-long dead	50.0

Red River at Muddy Boggy Creek (OK) opposite Lamar County, 21 August 1996:
Brief sand and gravel bar examinations produced:

Red River at Boggy Creek				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Fragile papershell	0	0.5 x 1	subfossil	25.0
Mapleleaf sp.	0	0.5 x 1	subfossil	25.0
Pimpleback sp(p).	0	0.5 x 2	subfossil	50.0

Red River at the confluence of the Kiamichi River (OK)(33°57'9.5", 95°14'16.3"), opposite Red River County, 22 August 1996:
Brief sand and gravel bar collections produced:

Red River at the Kiamichi River				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Pink papershell	0	0.5x3	relatively-recently dead-long dead	100.0

Red River downstream of the confluence of the Kiamichi River (OK)(33°55'7.4", 95°13'19.0"), opposite Red River County, 22 August 1996:
Brief sand and gravel bar collections produced:

Red River downstream of the Kiamichi River				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Pink papershell	0	0.5x2	very long dead	66.7
Bleufer	0	0.5x1	relatively-long dead	33.3

The six collections in the Red River were made by fishery management biologists during other work in the area. Though limited in scope, these are the first TPWD collections in the main-stream Red River (all previous collections were in tributaries) and are among only a few that have ever been taken in this river. Based upon the condition of some of the shells recovered, at least some unionid populations appear to remain in this area despite undesirable shifting-sand bottoms.

Sanders Creek, up- and downstream of SH 197, Lamar County, 7-8 June 1996:
C.M. Mather (University of Science and Arts of Oklahoma, Chickasha) and J.A.M. Bergmann (Boerne, Texas) surveyed this stream relative to a previous collection of Ouachita rock-pocketbook found in this area. Only live specimens were documented unless only dead shells were found for a particular species. They reported the following assemblage to HOH:

Sanders Creek				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	1.0	unreported	0.2
Giant floater	2	-	-	0.5
Rock-pocketbook	1	-	-	0.2
Yellow sandshell	29	-	-	6.6
White heelsplitter	10	-	-	2.3
Fragile papershell	8	-	-	1.8
Threehorn wartyback	148	-	-	33.6

Pink papershell	7	-	-	1.6
Bleufer	74	-	-	16.8
Southern mapleleaf	74	-	-	16.8
Wartyback	24	-	-	5.4
Pimpleback	60	-	-	13.6
Deertoe	1	-	-	0.2
Lilliput sp.	0	1.0	unreported	0.2
Asian clam	1	-	-	0.2

The pimplebacks found in Sanders Creek appear more like classic examples of *Quadrula pustulosa* than other pimplebacks found in Texas. They were also found to be more abundant in the June 1996 survey than observed previously. The wartybacks differ somewhat from the Neches River population and the mapleleafs present include individuals which appear to be southern mapleleaf (*Q. apiculata*) while others appear more like common mapleleaf (*Q. quadrula*). Mather and Bergmann retained 6 pimplebacks, 2 wartybacks, and 2 mapleleafs for tissue analysis at HOH. All other living specimens were released.

Pine Creek, up- and downstream of SH 906, Lamar County, 7-8 June 1996:

C.M. Mather (University of Science and Arts of Oklahoma, Chickasha) and J.A.M. Bergmann (Boerne, Texas) surveyed this stream relative to a previous collection of Ouachita rock-pocketbook found in this area. Only live specimens were documented unless only dead shells were found for a particular species. They reported the following assemblage to HOH:

Pine Creek Species	N live	N shell	Condition	Percentage
Paper pondshell	1	-	-	2.7
Yellow sandshell	1	-	-	2.7
White heelsplitter	8	-	-	21.6
Fragile papershell	8	-	-	21.6
Threehorn wartyback	9	-	-	24.3
Bleufer	1	-	-	2.7
Southern mapleleaf	9	-	-	24.3

The Sanders Creek run between Pat Mayse Reservoir and the Red River still appears to support a relatively abundant and diverse unionid assemblage; however, the Pine Creek population appears to have been reduced from previous 1993 observations. It seems reasonable to assume if the mussel population in general has been reduced, the Ouachita rock-pocketbook population must have been reduced as well. Yellow sandshell comprised about 30% of the specimens reported in 1993 (Howells 1995), but was found to be less than 3% by Mather and Bergmann in 1996.

Big Cypress Bayou

Cypress Springs Reservoir (three sites, combined), Franklin County, 8 July 1996:

Shallow-water areas were examined by wading and deeper waters were snorkeled to depths of ca 3 m:

Cypress Springs Reservoir Species	N live	N shell	Condition	Percentage
Louisiana fatmucket	1	0.0	-	2.8
Pond mussel	0	3.0	relatively recent-long dead	8.3

Mapleleaf	30	2.0	relatively recent-long dead	88.9
Asian clam - present				

Bob Sandlin Reservoir (five sites, combined), Camp and Titus counties, 10 July 1996; this reservoir was examined by wading shallow areas and snorkeling deeper waters:

Bob Sandlin Reservoir Species	N live	N shell	Condition	Percentage
Giant floater	12	5.0	recent	10.8
Paper pondshell	1	1.0	recent	1.3
Flat floater	10	6.0	relatively recent	10.1
Louisiana fatmucket	1	0.0	-	0.6
Yellow sandshell	20	0.0	-	12.7
Pond mussel	78	2.0+0.5x2	relatively recent	51.9
Mapleleaf	16	0.0	-	10.1
Texas lilliput	3	1.0	relatively recent	2.5
Asian clam - present				

Big Cypress Bayou immediately downstream of Fort Sherman Dam at Bob Sandlin Reservoir, Camp and Titus counties, 9 July 1996:

This area was examined by wading:

Big Cypress Bayou downstream of Fort Sherman Dam Species	N live	N shell	Condition	Percentage
Threeridge	18	4.0+0.5x1	long dead-very long dead	28.4
Giant floater	0	1.0	long dead	1.2
Pigtoe (<i>Fusconaia</i> spp.)	1	2.0	long dead	3.7
Louisiana fatmucket	0	2.0	long dead	2.5
Yellow sandshell	3	3.0+0.5x2	relatively recent-long dead	9.9
Washboard	3	1.0	long dead	4.9
Bankclimber	5	0.0	-	6.2
Western pimpleback	3	2.0	long dead-very long dead	6.2
Mapleleaf	11	1.0	long dead	14.8
Pistolgrip	1	4.0+0.5x2	long dead-very long dead	8.6
Tapered pondhorn	4	7.0	long dead	13.6
Asian clam - present				

Big Cypress Bayou at USH 271, Camp and Titus counties, 9 July 1996:

This area was examined by wading but no bivalves were found to be present.

Big Cypress Bayou at SH 11, Camp and Titus counties, 9 July 1996:

This area was examined by wading but no bivalves were found to be present.

Big Cypress Bayou at FM 947 upstream of Lake O' the Pines, Camp County, 9 July 1996:

Examination of shallow areas by wading and snorkeling found the following specimens:

Big Cypress Bayou at FM 947				
Species	N live	N shell	Condition	Percentage
Yellow sandshell	1	0.5x1	long dead	28.6
Texas lilliput	3	0.5x2	long dead	71.4
Asian clam - present				

Lake O'the Pines (five sites, combined), Marion and Harrison counties, 9 July 1996:

Examination of shallow areas and snorkeling deeper sites produced the following specimens:

Lake O'the Pines				
Species	N live	N shell	Condition	Percentage
Giant floater	20	8.0+0.5x3	relatively recent	9.3
Flat floater	11	18.0	relatively recent	8.7
Louisiana fatmucket	2	6.0+0.5x1	long dead-very long dead	2.7
Yellow sandshell	53	13.0+0.5x1	relatively recent-long dead	20.2
Pond mussel	82	81.0+0.5x8	relatively recent-very long dead	51.5
Mapleleaf	3	0.0	-	0.9
Texas lilliput	16	5.0+0.5x1	relatively recent	6.6
Asian clam - abundant				

Survey results in the Big Cypress Bayou drainage from Cypress Springs Reservoir downstream through Lake O'the Pines provoke some interesting environmental questions and possibilities. For example, pond mussel comprised less than 10% of the unionids in Cypress Springs Reservoir which was dominated by heavier-shelled, longer-lived mapleleaves. This relationship shifted moving downstream to Lake O'the Pines where pond mussels comprised over 50% of the population but mapleleaves were less than 1%. This could suggest increasing eutrophication moving downstream in this system. Additionally, good unionid populations were found in Cypress Springs Reservoir, Bob Sandlin Reservoir, and Big Cypress Bayou downstream of the dam at Bob Sandlin Reservoir. However, from that point nearly to Lake O'the Pines, no other bivalves were found. Even deposits of dead shells were lacking. This suggests some environmental problem occurring from the Tankersley Creek area downstream (mussels begin to appear again just upstream of Lake O'the Pines). The absence of shells in this area suggests the problem has been ongoing for an extended period of time.

Many unionid shells from this system displayed extensive shell erosion, even to the point of causing death of the animal through exposure of soft tissues. However, the soft, acid waters of the area are apparently the major contributor to this shell erosion also seen elsewhere in similar environments in eastern Texas. None the less, many of the unionids taken in Big Cypress Bayou displayed many shell imperfections both internally and externally including discolored or blackened areas suggesting disease or decay. Locally the number of individuals showing such anomalies seemed disproportionately high.

Finally, large, heavy-shelled, slow-growing species like washboards, threeridges, and mapleleaves were represented only by large, old adults. No juveniles or young adults of these species were found anywhere. Thinner-shelled, faster-growing species like pond mussels and yellow sandshells found did include younger specimens. The apparent absence of reproductive success among some of the unionid species in Big Cypress Bayou further suggests possible environmental problems may need to be examined more closely.

Little Cypress Bayou at SH 3001 (small side eddy near bridge), Harrison County, 9 July 1996:

Examination of shallow-water areas produced:

Little Cypress Bayou at SH 3001				
Species	N live	N shell	Condition	Percentage
Louisiana fatmucket	54	9.0	long dead-very long dead	82.9
Yellow sandshell	2	0.0	-	2.9
Bleufer	1	0.0	-	1.3
Wartyback	1	0.0	-	1.3
Texas lilliput	8	5.0	relatively recent-long dead	10.5
Deertoe	1	0.0	-	1.3
Asian clam - present				

Black Cypress Bayou, Pressit Lake area near SH 155, Cass County, 9 July 1996:

Examination of shallow areas found no dead shells on shoreline and the environment appeared favorable, but a lightning storm prevented further sampling

Black Cypress Bayou, just upstream of the Cass/Marion County line, 9 July 1996:

Examination of shallow areas produced only one long dead pond mussel and several Asian clams.

Black Cypress Bayou, First road crossing below the Cass/Marion County line in Marion County, 9 July 1996:

Examination of shallow areas produced only Asian clams.

Sabine River

Lake Fork, Rains and Wood counties, 29 February-1 March 1996:

Casual shallow-water collections produced the following specimens:

Lake Fork				
Species	N live	N shell	Condition	Percentage
Giant floater	0	2.0	relatively recent	14.3
Yellow sandshell	0	1.0	relatively recent	7.1
Pond mussel	1	5.0+0.5x4	relatively recent	71.4
Texas lilliput	0	0.5	relatively recent	7.1

Neches River

B.A. Steinhagen Reservoir, Jasper and Tyler counties, 27-30 January 1996:

Shallow shorelines and exposed reservoir bottom were examined during a partial drawdown to kill noxious aquatic macrophytes. A wide array of volunteers assisted with this effort and specimens documented from all sources (collected, examined and released, etc.) included:

B.A. Steinhagen Reservoir				
Species	N live	N shell	Condition	Percentage
Threeridge	47	47.0	very recent - long dead	6.7
Giant floater	45	35+0.5x1	very recent - long dead	5.8
Paper pondshell	3	2.0	relatively recent	0.4
Unidentified floater	2	2.0	relatively recent	0.3

Rock pocket-book	19	22.0	very recent - long dead	2.9
Louisiana fatmucket	70	71.0	very recent - long dead	10.0
Yellow sandshell	68	101+0.5x4	very recent - long dead	12.3
Fragile papershell	49	48.0	very recent - long dead	6.9
Washboard	4	3.0	relatively recent	0.5
Threehorn wartyback	59	78.0+05x4	very recent - long dead	10.0
Bankclimber	59	39.0	very recent - long dead	7.0
Texas heelsplitter	11	20.0	very recent - long dead	2.2
Bleufer	64	95.0+0.5x3	very recent - long dead	11.2
Southern mapleleaf	20	32.0	very recent - long dead	3.7
Western pimpleback	94	123.0	very recent - long dead	15.4
Gulf mapleleaf	20	18.0	very recent - long dead	2.7
Pistolgrip	1	0.0	-	0.1
Lilliput	0	1.0	very recent	0.1
Texas lilliput	3	5.0	undetermined	0.6
Fawnsfoot	11	4.0	relatively recent	1.1
Deertoe	0	1.0	relatively recent	0.1
Asian clam - present				

The U.S. Army Corps of Engineers, which operates this reservoir, originally contacted HOH concerning their planned drawdown and possible efforts to reduce potential mussel losses. They were advised that untreated noxious growths of macrophytes would serve to exclude mussels from many areas of the reservoir if left untreated. They were also advised if the drawdown was done at a very slow rate, many unionids would have the opportunity to follow the declining water levels, dig into the substrates, or bury under mats of macrophytes and survive the experience if the extent of the low-water period was of limited duration. The HOH staff arrived to initiate survey work just as the 1.8-m drawdown level was reached and collected the data presented above. In general, some unionid losses due to stranding or exposure to predators did occur, many mussels did behave as predicted and substantial numbers appeared to be surviving the experience. However, immediately after this survey by HOH, several days and nights of extremely cold weather followed (31 January through 5 February 1997). C.M. Mather and J.A.M. Bergmann (pers. comm.) resurveyed this area on 10-11 February 1996 and found all unionids which were not well below the water line had died (apparently killed by the unexpected cold). A more-detailed report on this event by Howells, Mather, and Bergmann is currently being prepared.

Neches River immediately below Town Bluff dam at B.A. Steinhagen Reservoir, Tyler and Jasper counties, 30 January 1996:

The HOH staff and the group of individuals above examined shoreline habitat and used a dredge and two brails to sample deeper waters. Specimens documented from all sources (collected, examined, and released, etc.) included:

Neches River downstream of Town Bluff Dam at B.A. Steinhagen Reservoir				
Species	N live	N shell	Condition	Percentage
Threeridge	1	18.0	relatively long dead	5.2
Giant floater	0	1.0	relatively recent	0.3
Paper pondshell	0	fragments	recent	-
Unidentified floater	1	0.0	-	0.3
Rock pocket-book	0	fragments	recent	-
Louisiana fatmucket	0	6.0+0.5x1	relatively recent	1.9
Sandbank pocketbook	1	12.0+0.5x3	relatively recent - long dead	4.4
Yellow sandshell	0	17.0+0.5x2	relatively recent - long dead	5.2
Fragile papershell	0	10.0+0.5x2	very recent - long dead	3.3
Pond mussel	0	1.0	long dead	0.3

Washboard	3	1.0	relatively recent	1.1
Threehorn wartyback	15	26.0+0.5x4	very recent - long dead	12.4
Bankclimber	3	15.0+0.5x1	relatively recent - long dead	5.2
Bleufer	3	12.0+0.5x8	relatively recent - long dead	6.3
Southern mapleleaf	0	11.0	very recent - long dead	3.0
Western pimpleback	44	44.0+0.5x10	relatively recent - long dead	26.9
Gulf mapleleaf	7	4.0	relatively recent	3.0
Wartyback	3	1.0	recent	1.1
Pistolgrip	7	25.0	very recent - long dead	8.8
Texas lilliput	0	1.0	undetermined	0.3
Fawnsfoot	2	11.0	relatively recent	3.6
Deertoe	6	21.0	relatively recent	7.4
Asian clam - present				

17 September 1996:

An attempt to return to this site for a gear comparison study was thwarted by extremely low water levels which precluded launching a boat. However, the low-water conditions did allow reexamination of the area by wading shallow waters and snorkeling deeper areas to mid-channel. Previous collections in all but the shallowest waters encountered cold, deep, fast waters which could only be sampled by brail or skimmer dredge. The following specimens were found:

Neches River downstream of Town Bluff Dam at B.A. Steinhagen Reservoir				
Species	N live	N shell	Condition	Percentage
Threeridge	35	4.0	relatively-long dead	7.3
Rock-pocketbook	1	0.0	-	0.2
Louisiana fatmucket	1	2.0	long dead	0.6
Sandbank pocketbook	4	41.0+0.5x1	very-recently-relatively-long dead	8.6
Yellow sandshell	15	0.0	-	2.8
Fragile papershell	1	1.0	recently dead	0.4
Washboard	2	2.0	relatively-recently dead	0.7
Threehorn wartyback	111	6.0	relatively-recently dead	21.9
Bankclimber	25	1.0	recently dead	4.9
Louisiana pigtoe	2	1.0	recently dead	0.6
Bleufer	13	2.0	recently dead	2.8
Southern mapleleaf	39	7.0+0.5x2	recently dead	9.0
Western pimpleback	49	4.0	recently dead	9.9
Wartyback	5	4.0	recently dead	1.7
Gulf mapleleaf	28	16.0	recently dead	8.2
Gulf mapleleaf ?	2	1.0	recently dead	0.6
Fawnsfoot	3	1.0	recently dead	0.7
Deertoe	49	16.0	recently dead	12.2
Pistolgrip	21	21.0	very recently to long dead	7.9
Asian clam - present but not abundant				

Proportion composition above is not representative of the actual mussel populations on the river bottom because of deliberate efforts to collect live specimens or shells of specific species for various reasons. This was our first opportunity to actually get a hands-on impression of the bottom. In some cases, 5-10 mussels could be touched with one hand simultaneously. This TPWD sanctuary supports one of the most abundant and diverse mussel assemblages located thus far anywhere in the state. Many hundreds of specimens were released. The Louisiana pigtoes taken here were the first living specimens found by TPWD. J.A.M.

Bergmann (Boerne, Texas; pers. comm.) reported finding a recently dead Louisiana pigtoe shell and another of Texas heelsplitter near this site in February 1996 as well.

Trinity River

Bardwell Reservoir (seven sites, combined), Ellis County, 7 August 1996:

This reservoir was examined by wading and snorkeling:

Bardwell Reservoir Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Giant floater	8	0.0	-	14.8
Paper pondshell	2	0.0	-	3.7
Southern mapleleaf	43	0.0	-	80.0
Lilliput sp.	1	0.0	-	1.9
Asian clam - present				

This reservoir has received an increased amount of commercial-harvest attention since the U.S. Army Corps of Engineers, which operates it, allowed commercial harvest of mussels in 1995. A local musseler interviewed during this survey indicated threeridges are taken occasionally in this reservoir, but are not common. He indicated he could harvest about 75 lbs of southern mapleleaves per day there by himself. Southern mapleleaves included small and medium-sized juveniles indicating successful recent reproduction. Additionally, upper Trinity River drainage southern mapleleaves are typically short, tall, and strongly inflated (rather globular). Many of the Bardwell specimens had this form, but several were strongly compressed and more closely resembled other populations in the upper Brazos and Colorado drainages suggesting possible musseler introductions at this site.

Chambers Creek at USH 45 (Trinity River drainage), Ellis County, 7 August 1996:

Shallow areas at this site were examined and the following specimens were found:

Chambers Creek at USH 45 Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	0.5x1	very long dead	12.5
Yellow sandshell	1	0.0	-	12.5
Fragile papershell	0	1.0	relatively recently dead	12.5
Bleufer	0	2.0	relatively recently dead	25.0
Pistolgrip	0	2.0+0.5x1	relatively recently dead	37.5

Navarro-Mills Reservoir (four sites, combined), Navarro County, 6 August 1996:

This site was examined by wading and snorkeling:

Navarro-Mills Reservoir Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Giant floater	3	1.0	recently dead	5.3
Paper pondshell	0	1.0+0.5x1	recently dead	2.7
Louisiana fatmucket	10	3.0	relatively recently dead	17.3
Yellow sandshell	1	0.0	-	1.3
Fragile papershell	2	0.0	-	2.7

Southern mapleleaf	49	0.0	-	65.3
Lilliput sp.	2	2.0	recently dead	5.3

Southern mapleleaves included small and medium-sized juveniles indicating successful recent reproduction. The lilliputs present appeared to include both lilliput (*T. parvus*) and Texas lilliput (*T. texasensis*).

Bar ditch between Cedar Creek and Trinidad, Henderson County, 13 March 1996:

The following species were collected during a low-water period:

Bar ditch between Cedar Creek and Trinidad				
Species	N live	N shell	Condition	Percentage
Giant floater	0	2.0+0.5x1	recent	75.0
Lilliput	0	1.0	very recent	25.0
Asian clam - present				

Trinity River just upstream of Elkhart Creek, Houston County, 26 July 1996:

C.M. Mather and J.A.M. Bergmann (pers. comm.) documented the following specimens on a soft mud bottom:

Trinity River upstream of Elkhart Creek				
Species	N live	N shell	Condition	Percentage
Yellow sandshell	66	-	-	54.1
Fragile papershell	7	-	-	5.7
Texas heelsplitter	49	-	-	40.2

Trinity River Halls Bluff and Elkhart Creek, Houston County, 26 July 1996:

C.M. Mather and J.A.M. Bergmann (pers. comm.) documented the following specimens on a soft mud bottom:

Trinity River between Halls Bluff and Elkhart Creek				
Species	N live	N shell	Condition	Percentage
Yellow sandshell	4	-	-	17.4
Washboard	1	-	-	4.3
Bankclimber	17	-	-	73.9
Texas heelsplitter	1	-	-	4.3

Trinity River at Halls Bluff, Houston County, 26 July 1996:

C.M. Mather and J.A.M. Bergmann (pers. comm.) documented the following specimens on a mud bottom during a timed search (time unreported) and random examination of a 20-ft section of river bank (combined):

Trinity River at Halls Bluff				
Species	N live	N shell	Condition	Percentage
Threeridge	34	-	-	21.4
Rock-pocketbook	*	-	-	-
Texas pigtoe?	19	-	-	11.9

Yellow sandshell	24	-	-	15.1
Fragile papershell	4	-	-	2.5
Washboard	36	-	-	22.6
Bankclimber	19	-	-	11.9
Threehorn wartyback	6	-	-	3.8
Texas heelsplitter	*	-	-	-
Bleufer	*	-	-	-
Southern mapleleaf	3	-	-	1.9
Gulf mapleleaf	1	-	-	0.6
Pimpleback sp.	12	-	-	7.5
Pistolgrip	1	-	-	0.6

* Number not given

Trinity River one mile downstream of SH 7, Leon County, 25 July 1996:

C.M. Mather and J.A.M. Bergmann documented the following specimens from a large gravel bar which they reported to have been badly damaged by extensive gravel mining:

Trinity River 1 mile below SH 7				
Species	N live	N shell	Condition	Percentage
Threeridge	5	-	-	7.2
Texas pigtoe?	2	-	-	2.9
Yellow sandshell	2	-	-	2.9
Fragile papershell	1	-	-	1.4
Washboard	1	-	-	1.4
Bankclimber	19	-	-	27.5
Threehorn wartyback	33	-	-	47.8
Bleufer	1	-	-	1.4
Pimpleback sp.	5	-	-	7.2

Trinity River at Alabama Crossing, Houston County, 27 July 1996:

C.M. Mather and J.A.M. Bergmann documented the following specimens found alive (but not counted) on a gravel, sand, and mud bar:

Trinity River at Halls Bluff				
Species	N live	N shell	Condition	Percentage
Threeridge	x	-	-	-
Rock-pocketbook	x	-	-	-
Texas pigtoe?	x	-	-	-
Yellow sandshell	x	-	-	-
Fragile papershell	x	-	-	-
Washboard	x	-	-	-
Bankclimber	x	-	-	-
Threehorn wartyback	x	-	-	-
Texas heelsplitter	x	-	-	-
Bleufer	x	-	-	-
Southern mapleleaf	x	-	-	-
Gulf mapleleaf	x	-	-	-
Pimpleback sp.	x	-	-	-
Pistolgrip	x	-	-	-

Fawnsfoot	x	-	-	-
Asian Clam	x	-	-	-

Trinity River SH 19 upstream of Lake Livingston (two sites, combined), Trinity/Walker counties, 31 July 1996:
This area was examined by wading and snorkeling:

Trinity River at SH 19				
Species	N live	N shell	Condition	Percentage
Giant floater	6	0.0	-	20.0
Yellow sandshell	17	0.0	-	56.7
Fragile papershell	3	0.0	-	10.0
Bleufer	4	0.0	-	13.3

Lake Livingston (three sites, combined), Trinity/Polk counties, 30 July 1996:
These sites were examined by wading and snorkeling:

Lake Livingston				
Species	N live	N shell	Condition	Percentage
Threeridge	7	4.0	relatively recent-long dead	6.3
Giant floater	8	4.0+0.5x1	recently dead-long dead	7.4
Paper pondshell	1	0.0	-	0.6
Flat floater	1	0.0	-	0.6
Louisiana fatmucket	1	1.0+0.5x1	relatively recent	1.7
Yellow sandshell	16	0.0	-	9.1
Fragile papershell	5	1.0	recently dead	3.4
Threehorn wartyback	1	0.0	-	0.6
Bankclimber	7	0.0	-	4.0
Bleufer	1	1.0	recently dead	1.1
Southern mapleleaf	91	4.0	very recent-relatively long dead	51.7
Texas lilliput	20	0.0	-	11.4

Lake Livingston, upper end upstream of the highlines, Trinity County, August-September 1996 (several dates combined):

Several shoreline collections made during other work in the area produced:

Lake Livingston				
Species	N live	N shell	Condition	Percentage
Giant floater	0	4.0+0.5x3	relatively-recently dead	19.4
Flat floater	0	2.0	recently dead	5.6
Yellow sandshell	0	3.0+0.5x5	recently dead	22.2
Fragile papershell	0	2.0+0.5x1	recently dead	8.3
Washboard	0	1.0	recently dead	2.8
Texas heelsplitter	0	1.0	recently dead	2.8
Bleufer	0	5.0	recently dead	13.9
Southern mapleleaf	0	6.0+0.5x3	recently dead	25.0

This sampling produced our first collection of washboards in Lake Livingston and the above collections by

Mather and Bergmann the first living specimens in the Trinity River which have not been either very-long dead or subfossil. The Texas heelsplitter specimen from Lake Livingston and those taken by Mather and Bergmann upriver had nacre which was purple throughout, but otherwise appeared to be this species and not pink papershell.

San Jacinto River

West Branch San Jacinto River upstream of Stubblefield, Walker County, 31 July 1996:
Wading and snorkeling this area produced:

West Branch San Jacinto River upstream of Stubblefield				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Giant floater	0	1.0	recently dead	11.1
Flat floater	0	1.0+0.5x1	recently dead-long dead	22.2
Round pearlshell	0	0.5x1	recently dead	11.1
Yellow sandshell	0	0.5x1	very long dead	11.1
Pond mussel	0	1.0	recently dead	11.1
Texas lilliput	1	3.0	recently dead	33.3

West Branch San Jacinto River between USH 59 and SH 242 (four sites), Montgomery County, 11-25 June 1996:
Casual examination of shallow waters produced:

West Branch San Jacinto River between USH 59 and SH 242				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	5.0+0.5x6	very long dead	28.2
Pigtoe sp. <i>Fusconaia</i> sp.	0	1.0	long dead	2.6
Yellow sandshell	0	6.0+0.5x2	relatively recent to long dead	20.5
Fragile papershell	2	2.0	relatively recent	10.3
Bleufer	0	2.0	long dead	5.1
Southern mapleleaf	0	0.5x1	long dead	2.6
Pimpleback sp.	0	11.0+0.5x1	relatively recent-long dead	30.8

26 June 1996: An airboat was required to access six sites where gravel bars and shallows were examined by wading and snorkeling:

West Branch San Jacinto River between US 59 and SH 242				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	2.0+0.5x4	very long dead	13.6
Yellow sandshell	5	2.0+0.5x1	relatively recent to long dead	18.2
Fragile papershell	1	1.0+0.5x2	very long dead	6.8
Bleufer	2	2.0+0.5x2	very long dead	13.6
Southern mapleleaf	0	3.0	very long dead	6.8
Pimpleback sp.	5	6.0+0.5x7	relatively recent to very long dead	40.9
Asian clam - relatively abundant				

Although this river once held significant unionid assemblages, little currently remains. Development and highway construction in the area have contributed to increased runoff resulting in scouring at some sites

and excess sand deposition at others. However, extensive gravel and sand mining along the river appears to be one of the major factors in unionid declines seen here. Silt, sand, and gravel from these operations as well as the mining itself have resulted in extensive habitat alteration

Spring Creek west of the West Branch San Jacinto River upstream of Lake Houston, Montgomery County, 26 June 1996:

Examination of over 9.7 km of the lower reaches of this creek by airboat found only deep-shifting sands and no evidence of bivalves.

Lake Houston, sandy flats north of SH 1960, Montgomery County, 26 June 1996:

This area was waded and snorkeled with the following results:

Lake Houston Species	N live	N shell	Condition	Percentage
Threeridge	1	14.0+0.5x5	very long dead	17.0
Giant floater	0	3.0	relatively recent	3.2
Louisiana fatmucket	2	2.0+0.5x3	very long dead	7.4
Yellow sandshell	0	2.0	long dead	2.1
Fragile papershell	0	1.0+0.5x1	relatively recent	2.1
Bankclimber	5	1.0	long dead	6.4
Bleufer	1	0.5x12	very long dead	13.8
Southern mapleleaf	11	5.0	long dead	17.0
Pimpleback sp.	21	7.0+0.5x1	relatively recent to very long dead	30.9
Asian clam - present				

Local rangers reported commercial harvest still occurs on this reservoir. However, extensive sand and silt deposition flushing from the West Branch of the San Jacinto River appears to be slowly filling the upper reaches of this reservoir.

Buffalo Bayou

Buffalo Bayou, Bear Creek downstream of Addicks Dam, Harris County, 10 October 1996:

The following species were obtained in shallow-water collections:

Buffalo Bayou downstream of Addicks Dam Species	N live	N shell	Condition	Percentage
Giant floater	1	0.0	-	3.3
Round pearlshell	5	1.0	relatively recently dead	20.0
Southern mapleleaf	23	0.0	-	76.7
Asian clam - present				

This area was examined in July 1994 by about 25 members of the American Malacological Union as part of a field trip associated with their annual meeting in Houston. Later in the fall of 1994, major flooding struck the area resulting in extensive property loss. This site had not been examined since. It was pleasing to find the local unionid populations had survived both the scientific collecting and flood events with no perceptible damage. Unionids were at least as abundant (if not more so) in 1996 as they were in 1994. Despite being surrounded by the growing city of Houston and associated environmental factors, mussels at this site continue to persist in good numbers.

Brazos River

Lake Trammel, Nolan County, 16 July 1996:

A volunteer obtained two recently-dead shells of giant floater during a scuba dive in this reservoir.

28 December 1996: Examination of shorelines and shallows by two volunteers found only Asian clams to be present.

Lake Sweetwater, Nolan County, 28 July 1996:

Examination of shorelines and shallows by two volunteers found only Asian clams to be present.

Possum Kingdom Reservoir, Palo Pinto County, 9 July 1996:

An area was briefly examined near a boat ramp area and only a single living and numerous fragments of Tampico pearlymussel and Asian clams were present.

Brazos River immediately downstream of Possum Kingdom Reservoir dam, Palo Pinto County, 9 July 1996:

This site was examined by wading and snorkeling but only a limited number of Asian clams were present.

Brazos River at SH 4 downstream of Possum Kingdom Reservoir, Palo Pinto County, 9 July 1996:

This site was examined by wading and snorkeling but only five long-dead valves of Tampico pearlymussel and Asian clams in limited numbers were found.

Brazos River at USH 180 downstream of Possum Kingdom Reservoir, Palo Pinto County, 9 July 1996:

This site was examined by wading and snorkeling which found:

Brazos River at USH 180				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	0	0.5x3	relatively recent-long dead	10.7
Pink papershell	0	1.0+0.5x1	relatively recent	7.1
Bleufer	0	0.5x1	long dead	3.6
Texas fawnsfoot	1	16.0+0.5x5	recent-relatively recent	78.6
Asian clam - present				

This site was reexamined on 16 July 1996 in an effort to obtain additional information on Texas fawnsfoot.

Brazos River at USH 180				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	1	0.5x11	very long dead	30.0
Fragile papershell	4	4.0+0.5x1	recent	22.5
Pink papershell	0	2.0	recent	5.0
Texas fawnsfoot	1	14.0+0.5x2	recent-relatively recent and one very long dead	42.5
Asian clam - present				

Brazos River at US 20, Palo Pinto County, 16 July 1996:

Examination of this site produced no bivalves.

Brazos River at USH 281 downstream of Possum Kingdom Reservoir, Palo Pinto County, 9 July 1996:
Wading and snorkeling at this site produced:

Brazos River at USH 281				
Species	N live	N shell	Condition	Percentage
Giant floater	0	0.5x1	relatively recent	20.0
Tampico pearlymussel	2	0	-	40.0
Fragile papershell	1	0	-	20.0
Pink papershell	0	1.0	recent	20.0

Brazos River at US 80 downstream of Possum Kingdom Reservoir, Parker County:
Examination of this site by wading and snorkeling found:

Brazos River at USH 281				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	4	0.0	-	50.0
Fragile papershell	2	0.0	-	25.0
Texas fawnsfoot	2	0.0	-	25.0

Brazos River at SH 1189 downstream of Possum Kingdom Reservoir, Parker County, 9 July 1996:
Examination of this site by wading and snorkeling found:

Brazos River at SH 1189				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	0	0.5x1	relatively long dead	25.0
Fragile papershell	1	1.0	relatively long dead	25.0
Pink papershell	0	1.0	relatively long dead	25.0
Fatmucket sp. <i>L. bracteata</i> sp.?	0	0.5x1	very long dead	25.0

Collection of living Texas fawnsfoot specimens at the above sites is significant in that no living specimens have been taken in approximately 20 years. Further, most of the shells found were recently dead. It is unclear why recently-dead shells are found but living specimens remain rare. However, despite the confirmed survival of this rare, endemic species, local unionid fauna is limited both in abundance and diversity.

Lake Granbury, Hood County, 10 July 1996:
Examination of this reservoir by wading and snorkeling found:

Lake Granbury				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	0	0.5x1	long dead	16.7
Fragile papershell	1	0.0	-	16.7
Mapleleaf sp.	4	0.0	-	66.6

These mapleleaves are very atypical of central Texas southern mapleleaves and may represent musseler introductions of animals from another area.

Brazos River immediately downstream of Lake Granbury dam, Hood County, 10 July 1996:
Examination of this site by wading and snorkeling found:

Brazos River downstream of Lake Granbury				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	0	0.5x1	subfossil	50.0
Yellow sandshell	0	1.0	very recent	50.0

North Bosque River north of Stephenville, Erath County, two sites, 2 July 1996:
Examination of these sites produced no bivalves.

North Bosque River at Hico, Bosque County, two sites, 2 July 1996:
Examination of these sites produced no bivalves.

Paluxy River at US 377 NE of Stephenville, Erath County, 2 July 1996:
Examination of this site produced no unionids.

Paluxy River at SH 1188, Erath County, 2 July 1996:
Examination of this site produced no unionids.

Paluxy River at Lofton Road 4.8 km E Bluffdale, Erath County, 2 July 1996:
Examination of this site produced only 10 subfossil fragments of threeridge.

Paluxy River at the Somervell/Erath County line, 2 July 1996:
Examination of this site produced no unionids.

Paluxy River immediately upstream of Dinosaur Valley State Park, Somervell County, 2 July 1996:
Examination of this site produced no unionids.

Paluxy River at SH 144, Somervell County, 2 July 1996:
Examination of this site produced no bivalves.

Paluxy River at SH 201 at Glen Rose, Somervell County, 2 July 1996:
Examination of this site produced no bivalves.

TPWD Public Lands had requested information on this system which appears not to have been examined historically by past malacologists working in Texas. In general, gravel areas upstream and bedrock substrates at downstream sites do not provide good mussel habitat. However, small microhabitat pockets could still support small populations in some areas and the lower few miles of river near the confluence with the Brazos remains to be checked.

Brazos River at USH 67, Somervell County, 2 July 1996:
Examination of shorezones and shallow areas by wading and snorkeling produced:

Brazos River at USH 67				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	5	0.0	-	29.4
Fragile papershell	1	2.0	recent	17.6
Pink papershell	0	5.0	recent	29.4

Southern mapleleaf	1	0.0	-	5.9
Texas fawnsfoot	0	3.0	recent	17.6

One of the Texas fawnsfoot specimens (59 mm sl) appears to be the largest recorded to date.

A second examination on 10 July 1996 produced:

Brazos River at USH 67				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	0	1.0+0.5x1	relatively long dead	22.2
Fragile papershell	0	5.0	very recent-relatively long dead	55.6
Texas fawnsfoot	0	1.0+0.5x1	relatively recent	22.2

Pat Cleburne Reservoir, Johnson County, 2 July 1996:

Shallow areas examined by wading produced the following specimens:

Pat Cleburne Reservoir				
Species	N live	N shell	Condition	Percentage
Giant floater	0	5.0+0.5x1	relatively recent-long dead	35.3
Paper pondshell	0	3.0	relatively recent-long dead	17.6
Southern mapleleaf	7	1.0	recent	47.1

Leon River at CR 431 1.6 km SW of Jonesboro, Hamilton County, 24 January 1996:

The following specimens were obtained in casual collections made during other work in the area:

Leon River at CR 431				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	0	2.0	very recent	33.3
Fragile papershell	1	2.0	recent	50.0
Bleufer	0	0.5	relatively long dead	16.7

Leon River at CR 303 ca 13 km SE of Hamilton, Hamilton County, 24 January 1996:

The following specimens were obtained in casual collections made during other work in the area:

Leon River at CR 303				
Species	N live	N shell	Condition	Percentage
Threeridge	0	0.5x7	subfossil	43.8
Fragile papershell	0	0.5x2	recent- relatively recent	12.5
Bleufer	0	0.5x1	relatively recent	6.3
Southern mapleleaf	0	0.5x1	subfossil	6.3
Smooth pimpleback	0	0.5x1	subfossil	6.3
Pistolgrip	0	0.5x4	subfossil	25.0

Leon River at USH 84, Coryell County, 24 January 1996:

The following specimens were obtained in casual collections made during other work in the area:

Leon River at USH 84				
Species	N live	N shell	Condition	Percentage
Threeridge	0	0.5 x 6	subfossil	28.6
Yellow sandshell	0	0.5 x 4	subfossil	19.0
Southern mapleleaf	0	0.5 x 1	subfossil	4.8
Smooth pimpleback	0	1 + 0.5 x 5	subfossil	28.6
Pistolgrip	0	1 + 0.5 x 2	subfossil	14.3
Asian clam sp.	0	1.0	recent	4.8

Leon River at SH 439, Bell County, 29 May 1996:

Attempts to sample this site were thwarted by very steep banks and swift current with no ready access; no mussels or shells were observed from bridge.

Lampasas River just upstream of the confluence with Little River, Bell County, 29 May 1996:

Examination of shallow waters and shoreline areas but found only:

Leon River at USH 84				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	0	0.5x2	subfossil	40.0
Southern mapleleaf	0	0.5x2	subfossil	40.0
Smooth pimpleback	0	0.5x1	subfossil	20.0

Belton Reservoir (four sites, combined), McClennan County, 6 August 1996:

Wading and snorkeling produced:

Belton Reservoir				
Species	N live	N shell	Condition	Percentage
Threeridge	7	0.0	-	3.0
Giant floater	3	2.0	relatively recently dead	2.1
Paper pondshell	1	0.0	-	0.4
Tampico pearlymussel	88	2.0+0.5x4	recently dead-long dead	40.2
Louisiana fatmucket	0	1.0	long dead	0.4
Yellow sandshell	1	0.0	-	0.4
Fragile papershell	25	5.0+0.5x2	recently dead-very long dead	13.7
Bleufer	19	5.0+0.5x2	recently dead-long dead	11.1
Southern mapleleaf	54	10.0+0.5x3	recently dead-long dead	28.6
Asian clam - present				

Nearly all species included small juveniles indicative of recent successful reproduction; the Tampico pearlymussel and southern mapleleaf populations were dominated by small adults.

Stillhouse Hollow Reservoir (four sites, combined), McClennan County, 6 August 1996:

Examination by wading and snorkeling produced:

Stillhouse Hollow Reservoir				
Species	N live	N shell	Condition	Percentage
Threeridge	21	1.0+0.5x1	recently dead-long dead	19.8
Giant floater	37	2.0+0.5x1	relatively recently dead	34.5
Tampico pearlymussel	33	2.0	relatively recently dead	30.2
Louisiana fatmucket	5	3.0	recently dead-relatively long dead	6.9
Yellow sandshell	2	0.0	-	1.7
Southern mapleleaf	6	0.0	-	5.2
Pistolgrip	1	0.5x1	relatively recently dead	1.7
Asian clam - present				

Brazos River N of Cedar Springs, Falls County, 7 and 14 January 1996 (dates combined):

A volunteer collected the following specimens along the shoreline:

Brazos River north of Cedar Springs				
Species	N live	N shell	Condition	Percentage
Threeridge	0	4.0	relatively recent - very recent	13.8
Tampico pearlymussel	0	2.0	relatively recent	6.9
Yellow sandshell	0	8.0	relatively recent - long dead	27.6
Pink papershell	0	9.0	relatively recent - long dead	31.0
Bleufer	0	0.5x1	long dead	3.4
Pimpleback sp.	0	1.0	relatively recent	3.4
Pistolgrip	1	3.0	recent	13.8
Asian clam - present				

This collection includes only the fourth living pistolgrip found by TPWD to date west of the Neches River.

Tributary of Pool Creek 1 mi. SW Cedar Springs, Falls County, 7 January 1996:

A volunteer collected the following specimens along the shoreline:

Tributary of Pool Creek				
Species	N live	N shell	Condition	Percentage
Floater sp. (<i>Utterbackia</i> sp.?)	0	8.0	relatively recent	80.0
Pondhorn sp.	0	2.0	recent	20.0

No Asian clams were found. The floaters closely resemble *U. peggyae* from the southeastern U.S.; its actual taxonomic status remains to be determined and it may be only a local form of paper pondshell.

Upper Camp Creek (Navasota River drainage) near Oenaville, Bell County, 14 January 1996:

A volunteer obtained the following specimens in shoreline collections:

Upper Camp Creek				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Paper pondshell	0	6.0	relatively recent	22.2
Pondhorn	0	21.0	relatively recent	77.8

Little River at SH 95, Bell County, 23 July 1996:

Examination of bars and shallow areas produced:

Little River at SH 95				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	8.0+0.5x15	very long dead-subfossil	85.2
Tampico pearlymussel	0	0.5x2	very long dead	7.4
Washboard	0	2.0	very long dead	7.4
Asian clam- present (recent)				

Little River at SH 437, Milam County, 23 July 1994:

Examination of bars and shallow areas produced:

Little River at SH 437				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	1.0+0.5x12	very long dead-subfossil	76.5
Tampico pearlymussel	0	0.5x1	very long dead	5.9
Washboard	0	0.5x1	very long dead	5.9
Smooth pimpleback	0	0.5x1	very long dead	5.9
Pistolgrip	0	0.5x1	subfossil	5.9

Little River, first crossing downstream of SH 437, Milam County, 23 July 1996:

No unionids were found during examination of bars and shallows.

Little River at USH 190 (SH 36), Milam County, 23 July 1996:

Examination of bars and shallow areas produced:

Little River at USH 190				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	0.5x6	very long dead-subfossil	60.0
Tampico pearlymussel	0	0.5x2	very long dead-subfossil	20.0
Washboard	0	0.5x1	very long dead	10.0
Bleufer	0	0.5x1	subfossil	10.0

Little River at USH 90 near Little River Academy, Bell County, 29 May 1996:

Local residents reported gravel bars and mussels in the area (none observed by TPWD). A private land owner was located for permission to examine the area at a later date (no samples taken).

Little River at Sunshine Road, Bell County, 29 May 1996:

This area was located but not examined. Sand bars were present with deep water. Elevated river levels observed at the time may represent releases from an upstream reservoir.

Lampasas River at FM 1123 (S of 439), Bell County, 29 May 1996:

This site was located but not sampled. It had very steep banks and no immediate access and apparent mussel habitat but signs indicate periodic scouring may occur.

Lampasas River at Elm Grove Lane (E of USH 35), Bell County, 29 May 1996:

This site was located but not sampled due to very steep banks and no immediate access. It had apparently good mussel habitat with a tree canopy over the river.

Lampasas River at USH 35, Bell County, 23 July 1996:

Examination of bars and shallows at this site found:

Lampasas River USH 35				
Species	N live	N shell	Condition	Percentage
Threeridge	0	0.5x3	very long dead	25.0
Tampico pearlymussel	0	0.5x5	very long dead	41.7
Louisiana fatmucket	0	1.0	long dead	8.3
Yellow sandshell	0	0.5x2	very long dead	16.7
Smooth pimpleback	0	1.0	long dead	8.3
Asian clam - present (recent)				

Granger Lake, Williamson County, 23 July 1996:

This site was examined briefly during a return trip to the Little River and only a single relatively-recent southern mapleleaf valve was found.

San Gabriel River at SH 486, Milam County, 23 July 1996:

No unionids were found during examination of bars and shallow areas.

San Gabriel River at SH 487, Milam County, 23 July 1996.

Examination of bars and shallow areas produced:

San Gabriel River at SH 487				
Species	N live	N shell	Condition	Percentage
Threeridge	0	0.5x2	very long dead	33.3
Tampico pearlymussel	0	0.5x1	subfossil	16.7
Bleufer	0	0.5x1	subfossil	16.7
Smooth pimpleback	0	1.0+0.5x1	very long dead	33.3

West Yegua Creek at SH 21, Lee County, 23 July 1996:

Wading and snorkeling at this site produced:

West Yegua Creek at SH 21				
Species	N live	N shell	Condition	Percentage
Giant floater	1	1.0	long dead	10.5
Yellow sandshell	1	3.0+0.5x1	recent-long dead	26.3
Fragile papershell	1	5.0	very long dead	31.6

Bleufer	2	0.0	-	10.5
Southern mapleleaf	1	1.0	relatively long dead	10.5
Texas lilliput	1	0.0	-	5.3
Pistolgrip	0	5.0	very recently dead	5.3

Middle Yegua Creek at SH 21, Lee County, 23 July 1996:

Wading and snorkeling at this location produced no unionids.

Yegua Creek at SH 21, Burleson and Lee counties, 23 July 1996:

Wading and snorkeling at this location produced no unionids.

Yegua Creek NW of Dimebox, Burleson and Lee counties, 23 July 1996:

Wading and snorkeling at this location produced no unionids.

Yegua Creek ESE of Dimebox off SH 1697, Burleson and Lee counties, 23 July 1996:

Wading and snorkeling at this location produced no unionids.

Nails Creek first crossing upstream of SH 1697, Burleson County, 23 July 1996:

Wading and snorkeling at this site produced no unionids.

Nails Creek at SH 1697, Burleson County, 23 July 1996:

Wading and snorkeling at this site produced no unionids.

Nails Creek first crossing downstream of SH 1697, Burleson County, 23 July 1996:

Wading and snorkeling at this site produced:

Nails Creek downstream of SH 1697

Species	N live	N shell	Condition	Percentage
Giant floater	2	7.0	recently dead	81.8
Paper pondshell	0	1.0	recently dead	9.1
Yellow sandshell	0	1.0	recently dead	9.1

Cedar Creek off SH 2780, Washington and Lee counties, 23 July 1996:

Wading and snorkeling at this site produced:

Cedar Creek off SH 2780

Species	N live	N shell	Condition	Percentage
Giant floater	3	1.0	recently dead	100.0

Somerville Reservoir (six sites, combined), Burleson-Lee-Washington counties, 23 July 1996:

Wading and snorkeling these sites produced:

Somerville Reservoir

Species	N live	N shell	Condition	Percentage
Threeridge	2	0.0	-	1.4
Giant floater	11	1.0	recently dead	8.2
Tampico pearlymussel	1	0.0	-	0.7

Yellow sandshell	10	0.5x2	relatively long dead	8.2
Fragile papershell	1	3.0	recently dead	2.7
Bleufer	10	2.0+0.5x1	recently dead-long dead	8.9
Southern mapleleaf	85	3.0	recently dead-long dead	60.3
Tapered pondhorn	0	1.0	relatively long dead	0.7
Texas lilliput	6	5.0+0.5x2	relatively recently dead	8.9

Three sites on Somerville reservoir were examined again on 6-7 September 1994 as part of a field-training work shop.

Somerville Reservoir, Rocky Creek Park, Washington County, 6-7 September 1994:
Wading and snorkeling at this site produced:

Somerville Reservoir, Rock Creek Park				
Species	N live	N shell	Condition	Percentage
Threeridge	0	1.0	relatively recently dead	5.9
Southern mapleleaf	5	7.0	relatively recently dead	70.6
Bleufer	0	1.0	relatively recently dead	5.9
Texas lilliput	0	1.0+0.5x2	relatively recently dead	17.6
Asian clam- present				

Somerville Reservoir, Yegua Creek Park, Washington County, 6-7 September 1996: Shallow water and shoreline examinations produced only one paper pondshell (*U. imbecillis*) and several fragments of threeridge and southern mapleleaf.

Somerville Reservoir, Overlook Park, Washington County, 6-7 September 1996:
Wading and snorkeling this area produced:

Somerville Reservoir, Overlook Park				
Species	N live	N shell	Condition	Percentage
Threeridge	0	2.0+0.5x1	relatively recently dead	10.7
Southern mapleleaf	14	0.5x1	relatively recently dead	53.6
Texas lilliput	0	4.0+0.5x6	relatively recently dead	35.7
Asian clam - present				

Several recently dead specimens of giant floater were observed but not collected.

Yegua Creek at SH 50 between Somerville Reservoir and the Brazos River, Washington County, 6 September 1996:

Wading and snorkeling at this site produced no specimens on the creek bottom but the following species were represented on three gravel bars in the area:

Yegua Creek at SH 50				
Species	N live	N shell	Condition	Percentage
Threeridge	0	1.0+0.5x6	very long dead to subfossil	13.0
Rock-pocketbook	0	0.5x1	very long dead	1.9
Tampico pearlymussel	0	1.0+0.5x2	very long dead	5.6
Yellow sandshell	1	2.0+0.5x14	very long dead to subfossil	29.6

Fragile papershell	0	2.0	recently dead	3.7
Bleufer	0	2.0x0.5x6	very long dead	14.8
Southern mapleleaf	0	2.0+0.5x8	very long dead to subfossil	18.5
Smooth pimpleback	0	0.5x6	very long dead to subfossil	11.1
Pistolgrip	0	1.0	very long dead	1.9
Asian clam - present				

The SH 50 site had substrates composed of very soft, sandy-silt except for several rock and cobble bars. It appears erosion of the sandy banks between Somerville Reservoir and this site causes excessively-fast substrate deposition making the area undesirable for unionids. It also appears water levels here rise and fall rapidly. The living yellow sandshell was actually found about 0.5 m from the water line on a dry gravel bar (suggesting it had been deposited there recently). Both yellow sandshell and fragile papershell (the only unionids alive or recently dead) are known to have greater tolerance of these conditions than some other species. Examination of this creek immediately downstream of the Lake Somerville dam found the area to have been stabilized with rock rip-rap and channelized; when examined, no water was being released and the stream was covered with surface growths of algae (no samples were taken). The next site immediately downstream at SH 36 had no access and was not sampled.

Brazos River at USH 10, Austin County, 12 October 1996:

Attempts were made to reach a rock and gravel bar present just downstream of this highway crossing; however, steep sand and mud banks and fast flow rates precluded access. Examination of deposits between rip-rap below the highway and adjacent railroad bridge produce a single, long-dead valve of Texas fawnsfoot and shells of Asian clam. A large gravel bar present ca 1 km upstream likewise could not be reached but should be examined at a future date.

Harris Reservoir, Brazoria County, 6 May 1996:

A volunteer examined shallow water areas and shorelines at this site and found specimens of paper pondshell, round pearlshell and Texas lilliput as well as several sphaeriids. One round pearlshell specimen found alive was atypically elongate.

Colorado River

Colorado City Reservoir, Mitchell County, 13-15 February 1996:

Examination of exposed bottoms and shorelines during other work in the area produced:

Colorado City Reservoir				
Species	N live	N shell	Condition	Percentage
Giant floater	2	9.0+0.5x1	very recent	60.0
Paper pondshell	1	6.0+0.5x1	very recent	40.0
Asian clam - present				

E.V. Spence Reservoir, Coke County, 25 June 1996:

Examination of exposed bottom areas (reservoir water level down 3 m) and shallow areas and found:

E.V. Spence Reservoir				
Species	N live	N shell	Condition	Percentage
Threeridge	0	0.5x7	subfossil	17.5
Tampico pearlmyssel	0	0.5x4	subfossil	10.0

Yellow sandshell	0	0.5x2	subfossil	5.0
Bleufer	0	0.5x1	subfossil	2.5
Southern mapleleaf	15	10+0.5x1	very recent to very long dead	65.0

Colorado River immediately downstream of E.V. Spence Reservoir, Coke County, 25 June 1996:
Examination of this sanctuary area by wading and snorkeling found only two relatively long-dead pondhorns sp. Banks were straight and cut; substrates were coarse gravel.

Colorado River US 277 to SH 211 downstream of E.V. Spence Reservoir, Coke County, 25 June 1996:
This area was examined by wading and snorkeling but no bivalves were found.

Colorado River, boat ramp upstream of O.H. Ivie Reservoir, Runnels County, 25 June 1996:
Examination of shallows and exposed bottoms produced:

Colorado River boat ramp upstream of O.H. Ivie Reservoir				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	0	2.0	very recent	50.0
Bleufer	0	1.0+0.5x1	very recent to subfossil	50.0

O.H. Ivie Reservoir, Coleman/Runnels/Concho counties, 28 August 1996:
Brief shoreline collections produced the following specimens:

O.H. Ivie Reservoir				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	0	3.0	very recently dead	50.0
Fragile papershell	0	2.0+0.5x1	very recently dead	50.0

This reservoir was completed just as TPWD work with mussels began in 1992. Exceptionally heavy rainfall at the time caused it to fill sooner than expected. Because it was so recently built and filled, HOH surveys had bypassed it to avoid sampling flooded terrestrial habitats. Some local unionids appear to be utilizing this new environment. All specimens were young adults.

Middle Concho River upstream of Twin Buttes Reservoir, Tom Green County, 30 July 1996:
Examination of exposed bottoms and standing pools during drought-drawdown conditions yielded:

Middle Concho River upstream of Twin Buttes Reservoir				
Species	N live	N shell	Condition	Percentage
Threeridge	0	0.5x2	subfossil	11.1
Giant floater	0	0.5x1	relatively recent	5.6
Bleufer	0	6.0+0.5x7	very recent- relatively long dead	72.2
Southern mapleleaf	0	0.5x1	relatively long dead	5.6
Texas pimpleback	0	0.5x1	subfossil	5.6

Twin Buttes Reservoir, Tom Green County 30 July 1996:
Examination of exposed bottoms and inshore areas during drought- and drawdown-related low waters produced:

Twin Buttes Reservoir				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	0.5x4	subfossil	50.0
Bleufer	0	1.0+0.5x3	recent-relatively recent	50.0

This reservoir was lowered in summer 1994 for dam-repair work. It has remained low and fallen further still under drought conditions. Musselers worked the reservoir immediately upon initial drawdown and are continuing harvest. It was recently reported this harvest included threeridges; however, TPWD has failed to find living threeridges upstream of Pecan Bayou in the Colorado River drainage. Reexamination of Twin Buttes in July still produced only subfossil threeridge valves. Low-water conditions and musseler harvest will likely reduce mussel population levels here for some years to come even after waters return to normal levels.

Comanche Creek, north of Mason on USH 87, Mason County, 11 June 1996:

This stream found to be dry when examined. No bivalves were found.

Corn Creek on USH 377, McCulloch County, 11 June 1996:

This stream was found to be dry when examined. No bivalves were present.

Upper Pecan Bayou (upstream of Brownwood Reservoir) (8 sites, combined), Brown and Coleman counties, 16-17 July 1996:

This area was sampled by brail, skimmer dredge, and wading (combined) which produced:

Upper Pecan Bayou				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Giant floater	0	2.0+0.5x10	relatively recent-long dead	52.2
Paper pondshell	0	1.0	recent	4.3
Yellow sandshell	0	1.0+0.5x2	relatively recent-subfossil	13.0
Fragile papershell	0	1.0+0.5x2	recent-subfossil	13.0
Bleufer	0	0.5x4	recent-relatively long dead	17.4

Brownwood Reservoir (11 sites, combined), Brown County, 16-17 July 1996:

Use of a brail, skimmer dredge, and wading to sample this reservoir produced:

Brownwood Reservoir				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	3	5.0+0.5x1	relatively recent-long dead	23.1
Giant floater	0	2.0	relatively recent-long dead	5.1
Paper pondshell	0	1.0	recent	2.6
Yellow sandshell	0	1.0+0.5x2	recent-relatively recent	7.7
Fragile papershell	0	5.0+0.5x6	recent-very long dead	28.2
Bleufer	0	4.0	recent-relatively long dead	10.3
Southern mapleleaf	1	4.0+0.5x2	relatively recent-long dead	17.9
Pistolgrip	0	2.0	recent	5.1

Pecan Bayou, second dam downstream of Brownwood Reservoir dam to River side park in Brownwood, Brown County, 11 June 1996:

Wading and snorkeling this area and found only a few long-dead Asian clam valves and subfossil fragments of *Quadrula* spp. See the following comments on Pecan Bayou.

Pecan Bayou at SH 573, Mills County, 11 June 1996:

Wading shallow areas at this site produced only one subfossil valve of threeridge and one very long-dead valve of southern mapleleaf. No Asian clams were found. See the following comments on Pecan Bayou.

Pecan Bayou at SH 574, Mills County, 11 June 1996:

Wading and snorkeling at this site produced:

Pecan Bayou at SH 574				
Species	N live	N shell	Condition	Percentage
Threeridge	0	Present	subfossil	-
Southern mapleleaf	0	Present	subfossil	-
Texas pimpleback	0	Present	subfossil	-
Bleufer	0	Present	subfossil	-
Asian clam - present				

Little appears to remain of the unionid fauna from downstream of Brownwood Reservoir to the Colorado River. Scouring typical of many Central Texas rivers does not appear to be especially problematic at many locations; however, steep sandy banks appear to be slumping at numerous sites with subsequent excess deposition of sand and mud on the bayou substrate. Areas immediately downstream of Brownwood Reservoir include several smaller dams to impound water used to supply local Pecan orchards and, although hydrological conditions appear relatively stable, no living unionids were found. It may be possible chemicals associated with pecan production over an extended period of time have impacted local unionids.

Lake Coleman, Coleman County, 1-2 July 1996:

This site was examined by wading and snorkeling:

Lake Coleman				
Species	N live	N shell	Condition	Percentage
Paper pondshell	0	0.5x1	very long dead	0.9
Tampico pearlymussel	6	10.0+0.5x6	relatively recent-long dead	19.3
Fragile papershell	3	13.0+0.5x16	relatively recent-long dead	28.1
Bleufer	1	6.0+0.5x6	relatively recent-long dead	11.4
Southern mapleleaf	1	16+0.5x29	relatively recent-long dead	40.4

Jim Ned Creek, first crossing downstream of Coleman Reservoir, Coleman County, 1-2 July 1996:

Examination of this site produced no bivalves:

Jim Ned Creek at SH 206, Coleman County, 1-2 July 1996:

This site was nearly dry when examined and no bivalves were found.

Jim Ned Creek, first crossing upstream of Hords Creek mouth, Coleman County, 1-2 July 1996:

Examination of this site by wading and snorkeling produced;

Jim Ned Creek, first crossing upstream of Hords Creek				
Species	N live	N shell	Condition	Percentage
Threeridge	0	0.5x3	subfossil	15.8
Giant floater	1	0.5x4	relatively recent-long dead	26.3
Paper pondshell	0	1.0+0.5x1	relatively recent	10.5
Yellow sandshell	0	0.5x1	subfossil	5.3
Fragile papershell	0	5.0	relatively recent	26.3
Texas pimpleback	0	0.5x3	subfossil	15.8

Jim Ned Creek, first crossing downstream of Hords Creek mouth, Coleman County, 1-2 July 1996:
Examination of this site by wading and snorkeling produced:

Jim Ned Creek, first crossing downstream of Hords Creek				
Species	N live	N shell	Condition	Percentage
Threeridge	0	1.0+0.5x9	subfossil (1 relatively recent)	27.0
Giant floater	0	1.0+0.5x8	relatively recent-long dead	24.3
Yellow sandshell	0	2.0+0.5x2	very long dead-subfossil	10.8
Fragile papershell	0	0.5x9	long dead	24.3
Bleufer	0	1.0+0.5x3	very long dead	10.8
Pondhorn sp.	0	0.5x1	very long dead	2.7

Jim Ned Creek at SH 568, Coleman County, 1-2 July 1996:

Examination of this site found cobble bottom and only a few unionid shell fragments present.

Jim Ned Creek at SH 585, Coleman County, 1-2 July 1996:

Attempts to sample this site were thwarted by private land and no access.

Hords Creek at SH 355, Coleman County, 1-2 July 1996:

This site was found to be dry when examined and no bivalves were present.

Hords Creek at SH 2805, Coleman County, 1-2 July 1996:

This site was found to be dry when examined and no bivalves were present.

Hords Creek, first crossing upstream of Hords Creek Reservoir, Coleman County, 1-2 July 1996:

This site was found to be nearly dry when examined and no bivalves were present

Hords Creek Reservoir, Coleman County, 1-2 July 1996:

This site was examined by wading and snorkeling:

Hords Creek Reservoir				
Species	N live	N shell	Condition	Percentage
Giant floater	0	0.5x3	relatively recent	25.0
Paper pondshell	0	6.0+0.5x3	relatively recent	75.0

Hords Creek at SH 503, Coleman County, 1-2 July 1996:

This small rocky stream produced no bivalves when examined.

Hords Creek, first crossing below SH 503, Coleman County, 1-2 July 1996:
 This site was nearly dry (two small pools) when examined and no bivalves were found.

Hords Creek, second crossing below SH 503, Coleman County, 1-2 July 1996:
 This site was dry when examined and no bivalves were found.

Hords Creek at SH 59, Coleman County, 1-2 July 1996:
 This site was dry when examined and no bivalves were found.

Hords Creek at USH 283, Coleman County, 1-2 July 1996:
 This site was dry when examined and no bivalves were found.

Hords Creek, first crossing downstream of Coleman, Coleman County, 1-2 July 1996:
 This site was dry when examined and no bivalves were found.

Hords Creek, second crossing downstream of Coleman, Coleman County, 1-2 July 1996:
 This site was dry when examined and no bivalves were found.

Hords Creek at SH 1175, Coleman County, 1-2 July 1996:
 This site was dry when examined and no bivalves were found.

Buck Lake (Llano River), Llano River State Park, Kimble County, 20 August 1996:
 Examination of shallow areas and shorelines produced only several subfossil fragments of threeridge.

Colorado River at Colorado Bend State Park, Burnet and San Saba counties, 28 February 1996:
 A single recently-dead valve of pistolgrip was found during creel survey work in the area. Thus far, HOH surveys have produced only a single living specimen of this species in the Colorado River drainage. It appears to have declined dramatically in the area in recent years.

Colorado River between Colorado Bend State Park and Lake Buchanan, Llano and Burnet counties; 22 and 26 April 1996:
 The following specimens were collected on exposed bottoms during a low-water period:

Colorado River between Colorado Bend State Park and Lake Buchanan				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	1.0	long dead	6.3
Giant floater	0	0.5x1	relatively recent	6.3
Tampico pearlymussel	0	2.0+0.5x2	relatively recent	25.0
Fragile papershell	0	1.0+0.5x1	relatively recent	12.5
Bleufer	0	0.5x3	recent to long dead	18.8
Southern mapleleaf	0	4.0+0.5x1	recent to long dead	31.3

Upper Lake Buchanan, Burnet and San Saba counties, several dates (1-3, 5-6, 27 March 1996):
 The following specimens were found on exposed bottoms during a low-water period:

Lake Buchanan - upper reaches				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	0.5x6	relatively recent	8.6
Giant floater	0	0.5x1	relatively recent	1.4
Tampico pearlymussel	0	12.0+0.5x12	very recent-subfossil	34.3
Fragile papershell	0	2.0+0.5x2	relatively-very recent	5.7

Bleufer	0	9.0+0.5x6	very recent-subfossil	21.4
Southern mapleleaf	0	10.0+0.5x10	relatively recent-subfossil	28.6
Asian clam - present				

Lake Buchanan, lower reaches, Llano County, 15 March 1996:

The following specimens were collected on exposed bottoms during a low-water period:

Lake Buchanan - lower reaches				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Tampico pearlymussel	0	1.0	relatively recent	50.0
Pistolgrip	0	1.0	recently dead	50.0

Other species typical of this reservoir were observed but not collected; one lilliput sp. was also observed but not taken. This pistolgrip and the previous specimen (above) represent only the second and third found by TPWD in surveys in this area of the Colorado River basin. Apparently this species still persists in the area.

Lake Buchanan, Cedar Point area, Llano and Burnet counties, 15 April 1996:

Several shells were obtained on exposed bottoms during a low-water period:

Lake Buchanan - Cedar Point area				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	1.0	long dead	3.7
Tampico pearlymussel	0	4.0	relatively recent	14.8
Fragile papershell	0	1.0	relatively recent	3.7
Bleufer	0	3.0+0.5x2	recent to long dead	18.5
Southern mapleleaf	0	5.0+0.5x7	recent to long dead	44.4
Lilliput	0	2.0	recent	7.4
Pistolgrip	0	1.0+0.5x1	relatively recent	7.4

Lake Buchanan, Llano and Burnet counties, 9 Dec 1996:

Casual collection of specimens on exposed bottoms during a low-water period included:

Lake Buchanan - lower reaches				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	1.0	long dead	9.1
Tampico pearlymussel	0	0.5x2	relatively long dead	18.2
Fragile papershell	0	1.0	recently dead	9.1
Southern mapleleaf	0	5.0+0.5x2	very recently dead - long dead	63.6

Inks Lake (3 sites combined), Burnet County, 7 February 1996:

The following specimens were obtained on exposed bottoms at several sites around this reservoir following a drawdown of 3.2 m.

Inks Lake Species	N live	N shell	Condition	Percentage
Threeridge	7	9.0 (many)	very recent-long dead	15.1
Giant floater	17	2.0 (many)	very recent	17.9
Paper pondshell	3	1.0	very recent	3.8
Tampico pearl mussel	31	6.0 (many)	very recent-long dead	34.9
Fragile papershell	0	1.0	very recent	0.9
Bleufer	0	0.5x1	relatively long dead	0.9
Smooth pimpleback	0	3.0+0.5x1	long dead	3.8
Southern mapleleaf	16	8.0 (many)	very recent-long dead	22.6
Asian clam - abundant				

Except for a small number of very-recently dead specimens, nearly all dead shells found were long dead (several years) and appeared to have been dead about the same period of time. The local river authority does an abrupt partial-drawdown during winter every 2-3 years for maintenance and repair work. The 3.2-m drawdown usually occurs in about 24 hours and is maintained for about one week before water levels are returned to normal. The drawdown occurs so rapidly unionids are usually unable to follow the declining water line most of the population living at less than 3.2 m deep are lost every few years. A slower drawdown rate would dramatically enhance survival. Percentages given above represent only those specimens collected; several species were much more abundant.

Lake Marble Falls (5 sites combined), Burnet County, 11 September 1996:

Hookah pump and SCUBA were used to examine several sites around this reservoir and the following specimens were collected:

Lake Marble Falls Species	N live	N shell	Condition	Percentage
Tampico pearl mussel	0	1.0	long dead	33.3
Giant floater	1	0.0	-	33.3
Southern mapleleaf	1	0.0	-	33.3
Asian clam - present in limited numbers.				

This reservoir was first examined by HOH in November 1995 when water levels were extremely low. Although unionids were not extremely abundant, a reproducing population of smooth pimplebacks was found. This current trip found only two living unionids and one shell despite 3.4 man-hours of bottom time. It seems unlikely the prior drawdown (which ended by December 1995 when reservoir levels were returned to normal) killed vast number of unionids because the current effort only found a single dead shell. More likely, the prior drawdown concentrated mussels from a relatively-small population in available pools where they were more-readily collected. Mussels dispersed in the 10 months since and are currently very difficult to locate.

Lake Travis near Turkey Bend, Burnet County, 20 May 1996:

A volunteer found a large number of living bleufers here during a low-water period.

Pedernales River tributaries, Gillespie and Blanco counties, 20 August 1996:

A number of tributaries were examined during drought conditions. No bivalves were found. Sites included:

<u>Water body</u>	<u>Location</u>	<u>County</u>	<u>Condition</u>
Pedernales River (W of Fredericksberg)	USH 290	Gillespie	dry
Stockens Creek	USH 290	Gillespie	dry
Walnut Creek	USH 290	Gillespie	dry
Spring Creek	USH 290	Gillespie	small, stagnant puddles
Honey Creek	USH 290	Gillespie	dry
Live Oak Creek	USH 290	Gillespie	dry
Barons Creek (W of Fredericksberg)	USH 290	Gillespie	dry
Barons Creek (in Fredericksberg)	USH 290	Gillespie	standing water
Barons Creek (E of Fredericksberg)	USH 290	Gillespie	standing water
Pedernales River (E of Fredericksberg)	USH 290	Gillespie	nearly dry, low flow
Grape Creek	USH 290	Gillespie	standing stagnant water
Threemile Creek	USH 290	Gillespie	dry
Rocky Creek	USH 290	Blanco	dry
Towhead Creek	USH 290	Blanco	dry
Flat Creek	USH 290	Blanco	dry
Miller Creek	USH 290	Blanco	dry
McCall Creek	USH 290	Blanco	dry
Middle Creek	USH 290	Blanco	dry
Yeager Creek	USH 290	Blanco	dry

Giddings State School Lake, Lee County, 22 June 1996:

The following specimens were obtained for genetic analysis:

Giddings State School Lake				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Paper pondshell	2	0	-	3.8
Texas lilliput	38	2	recent	76.9
Tapered pondhorn	10	0	-	19.2

Fayette Reservoir (Cedar Creek Reservoir)(four sites, combined), Fayette County, 7 August 1996:

Wading and snorkeling at this reservoir produced:

Fayette Reservoir				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Texas lilliput	0	1.0+0.5x2	relatively recently dead	100.0
Asian clam- very abundant but virtually all dead				

Colorado River at SH 71 at La Grange, Fayette County, 7 August 1996:

Wading and snorkeling at this site produced only subfossil shell:

Colorado River at SH 71				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	0.5x2	subfossil	5.1
Tampico pearlymussel	0	0.5x16	subfossil	41.0
Yellow sandshell	0	0.5x3	subfossil	7.7
Bleufer	0	0.5x1	subfossil	2.6
Southern mapleleaf	0	0.5x3	subfossil	7.7
Pimpleback spp.	0	0.5x14	subfossil	35.8

Like the Columbus site examined downstream in July, pimplebacks here appeared to include smooth pimpleback, Texas pimpleback, and possibly golden orb; however, the badly eroded condition of the shells makes positive identification difficult.

Colorado River, mid-river shoal and riffle with aquatic vegetation ca. 4 km upstream of USH 10, Colorado County, 16 July 1996:

Wading and snorkeling at this site produced only Asian clams. These were abundant but were all very small individuals

Colorado River, city park at Columbus, Colorado County, 25 June 1996:

An attempt to access this site found the boat ramp of marginal quality and chained. Examination of sand bars found one subfossil valve of Texas fawnsfoot and Asian clams.

Colorado River, mid-river gravel bar between US 10 and SH 102, Colorado County, 16 July 1996:

Wading and snorkeling here found only a few subfossil unionid shells and long-dead Asian clams.

Colorado River, exposed gravel bar ca 0.5 km downstream of USH 10, Colorado County, 16 July 1996:

Examination of the exposed bar and adjacent shallows produced:

Colorado River ca 0.5 km downstream of USH 10				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	0	0.5x6	subfossil	11.8
Tampico pearlymussel	0	0.5x16	subfossil	31.4
Yellow sandshell	0	0.5x3	subfossil	5.9
Bleufer	0	0.5x2	subfossil	3.9
Southern mapleleaf	0	0.5x3	subfossil	5.9
Pimplebacks spp.	0	0.5x19	subfossil	37.3
Texas fawnsfoot	0	0.5x1	subfossil	2.0
Pistolgrip	0	0.5x1	subfossil	2.0
Asian clam - present (very long dead)				

Colorado River, bottom off gravel bar ca 0.5 km downstream of USH 10, Colorado County, 16 July 1996:

Wading and snorkeling at this site produced no unionids.

Colorado River bend ca 1 km downstream of USH 10, Colorado County, 16 July 1996:

Examination of the exposed bar and wading and snorkeling adjacent shallows produced only dead shells similar to those listed for the above site. No living unionids were found.

Lavaca - Navidad River

Lavaca River 0.8 km upstream of SH 616, Jackson County, 23 April 1996:
Collections along exposed banks and in shallow waters produced:

Lavaca River 0.8 km upstream of SH 616				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Atlantic rangia	0	0.5x8	recent to long dead	100.0

Lavaca River 1.6 km downstream of SH 616, Jackson County, 23 April 1996:
Collections along exposed banks and in shallow waters produced:

Lavaca River 1.6 km downstream of SH 616				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Atlantic rangia	2	0.5x6	recent to long dead	66.7
False angle wing	0	0.5x1	relatively recent	8.3
Stout tegelus	0	1.0	long dead	8.3
Atlantic bay scallop	0	1.0+0.5x1	relatively recent	16.7

These Lavaca River collections represent our first collection of living *Atlantic rangia*. However, this largely reflects limited sampling at downriver sites. It and the other bivalves listed are low-salinity species in families other than Unionidae. No unionids or their shells were found, including round pearlshell which has been reported from the lower Guadalupe River nearby.

Guadalupe River Drainage

North Fork Guadalupe River at SH 1340, Kerr County, 25 May 1996:

Examination of this site by SCUBA and snorkeling produced only a limited number of Asian clams and their shells and a single recently-dead sphaeriid clam. Bottom was largely bedrock with dense, deep beds of *Chara* and experiences periodic scouring.

Guadalupe River, immediately downstream of the Upper Guadalupe River Authority (UGRA) dam, Kerrville, Kerr County, 28 October 1996:

A UGRA biologist collected two living Texas fatmuckets in flood debris near the UGRA headquarters and sent them to HOH.

This same site was reexamined on 5 November 1996 and the following specimens were found:

Guadalupe River downstream of UGRA dam				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Paper pondshell	0	1.0+0.5x5	Relatively-recently dead	37.5
Texas fatmucket	0	5.0	very recently dead	31.3
Texas lilliput	0	2.0+0.5x3	relatively recently dead	31.3

Guadalupe River tributaries, Kendall County, 13 August 1996:

These sites were examined during drought condition. No bivalves were found.

Water body	Location	County	Condition
Block Creek	SH 473	Kendall	dry
Coffee Hollow Creek	SH 473	Kendall	dry
W. Sister Creek	SH 473	Kendall	pools standing water
E. Sister Creek	SH 473	Kendall	pools standing water
Jacobs Creek	SH 473	Kendall	dry
Cury Creek	SH 473	Kendall	dry
Dry Creek	SH 473	Kendall	dry
Kruse Creek	SH 473	Kendall	dry

Blanco River tributaries, Blanco and Comal counties, 13 August 1996:

These sites were examined during drought conditions. No bivalves were found.

Water body	Location	County	Condition
Little Blanco R.	USH 28/SH 473	Blanco	some water above dam W of USH 28 but dry below
Little Blanco R.	between USH 28 and SH 32	Blanco	dry
Little Blanco R.	SH 473	Blanco	small pool of stagnant water, otherwise dry
Rocky Creek	SH 32	Comal	dry

Canyon Reservoir, North Park, Comal County, 20 April 1996:

Casual collection of specimens during a SCUBA dive in the area produced one valve each of Tampico pearlymussel (long dead) and Texas lilliput (long dead) in 1.3 m of water. The lilliput valve was likely transported here from a shallower adjacent area.

Lake Placid (Guadalupe River), Guadalupe County, 10 January 1996:

A single, relatively-recently dead paper pondshell valve was found during other research in the area.

Guadalupe River between Seguin and Lake Gonzales, Guadalupe County, 10 February 1996:

A single, juvenile, long-dead washboard shell was found during other research in this area.

Guadalupe River downstream of Lake Gonzales, Gonzales County, 12 May 1996:

Examination gravel bars in this area produced the following species:

Guadalupe River downstream of Lake Gonzales (general area)				
Species	N live	N shell	Condition	Percentage
Giant floater	1	0.0	-	10.0
Yellow sandshell	2	1.0	relatively long dead	30.0
Washboard	3	2.0	long dead	50.0
Southern mapleleaf	0	1.0	long dead	10.0

Guadalupe River ca 0.2 km downstream of Lake Gonzales dam, Gonzales County, 11 August 1996:

Examination of shallows in this area during a low-water period produced:

Guadalupe River 0.2 km downstream of Lake Gonzales				
Species	N live	N shell	Condition	Percentage
Threeridge	2	0.5x1	recently dead	30.0
Louisiana fatmucket	2	0.0	-	20.0
Yellow sandshell	1	2.0	relatively long dead	30.0

Golden orb	1	0.0	-	10.0
Pistolgrip	1	0.0	-	10.0

Guadalupe River ca 0.4 km downstream of Lake Gonzales dam, Gonzales County, 11 August 1996:
Qualitative examination of shallows in this area during a low-water period produced:

Guadalupe River 0.4 km downstream of Lake Gonzales				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	15	0.0	-	23.4
Tampico pearlymussel	1	1.0	recently dead	3.1
Yellow sandshell	0	2.0	relatively recently dead	3.1
Washboard	10	0.0	-	15.6
Southern mapleleaf	0	4.0	long dead	6.3
Golden orb	24	1.0	relatively recently dead	39.1
Pistolgrip	3	3.0	recently dead- relatively long dead	9.4

Guadalupe River downstream of Lake Wood, gravel bar launch downstream of Lake Wood dam, Gonzales County, 22 May 1996. Collections included random area collections (qualitative samples) and quadrat samples (quantitative samples) at some sites downstream of Lake Wood:
Qualitative examination of the exposed bottom and adjacent shallows produced:

Guadalupe River boat launch downstream of Lake Wood				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	3+	1+	recent	-
Washboard	2+	4+	recent to long dead	-
Southern mapleleaf	present	present	long dead	-
Golden orb	11+	5+	recent to long dead	-
Pistolgrip	0	1.0	relatively recent	-
Asian clam - abundant				

Guadalupe River ca 1.2 km downstream of Lake Wood dam (Site 1), Gonzales County, 12 May 1996:
Qualitative examination of banks, gravel bars, and shallows produced:

Guadalupe River Site 1 downstream of Lake Wood				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	11	present	recent to long dead	-
Tampico pearlymussel	1	present	recent to long dead	-
Yellow sandshell	present	present	recent to long dead	-
Washboard	2	present	recent to long dead	-
Southern mapleleaf	present	present	long dead	-
Golden orb	6	present	recent to long dead	-
Asian clam - abundant				

Site 1 downstream of Lake Wood dam, 22 May 1996:
Quantitative sampling (10, 0.25-m² samples) produced:

Guadalupe River Site 1 downstream of Lake Wood				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	7	6.0+0.5x8	recent to long dead	65.6
Tampico pearlymussel	0	0.5	long dead	3.1
Washboard	1	0.5	long dead	6.3
Southern mapleleaf	0	0.5x2	long dead	6.3
Golden orb	5	0.0	-	15.6
Pistolgrip	0	1.0	relatively recent	3.1
Asian clam - abundant				

Site 1 downstream of Lake Wood dam, 22 May 1996:
Quantitative sampling (1, 10.0-m² sample) produced:

Guadalupe River Site 1 downstream of Lake Wood				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	41	50.0+0.5x31	recent to long dead	84.7
Tampico pearlymussel	0	1.0	long dead	0.7
Yellow sandshell	4	0.0	-	2.8
Washboard	7	2.0	long dead	6.3
Southern mapleleaf	0	2.0+0.5x1	long dead	2.1
Golden orb	3	1.0	relatively recent	2.8
Pistolgrip	0	0.5	long dead	0.7
Asian clam - abundant				

Guadalupe River ca 2.0 km downstream of Lake Wood dam (Site 2), 12 May 1996:
Qualitative examination of banks, gravel bars, and shallows produced:

Guadalupe River Site 2 downstream of Lake Wood				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	6	present	recent to long dead	-
Yellow sandshell	present	present	recent to long dead	-
Washboard	present	present	recent to long dead	-
Golden orb	6	present	recent to long dead	-
Asian clam - abundant				

Site 2 downstream of Lake Wood dam, 22 May 1996:
Quantitative sampling (10, 0.25-m² samples) produced:

Guadalupe River Site 2 downstream of Lake Wood				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Threeridge	37	15.0+0.5x37	recent to long dead	66.4
Tampico pearlymussel	0	1.0	long dead	0.7
Louisiana fatmucket	1	0.0	-	0.7
Yellow sandshell	1	1.0+0.5x1	relatively recent	2.2
Washboard	12	0.5x2	long dead	12.7
Southern mapleleaf	0	6.0+0.5x11	long dead	12.7

Golden orb	5	0.0	-	3.7
Pistolgrip	0	0.5	long dead	0.7
Asian clam - abundant				

Guadalupe River ca 2.8 km downstream of Lake Wood dam (Site 3), 22 May 1996:

This location was at a bend in the river with both swift-current scouring and collapsing sand and mud banks above. Living and dead (recent predator kills with soft tissue) yellow sandshells were the only unionids found by wading and snorkeling. Asian clams were abundant. Gravel bottoms and significant unionid densities extended from above this site ca 2.8 km back upstream to the Lake Wood dam.

Analysis of quantitative data from the above Guadalupe River collections downstream of the dam at Lake Wood indicated that 20 0.25-m² and one 1.0-m² quadrats were insufficient to provide confident statistical evaluation of these data. None the less, extrapolating the densities obtained to the 2.8-km area examined indicated population size of threeridges to be 263,000-1,392,000 and washboards to be 38,000-451,000 living animals. Further, taking the midpoints of these ranges, approximately 116,000 threeridges and 54,000 washboards were larger than minimum legal harvest size. Although these numbers are not statistically valid, they do suggest that significant populations of both species do remain in the area. It was also noted that both threeridges and washboards in this area are often somewhat elongate in shape. Subsequently, a larger proportion of each species can reach maturity and spawn before being legally harvestable than in morphologically less-elongate populations.

The area downstream from Lake Wood and another upriver, downstream of Lake Gonzales, represent only the second and third surviving populations of golden orbs located by HOH since 1992. This local, endemic species is only known to continue to survive at the two Guadalupe River sites and in Lake Corpus Christi on the Nueces River. Based on the density estimates given above, the golden orb population downstream of Lake Wood was calculated to be about 188,000 living specimens.

San Marcos River at USH-35, Hays County, 7 May 1996:

Examination of this site surveyed earlier produced no unionids but found shells of Asian clam and the exotic snails *Marisa*, *Melanoides*, and *Thiara* in abundance. Water levels were down 0.3-0.7 m lower than previously observed by HOH (due to drought conditions and lessened spring output). Lower levels in February when record-setting cold temperature hit the area may have been responsible for extensive mortality seen among all four exotic mollusks at this site. Relatively few living specimens of any of these species were found.

Cibolo Creek, first crossing downstream of Schertz, Guadalupe County, 7 May 1996:

Examination of this site by wading found the substrate was covered with organic litter and no bivalves were found.

Cibolo Creek, second crossing upstream of USH 10, Guadalupe County, 7 May 1996:

Wading and examination of gravel bars produced long-dead valves of Tampico pearlymussel (0.5x1) and giant floater (2.0). Asian clam was abundant at this low-water crossing. Earlier examination of areas just upstream found a number of unionid species; however, a new landowner had fenced and posted this site since. His name and address were obtained and attempts to obtain written permission to reexamine this site will be made in the future.

Cibolo Creek, first crossing upstream of USH 10, Guadalupe County, May 1996:

This gravel-bottom, shallow-water area was examined by wading for several hundred meters. Asian clams were abundant but the only trace of unionids was several old fragments of an anodontid.

Cibolo Creek at USH 10, Guadalupe County, 7 May 1996:

Attempts to examine this site were thwarted by stagnant conditions and deep, organic deposits on the

bottom related to limited-flow, drought conditions suggested unionids would not likely be present and swimming would be unwise. Asian clams were abundant at several sites.

Cibolo Creek at SH 81 (upstream of confluence with San Antonio River), Karnes County, 19 June 1996:
Wading at this site found:

Cibolo Creek at SH 81 Species	N live	N shell	Condition	Percentage
Threeridge	0	1	very long dead	33.3
Yellow sandshell	0	2	relatively long dead	66.7
Asian clam - abundant				

This area appears to become anoxic during low-flow summer periods.

South Side Lions Camp Pond (San Antonio River drainage), Bexar County, 20 August 1996:
Wading and examination of shorelines found a single long-dead valve from Tampico pearlymussel.

Millers Pond (San Antonio River drainage), Bexar County, 7 May 1996:
Wading and examination of shorelines produced 2.5 long-dead paper pondshells.

Victor Braunig Reservoir (San Antonio River drainage), Bexar County, 9 July 1996:
A skimmer dredge was used to examine several sites on this reservoir. Only shells of long dead Asian clams were found. Asian clams were very abundant here in 1992, but all appear to have died for undetermined reasons. No unionids were found.

Calaveras Reservoir (San Antonio River drainage), Bexar County, 9 July 1996:
A skimmer dredge was used to examine several sites on this reservoir and waded at two sites. Only shells of long dead Asian clams were found as well as a single living lilliput taken at a tributary creek upstream of the heated discharge.

San Antonio River at SH 326, Karnes County, 19 June 1996:
This area was examined by wading and snorkeling:

San Antonio River at SH 324 Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	1	0	-	100.0
Asian clam - abundant				

Although this site was dominated by an undesirable deep-shifting sand bottom, even mud and gravel areas lacked evidence of unionids.

San Antonio River at SH 80 south of Helena, Karnes County, 19 June 1996:
Sampling attempts here were thwarted by lack of access to this site.

San Antonio River at SH 123 north of Karnes City, Karnes County, 19 June 1996:
Wading and snorkeling in this area found:

San Antonio River at SH 123				
Species	N live	N shell	Condition	Percentage
Threeridge	0	1.0+0.5x11	very long dead-relatively recent	37.5
Tampico pearlymussel	0	0.5x11	very long dead	34.4
Yellow sandshell	0	0.5x1	very long dead	3.1
Golden orb	0	0.5x6	very long dead	18.8
Pistolgrip	0	0.5x2	very long dead	6.3
Asian clam - relatively abundant				

San Antonio River at USH 181 near Falls City, Karnes County, 19 June 1996:

Steep banks blocked access to this site, but no evidence of bivalves was noted on exposed gravel areas in the river bed.

San Antonio River at SH 887 and 791 near Falls City, Karnes County, 19 June 1996:

Private lands blocked access to these areas, but waters were deeper than previous sites and extremely eutrophic suggesting significant local nutrient input.

San Antonio River at Floresville City Park, Karnes County, 19 June 1996:

Wading and snorkeling this area and found:

San Antonio River at Floresville City Park				
Species	N live	N shell	Condition	Percentage
Yellow sandshell	0	0.5x1	very long dead	33.3
Southern mapleleaf	0	0.5x1	very long dead	33.3
Golden orb	0	0.5x1	very long dead	33.3
Asian clam - abundant				

Coletto Creek Reservoir, Victoria County, 7 February 1996:

A volunteer collected the following specimen in the area:

Coletto Creek Reservoir				
Species	N live	N shell	Condition	Percentage
Paper pondshell	0	1.0	relatively recent	100.0

Historically, members of this genus in Texas have been considered to be *imbecillis*; however, questions have arisen within the last year which suggest this may be another species of *Utterbackia* and this animal was one of the questionable types.

Coletto Creek, downstream of Coletto Creek Reservoir dam, Victoria County, 4 December 1995:

A volunteer collected the following material (arrived at HOH in 1996):

Coletto Creek downstream of Coletto Creek Reservoir				
Species	N live	N shell	Condition	Percentage
Giant Floater	0	5.0	relatively recent	100.0

Nueces River

Utopia City Park Lake, (Sabinal-Frio River drainage) Uvalde County, 6 December 96:

This impoundment was examined during a drawdown but no bivalves were found.

Nueces River at George West, Live Oak County, 22 January 1996:

A volunteer collected the following material:

Nueces River at George West				
Species	N live	N shell	Condition	Percentage
Bleufer	0	1.0	recent	100.0

Nueces River, first island upstream of Lake Corpus Christi, Live Oak County, 8 December 1996:

Wading and snorkeling produced:

Nueces River upstream of Lake Corpus Christi				
Species	N live	N shell	Condition	Percentage
Tampico pearlymussel	48	0.0	-	90.6
Giant floater	4	0.0	-	7.5
Yellow sandshell	present	0.0	-	-
Southern mapleleaf	0	1.0	relatively long dead	1.9

These specimens were collected to provide glochidia for host-determination work and tissue for genetic analysis; proportions above are not representative of the local unionid assemblage.

Lake Corpus Christi, KOA camp ground inlet, Live Oak County, 16 July 1996:

Examination of shallows and exposed bottoms during a drought produced:

Lake Corpus Christi, KOA camp ground inlet				
Species	N live	N shell	Condition	Percentage
Giant floater	4	present	-	1.8
Tampico pearlymussel	105	present	-	46.1
Louisiana fatmucket	5	0.0	-	2.2
Yellow sandshell	20	present	-	8.8
Bleufer	0	1.0	long dead	0.4
Southern mapleleaf	52	present	-	22.8
Golden orb	15	0.0	-	6.6
Western lilliput	26	present	-	11.4
Asian clam - present				

Lake Corpus Christi at SH 888, Live Oak County, 16 July 1996:

Examination of shallows and exposed bottoms during a drought produced:

Lake Corpus Christi at SH 888				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Tampico pearlymussel	32	1.0	recent	22.6
Yellow sandshell	10	present	-	6.8
Southern mapleleaf	7	present	-	4.8
Golden orb	70	0.0	-	47.9
Western lilliput	26	present	-	17.8
Asian clam - present				

Lake Corpus Christi, Lake Corpus Christi State Park, San Patricio County, 16 July 1996:
Examination of shallows and exposed bottoms during a drought produced:

Lake Corpus Christi, Lake Corpus Christi State Park				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Giant floater	2	0.5x1	recent	7.1
Tampico pearlymussel	21	1.0	recent	52.4
Yellow sandshell	1	present	-	2.4
Southern mapleleaf	7	present	-	16.7
Golden orb	1	1.0	recent	4.8
Western lilliput	6	1.0	recent	16.7
Asian clam - present				

Drought conditions from 1995 through 1996 dropped reservoir levels in Lake Corpus Christi dramatically and revealed more golden orbs than encountered in all previous years of HOH surveys at this site. Because reservoir levels were continuing to decline at the time, living golden orbs were collected and returned to HOH where they could be held in ponds until water levels returned to normal.

Nueces River downstream of Lake Corpus Christi, Jim Wells County, 7 January 1996:
A volunteer collected the following material in the area:

Nueces River downstream of Lake Corpus Christi				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Giant floater	0	0.5x1	recent	50.0
Tampico pearlymussel	1	0.0	-	50.0

Nueces River immediately downstream of Lake Corpus Christi dam, San Patricio and Nueces counties, 16 July 1996:

Wading and snorkeling at this site found only a limited number of Asian clams were present.

Nueces River at San Patricio, San Patricio County, 16 July 1996:

Wading and snorkeling at this site found only a limited number of Asian clams were present.

Nueces River at US 37 at Nueces River Park, San Patricio and Nueces counties, 16 July 1996:

During wading and snorkeling at this site, 32 living Atlantic rangia were found but no unionids were present.

Rio Grande

Elm Creek (Rio Grande drainage) at USH 277 and SH 1589 upstream of Eagle Pass, Maverick County, 1-2 July 1996:

When examined, the USH 277 site was found to be to be dry. The SH 1589 location produced several recently-dead unionid shells from a gravel bottom during a fish survey in 1992; however, the site is now covered with > 1 m of deep, soft silt and no longer supports any bivalves. It was hoped this tributary may still hold some of the last remaining specimens of local endemic unionids. Dramatic recent urban and commercial growth and development in the Eagle Pass area have resulted in habitat modification and contributed to elimination of bivalves here.

Lake Casa Blanca (Rio Grande drainage), Webb County, 12 August 1996:

Examination of shallow waters and shoreline areas produced:

Lake Casa Blanca Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Paper pondshell	0	1.0	relatively long dead	3.0
Tampico pearlymussel	1	3.0+0.5x28	long dead	97.0

Rio Grande upstream of Arroyo del Burro, Zapata County, 1-2 July 1996:

This site was found to be deep water and not sampled.

Rio Grande upstream of Arroyo Molletes, Zapata County, 1-2 July 1996:

This site was found to be deep water and was not sampled

Falcon Reservoir, county road access point at Zapata city, Zapata County, 1-2 July 1996:

Examination of exposed bottoms and shallows associated with drought and drawdown conditions found only dead shells of Tampico pearlymussel and southern mapleleaf.

Falcon Reservoir, county road access point between Zapata city and Arroyo Leon, Zapata County, 1-2 July 1996:

Examination of exposed bottoms and shallows associated with drought and drawdown conditions found only dead shells of Tampico pearlymussel and southern mapleleaf.

Falcon Reservoir, County road access upstream of Arroyo del Tigre, Zapata County, 1-2 July 1996:

Examination of exposed bottoms and shallows associated with drought and drawdown conditions found only dead shells of Tampico pearlymussel and southern mapleleaf and one living southern mapleleaf:

Falcon Reservoir, county road upstream of Arroyo del Tigre Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Southern mapleleaf	1	0.0	-	100.0

Falcon Reservoir, at Arroyo del Tigre confluence with the Rio Grande, Zapata County, 1-2 July 1996:

Examination of exposed bottoms and shallows associated with drought and drawdown conditions found:

Falcon Reservoir at Arroyo del Tigre Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Tampico pearlymussel	0	7.0+0.5x2	relatively recently dead	37.5

Southern mapleleaf	0	12.0+0.5x2	relatively recently dead	58.3
Mexican fawnsfoot	0	0.5x1	relatively long dead	4.2

This appears to be the first collection of Mexican fawnsfoot since it was last reported near Del Rio in the 1970s.

Falcon Reservoir, County road access point upstream of New Falcon, Zapata County, 1-2 July 1996:

Examination of exposed bottoms and shallows associated with drought and drawdown conditions found:

Falcon Reservoir, county road access point upstream of New Falcon				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Tampico pearlymussel	0	1.0+0.5x10	relatively recently dead	52.4
Southern mapleleaf	0	6.0+0.5x4	relatively recently dead	47.6

Falcon Reservoir, Falcon State Park, Zapata County, 1-2 July 1996:

Examination of exposed bottoms and shallows associated with drought and drawdown conditions found:

Falcon Reservoir, Falcon State Park				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Tampico pearlymussel	0	4.0+0.5x11	relatively recently dead	93.8
Southern mapleleaf	0	1.0	relatively recently dead	6.3

All Falcon Reservoir sites had large numbers of Tampico pearlymussel and southern mapleleaf (as well as Asian clams) shells which had died during the drought and drawdown of water levels which has been ongoing since late 1995. With only a single living specimen found in the area and mussel losses so extensive, it may be many years before this reservoir can recover even after water levels return to normal. The Mexican fawnsfoot valve is the first trace of this species found by TPWD to date; it may have been surviving in Arroyo del Tigre drainage but this is now dry.

Rio Grande downstream of Falcon Reservoir, Starr County, 1-2 July 1996:

Wading and snorkeling this area produced:

Rio Grande downstream of Falcon Reservoir				
Species	<i>N</i> live	<i>N</i> shell	Condition	Percentage
Paper pondshell	0	0.5x1	very long dead	16.7
Southern mapleleaf	0	4.0	very long dead	66.7
Asian clam	0	1.0	recent	16.7

Water Body Summary

Survey work within the Red River drainage was limited in 1996 to collections made in Lake Arrowhead (Little Wichita River) to obtain specimens for genetic studies, a group of gravel-bar collections by TPWD fishery management crews downstream of Lake Texoma, and surveys by C.M. Mather and J.A.M. Bergmann in Lamar County streams where Ouachita rock-pocketbook had been previously found. Downstream of Lake Texoma, the Red River is often characterized by shifting sandy bottoms with limited good mussel habitat; however, several species still appear to persist in the area. In Sanders Creek in Lamar County, pimpleback and wartyback were found

in greater abundance than had been found in prior surveys. In adjacent Pine Creek, unionid numbers appeared to have decreased.

The first major TPWD efforts on Big Cypress Bayou occurred in 1996; however, Caddo Lake remains to be surveyed. Within this system, long-lived, heavy-shelled species like washboards, threeridges, and mapleleafs were present in the upper reaches but declined dramatically in numbers downstream. Additionally, there was no evidence of reproductive success among these taxa; only large, old adults were found. Thinner-shelled, shorter-lived species like pond mussels and floaters increased in abundance at downstream sites. This system may be experiencing increased or accelerated eutrophication. Additionally, a significant stretch of river from just downstream of Bob Sandlin Reservoir nearly to Lake O'the Pines produced no bivalves at all, suggesting major environmental concerns in the area.

The only sampling in 1996 within the Sabine River drainage basin was at Lake Fork. Its unionid fauna was dominated by thinner-shelled, faster-growing species typical of newer reservoirs. Within the Neches River system sampling was restricted to B.A. Steinhagen Reservoir and the Neches River immediately downstream of Town Bluff dam. Some of the most diverse, abundant unionid assemblages remaining in Texas were found in these areas. However, a partial drawdown to control noxious macrophytes in January and February associated with exceptionally cold weather resulted in significant losses in B.A. Steinhagen Reservoir. The extent of these losses remains to be assessed.

Within the Trinity River System, a number of reservoirs in the upper-central drainage basin were sampled and found to contain established unionid populations. C.M. Mather and J.A.M. Bergmann surveyed sites on the Trinity River upstream of Lake Livingston, where unionids have declined dramatically in past decades, and found both numbers and diversity appeared to be rebounding. Lake Livingston itself also continues to support significant unionid populations.

The West Branch of the San Jacinto River produced very few living unionids. Area development, road construction, and extensive sand and gravel mining within the drainage basin have contributed to extensive declines in a once-unique unionid assemblage. The upper reaches of Lake Houston were found to support a number of mussel species, but sand and silt deposition from upstream sources could put these at risk in the future. A site on Buffalo Bayou was reexamined in 1996 and the resident mussel populations appeared unchanged from previous surveys in 1994.

A number of riverine and reservoir sites on the upper and central Brazos River were also surveyed in 1996. At many of the sites in the upper drainage basin, unionids were limited in number and diversity. No living unionids were found in the Paluxy, North Bosque, Little, San Gabriel, or Lampasas rivers and only a single living mussel was found in the Leon River. However, Belton, Stillhouse Hollow, and Somerville reservoirs still supported significant unionid populations.

Within the Colorado River drainage basin, Colorado City Reservoir produced only anodontids and E.V. Spence Reservoir (a relatively new impoundment) appeared to be developing a population of southern mapleleafs. No living unionids were taken in the Colorado River from this reservoir downstream nearly to O.H. Ivie Reservoir. Mussels were found in Brownwood Reservoir on Pecan Bayou, but few living or recently-dead specimens were present in Hords Creek or Jim Ned Creek and none were found between Brownwood Reservoir and the Colorado River. Lake Buchanan and the Colorado River immediately upstream continue to support mussel populations as does Inks Lake downstream. Attempts to examine Lake Marble Falls were confounded by deep water and few living specimens or shells were found despite collection of several taxa at this site in 1995. In the lower reaches of the Colorado River at USH 10, only subfossil shell remains were found.

Collections were made at two sites in the lower Lavaca River further downstream than previous collections. However, only estuarine bivalves of non-unionid families were found.

Previous TPWD surveys in the upper Guadalupe River had found a few living paper pondshells and recently-dead shells of Texas lilliput to suggest some living unionids did remain in the area, but otherwise local

mussel populations appeared lost in this area. However, in late 1996, living Texas fatmuckets were found in a small area (about 30 x 30 m) in Kerr County. Further downstream between Seguin and Gonzales, unionid populations were examined several times and significant numbers of threeridges, washboards, and other taxa were still present. A number of locations in the upper San Antonio River drainage basin were examined for the first time, but collectively, only a single living Tampico pearlymussel was found.

Within the Nueces River, Lake Corpus Christi was examined on two occasions and the previously reported unionid assemblage remained present. Downstream of this reservoir, few to no mussels were found. However, a population of large-size Atlantic rangia was located in the lower reaches of the Nueces River.

Elm Creek in the Rio Grande drainage near Eagle Pass was examined but was found to have recently filled with silt with the resulting elimination of local bivalve populations. Lake Casa Blanca was reexamined and Tampico pearlymussels remained present. Efforts around Falcon Reservoir and its Texas tributaries produced only a single living southern mapleleaf. Much of the previously-observed unionid fauna was found to have been lost during drought and drawdown conditions in 1996.

Species Summary

Threeridge, washboard, and southern mapleleaf, which are major commercial shell species in Texas, remain sufficiently abundant in many areas to support commercial harvest. Mapleleaf appears to be present in Big Cypress Bayou at upstream locations, but genetic analysis to confirm identification remains to be completed. Some populations, especially those of washboard, show little evidence of reproduction in certain areas. Reasons for apparent reproductive failure are unclear; however, high-density adult populations which preclude settling of juveniles do not appear to be a major concern in Texas waters. Tampico pearlymussel remains abundant at some locations and continues to support a pearl fishery. Bleufer, which also produces pearls, is also locally abundant in some areas.

Several rare local species were encountered in 1996. Texas fatmucket, a central Texas endemic, was believed to only survive in a single Colorado River tributary in Runnels County until this year when an additional small population was found in the Guadalupe River in Kerr County. Similarly, golden orb, another central Texas endemic, which had only been found alive in recent years in the lower Nueces River drainage was found to be more abundant at that site than first thought and two additional populations were located in the Guadalupe River between Seguin and Gonzales. Living Texas fawnsfoot was found for the first time in several decades as were a number of recently-dead shells in areas of the central Brazos River. Texas heelsplitter, which was known from only about 150 specimens since its description in 1898 and only two living animals in recent years, was found to support populations in both the Neches and Trinity rivers. Finally, two living Louisiana pigtoes were found in the Neches River along with several recently-dead shells.

Flat floater appears to be increasing in abundance and distribution in eastern Texas by utilizing reservoirs which provide desired habitat. Abundance and distribution of other unionid taxa was found to be generally similar to that reported in Howells (1996a, b).

Seasonal Weather Patterns

Low-water conditions associated with limited precipitation beginning in summer 1995 continued through 1996 virtually statewide. Although these conditions expedited mussel surveys and collection, the potential negative impacts remain to be evaluated. Mortalities were documented in many areas of the state. For example, when HOH crews surveyed Falcon Reservoir on the Rio Grande in 1995, so many living mussels were present in shallow waters and on recently-exposed bottoms, it was not possible to return all of them to deeper waters. However, when reexamined in 1996, countless shells were observed and in two man-days only a single living specimen was found. What proportion of the population might have survived in deeper channel areas is undetermined, but significant

numbers were clearly lost. At other locations, predators and musselers used reduced depths to increase access to unionids and increase associated depredation and harvest rates.

Specific efforts were made by HOH to use these conditions to examine as many locations as possible. Further, drought conditions probably increased ability to locate particularly rare species. Numerous survey efforts by TPWD in Lake Corpus Christi, for example, had failed to find Louisiana fatmucket there, but several living specimens were found under low-water conditions in 1996. Similarly, golden orb populations in the Guadalupe River had been overlooked under higher flow rates and Louisiana pigtoes in the Neches River were not previously found during three prior collection efforts at the same site.

At this time (early 1997), precipitation has filled many reservoirs and rivers across the state and flooding has been problematic in many areas. Mussels which survived low waters in 1995 and 1996 are now at significant depths at some locations. Long-term impact of drought-related low waters and subsequent high-water conditions will require time to evaluate.

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Figure 1. Texas locations examined for the presence of freshwater mussels (Family: Unionidae) in 1996 by Texas Parks and Wildlife Department (TPWD) Inland Fisheries Research staff or where mussels were collected by other TPWD personnel or volunteers and sent to TPWD for examination.

