

Red River Waterway
Shreveport, LA, to Daingerfield, TX, Reach
Reevaluation Study In-Progress Review

MUSSEL SURVEY

PREFACE

1. In October 1988 (Fiscal Year 1989), the U.S. Army Corps of Engineers, Vicksburg District, was directed by Congress to initiate a reevaluation of the feasibility of the Shreveport, LA, to Daingerfield, TX, reach of the Red River Waterway Project. Subsequent funding was provided by Congress in Fiscal Years 1990-1993.

2. In December 1992, an in-progress review of the feasibility of extending navigation on the Shreveport to Daingerfield reach was completed. The review was a preliminary assessment of project costs, benefits, and environmental impacts. The review revealed that construction of this reach of the project was not economically feasible. The project was also found to result in significant environmental impacts for which mitigation was not considered to be practicable. The reevaluation studies were terminated as a result of the in-progress review.

3. Various documents are available so that the public can better understand the results of the reevaluation study. The documents are:

- a. In-Progress Review Documentation prepared in December 1992 for headquarters review.
- b. Environmental Summary.
- c. Regional Economic Development.
- d. Public Involvement.
- e. Recreation.
- f. Mussel Survey.
- g. Historic Watercraft Survey.
- h. Geotechnical Investigations.
- i. Geomorphic Investigations.

Copies of all these documents have been placed in the local depositories listed in the Public Involvement documentation. Copies can be obtained from the Vicksburg District for the cost of reproduction.

4. Construction of the Shreveport to Daingerfield reach of the Red River Waterway Project would require extensive work in existing streams and water bodies. Because of concern over the potential impact of this work on existing mussel communities, especially endangered mussel species, a survey of the existing mussel communities was included as part of the study effort. The mussel survey was conducted by the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

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REEVALUATION STUDY IN-PROGRESS REVIEW

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MUSSEL SURVEY

BACKGROUND

1. The Shreveport, LA, to Daingerfield, TX, reach of the Red River Waterway Project begins upstream of Shreveport, LA, with an overland channel to Twelvemile Bayou and continues through Caddo Lake and Cypress Bayou, ending in Lake 0' The Pines near Daingerfield, TX. The project includes three locks and one additional dam connected by a 9- by 200-foot navigation channel.

2. The survey was conducted because of concerns that construction and maintenance of this reach of the Red River Waterway project could have a negative impact on the native freshwater mussel communities.

3. Historically, mussels have long been a resource of cultural, esthetic, and economic value to the area. Ancient Caddo Indian tribes wore jewelry made of shells (Gleason 1981). Caddo Lake was also home to a short-lived but valuable commercial freshwater pearl industry during the years 1909-1912 (Tarpley 1983, Dahmer 1988). The principal pearl-bearing species were Plectomerus dombevanus, Mesaloniaias nervosa, and Tritosonia verrucosa (Shira 1913).

4. Mussels are still an important economic resource in the area. Nearly one-half (48.9 percent) of all Texas mussel licenses from September 1990 through December 1991 were sold to residents in the northeast region of the state, which includes Lake 0' The Pines, Cypress Bayou, and a portion of Caddo Lake. The number of licenses sold has approximately doubled in the last 10 years (Howell 1992).

5. Modern commercial fishermen collect live mussels by diving, brail, rakes, or other methods. These are sorted and sold to a shell buyer, where they are cleaned and packed for shipment to China or Japan. Finally, they are processed into small round beads which can be inserted into marine pearl oysters (Margaritana sp.) to form cultured pearls (Miller and Nelson 1983).

PURPOSE AND SCOPE

6. The project area was surveyed to determine the location and composition of existing mussel communities.

7. From 27 August through 2 September 1992, the proposed project area was surveyed. Data on species composition, substrate type, water temperature, and suspended solids were collected, with particular emphasis on the possible presence of the endangered Louisiana pearlshell mussel, Marsaritifera hembeli.

THE STUDY AREA

8. The Cypress Bayou drainage basin totals 2,812 square miles in Texas (U.S. Geological Survey (USGS) 1968). Lake 0' The Pines occupies 18,700 acres in western Marion County, TX. The Corps of Engineers completed construction of the dam on Cypress Bayou creating the lake in 1958. From the dam, Cypress Bayou meanders through the irregularly rolling hills of the West Gulf Coastal Plain, forming a flat alluvial flood plain bounded by steep terraces. The top stratum consists mainly of silts, sands, loams, and clays of a yellowish to reddish hue (USGS 1966). Cypress Bayou is joined by two of its major tributaries, Black Cypress Bayou and Little Cypress Bayou, approximately 12 miles west of the Texas state line, and continues eastward into Caddo Lake. Caddo Lake occupies approximately 28,600 acres in southeast Marion County, TX, and Caddo Parish, LA. Overflow from the dam at Caddo Lake spills into Twelvemile Bayou and continues southeastward toward the Red River near Shreveport, LA.

9. Oil and timber production form the primary economic base in the area. However, recreational activities such as hunting and fishing are important sources of revenue, especially in the vicinity of Lake 0' The Pines and Caddo Lake (USGS 1968).

10. The Shreveport to Daingerfield Reach of the Red River Waterway Project begins just north of Shreveport, LA, on Twelvemile Bayou and continues along Twelvemile Bayou in a westerly direction through Caddo Lake, Big Cypress Bayou, and Lake 0' The Pines near Daingerfield, TX. More than 32 sites in the project area were surveyed for the presence of mussels (Figure 1, Table 1).

METHODS

11. Two persons with a 14-foot aluminum boat surveyed the study area using Jefferson, TX, as field base of operations. Three factors were involved in choosing sites to be examined. Sand and gravel shoals were targeted as being potentially good mussel habitat, following the model developed by Miller et al. (1987). In several locations, the presence of shell middens on shore indicated a mussel bed in shallow water just offshore. Sites near inflow or outflow streams were also checked for live mussels.

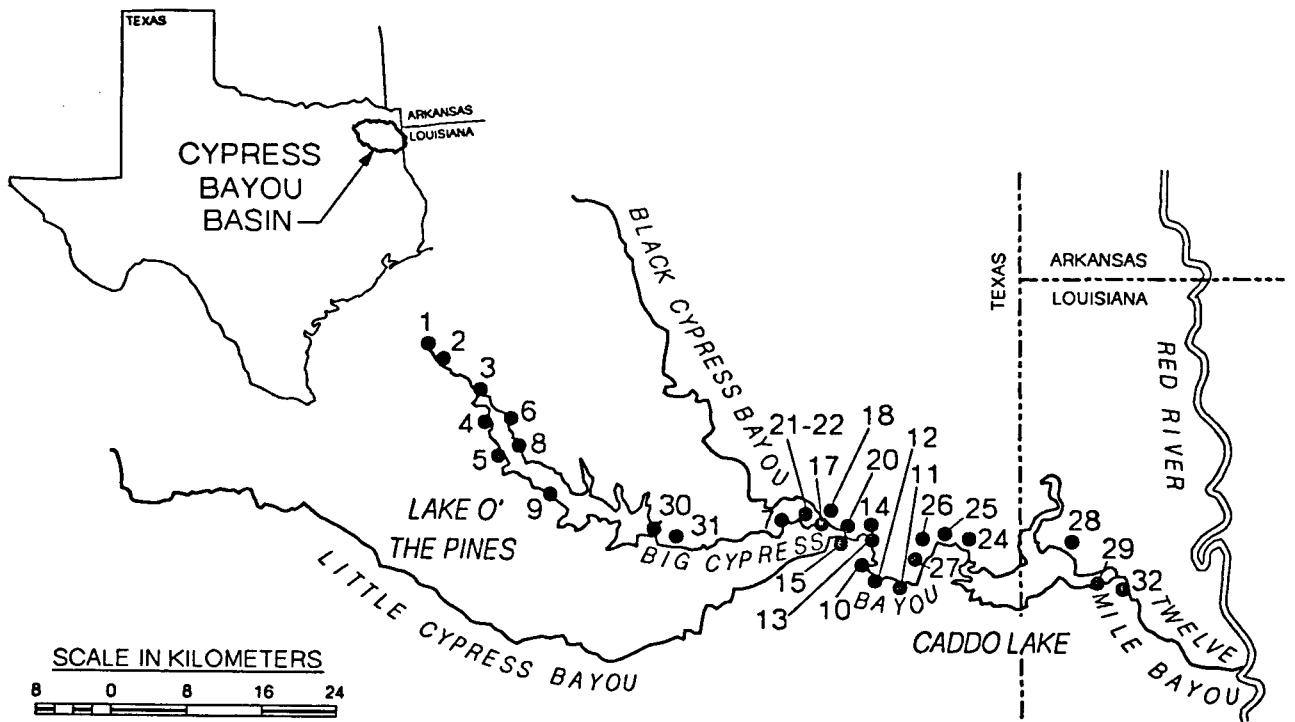


Figure 1. Map of the study area showing mussel collection sites.

TABLE 1
DESCRIPTIONS OF MUSSEL COLLECTION SITES

Site	Description	Substrate
1	Cypress Creek (CC) near Lone Star Steel	Silt
2	Upper Lake O' The Pines (LOP) just below Highway 259 bridge	Silt/clay
3	LOP near access road at the foot of Buzzard Roost Mountain	Sand/silt
4	LOP on peninsula near power station	Sand/silt
5	LOP at Cedar Creek campground	Sand/gravel
6	LOP at Oak Valley boat ramp	Sand/gravel
7	Cypress Bayou (CB) approximately 1 mile upstream from Highway 59 bridge	Sand/gravel
8	LOP at Copeland Creek boat ramp	Sand/gravel
9	LOP at Pop's Landing boat ramp	Sand/gravel
10	CB, left descending bank (LDB) downstream of Jefferson, TX	Sand/silt
11	CB, LDB at Highway 43 bridge	Sand
12	CB, RDB at sandbar, upstream of Site 11	Sand
13	CB, RDB, downstream of Black Cypress Bayou	Sand
14	CB, RDB, at confluence of Black Cypress Bayou and Little Cypress Bayou	Silt/clay
15	CB, LDB, approximately .25 mile upstream of Site 14	Sand
16	CB, LDB, downstream of Black Cypress Bayou	Sand/silt
17	CB, LDB, near Thompson's Landing	Sand
18	CB, LDB, near mouth of Black Cypress Bayou	Sand/silt
19	CB, LDB, upstream of Site 18	Sand
20	CB, LDB, near power line crossing	Sand/silt
21	CB, LDB, upstream of Site 20	Sand/silt
22	CB, RDB, upstream of Site 21	Sand
23	CB, LDB, near railroad trestle	Sand

TABLE 1 (Cont)

Site	Description	Substrate
24	Upper Caddo Lake (CL) at entrance to Clinton ditch, just upstream of Mound Pond	Sand/silt
25	Upper CL, LDB, downstream of Site 24	Sand
26	Upper CL, RDB, at Big Pine Lodge	Sand
27	Upper CL, RDB, just below Highway 43 ramp	Sand/silt
28	CL at Oil City park ramp	Sand/silt
29	CL on upstream side of Highway 1 bridge	Sand/silt
30	CB just below Lake 0' The Pines dam	Sand/gravel
31	CB approximately .50 mile below Site 30	Sand/gravel
32	Twelvemile Bayou at Highway 169 bridge	Sand/silt

METHODS

12. As many areas as possible were checked by wading and snorkeling in shallow water near shore. Very low water conditions at the time of the study made it possible to explore a larger area of shoreline that would otherwise have been covered during high water periods. Those areas in which the mussel density was less than one per square meter were not considered to be mussel beds worthy of detailed study. At these sites only one or two mussel beds were located in 10 to 15 minutes of searching. Areas with mussel densities greater than one per square meter were considered to be mussel beds where more detailed searches would be done. Mussels were collected at each of these sites for 15 to 30 minutes. Several hundred mussels were sorted and identified in the field, then most were returned to the water. Voucher specimens of each species were retained for the reference collection at U.S. Army Engineer Waterways Experiment Station (CEWES), Vicksburg, MS. Identification of voucher specimens was confirmed by comparison with the collection at the Natural Science Museum, Jackson, MS, with the assistance of Mr. Paul Hartfield, U.S. Fish and Wildlife Service, Jackson, MS.

13. Water temperature was measured and recorded at selected sites and water samples were returned to the lab at CEWES for gravimetric analysis of total suspended solids.

RESULTS

14. Twenty-one species of mussels plus the Asian clam, Corbicula fluminea, were identified (Table 2). Plectomerus dombevanus was the most frequently encountered species (18 sites), followed by Corbicula fluminea (17 sites), and Lampsilis teres (15 sites).

15. Mussel communities in the study area were typically small in size, consisting of a few scattered individuals. This is consistent with Shira's report (1913) in which he noted that the mussels of Caddo Lake did not seem to be located in discrete beds, but were randomly scattered throughout the lake. In most medium to large river systems in the central and southeastern United States, highest mussel density and diversity for thick-shelled unionid species occurs on large, stable sand-gravel shoals which are not subject to excessive erosion or sedimentation (Miller, Payne, and Hartfield 1992). Sand and gravel shoals in the Cypress Bayou area were often stabilized by woody debris or aquatic macrophyte growth and could be subject to the effects of erosion and deposition during periods of high water.

16. The unionid fauna of Caddo Lake and Lake 0' The Pines was dominated by thin-shelled species such as Anodonta grandis and Anodonta suborbiculata. These species are typical of lentic habitats with fine-grained substrates (Miller, Payne, and Harfield 1992, Neck 1986). The introduced Asian clam, Corbicula fluminea, is distributed throughout the area and was found in high densities (several hundred/square meter) at sites 6, 8, and 30.

17. The largest and most dense assemblage of mussels was found on Twelvemile Bayou near the Louisiana state Highway 169 bridge. Large numbers of shells were found on the sandbar. From the position and arrangement of the shells, it appeared that they had been exposed and died as water levels dropped. Two species of live mussels, Obliquaria reflexa and Quadrula pustulosa, were found here that were not found at any of the other sites in the study area.

18. Water temperatures at sites where mussels were collected ranged from 24 to 30.5 degrees C. Mean total suspended solids was highly variable among sites and ranged from a low of 5.5 milligrams per liter (mg/l) to a high of 63.0 mg/l. Recently deposited sediments affect mussel populations more than any other single physical factor. Studies have shown that certain mussels are unable to remain viable when covered with 0.6 to 2.5 cm silt (Grantham 1969).

TABLE 2.
 SPECIES OF FRESHWATER MUSSELS COLLECTED AT SITES SURVEYED
 IN THE SHREVEPORT-DAINGERFIELD REACH, RED RIVER WATERWAY
 AUGUST 27-SEPTEMBER 2, 1992
 (Nomenclature used is consistent with Turgeon, et al. 1988)

SPECIES	SITE #															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Amblema plicata</i>							X									
<i>Anodonta grandis</i>		X	X	X	X				X							
<i>Anodonta suborbiculata</i>			X	X	X				X							
<i>Anodonta imbecilis</i>			X													
<i>Corbicula fluminea</i>	X	X	X	X	X	X	X	X	X			X	X			
<i>Fusconaia cerina</i>							X									
<i>Lampsilis hydiana</i>							X									
<i>Lampsilis teres</i>		X								X	X	X			X	
<i>Lampsilis straminea</i>			X	X			X		X	X	X		X	X	X	X
<i>Lampsilis ovata</i>																
<i>Leptodea fragilis</i>				X								X	X			
<i>Ligumia subrostrata</i>		X	X	X			X		X					X		
<i>Megalonaias nervosa</i>							X						X			
<i>Obliquaria reflexa</i>																
<i>Plectomerus dombeyanus</i>							X			X			X	X	X	X
<i>Potamilus purpuratus</i>							X									
<i>Quadrula apiculata</i>							X						X			X
<i>Quadrula pustulosa</i>																
<i>Strophitus undulatus</i>							X									
<i>Toxolasma parva</i>																
<i>Toxolasma texasensis</i>	X	X	X						X							
<i>Villosa lienosa</i>			X										X	X		

SUMMARY

19. A mussel survey of the Shreveport-Daingerfield study area was conducted from 27 August to 2 September 1992. Thirty-two sites were sampled and freshwater bivalves were found at each those sites. However, the Asian clam, *C. fluminea*, was the only species found at four sites (6, 8, 30, 31). The largest and most dense mussel bed was found on Twelvemile Bayou near the Louisiana state Highway 169 bridge.

20. Twenty-one species plus the Asian clam *C. fluminea* were collected and identified. *Plectomerus dombeyanus* was the most frequently encountered species, followed by *Corbicula fluminea* and *Lampsilis teres*. All species have been commonly collected in medium-sized to large rivers in the central and southeastern United States. Most species have been previously reported from the state of Texas (Strecker 1931, Valentine and Stansbery 1971, Neck 1986, Neck 1989). *Margaritifera hembeli*, listed as endangered, was not found at any of the sites investigated during this study.

21. With the exception of site 32 on Twelvemile Bayou, the study area did not support dense and diverse beds of freshwater mussels such as those usually found in gravel shoals in large rivers of the central United States. No evidence of low water quality that could negatively affected freshwater bivalves was observed, although it is likely that commercial shell fishermen have affected the resource in some areas (Howells, personal communication). No uncommon or endangered species were found. Although the fauna is sparse, it can be characterized as healthy, with good species richness.

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