FRESHWATER BIVALVES OF MEDINA LAKE, TEXAS: FACTORS PRODUCING A LOW-DIVERSITY FAUNA

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ABSTRACT.—The freshwater bivalve fauna of Medina Lake, Texas (a reservoir on the Medina River of the San Antonio River drainage), consists of three species of native unionids, one species of native fingernail clam, and the introduced Asiatic clam. The low-diversity fauna is the result of naturally low species diversity in the source-fauna (of the Medina River) adapted to lotic waters, steepness of reservoir bottom, and frequent major fluctuations in water elevation.

Surveys of various reservoirs in Texas (Neck, 1986*b*; unpublished studies) have revealed generally low species diversity but, at times, high population densities of freshwater bivalves. The severe drought of 1983-1984 resulted in drastic drops in water level in a number of these reservoirs. One of the more severely affected reservoirs was Medina Lake. Strecker (1931) gave no records for Medina Lake, and there are no known published records since his work. This survey was undertaken to determine the species present, to characterize the preferred microhabitats of the species and to analyze the factors that have produced the present fauna of Medina Lake. *Key words*: freshwater bivalves; Medina Lake, Texas.

Medina Lake (Fig. 1) is located in the Texas Hill Country on the mainstem of the Medina River in Medina and Bandera counties. The damsite is located 35 kilometers northwest of San Antonio and 14 kilometers north of the Balcones Fault Zone. Impoundment of water began on 7 May 1913 with completion of the dam by the Bexar-Medina-Atascosa Counties Water Improvement District Number 1 (Dowell and Petty, 1971). Spillway crest is at 324.4 meters (1064.2 feet) above mean sea level; at this elevation a total of 313 million cubic meters (254,000 acre feet) covers 2256 hectares (5575 acres). Lower Cretaceous limestones and dolomites of the Glen Rose Formation and limited areas of Pleistocene and Holocene terraces of the Medina River and tributaries are normally covered by reservoir waters.

METHODS

Localities were selected from appropriate quadrangle maps published by the U. S. Geological Survey and were chosen to provide samples from various portions of the reservoir as well as various habitat types. Several localities were chosen on watercourses draining into Medina Lake to determine if these streams function as foci of recolonization following reservoir refill. Bivalves were counted along a two by 200 meter transect. Observations on factors affecting relative abundance of bivalves, both inter- and intrasite, were noted. Conversations with a local resident provided valuable information spanning a longer period of time. A survey of various Texas museums was undertaken to determine which species likely were present in the Medina River within and above the present reservoir limits at the time of impoundment. Limited published records (Strecker, 1931) of the fauna of the Medina River also were consulted. The field survey was performed in August 1984.

Texas Journal of Science 41:319-325 1989

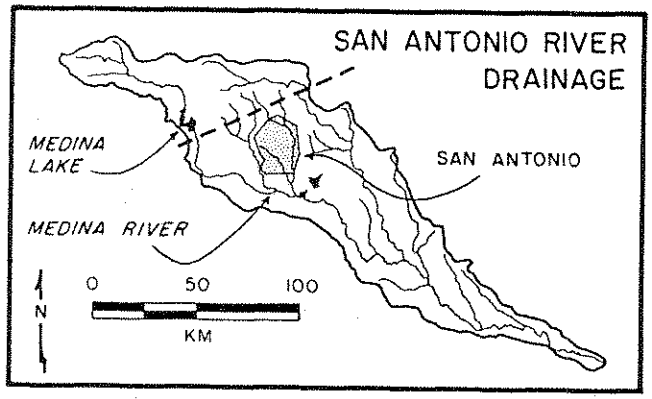

FIGURE 1. Map of San Antonio River drainage, Texas, including Medina Lake.

RESULTS

Faunal Survey

The bivalve fauna of Medina Lake is a low-diversity fauna that is heavily dominated by the nonnative Asiatic clam, *Corbicula fluminea* (Table 1). Native unionid species are rare.

Anodonta imbecilis Say, 1829, is the most abundant and widespread native unionid in Medina Lake. The largest specimen measured 68.5 mm in shell length. In Medina Lake, this species typically is found in mud accumulations on narrow, limestone shelves as well as in deep, firm mud. *Anodonta imbecilis* may be absent from the northern part of the reservoir. The periostracum is pale brown with the posterior rays being slightly darker brown and of only moderate prominence. The greenish blush found in many Texas populations of *A. imbecilis* was not observed in shells from Medina Lake. Nacre is white with only hints of iridescence. This population probably is referable to *horda* Gould, 1855, which may merit recognition as a subspecies.

Cyrtonaias tampicoensis (Lea, 1838) is the largest bivalve found in Medina Lake occurring in deep, firm mud. The largest shell had a length of 129.8 mm. The periostracum of young shells and umbonal portions of older shells are pale brown. Color of periostracum becomes dark brown in older individuals; faint greenish-brown rays are present on the posterior portion of some immature specimens. Nacre varies from white to light purple and salmon; such variation in color may occur in a single shell. This population is referable to *heermanni* Lea, 1861, a variety that is more compressed than most populations of *C. tampicoensis* in Texas. Field and museum specimen surveys indicate that this compressed form is more common in the upstream (piedmont-like) portion of the San Antonio River in the Texas Hill Country than in the downstream portion in the Coastal Plain.

TABLE 1. Results of bivalve transect counts at Medina Lake, Medina and Bandera counties, Texas, in August 1984. Each transect was two by 200 meters.

Locality	*Corbicula fluminea*	*Anodonta imbecillis*	*Cyrtonaias tampicoensis*	*Toxolasma texasensis*	*Sphaerium transversum*	Species totals
Elm Cove	18,475	1	3	0	0	3
Pebble Beach	15,391	5	0	0	0	2
Cedar Point	5,675	1	0	0	0	2
Sawmill Cove	19,229	7	0	0	0	2
Avalon Park	3,255	1	0	0	0	2
Fauries Cove	6,280	18	8	3	0	4
Tschirhart Cove	1,256	2	2	0	0	3
Leibold Camp	1,262	4	2	0	5	4
Wharton's Docks	138	0	0	0	0	1
Upper Reservoir	756	0	0	0	0	1
Alamo Beach	902	0	0	0	0	1
Red Cove	6,318	3	0	0	0	2
12 localities	12	9	4	1	1	—
79,002 individuals	78,937	42	15	3	5	—

Toxolasma texasensis (Lea, 1857) was found at only one locality, but the specimens recovered were larger than most specimens that I have seen from Texas. The largest specimen recovered (presumed female shell) measured 59.7 mm in shell length. The largest presumed male shell measured 56.3 mm in shell length. The periostracum is dark brown whereas the nacre is white with buff highlights. Moderate iridescence is present. The single site (no. 6) was below a normally inundated limestone bluff that would be an area of prime fish microhabitat.The few specimens recovered during this survey compare favorably to shells in the Strecker Museum referred to *mearnsi* Simpson, 1900, by Strecker (1931). However, the extreme variability of *T. texasensis* both between and within geographical areas appears to preclude the acceptance of a subspecific epithet.

Corbicula fluminea (Müller, 1774) is extremely abundant (and the only species found at all collection sites) in Medina Lake but has apparently only recently colonized this reservoir (see below). The largest specimen measured 45.0 mm in shell length. Although some variation in nacre and periostracum color was noted, all examined shells are referable to the "white form" (Hillis and Patton, 1982). Preferred microhabitat is a coarse-grained substrate of limestone and shell fragments with some clay overlying limestone bedrock in relatively shallow water. In general, *C. fluminea* was found in higher energy microhabitats than native unionids. Deep mud substrates supported populations of low density when compared to rocky substrates. The observed microhabitat occurrences are similar to those previously observed for Texas populations of *C. fluminea* (Neck, 1986*a*). *Corbicula fluminea* has not been reported from Medina Lake previously, although Britton (1982) recorded specimens taken from downstream parts of the Medina River in 1979.

Sphaerium transversum (Say, 1829) was represented in Medina Lake at a single site (no. 8). All shells were found *in situ* in a sand deposit in the protected area immediately downstream of an old trunk base of a bald cypress. Shells of *C. fluminea* also were present in this same deposit. Absence of *S. transversum* at other reservoir localities indicates that limestone and mud substrates under several meters of water in Medina Lake are not suitable for this fingernail clam.

Local Informant

Milton Leibold, a septuagenarian, has lived next to the present location of Medina Lake for his entire life. He was quite familiar with the bivalves of this reservoir and referred to the "soft mussel" (*A. imbecilis*) and the "hard mussel" (*C. tampicoensis*). He was not familiar with *T. texasensis* as being different from *C. tampicoensis*. The "small mussel" (*C. fluminea*) had only been seen in the last "four or five years" (questioned in 1984).

Leibold recounted that *A. imbecilis* made an excellent bait for trot lines. He had eaten both *A. imbecilis* and *C. tampicoensis* but wasn't particularly impressed with their taste. In 1983, he had caught channel catfish, *Ictalurus punctatus*, the entrails of which "were so full of the 'small mussel' [*C. fluminea*] that they rattled." He felt that *C. fluminea* was less abundant at the time of this survey (1984) as recently collected catfish did not have nearly as many shells in them.

Especially *A. imbecilis*, but also *C. tampicoensis*, were more common in previous years than presently. This decline "may have" been contemporaneous with the appearance and population explosion of *C. fluminea*. During approximately the same time period the fish fauna also had changed from domination by white bass (*Roccus chrysops*) to domination by large-mouth bass (*Micropterus salmoides*).

Museum Collections and Published Records

As part of a general survey of unionids in Texas, a survey of museum collections is being conducted. This survey has revealed a number of lots containing unionids from the Medina River but none from Medina Lake (except those in the Strecker Museum). Museum collections of Texas Christian University (TCU), The University of Texas at El Paso (UTEP), and Trinity University (TU) were examined. Occurrence of species records in these collections and the only known applicable published records (Strecker, 1931) are presented in Table 2. Specimens that were the basis of the Strecker (1931) records are present in the collection of the Strecker Museum, Baylor University.

Discussion

The most noticeable characteristic of the bivalve fauna of Medina Lake is the low species diversity. This low-diversity fauna is the result of several factors.

Table 2. Literature and museum records of unionids from San Antonio River (other than Medina River), Medina River, and Medina Lake.

Species	Water body		
	San Antonio River	Medina River	Medina Lake
Anodonta grandis	1, 2, 4*		
Anodonta imbecillis	1, 4	1	X
Amblema plicata	1, 2, 4	1, 2, 3	
Megalonaias nervosa	2, 4		
Quadrula quadrula apiculata	2, 3, 4	2, 3	
Quadrula aurea	1, 2, 4	1, 3	
Tritogonia verrucosa	1, 4	2, 3	
Cyrtonaias tampicoensis	1, 2, 4	1, 3	X
Lampisilis bracteata		4	
Lampsilis radiata hydiana	2, 4	3	
Lampsilis teres	1, 2, 4	1	
Toxolasma texasensis	1, 2, 4	1	X
Species totals	11	10	3

*Numbers refer to sources as follows: 1) Strecker, 1931; 2) collection at TCU; 3) collection at UTEP; 4) collection at TU.
X = records established in this study.

A small number of unionid species (10) is native to the entire Medina River drainage (Table 2). Four of the 10 (*Lampsilis teres, Tritogonia verrucosa, Quadrula guadrula apiculata, Lampsilis radiata hydiana*) require soft substrate that may not have been present in the portion of the Medina River now covered by Medina Lake. A fifth species (*Amblema plicata*) may have occurred in deeper pools of this portion of the river. Two species (*Quadrula aurea* and *Lampsilis bracteata*) are characteristic of clear, fast-running waters of the Texas Hill Country and would not be expected to survive in the lentic waters of Medina Lake. The three remaining species are presently found in Medina Lake. Several of the above species (*L. teres, L. r. hydiana Q. q. apiculata,* and *A. plicata*) are able to survive in some Texas reservoirs (Neck, 1986*b*; unpublished data). Reasons for their absence in Medina Lake are discussed in the following paragraphs.

Most of the bottom of Medina Lake consists of moderate and steep limestone slopes of the Glen Rose Formation. Most of the bivalve species native to the Medina River were unable to adapt to such habitats once they were inundated. As noted above, *Anodonta imbecilis* is able to survive in mud-limestone detritus accumulations on shelves of limestone. These accumulations are generally less than five centimeters in depth; no large unionids would be able to burrow and maintain proper orientation in such a microhabitat. Deeper, nonindurated substrates are restricted to flooded broad creek valleys. In these cove areas, *C. tampicoensis* and *T.*

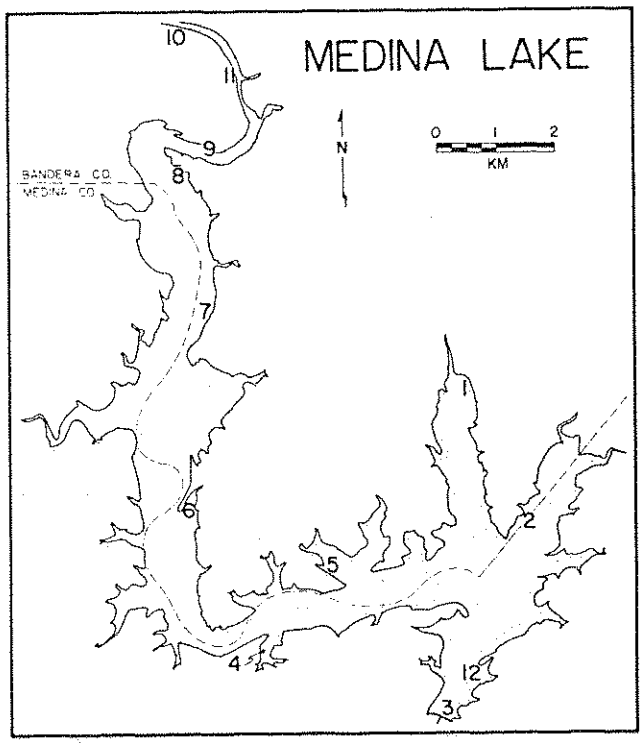

FIGURE 2. Map of Medina Lake, Texas, with collection sites indicated. Numbers are keyed to Appendix.

texasensis are able to survive; even *A. imbecilis* and *C. fluminea* have denser populations in these mud substrate areas than on limestone slopes.

An additional and probably more significant factor is the periodic occurrence of drastic drawdowns (Reeves et al., 1984), which expose vast amounts of reservoir bottom and cause death of numerous bivalves by thermal stress, desiccation and predation. The major causal factor for drawdowns is downstream demand for irrigation of truck crops. Droughts are frequent and further increase the normally high evaporation rates. Another important factor results from the location of Medina Lake in the recharge zone of the Edwards Aquifer (Garza, 1962), which is utilized for agricultural, industrial, and municipal needs of more than one million people in central Texas. Significant amounts of reservoir water enter the aquifer system. Such dynamic changes in water levels do not allow the bivalve fauna to reach an equilibrium of species diversity (White and White, 1977).

Habitat changes affect freshwater mussels both directly on the individual animals themselves and indirectly upon the freshwater fish

fauna of the area. Freshwater fish act as a temporary host to the parasitic glochidium stage. No records of fish hosts are known for Texas freshwater mussels. Unpublished fishery surveys in the files of the Texas Parks and Wildlife Department reveal that Medina Lake still supports a diverse freshwater fish fauna, although the relative abundance of species undoubtedly has changed during the period of inundation. The effects of a change in a fish fauna as a factor in change in a related freshwater mussel fauna is unknown.

ACKNOWLEDGMENTS

I thank T. B. Samsel, Jr., who allowed access to portions of Medina Lake, provided lodging, and suggested collection sites. Milton Leibold gave freely of his observations of the bivalves of the lake. Joseph C. Britton, Artie L. Metcalf, Harold D. Murray, and Calvin Smith allowed access to museum collections. Christopher B. Beckcom drafted the maps. Harold D. Murray also reviewed a previous version of this manuscript.

APPENDIX

Collection sites are as follows (keyed to Fig. 2): 1) Samsel residence, Elm Cove; 2) Pebble Beach Park, Haby's Cove; 3) Cedar Point landing; 4) Sawmill Cove; 5) Avalon Park; 6) Fauries Cove; 7) Tschirhart Camp; 8) Leibold Camp; 9) Wharton's Docks; 10) Upper Reservoir; 11) Alamo Beach; and 12) Red Cove.

LITERATURE CITED

Britton, J. C. 1982. Biogeography and ecology of the Asiatic clam, *Corbicula*, in Texas. Pp. 21-31, *in* Proceedings of the Symposium on Recent Benthological Investigations in Texas and Adjacent States (J. R. Davis, ed.), Texas Acad. Sci., Austin, 278 pp.

Dowell, C. L., and R. G. Petty. 1971. Dams and reservoirs in Texas, Part III. Texas Water Development Board Rept., 126:1-687.

Garza, S. 1962. Recharge, discharge, and changes in ground-water storage in the Edwards and associated limestones, San Antonio area, Texas. A progress report on studies, 1955-59. Texas Board Water Engin. Bull., 6201:1-42.

Hillis, D. M. and J. O. Patton. 1982. Morphological and electrophoretic evidence for two species of *Corbicula* (Bivalvia: Corbiculidae) in North America. Amer. Midland Nat., 104:74-80.

Neck, R. W. 1986*a*. *Corbicula* in public recreation waters of Texas: Habitat spectrum and clam-human interactions. Amer. Malacol. Bull., Spec. Ed., 2:179-184.

——. 1986*b*. Freshwater bivalves of Lake Tawakoni, Sabine River, Texas. Texas J. Sci., 38:241-249.

Reeves, R. D., R. W. Maclay, and G. B. Ozuna. 1984. Compilation of hydrologic data for the Edwards Aquifer, San Antonio area, Texas, 1981, with 1934-81 summary. Edwards Underground Water District Bull., 41:1-135.

Strecker, J. K. 1931. The distribution of the naiades or pearly fresh-water mussels of Texas. Baylor Univ. Mus. Spec. Bull., 2:1-71.

White, D. S., and S. J. White. 1977. Observations on the pelecypod fauna of Lake Texoma, Texas and Oklahoma, after more than 30 years impoundment. Southwestern Nat., 22:235-254.