due to those same factors, there is a relatively intact fish fauna typical of a healthy headwater system in the Tennessee River valley of north Alabama. In fact, one of the recognized fish hosts for the Cumberland Moccasinshell, the Redline Darter, was the most commonly encountered of the 24 fish species collected during the fish IBI, and represented 24% of the catch. However, habitat quality of Lookout Creek greatly degrades downstream of Rising Fawn, Georgia, and mussels occur sporadically in the creek.

Appreciation is extended to the family of Paul Ray for permitting access to the stream on their property and for assistance with field sampling, and to Tom Shepard, Brett Smith, and Cal Johnson of GSA and Andrew Gascho Landis, Deb Weiler, and Ani Popp of Georgia DNR for field assistance.

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First Record of a Live Sandbank Pocketbook, *Lampsilis satura*, from the Trinity River near Dallas, Texas.

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We have recorded an impressive diversity and abundance of Unionids during recent surveys in the Trinity River near Dallas, Texas (McDermid et al. 2013), including new records for the state-listed (threatened) sandbank pocketbook, *Lampsilis satura.* Until recently, the sandbank pocketbook in the Trinity River was represented from only one record of a single long dead individual that was collected from Lake Lewisville during surveys conducted in 1977 - 1978 (Neck 1990). Neck (1990) proposed that an earlier record of a plain pocketbook (*Lampsilis cardium;* Read 1954) may also represent this species; however Howells et al. (1997; as cited in Randlkev 2011) reported that the sandbank pocketbook only occurred in rivers east of the Trinity basin, and has questioned the identifications made in these earlier records (Howells 2000, 2002).

We collected a single live sandbank pocketbook during SCUBA-based surveys in the Elm Fork of the Trinity River near I-35 in Dallas on 13 August 2013. This individual was collected approximately 22.5 river k downstream of two long dead valves that were collected during surveys in 2012 (Zara Environmental, LLC [Zara] 2012), and approximately 59.5 river k downstream of the Lake Lewisville collection site reported in Neck (1990) (Figure 1).

Figure 1. Sandbank pocketbook (*Lampsilis satura*) collected live from the Trinity (top left) and Sabine Rivers (bottom left). The Trinity specimen was collected from a site in downtown Dallas, Texas near I-35 (right). Previous collections of dead individuals, were made farther north in this system (Neck 1990 and Zara 2012).

The specimen was slightly deformed and so not identical in external morphology to previously described specimens (Howells et al. 1996). We used internal morphological characteristics to make the specific identification, which was confirmed by the second author (Dr. Neil Ford), in consultation with Dr. Charles Randklev. The specimen exhibited the sigmoid shaped hinge margin typical of sandbank pocketbooks, but it was a male and so did not have the diagnostic truncated posterior. This small individual (length 73.4 mm, height 56.3 mm, width 45.8 mm) differed from a specimen of the same length from the Neches River (in the invertebrate collection of The University of Texas at Tyler) by being much thicker shelled and more inflated. This may suggest early maturity or slower growth in the Trinity River for this species. Soft tissues were pale tan. The Trinity River specimen resides in the invertebrate collection at the University of Texas at Tyler (accession number UTT 191).

The live individual was collected from mixed sand and silt substrate during a dive with a maximum depth of two m, and the dead individuals reported in Zara (2012) were collected during dives reaching maximum depths of 4.27 m with gravel and silt substrates. Howells et al. (1996) indicates that this species is found on gravel, gravel-sand, and sandy substrates in rivers with moderate to swift flows, while Isely (1924) collected specimens from Oklahoma in slow moving currents out of the main river channel, in areas with mud and/or sand-gravel bottoms. The characteristics of our collection sites are in loose concurrence with both of these descriptions, and indicate that sandbank pocketbooks in the Trinity probably occur on substrates that are somewhat intermediate between the two previously described.

These surveys on the Elm Fork and main stem of the Trinity River have taken place as part of the Texas Department of Transportation (TxDOT) work to upgrade several bridges over the Trinity River in and around the Dallas – Ft. Worth metroplex, including California Crossing, IH-30, and IH-35. TxDOT conducts surveys for rare and state-listed freshwater mussels in waterways that could be impacted by infrastructure upgrade projects as a routine part of its environmental stewardship. Until recently these waterways were not considered potential habitat based on a lack of species records in the area, poor water quality, functional impoundment, channelization, high levels of impervious cover, and other anthropogenic changes. This new record demonstrates the continued need to monitor for rare species even after substantial habitat alteration.

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Identification of Freshwater Mussels: the Dangers of Minimalism

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Those of us who have been in the unionid identification business for more than a few years readily recognize how challenging species determination can be (note scientific understatement). Efforts by the founding fathers of the field through more recent work in the 1960s, 70s, and 80s were often plagued by errors resulting from poor appreciation of intraspecific variation, limited numbers of specimens available for examination, imperfect understanding of historic ranges, and lack of biochemical genetic confirmation of identity and relationships. More recently, increased field work, greater specimen availability, comparative morphological studies, and electrophoretic and DNA analyses has helped better define species and their distributions. Nonetheless, unionid identification remains complicated. This is particularly true in regions of the country like Texas where numerous isolated drainage basins with dramatically varied ecological conditions produce a large number of ecophenotypes. Even though historic distributions in Texas waters are relatively well defined, identification difficulties remain.

Taxonomic keys can be useful in areas with limited numbers of mussel species in a single drainage, but in regions with many species, drainages, and environments, classic taxonomic keys become either complex and cumbersome or risk being potentially more harmful and misleading than helpful. Internet availability of instant information in the modern digital-data age further proves to be a double edged sword. On one hand, identification descriptions and images can be quickly accessed, but simultaneously some such information is incomplete, badly flawed, or simply wrong. However, individuals entering the freshwater mussel field often request short taxonomic keys or quick digital identifications over laboring over lengthy books and journals. Sadly, as more information on unionids has become available in recent years, so also has inaccurate identifications and misinformation. Following are cautionary examples of some identification problems that have been noted locally in Texas.

Identification errors can sometimes reflect the geographic work or training areas of biologists themselves. Individuals coming to Texas from states east of the Mississippi River often default to species names with which they were familiar in their home waters. Local *Fusconaia askewi* and *Lampsilis hydiana* from Texas have been inaccurately identified as *F. cerina* and *L. straminea*, respectively, though neither occurs west of the Mississippi. In other cases, biologists from the East Coast may report repeatedly finding *Elliptio* species in Texas, though none are native or established here. Others whose experience has focused on morphologically distinct *Quadrula apiculata* and *Q. houstonensis* in Central Texas have been confused by similarities in *Q. apiculata* and *Q. mortoni* forms in the San Jacinto Basin of southeastern Texas.

Atypical ecophenotypes in Texas are often particularly problematic. *Amblema plicata* is common in much of the U.S. and usually easily recognized by its bold, diagonal ridge sculpturing. However, some juveniles and adults in Texas (and elsewhere) may completely lack any suggestion of external shell sculpturing (Figure 1). Unsculptured specimens from the upper Trinity River drainage have been confused with *Quadrula mortoni* and those from the central Colorado River with *Q. houstonensis.* Although both *A. plicata* and *Q. mortoni* have stable populations in Texas, *Q. houstonensis* is state listed as legally threatened and is being considered for listing by U.S. Fish and Wildlife. Reliance on sources that key only on external ridges or pustules or images that only show these traits without addressing other unsculptured forms could result in inaccurate identifications and legal violations.

A similar case of mistaken identity arose with *Cyrtonaias tampicoensis* when biologists from central and eastern Texas collected this species in southern Texas without recognizing ecophenotypic differences. Populations in the Brazos and Colorado rivers often have moderately heavy shells and boldly colored nacre (most often dark purple) (Figure 2). Short descriptions and keys usually focus on these traits. However, in the Nueces-Frio Drainage of southern Texas, *C. tampicoensis* usually has thinner shells with nacre that is either white or pale pastel. Subsequently, when the visiting biologists collected the local Nueces River form, they suspected it could be *Leptodea fragilis* that also has a thinner shell with white nacre. Here too, ranges of both species are well established in Texas and *L. fragilis* populations are known to be restricted to areas in the Colorado River Drainage and other waters well to the north and east. Knowledge of distribution alone could help contribute to accurate identification, but recognition of different ecophenotypes is paramount.

On several occasions over the years State-threatened *Lampsilis satura* has been reported from areas where confirmed specimens are largely lacking (Figure 3). Demonstration of such populations would be ecologically and legally important. However, subsequent reexamination of some records showed specimens to actually be *Potamilus purpuratus*, a common and widely-distributed mussel in the state. The initial misidentification appears to have focused on their being inflated unionids with dark periostracums, but failed to note significant differences in beak size, beak sculpture, nacre color, hinge tooth morphology, or other traits.

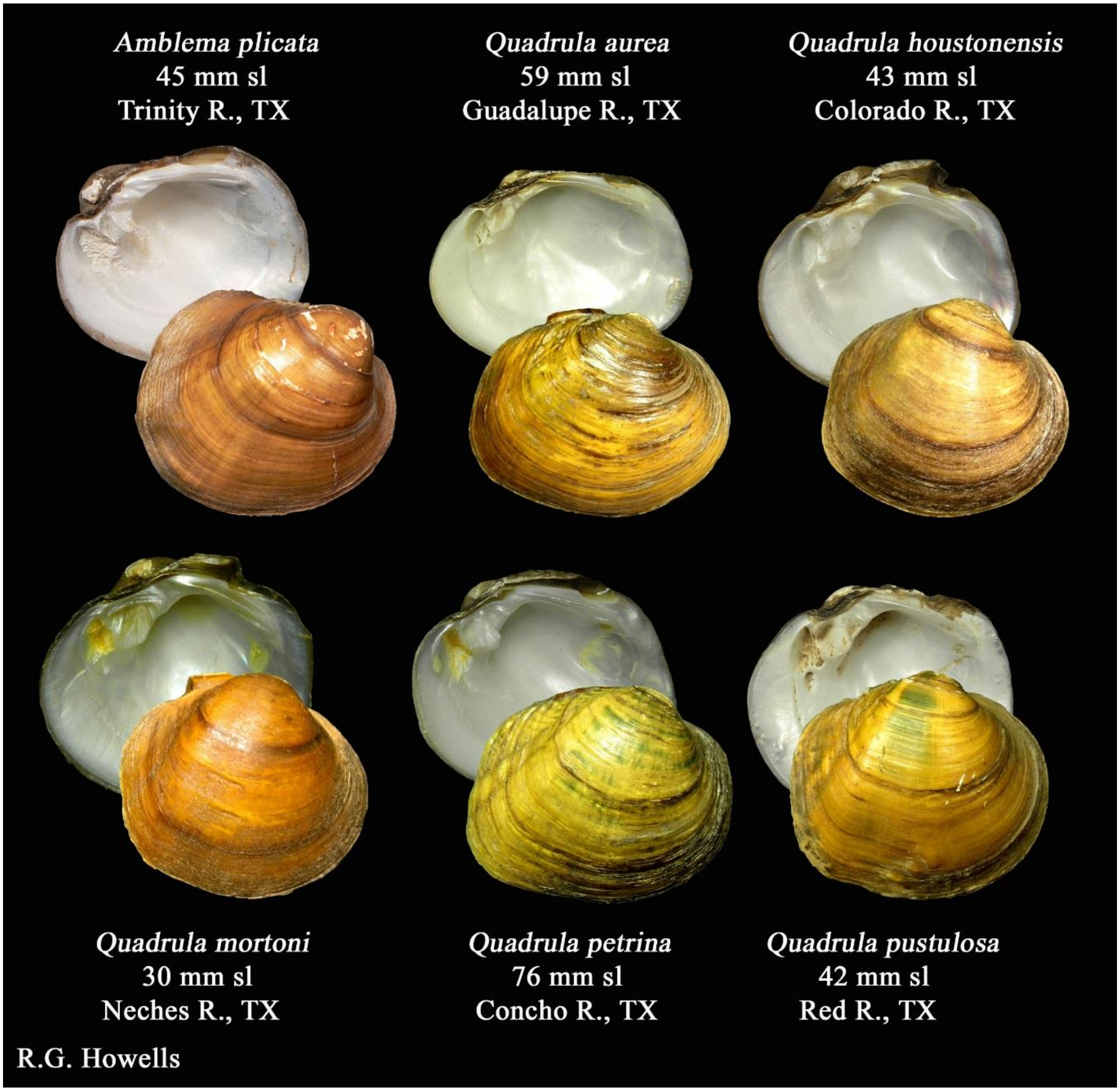

Figure 1. Threeridge (*Amblema plicata*) and Pimpleback species (*Quadrula* spp.) from Texas. Non-sculptured forms of Threeridge can be confused with apustulose Pimpleback taxa when morphological variation in different ecophenotypes is not recognized. Here, the dorsal margin of Threeridge angles upward posterior to the beak and the major axis of the right pseudocardinal tooth angles to the posterio-ventral margin (when the lateral tooth is horizontal). Dorsal margins in Pimpleback species angle downward and the right pseudocardinal tooth angles to the ventral margin anterior of the mid-point (and often directly downward).

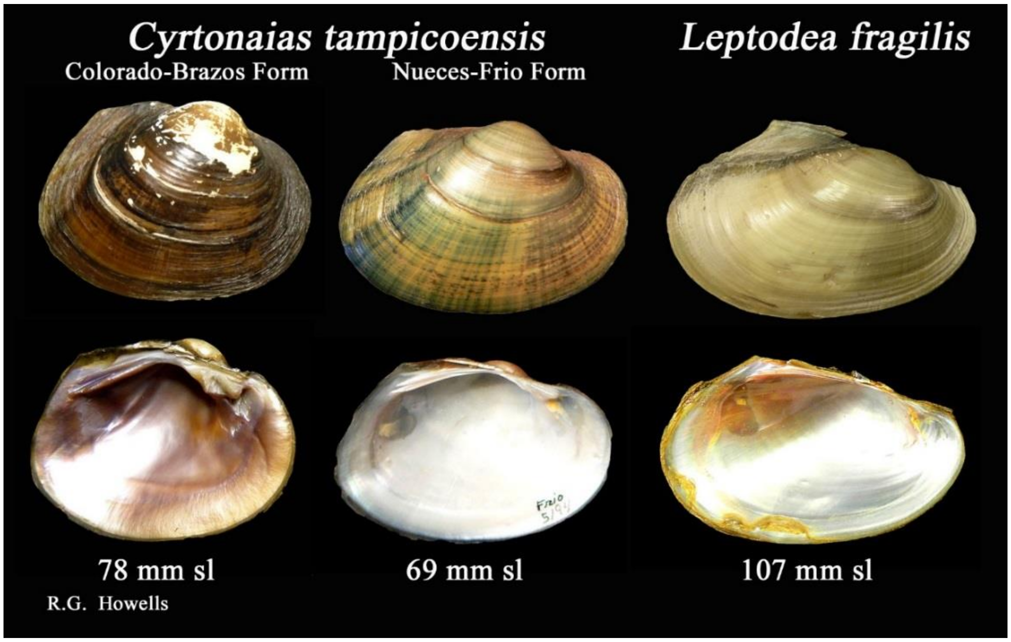

Figure 2. Typical Tampico Pearlymussel (*Cyrtonaias tampicoensis*) shells from Central Texas are often moderately thick with dark purple nacre, but forms from the Nueces-Frio drainage in southern Texas frequently have thinner shells that are more elongate and generally have white or pastel nacre. This South Texas morph has been confused with Fragile Papershell (*Leptodea fragilis*) that occurs only in waters to the north and east.

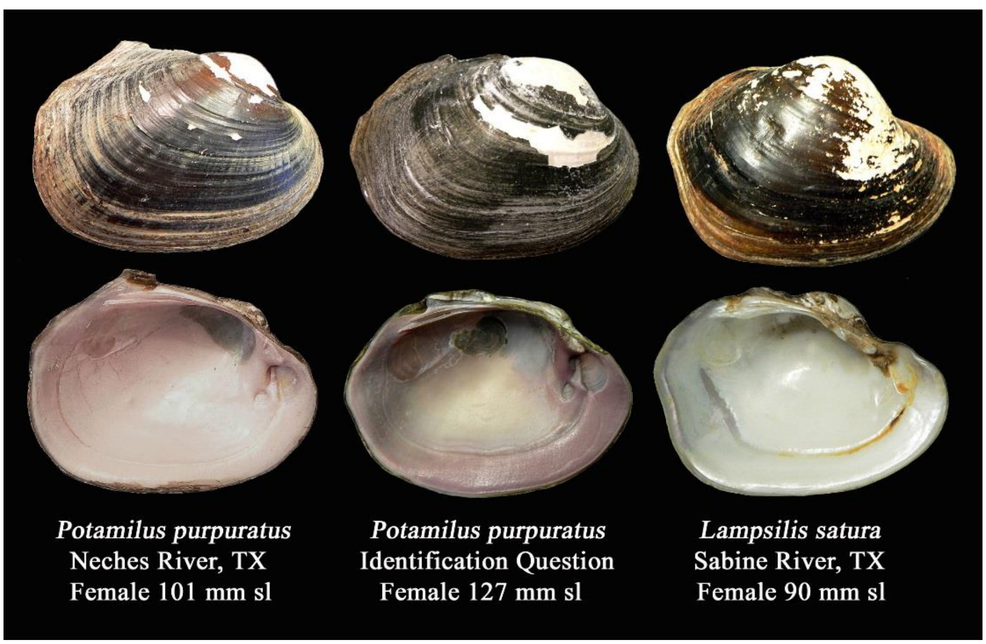

Figure 3. Bleufer (*Potamilus purpuratus*) and Sandbank Pocketbook (*Lampsilis satura*) from eastern Texas waters may both have inflated shells with dark periostracum coloration, but numerous other traits should easily distinguish these two unrelated mussels.

Although requests for short, to-the-point keys and photographic guides continue, accurate mussel identification is likely to remain a complex, multi-dimensional problem…especially in areas like Texas where there are multiple drainages, ecophenotypes, and species. Some recommended points to incorporate into identification efforts include:

1) Examine multiple specimens where possible to develop an appreciation for differences in age, sex, and the full range of morphological variation.
2) Avoid relying only on external shell features alone. Internal shell morphology may be necessary to confirm identification (some species cannot be distinguished based only on external morphology). When living specimens of rare taxa cannot be sacrificed, associated dead-shell material may provide clues to the shell interior.
3) Examine soft tissues for clues to identity. Even in living specimens, tissue color or number of gravid gills can be observed without sacrificing the animal.
4) Accept that in some cases, biochemical genetic analysis may be necessary to confirm identity. Morphological variation within some species may be greater than differences between two similar species. In some cases, conchological features are simply insufficient.
5) Recognize that many museum specimens and those in dated books and reports often include misidentifications. Check collection and publication dates and compare these to current references. Recognize that the Internet is awash with misinformation.
6) Consider distributional information. In an increasing number of states like Texas, historical distributions have become well defined. Many identification errors reflect reports from waters where a given species would not be expected.
7) Be very cautions of information sources that are too simplistic.
8) Be aware that there are no keys in Freshwater Mussels of Texas (Howells et al. 1996) and documents and articles claiming otherwise are false.

Freshwater mussel identification is often complex and frequently relies on employing a suite of traits to determine species. Depending on only a few features or a single trait can produce inaccurate conclusions.

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A First Record of the Common Bladder Snail *Physa fontinalis* from Israel

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The development of the aquatic fauna of Agamon HaHula, a reinstated wetland in the former drained Hula swamps, Upper Galilee, Israel, is being monitored for over 20 years by my colleague Dr. Chanan Dimentman of the Hebrew University of Jerusalem. The fieldwork supporting this project is carried out either by himself or by local collaborators. All the molluscs among the material are submitted for identification to the author and permanently stored in the Mollusc Collection of the National Natural History Collections at the Hebrew University of Jerusalem.

A sample collected by I. Barnea on 29 April 2012 in the Ma'agan of Agamon HaHula contained to my surprise a specimen of the Common bladder snail *Physa fontinalis* (Linnaeus, 1758) (HUJ 53841). This common European species has never been reported before from Israel. It differs from the invasive North-American species *Haitia acuta* (Draparnaud, 1805), an extremely common species in Israel, by its blunt apex and much lower spire.