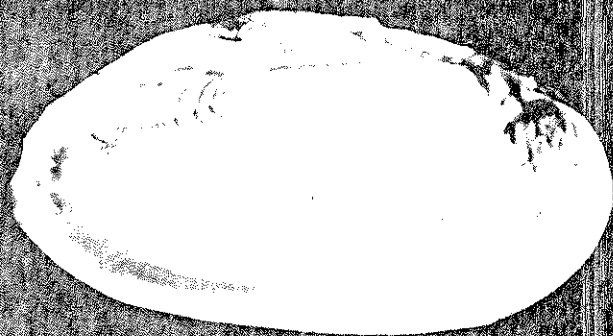
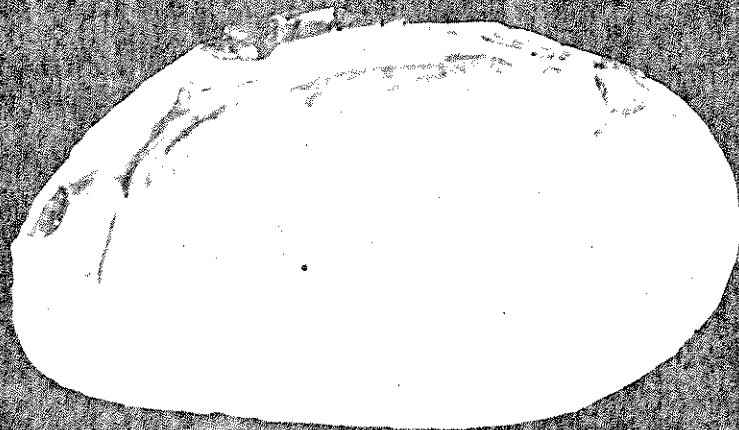


Everything You Always Wanted to Know About Freshwater Mussels



But Were Afraid to Ask

Stalking
the freshwater mussel
takes a young scientist
to Kentucky clamming camps
and down nostalgic
footpaths
of American history.

By Sam Fuller

Shells like these
help preserve the privacy
of *Elliptio complanata*.

The car crawled in low gear up a dirt road in the east Kentucky foothills which line the middle Green River valley. Among the corroded autos and maples, the Brown place was conspicuous for a half-ton pickup overflowing with drying clam shells. Old Brown ran the clambers' camp by the river below, where itinerant men gather and live in shacks and bus bodies near the slack water. They come from far and wide—Tennessee, Arkansas, Iowa—to fish the freshwater mussels wherever these animals have not been destroyed by damming, over-farming, strip-mining wastes, or heated waters from power plants.

I picked my way across Old Brown's yard, knocked, and tripped flat on my face into his kitchen. He helped me to the table, offered a scalding cup of coffee, and asked my business. I hate coffee and demurred as graciously as I could. Old Brown amiably pointed out that "Folks in these parts be insulted if a man don't drink another man's coffee if it be offered. 'Course, if it don't be offered, you don't be welcome." Making the necessary adjustment in my manners, I drank several-cups of coffee. I *detest* coffee. Old Brown said I could go out on a musseling rig in the morning—"with Dewey, that owes me a favor"—and so we parted. I managed not to fall out of the kitchen into the yard.

musseling with Dewey

I returned in the chill autumn morning to where the mussel boats are drawn up on rock ledges at the base of the Rochester falls. The heavy, flat-bottomed boats could be made out through a haze misting off the water and across the rising sun. Each was equipped with a motor-driven winch, with which the heavy mussel "brail" is hauled up after it has dragged across the bottom for awhile. A brail is a heavy bar of wood or metal about the length of the boat—in this case, some 15 to 20 feet. Along the bar are strung four-pronged hooks at the ends of short chains. The entire contraption is thrown overboard on heavy ropes secured to either end of the brail. The fisherman controls the set of the brail by tugging on the ropes.

I met Dewey—a lanky, laconic farmer—and we pushed off to float broadside downriver. A heavy, weighted canvas—called the "mule"—is nailed suspended from the upstream side of the boat; it acts as a giant rudder. In the straight stretch of several

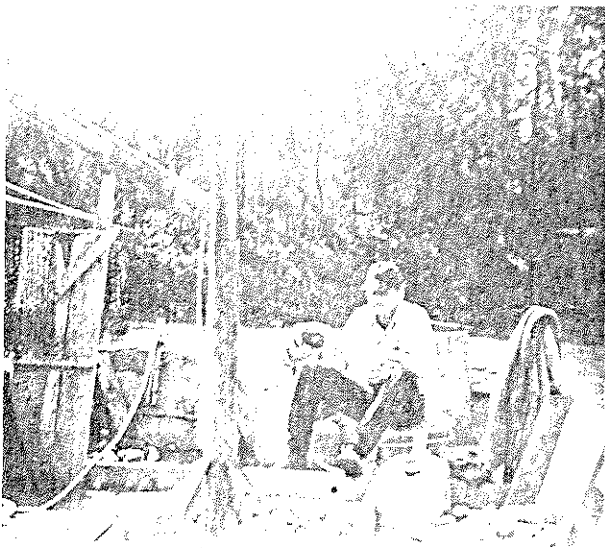
miles we traveled, the mule kept us going dead center downstream.

The inertia of the vessel is enormous: the bottom and sides are oaken inches thick. The great weight, driven by the current, is sufficient to draw a brail evenly across the bottom and through most snags. We did snag once and brought up most of an entire tree with the winch. Dewey rushed about in the azure air of his annoyance.

Slightly agape and feeding, the mussels live buried in the substrate. This late in the year they were still "biting"—immediately shutting their valves when a hook slips between. Some mussels grow to almost a foot in length and several pounds in weight. Their grip on the hooks is such that they are jerked easily from their homes by the weight of the boat,—whereas a grown man can pull them out by hand only with an effort.

Then Dewey pulled up the brail. The brail swayed as we took the spangled, dripping mussels from the chains; they thudded into the sides of the boat. Dewey, the professional, broke them from their grips with a snap which often damaged the shells. I persuaded him to tug them loose because I wanted them perfect. This takes longer: I used perhaps a 20-pound pull to disengage some of the great "Washboards"—largest and heaviest of North American mussels.

Dewey is an expert on where the mussels are "biting" and on how to get them out of the riverbed and into the boat.



survival in the substrate

The mussel is much like a plant in its pacific struggle for survival. As an adult, it has limited mobility. Bulky and heavy, it uses its muscular, hatchet-shaped foot to plow slowly about in the bottom of lake or stream. Related to more familiar bivalve mollusks like the edible marine mussels and steamer clams, it has a heavy, hinged shell—secreted by the softer tissues—to guard against attacks from predatory enemies: fish, raccoons, muskrats, and man. Like plants, again, mussels have a virtually inexhaustible food supply of micro-organisms and decaying organic matter borne on currents of water.

Thus locomotion, mechanical protection, and nourishment are not of primary concern to these sedentary creatures—but they could experience a severe housing shortage—and, perhaps, a food shortage—had they not developed a curious way to guarantee that not all of their progeny wind up living with the parents.

hitchhiking larvae

The male mussel sheds sperm into the water. These are inhaled by the female and fertilize the eggs, which develop within pouches in her gills. Eventually the larval mussels (or "glochidia") are expelled from the mother. Most glochidia form cysts on the fins or gills of passing fishes, where they are transported far and wide according to the movements of their hosts. It is to the advantage of any species to populate new areas against the day when it may be unable to survive in its original home. The mussel continues to probe its environs for other (and perhaps better) habitats just as many plants have developed seeds which are borne to new ground on animals and winds.

When the glochidium is released to "seek" a fish host, it cannot swim in search. It lies on the bottom, rapidly snapping its embryonic shell to increase the chance of securing a foothold on a by-passing fish. Some glochidia are hooked or spined to facilitate this capture. Others are released in packets, sometimes highly colored, which are attractive to fish; nosing or devouring them, the host is inadvertently infected. Most mussels have become so greatly specialized

The thick shell of *Quadrula cylindrica* is good for making buttons. The species was described in 1816 by Thomas Say from a shell which is still preserved at the Academy.

Unscholarly wrangling marred the early decades of the Academy's history as naturalists quarreled over credit for the original description of this or that species of mussel.

that the larvae have lost the ability to develop *without* a few weeks' parasitism on a host.

when man disrupts

Dependence upon fish as a solution to the problems of dispersal and overcrowding is a potential weakness in the mussel life cycle—if hosts are not available, glochidia die within a few hours after leaving the female. Man unwittingly forces the mussel into an evolutionary *cul de sac* when he disrupts the ways of life of fishes.

Mussels are vulnerable to interruptions in their reproductive cycle. If damming a river or changing the temperature of its water restricts the range of a host, the mussels which depend upon this fish will be extinguished in the affected area. Silt and fine gravels from road building and poor agricultural practices create a soft bottom in a river or lake: heavier glochidia and adults are buried and asphyxiated in the mud.

the name game

A colorful thing about mussels is their names, both vernacular and scientific. The Washboard—large, broad, and strongly ridged—is *Megalonais gigantea* (Barnes 1823), redundantly christened in Latin as both giant and large. The capitalized *Megalonais* is the name of the genus to which the species *gigantea* belongs, and it was in 1823 when the first description of this animal was published by Daniel Henry Barnes. It is customary to write Barnes' name in parentheses in order to show that he had originally placed his species in another genus. This was the

sprawling group called *Unio* (the Latin for "little pearl"), in which early authorities classified almost every species of mussel.

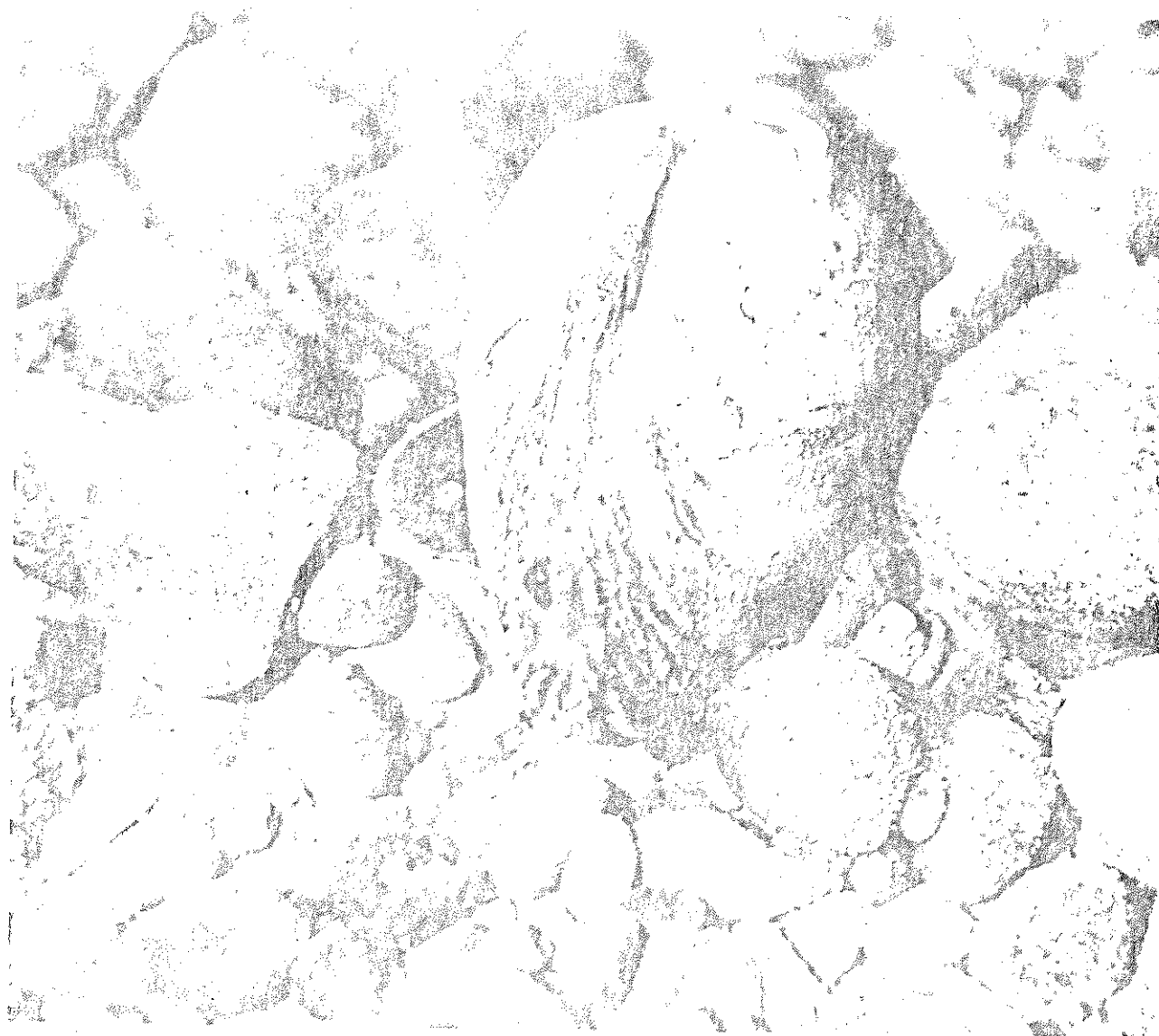
Obliquaria reflexa is the "Three-horned Warty-back" because of the three large knobs on each valve of its occasionally bumpy shell. Constantine Samuel Rafinesque-Schmaltz described this genus and species in 1820. An erratic and brilliant man, Rafinesque was the first to understand that *Unio* contains many more or less unrelated groups of species. He provided the generic name *Obliquaria* for "oblique" species whose outline is not rectangular. Perhaps *reflexa* is an obscure reference to the fact that the knobs on one valve do not directly oppose those on the other.

Unscholarly wrangling marred the early decades of the Academy's history as several naturalists quarreled over credit for the original description of this or that species of mussel. Early nineteenth century natural history was largely a matter of giving scientific names to the plants and animals constantly being "discovered" when most of the country was new.

Naturalists scrambled to publish more descriptions of new species than their rivals. Disputes over "priority" were prevalent. Isaac Lea—who ultimately conferred upon mussels more scientific names than any other man—and another Academy scientist, the great geologist Timothy Abbott Conrad, regularly published "rectifications" of one another's work, in which each tried to show that his description of a given species had priority over the other's.

Anyone who wishes to gain a sense of the jealousy

This drawing of *Quadrula metanevra* was done by R. Ellsworth Call, who was a mentor of Henry Augustus Pilsbry, long-time curator of mollusks at the Academy until 1957.



Camouflaged by stones and gravel, *Lampsilis cariosa* lives in the shallow rivers of eastern Pennsylvania—but not in the lower Schuylkill or Delaware, where pollution and silting have literally smothered it. This species, shown life size, was described by Thomas Say from a specimen found in a river near Philadelphia in 1817.

and acrimony of these expository confrontations has only to consider H. G. Wells' "The Moth," a fanciful tale of the fates of two lepidopterists who trafficked in this sort of bickering.

Thomas Say—another student of mussels and a founder of the Academy—was also involved in the Lea-Conrad controversies. Yet the tragic figure in all of this was Rafinesque, who bitterly denounced Say and other American conchologists who "neglected to verify, or properly notice my previous labors, *although they were known to them.*" Rafinesque died in penury and paranoia on Race Street in the City of Brotherly Love.

(Rafinesque was part architect of his own unhappiness: it was he, for example, who demolished John James Audubon's Cremona violin by swatting down new species of bats, wheeling about him in the wilderness night.)

in Say's footsteps

Thomas Say eventually left Philadelphia and traveled to Indiana, where he helped found the Utopian community of New Harmony on the banks of the Wabash River. And here, in the Great Rapids of the Wabash, naturalist Say discovered and described several new species of mussels.

Some summers ago, I traced Say's century-old footsteps along the Wabash River. Driving disoriented through a wood, I was hailed by a stumpy, disheveled creature, who explained that he "was clammin'" and had pulled his skiff ashore to barter the morning's catch for some "drinkin's." Would I take him back to where he had left the boat? I would. Would he show me a mussel bed? He would. So we did.

I am pretty good at collecting freshwater mussels, but Andrew—for that was his name—gave me a lesson in humility. We paddled the skiff across the shallow Wabash and got out on the hard-packed gravel bars. As I had been accustomed since childhood in the sandy-muddy rivers of the Atlantic slope, I dropped neck-deep and felt uselessly amongst the pebbles which disguised the mussels from my touch.

When I finally surfaced with a Washboard and a Three-horned Warty-back, Andrew was 50 feet or so away, drawing the skiff behind him, a hand on the gunwale, stopping here and there to do a little jig, then, steadying himself, throwing a dark object into the boat. I thought he was so undone with "drinkin's" that he was collecting rocks, but, without stooping, he was digging mussels out of the gravel barefoot. He would snap his ankle, and a mussel appeared at the surface. Before it could sink, Andrew reached out and tossed it into the skiff.

After several hours of cold, wet work, I had gathered a couple dozen mussels. And Andrew—tipsy, besodden Andrew—had, with fancy footwork, filled one quarter of the skiff. He never said a belittling word.

twilight of a lifestyle

Once upon a time, a small pearl-button industry flourished in this country. "Blanks" of pearl were stamped from the shells, then polished and bored for a needle hole. Pearl buttons died when plastic was born.

Today, carloads of American mussels are shipped to Japan, where they are used to culture pearls. Tiny spheres, cut from the mussel's pearly interior, are inserted into oysters. The oyster slowly coats the irritating fragment with nacreous layers. The process

guarantees a high proportion of pearls with perfect shape and depth of lustre.

This new market for mussels does not require that they be in good condition—or even particularly thick and solid. This encourages the illegal and biologically indefensible practice of killing *all* mussels that are captured—whereas many clammers used to throw back those sizes and species which have no value as button shells.

When I visited old Brown and Dewey in 1965, large and healthy beds of mussels extended several miles downstream from the falls at Rochester. Season and size limits have been imposed by the government to guard against decimation of the mussel beds, and clammers have settled into a pattern of in-season fishery.

Mussels are vulnerable to overfishing and ecological disruptions, and dwindling numbers of mussels in a body of water are a subtle sign of its sickness. When mussels go, so go a life style and livelihood of clammers throughout the giant Mississippi basin. And the value of mussels as natural water filters is lost for a long, long time. Wonderful is man's genius for innovative destruction.



Sam Fuller is a zoologist in the Academy's Department of Limnology. His interest in the comparative anatomy of freshwater mussels has led him to more than 20 states as well as countries in South America and Africa.