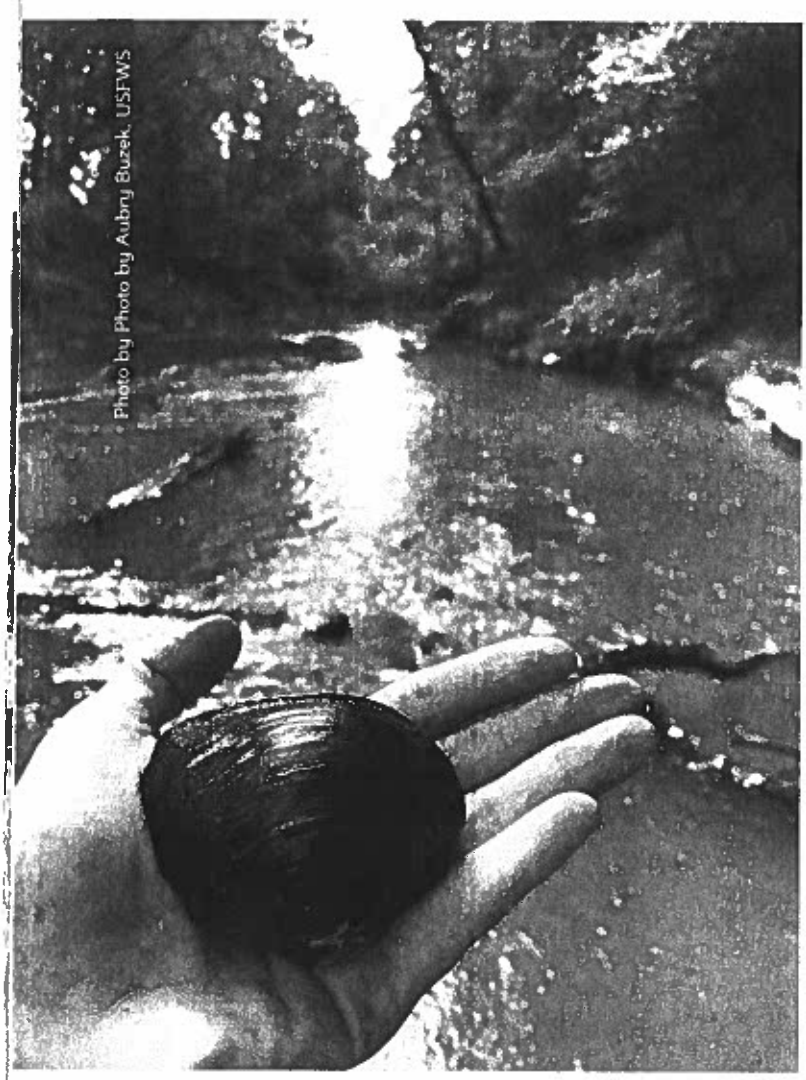
CONSERVING FRESHWATER MUSSELS, THE UNSUNG HEROES OF TEXAS RIVERS

Article by **AUBRY BUZEK**



A Trinity pigtoe mussel found in Lake Fork Creek, a tributary of the Sabine River in East Texas.

A SIGN OF TROUBLE

As teenagers, TWA Member Charles Granstaff and his future wife Marci often roamed her family's property on the San Saba River, fishing, exploring, and picking up curiosities they found along the way. Of particular interest were giant, dish-sized mussel shells they found strewn abundantly about.

"Those would always get our attention," Charles said.

After the couple married, started a family, and took over the management of the property in the late 1990s, Charles noticed the river wasn't running as it did previously. By 2011, the effects of excessive pumping and frequent drought at times left a 40-mile stretch of the river completely dry.

Not only was the water disappearing, but the attention-grabbing mussel shells that were once a common sight on the river were vanishing, too. Aside from the collection the family had displayed on its mantle, Charles realized he hadn't actually seen one in decades.

Charles' experience isn't unique. According to Texas Parks and Wildlife Department (TPWD) Freshwater Mussel Biologist Clint Robertson, landowners from around the state have told him that the mussels they once saw everywhere are now getting harder to find.

AN UNSUNG HERO

One couldn't be faulted for not noticing the presence or absence of freshwater mussels in Texas rivers. It's easy to overlook a species that looks and acts more like a rock than an animal.

But there's more to Texas' freshwater mussels than meets the eye. As renowned Texas outdoor writer Larry Hodge once said, "Beauty would serve little purpose for a creature that spends its life partially buried in mud."

Because mussels lack the aesthetic appeal of a warbler or monarch, mussel enthusiasts tend to use colorful analogies to get people excited about the species' conservation, calling them "canaries in the coalmine" or "silent sentinels." Robertson may have come up with the best elevator pitch for the species yet.

"They're the little water treatment plants of the river," he said.

Like water treatment plants, freshwater mussels clean the aquatic ecosystem by filtering impurities from the water. Mussels also feed on algae, bacteria and silt and serve as water quality indicators.

Anyone who enjoys fishing or swimming in Texas rivers might consider thanking these unsung heroes for their contributions to ecosystem health.

"Having healthy, diverse mussel beds helps clean the river and clean the water," Robertson said. "They feed fish, raccoons, otters, and even birds."

He continued, "They're also a good indicator the fish population is good, because mussels need the fish as part of their

reproductive cycle. They really are just like the umbrella species for river systems, because so many components need them to survive. They're kind of incredible in that way."

"Because mussels are often more sensitive than fish, finding mussels likely means the waterway is also supporting healthy fish populations too," added Gary Pandolfi, freshwater mussel biologist with the U.S. Fish and Wildlife Service's (USFWS) Austin Ecological Services Field Office.

The United States has the highest diversity of freshwater mussels in the world, with more than 300 species occurring in its watersheds. The Lone Star State is home to more than 50 of these species, with some East Texas rivers like the Neches boasting nearly half.

For comparison, Texas alone has greater mussel diversity than the entirety of North Eurasia, including the basins from Europe and Arctic Russia to northern Africa and the Middle East.

"Texas is unique because there are so many endemic species that literally don't exist anywhere else," Pandolfi said.

Despite their incredible diversity, mussels are among the most imperiled groups of animals in North America. Twenty-one species are already extinct, and another 91 are protected under the Endangered Species Act (ESA).

The decline in Texas' native mussels has the attention of federal and state natural resource management agencies. Since 1989, the Service has added 15 species of Texas' freshwater mussels to the work plan for consideration as federally listed species. TPWD has added 16 species to the state's list of threatened and endangered species.

FEDERAL PROTECTION

Under the ESA, anyone can submit a petition to add or remove a species from the list of threatened and endangered species. "Endangered" means it's in danger of extinction throughout a significant portion or all of its range, and "threatened" means it's likely to become endangered in the foreseeable future.

Most of the freshwater mussels under review in Texas ended up on the national listing work plan in the late 2000s, when environmental organizations submitted several "mega-petitions" with hundreds of plant and animal species to the USFWS.

Once the USFWS receives a petition, it evaluates whether it presents substantial scientific or commercial information indicating that listing may be warranted. If it does, the USFWS conducts a "12-month finding" that includes a species status assessment (SSA). The USFWS drafts the assessments with input from the public, scientific community and state and federal agencies. A recommendation team then determines whether the species needs federal protection, and if so, whether it is threatened or endangered.

If the team recommends a listing, the USFW initiates a formal rule-making process before the species can receive protection. This process requires public comment and additional scientific peer review.

As of April 2021, the USFWS has found one Texas freshwater mussel species requires federal protection. In 2018, it listed the Texas hornshell as endangered based on impairment of water quality and quantity in its native Rio Grande River.

Four Texas mussel species have been removed from the listing work plan. The USFWS removed the Southern hickorynut after finding no substantial information warranted the listing. The smooth pimpleback, golden orb, and triangle pigtoe were found to be genetically identical to more common, widespread species.

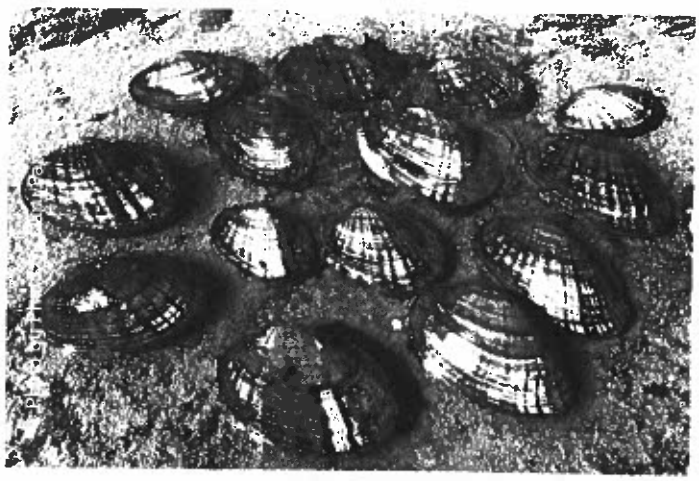
For 10 other Texas mussel species, the USFWS will announce findings on whether they warrant federal protection as early as this year. This includes six Central Texas species: the Texas fawnsfoot, Texas pimpleback, Guadalupe orb, Texas fatmucket, Guadalupe fatmucket and false spike. Two East Texas species will also be evaluated: the Louisiana pigtoe and Texas heelsplitter. In 2022, the USFWS will announce findings for two Rio Grande mussel species, the Salina mucket and Mexican fawnsfoot.

Federally listed species receive several conservation benefits, including protection from harm by federal activities, restrictions on take and trade, authorization to seek land purchases or exchanges for important habitat, and federal aid to state conservation departments with cooperative endangered species agreements.

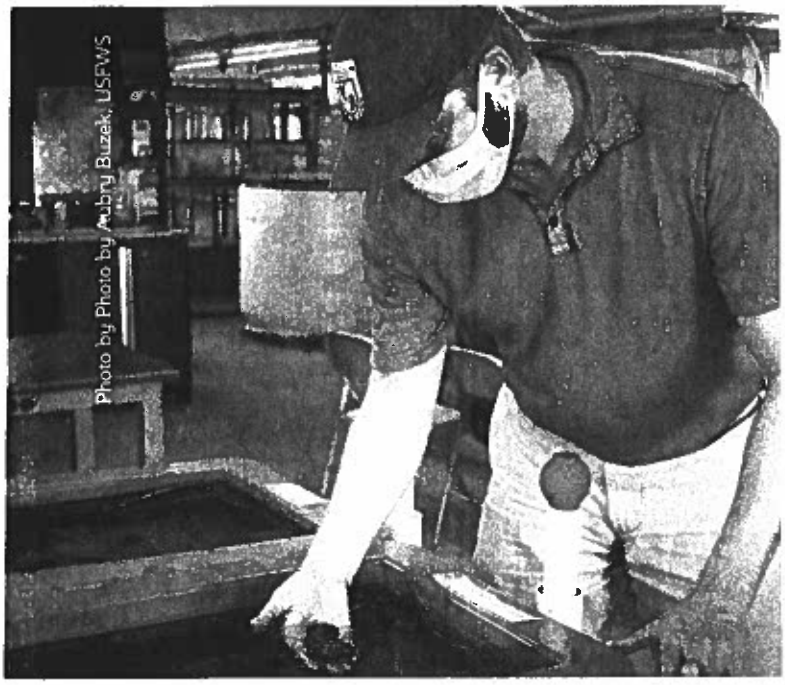
Protection from harm by federal activities comes in the form of critical habitat, which are areas designated as essential to the species' conservation. This critical habitat requires federal agencies to ensure that their activities do not destroy that habitat.

"It just comes down to finding a way to avoid or reduce the impact on the species that inhabit that area," said Matt Johnson, the USFW's 's freshwater mussel conservation and recovery coordinator for Texas. "For freshwater mussels, it typically consists of us saying 'We know that mussels are in this area, we would like you to avoid working here if possible.' If they can't, we then work with the project developer on mitigation options, such as relocating the mussels away from the project area before starting work in the stream."

For non-federal landowners, the USFWS offers a variety of tools and incentives to protect landowner interests while benefiting listed and other at-risk species.



Texas fatmucket mussels found in the San Saba River in Central Texas.



The U.S. Fish and Wildlife Service's Texas freshwater mussel conservation and recovery coordinator Matt Johnson.

One of the main tools is the Candidate Conservation Agreement with Assurances (CCAA). In return for implementing voluntary conservation practices, non-federal landowners and developers receive assurances they can manage their land as outlined in agreements with no additional requirements should be species become listed.

Another is a Habitat Conservation Plan, which describes how impacts to federally listed species will be minimized. This plan allows "incidental take" by the permit-holder to legally proceed with an activity that would otherwise result in the unlawful take of a listed species.

In October 2020, the Brazos River Authority submitted the first CCAA for freshwater mussels in Texas. The CCAA, which covers the Texas fawnsfoot and the false spike mussels, includes flow requirements to minimize impacts to freshwater mussels and their habitats.

"Right now, the Brazos River Authority is the furthest along in the process to where we are reviewing a document or an application that they put together," Johnson said. "Some other agencies and river authorities are looking to go the CCAA route, and some others are considering Habitat Conservation Plans because they already have a number of other listed species in their basins."

STATE PROTECTION

For the state's list of threatened and endangered species, TPWD uses the Conservation Status Assessment protocol developed by NatureServe as a standardized method for listing, down-listing or de-listing species. NatureServe rankings consider multiple criteria including range extent, known occurrences, abundance, and threats.

The state list of threatened freshwater mussel species includes Central Texas' false spike, Guadalupe orb, Texas fatmucket, Texas pimpleback, Texas fawnsfoot, Brazos heelsplitter, and Guadalupe fatmucket; East Texas' Louisiana pigtoe, Texas heelsplitter, Trinity pigtoe, southern hickorynut, Texas pigtoe, and sandbank pocketbook; and the Rio Grande's Mexican fawnsfoot and salina mucket. One endangered mussel, the Rio Grande's Texas hornshell, is also on the state's list.

For mussel species, a state listing makes collection or possession a Class C misdemeanor without a TPWD-issued scientific permit.

Non-listed mussel species also receive protection by the state through harvest regulations. For these species, harvest is by hand collection only, and there is a minimum shell size requirement. A commercial mussel and clam fisherman's permit is required to take mussels or their shells from state waters for commercial purposes.

To help protect native mussels from overharvest and recover areas with depleted mussel populations, TPWD designated several areas of the state as mussel sanctuaries. These are found in 15 rivers and creeks in Texas, including portions of the Sabine, Angelina, Neches, Trinity, Brazos, Guadalupe, Concho, San Saba, San Marcos and Rio Grande rivers.

A NEED FOR HELP

A variety of threats have caused decline in mussels. Among these are historic overutilization for the commercial pearl and button industry, introduction of non-native species like Asian clams and zebra mussels, impoundments, pollution, and disease. The most important threat is the destruction of instream and riparian habitat, which is linked to degraded water quality and quantity.

Though habitat destruction is bigger than any one person, landowners can help mussels by maintaining riverine and riparian habitats on their properties. Helpful steps include adding cross-fencing to keep livestock out of sensitive habitat, avoiding driving in streams or the flood plain, leaving native vegetation intact, conserving surface and groundwater, avoiding introducing non-native plants, avoiding mowing or paving in riparian areas, leaving vegetative buffers between cropland and riparian areas, and adding designated access points to help focus foot and vehicle traffic.

Landowners who need financial and technical assistance with habitat restoration can seek help through several state and federal voluntary programs, including theUSFWS's Partners for Fish and Wildlife Program (PFW), TPWD's Landowner Incentive Program, and the United States Department of Agriculture's Natural Resources Conservation Service Conservation Stewardship Program, among others.

Through these programs, local field biologists work one-on-one with private landowners to plan and implement restoration projects that are consistent with their existing land uses. They can also help landowners find other sources of funding and help them through the permitting process when needed.

A WAVE OF RESEARCH

When Charles Granstaff noticed a die off of mussels on the San Saba, he called TPWD to investigate. Though they found a variety of dead mussels in the riverbed, they were lucky to find some live mussels hanging on in stagnant pools, including four of the mussel species currently under review for an ESA listing.

Since then, a wave of research has centered on the river. One study by Texas A&M AgriLife Research and The Nature Conservancy is researching how the extreme low and high flows in the Hill Country impact populations of rare mussel species and how climate change might exacerbate their struggle to survive.

Studies like this one couldn't come at a better time. With so many mussel species currently under review for an ESA listing, one would think there is a comprehensive historical data set for biologists to review for species status assessments. Unfortunately, little was known about Texas' mussel species until the 1990s. It was only in the last decade that researchers started receiving funding to begin focusing on the imperiled species.

"In Texas, we're kind of behind the ball as it pertains to mussel research in the U.S.," Robertson said. "The Southeast has had listed species for 30 plus years already—and they understand basic biology and distribution for species in their states—so we've got some catching up to do. But we're committed to doing that so we can make more informed listing decisions, and hopefully, also help us focus recovery efforts for federal or state listed species."

Today, many nonprofit, state and federal agencies are funding freshwater mussel studies in Texas, including The Nature Conservancy, TPWD, the USFWS and the Texas Comptroller's Office. These studies range from finding out basic biological requirements and thermal tolerance of certain species to studying unique parasites that consume the gonads of mussels.

"It's amazing the amount of published research that's come out in the last five years on Texas mussels," Robertson said.

As new data are collected and compiled, state and Service biologists can use the information to better evaluate species for listing. These data can also contribute to recovery act ions that natural resource management agencies might plan down the road.

"We always want to know what else people are seeing out there," said Erik Orsak, supervisory biologist with the Service's Arlington Ecological Services Field Office. "Recovery plans, conservation strategies—all those can be informed by what they're finding. When you start putting the pieces of the puzzle together you can be more strategic with the conservation measures you're trying to put on the landscape."

Private landowners can assist with mussel research in Texas by helping university, state and federal researchers learn more about the mussel communities in their stretches of river. Because public access points aren't usually the ideal mussel survey locations, landowners can open the door to remote areas that are more suitable for mussels.

"That is probably the single most helpful thing any river landowner in Texas can do, given 98 percent of this state is private property with very little river access other than at road crossings," Robertson said. "Having a collaborative landowner opens up a lot of river miles for us to look at and to get a better sense of what's going on."

This access could also one day be helpful if researchers determine a need for mussel stocking in Texas' rivers and streams. Though there are no plans to start stocking any time soon, multiple university and federal researchers are refining the process for propagating mussels in the hatchery setting.

At Inks Dam National Fish Hatchery in Burnet, the hatchery team is already producing tens of thousands of native freshwater mussels per year. While most propagation involves using host fish to carry the mussel larvae, researchers are working on other techniques. In 2020, Inks Dam staff were the first to use in-vitro transformation to grow Texas fatmucket larvae into juvenile mussels using rabbit serum.

"Right now, the goal is to figure out how to produce mussels," Johnson said. "We're not at a point where we're looking to produce them en masse for releases, it's more about seeing if the mussels that we produce could survive in the areas that we may select for mussel restoration in the future."

A SIGN OF HOPE

Since the historic drought that hit Texas in 2011, rivers like the San Saba have experienced some relief with higher precipitation in recent years. Though threats to the mussels remain, the hope is that with increased research and conservation efforts the USFWS and other partners will be able to help them persist into the future.

"A state is defined by the people who exist there and the nature and species that inhabit it," Pandolfi said. "That's what we're shooting to do—we want to help keep the unique species that exist in Texas around for future generations."

After a historic flood tore through Central Texas' Hill Country rivers in 2018, the Granstaffs visited their family ranch to survey the aftermath. With the kids and grandkids in tow, Charles wandered down to the river, where something on the shore caught his eye.

He picked up a large, muddy shell and slipped it into his pocket to examine further once they got back up to the house. At the time, he thought it might make a nice addition to the collection on their mantle.

Then, Charles realized something exciting.

"All of a sudden it dawned on me—it was kind of heavy," Granstaff said. "I said you know, I better check this, and then when I got it back out and I looked at this thing I realized it's alive—the mussel is still in there."

It was the first he had found like it in decades—just like the ones he and Marci used to encounter when they were teens. And, it was alive.

"It was really kind of a revelation," he said. "Somehow they've been resilient. And even with the lack of flow, and some of these years hot, stagnant pools of water, somehow, they've been able to hang on. And it really is nice that they have."