

Opposite: miniature model of a mastodon, Truman Dam and Reservoir Visitor Center.

Government museums are deferential to the theory of evolution. Here, time marches to the tattoo of Darwin's drums, regulating the advance of progress. Actual contemporary, scientific theories often do not describe such an orderly world.

The controversial Paul Allen, best known advocate of the "prehistoric overkill" thesis, visited the Pomme de Terre excavations. As no association of man and extinct mammals were made in that dig, no evidence for or against the idea Paleoindians hastened the demise of some thirty-five genera of creatures could be made.

Perhaps had the archeological and paleontological sites not been subject to being worked over a limited time period with inadequate funds, some partial answers to these questions might have been found. Climate change research would certainly have been advanced. Aware of rapidly advancing technologies, scientists now leave portions of their excavations undisturbed for future investigation. Chemical and geologic processes at the bottom of reservoirs alter the usefulness of such buried resources, if and when they are ever again exposed.



Few displays at the Harry S. Truman Dam and Reservoir Visitor Center are actual historical objects. Most are casts. Near the entrance, on the right, there is a subsurface diorama with a plastic paddlefish floating above a sunken tree stump. A plaque acknowledges that Corps river modifications have impeded their spawning run, but indicates there has been a satisfactory technical solution to this problem:

Construction of dams, levees, and locks has restricted the paddlefish's normal upstream spawn migration to very few locations. Therefore, the Missouri Department of Conservation began a stocking program to maintain populations. Our Osage River continues to be one of the best paddlefish sport fisheries in the U.S. Many fishermen travel long distances for the opportunity to try their luck at snagging spoonbill on Truman Lake and the Osage River. The Missouri Department of Conservation manages the fishers, promoting paddlefish as a trophy sport fishery. As of 2011, the largest spoonbill taken from the Osage River weighed in at 134 pounds.

Replica bones and tusks of mastodons and mammoths occupy the central gallery. A timeline of the many species of Pleistocene creatures that once inhabited the area ascends to the ceiling. Paleontologists toiled to excavate the springs on the Pomme de Terre before Truman's waters ended further study. There was a theory that Paleoindians hunted these giant creatures to extinction. Many scientists believe that climate was responsible and not predation by man.

The paddlefish probably will not be exterminated by the works of the Corps of Engineers either, but a case could be made that dams will play a larger role in whatever fate has in store for *Polyodon spathula* than the effect ancient Indians had on the great megafauna die off.

Mastodon

The American mastodon was a large, powerful ice age mammal with a long trunk. Ancestors of the mastodon migrated from Asia to North America approximately 30,000 years ago and lived here until after the final glacial retreat about 12,000 years ago. Mastodons were originally thought to be a crossbreed between elephants and mammoths. They were often found with pointed tusks. Today scientists believe that mastodons were primarily forest dwellers and were probably skilled at stripping branches, twigs, and needles to eat. The first discovery of a mastodon was made in 1804 in Dorsey, Ohio, and a single tusk was found in 1829 in New Haven, Ohio. The mastodon measured approximately 2 feet at the shoulder and was similar in appearance to elephants.



1800

1804





The Corps claims that the “Osage River continues to be one of the best paddlefish sport fisheries in the U.S.” The dirty secret is that this paddlefishery is now a heavily subsidized put-and-take operation. These large, odd-looking, valuable but vulnerable fish lost their only known spawning grounds when Truman Dam blocked the Osage River in 1978. Annual stocking of hatchery raised fingerlings is thought by many biologists to be a problematic long-term solution.

After an amazing two hundred million year run, the luck of the American paddlefish has not been good elsewhere either. Throughout their considerable range, the industrialization of the Mississippi River system has made life difficult for *Polyodon spathula*. Their only family member, the Chinese paddlefish, has had to cope with rivers even more over-developed. Efforts to locate even one fish have recently failed, and the twelve to twenty-three foot giant is feared extinct.



Before dams, locks, channelization, and pollution impacted them, excessive harvest initiated the paddlefish’s long decline. In 1899, their commercial catch for food peaked at 2.4 million pounds. Soon after, the great sturgeons of North America dramatically declined due to overfishing. Tons of caviar were consumed here and shipped to Europe. Demand for paddlefish roe as a substitute put additional pressure on the easily-netted *Polyodon*. While not as desirable as Beluga roe, paddlefish eggs make better caviar than many sturgeon species.

Precarious as the survival of paddlefish is, problems for their close relative the sturgeon are more acute. European and Asian rivers are as highly modified as American. With the fall of the Soviet Union, the sturgeon harvest is now in the hands of the Russian mafia, a group not known as good conservationists. In 2006, all caviar trade in the Caspian and Black seas was suspended by the Convention on International Trade in Endangered Species (CITES). Paddlefish eggs shot up in price. In May 2011, alleged Russian mafia members Anatoly and Fedor Natekin were arrested in Oklahoma with 305 pounds of illegally procured paddlefish caviar.



In 1989, the US Fish and Wildlife Service was petitioned to list the paddlefish as an endangered species even though they are found in twenty-two states. There was insufficient data to comply. Their wandering habits make study difficult. One tagged individual swam from South Dakota to Kentucky, 1,180 miles, over five dams. Because they share so many of the vulnerabilities of sturgeon, CITES classified paddlefish as an Appendix II species, which regulates their export. The Mississippi Interstate Cooperative Resources Agency (MICRA), an organization of twenty-eight states, studies and coordinates regulations concerning the species, but has no federal funding or authority.



Above and left: The Conservation Department's Blind Pony hatchery was the site of many innovations in paddlefish aquaculture. It now supplies an average of thirty thousand 10 to 12 inch fingerlings for stocking in Lake of the Ozarks, Truman and Table Rock reservoirs, and the Black River.

Current programs of perpetually stocking hatchery raised fish come at a high price, not just monetarily. Scientists believe that over time, altered genetics caused by this factory system will create a fish unable to survive on its own should habitat restoration allow spawning.

A patchwork of state regulations complicates management.

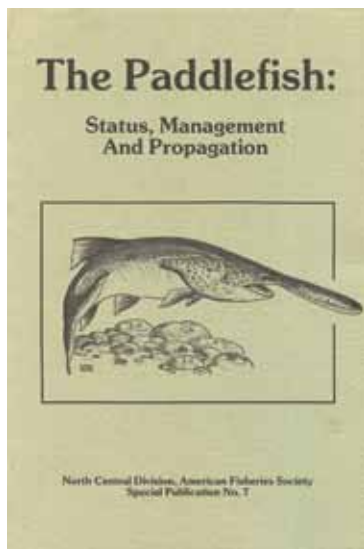
Concerns for the future of paddlefish have led to extensive artificial propagation and release. Millions of tagged young have been stocked to study their habits. While this may be necessary, as natural spawning seems to be infrequent, it could lead to genetic introgression, reduced diversity, and produce fish with poor survival fitness in the wild. Natural selection in a hatchery may produce fish that have inferior responses to a wild environment. Traits that help them survive in hatchery jars, tanks, and ponds do not necessarily aid their survival in a free-flowing river. Should released hatchery fish spawn, even if one parent is native, the offspring may be maladapted. Hatchery managers take steps to minimize genetic hazards, but paddlefish may become essentially a domesticated species.

Paddlefish have become globalized. Eggs and brood stock have been exported to Russia, China, Moldavia, Romania, Poland, and other foreign countries for propagation. There are efforts to create all-female hatches through chromosome manipulation and sex reversal. A laboratory created Frankenpaddlefish may emerge that is unable to reproduce in nature.

In spite of, or perhaps because of, the controversy over the Osage River paddlefish, the technology for their aquaculture developed here. Harry Mills forced the Missouri Department of Conservation to support Truman Dam. Articles in their magazine tell the true story of the staff's long-time concern for the threatened species. The August 1971 *Conservationist* article "Paddlefish Out Progressed: More Gloom and Doom" quotes fisheries biologist Tom Russell as saying, "it doesn't look like there's a great deal of hope once the dam is completed.

Between 1988 and 2007, more than 2.2 million paddlefish were released in fourteen states. More than \$10.7 million was expended by state and federal hatcheries. Each little spoonbill stocked in Missouri is estimated to cost \$3.35. Salaries, hatchery construction and overhead, and other capital costs not included.

In the September 20, 2011, *New York Times* blog "Can the Paddlefish sustain itself?," Debrah Weisberg reported the varied successes of efforts at restoration and augmentation. "This is an expensive program," said David Miko, Pennsylvania fisheries management chief, "We're having serious discussions about whether our resources would be better spent on something else." The failure of stocked fish to reproduce, said Weisberg, is discouraging: "Pivotal to the mission is whether paddlefish will generate self-sustaining populations. Indications range from unlikely to maybe."



The wrapup for this 1986 publication included:

"Finally, a note of caution. Although techniques for producing and stocking paddlefish were presented in this symposium, we do not consider stocking to be an answer to habitat deterioration and management problems. These techniques were developed for special circumstances where stocking was the only way to maintain a population. Artificial propagation and stocking should not be used as a cure-all or substitute for wise or practical management. Trying to solve problems by treating symptoms is expensive and ineffective. In addition, stocking would affect the integrity of paddlefish gene pools and is ill-advised until we know a lot more about the genetics of this species."

The MICRA paddlefish-sturgeon committee issued a warning in 1998 that "the use of hatcheries to reduce population declines is not a substitute for solving the causes of declines." In addition to genetic considerations, the paper listed six other problems with stocking of which "delaying habitat restoration" was the worst.

Using what we know now, it looks as if the paddlefish will be just another declining species."

"Epitaph for Lake Ozark Paddlefish" in the April 1977 issue mentions that "environmental groups" sued the Corps and lost. It explains that the Corps, "has set aside money to help in life history and hatchery research." Progress has been made in artificially spawning paddlefish, but an unanswered question remains, "who will build and operate the hatchery?" The March, 1980 *Conservationist* article "Paddlefish: Good News and Bad News" explains that at the department's Blind Pony Hatchery there has been a "breakthrough in developing methods to artificially produce paddlefish in hatcheries." The article acknowledges, "No decision has been made whether the funding and construction of such a facility will be the responsibility of the U. S. Army Corps of Engineers or the Department of Conservation." The Corps finally paid the Department \$150,000 for three years to research propagation, but nothing afterward.

There is a how-to-catch-paddlefish article in the February 2005 *Conservationist*. Despair over the survival of the species has vanished. "Annual stocking of hatchery produced fingerlings," is touted as good news. The article continues: "The goal of this plan is to manage paddlefish statewide as a trophy sport fishery." Seven years later, in the March 2012 issue "Big Game Fisheries" unabashedly promotes snagging. "Our goal is to manage paddlefish statewide as a trophy sport fishery. It brings in a lot of people," said Trish Yasger, fisheries management biologist. "Paddlefish are one of MDC's restoration success stories," the article states. It doesn't mention the long term genetic issues created by stocking generations of hatchery-raised fish.

Managing paddlefish exclusively for the goal of creating a "trophy sport fishery" is a reversion to old-time, pre-scientific fish and game department policies. Then a species' future was not as important as the pleasure its taking gave sportsmen. Efforts to restore habitat or research on natural reproduction are nonexistent. That Missouri's official state fish, a title bizarrely adopted after Truman Dam closed, continues to swim in its waters depends now on the costly and elaborate intervention of fisheries management technicians. The survival of paddlefish is questionable if money for hatcheries runs out or snaggers' interest declines.

Though it failed, "the paddlefish case," as the 1972 lawsuit was called, received national publicity. Some well known sports and environmental writers were prompted to write about the fate of the ancient fish. Bil Gilbert concluded the poignant article "End of a Long Journey for the Spoonbill Cat" in the March 1981 *Audubon*:

The sterile, brightly lit laboratory building at Blind Pony Hatchery is perhaps the best paddlefish spawning ground left in this country. In it, in a steel tank, lies a gravid, fifty-pound sow that has been captured, transported, manipulated, probed, and stimulated by attending biologists and technicians. If their techniques continue to be effective; if the thermostats, water filters, circulators, and air-conditioners are properly maintained; if secondary support systems, telephones, combustion engines, highways, petroleum refineries, and electrical generating plants continue to function as planned; if legislative appropriations committees, bureau supervisors, taxpayers, and voters remain supportive; if inflation or depression, and political, social, or international crises do not disrupt everything, this paddlefish will give up her eggs, and some of her daughters will do the same in the same way. The eggs will hatch, and the line of the species, which has survived the settling of continents, the lifting of mountains, the ages of ice, coal, and reptiles, may continue in the late Engineering Age.

That we have figured out how to do these things to and for such an ancient creature is a credit to our intelligence. That we want to do them speaks well for our compassion—or at least says something about how well we regard sport. That we need to do these things—that the paddlefish, her attendants, and the rest of us have met for these purposes at Blind Pony—is unspeakably sad.

Thirty years after Gilbert's article, what was once the largest self-sustaining paddlefish population in the world has vanished. Both the Corps of Engineers and their former critics, the Missouri Department of Conservation, celebrate replacing a viable wild species with hatchery raised, costly, and, increasingly genetically challenged substitutes. It may be an ugly necessity, but to call this a "success story" is "unspeakably sad."



Just as Missouri's Conservation Department was an innovator in propagating paddlefish, the Osage Catfisheries was one of the first private concerns to master that art. Their mission was of course simpler. Growing paddlefish for food and eggs does not involve preserving a self-sustaining, genetically diverse population, which is the mandate of the state conservation agency. In the aquaculture business since 1953, this Osage Beach, Missouri, family has been farm-raising paddlefish since 1981. Aware of genetic issues, they spawn fish from four different lines.

Fertilized eggs are either sold overseas to other aquaculturists or raised and then stocked in private ponds or lakes. When harvested in nets ten or twelve years later, property owners receive a dollar per pound payment. The high quality, boneless flesh is sold, and the roe is processed into L'Osage Caviar, their brand. As the mature fish feed only on zooplankton, not commercial fish food, it is considered to be an excellent product. At this time, a 1.5 ounce jar sells for \$67.50. There are many more orders for their caviar than they can currently fulfill. Osage Catfisheries is one of only a handful of US hatcheries approved by CITES and the Fish and Wildlife Service to export paddlefish and eggs.

Below: McDonald hatching jars of paddlefish eggs, Missouri Department of Conservation's Blind Pony Hatchery.