

Sturgeon Surgeons

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It seemed a primitive setting for a cutting-edge operation: a dank room so dark that someone had to hold a floodlight as the surgeon traced his scalpel along the patient's belly, looking for a place to cut.

Fortunately, the patient—its pale white belly contrasting sharply with the black stretcher serving as an operating table—was heavily sedated.

"I'm looking for a clean spot where there are no scutes," said Dr. Frank Chapman, his sleeves rolled up and his hands covered with latex gloves.

Dr. Chapman was no ordinary doctor—his patient was a four-foot fish. An Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*), to be precise. It's a species left over from the dinosaur-dominated Jurassic Age. And it looks the part, being covered with bony shields called scutes, rather than scales, which give it a primitive appearance.

Chapman, a sturgeon expert from the University of Florida Department of Fisheries and Aquatic Sciences, was surrounded by a dozen potential sturgeon surgeons as he demonstrated a technique he developed to quickly identify the sex of a sturgeon in the field.

This will be a useful skill if—as many hope—a regional effort to bring back the Chesapeake Bay's largest native fish is launched in the coming years.

Atlantic sturgeon supported a major fishery in Chesapeake Bay a century ago, but it is a rare fish almost everywhere

today. No reproduction has been documented in Maryland's portion of the Chesapeake in 45 years. It spawns, but only sporadically, in the James River in Virginia.

For nearly a decade, a handful of biologists throughout the region have advocated a hatchery-based stocking program similar to those used to rebuild stocks of striped bass and American shad.

That interest resulted in an experimental release in 1996 of 3,300 sturgeon, reared by a U.S. Fish and Wildlife Service hatchery in Lamar, PA, into the Nanticoke River by the Maryland Department of Natural Resources.

Now, federal and state agencies, university researchers, and an electric utility may team up for the first sustained effort to stock Atlantic sturgeon since federal biologists gave up on hatcheries as a way to salvage plummeting sturgeon populations more than a century ago.

"If we don't do anything, 100 years from now we'll have exactly what we have today, which is nothing," said Steve Minkkinen, who heads the USF&WS Maryland Fisheries Resource Office and previously oversaw hatchery programs at the Maryland DNR.

Minkkinen is trying to build a partnership between the USF&WS, Maryland and Delaware that would allow fish to be taken from Delaware Bay to serve as brood stock to rear tens of thousands of fish annually in the hope of rebuilding sturgeon populations in both bays.

Other partners in the fledgling relationship would include the Mirant Energy's aquaculture facility at its Chalk Point plant on the Patuxent River—one of the few places with tanks big enough to hold the giant fish—and the Horn Point Lab of the University of Maryland's Center for Environmental Science, where biologists are working to perfect feeding programs for captive sturgeon.

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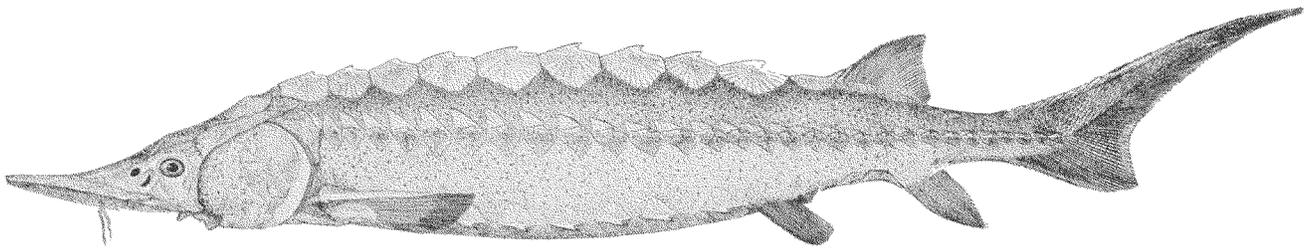


Fig. 1.
Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*. Illustration courtesy NOAA Photo Library.

But a hatchery-based stocking program is rife with practical and logistical problems. The fish don't reach maturity until they are a decade or more in age. By then, they are five feet or more in length, making it difficult to store the scores of fish that would be needed to create genetically diverse offspring.

Further, sturgeon are an ancient species, dating back at least 70 million years and possibly twice that. Their biology is different from most other fish—some of the drugs used on other fish species don't faze a sturgeon.

It's almost impossible to determine the sex of a sturgeon from its external appearance—a basic problem for any breeding program. "If we want to undertake this, we have to develop the expertise," Minkkinen said.

Hence the need for the recent workshop to train sturgeon surgeons. "Sturgeon," Chapman said, "do not tell us who they are."

To find out, Chapman makes a short, one-inch incision, which allows biologists to quickly peer at the gonads of the fish and determine whether it is male or female, whether it is mature, and—if female—whether it is producing eggs.

"It's a male," Chapman said, after peering at its gonads through the incision. "But not very mature at all." The procedure is relatively harmless to the fish. In thousands of sturgeon examined over the years, Chapman has yet to lose a patient.

The skill is critical for restoration efforts. Collecting fish that are rare is no easy job to begin with. Further, large adult fish like to smack captors with their bony armor-like body. After going through all that effort, it would be nice to know that the fish placed in captivity are not all males.

"It's not inexpensive to keep these fish," noted Andrew Lazur, an aquaculture specialist with the Horn Point Lab "This is really important stuff here today."

Also, while the setting at the Mirant aquaculture facility might seem primitive for surgery, it was better than the conditions the biologists would encounter when practicing their new skills on a boat. "This is luxury," Chapman pointed out.



Sturgeon from the East Coast and Chesapeake Bay supplied a huge European demand for caviar and meat in the late 1800s. Bay sturgeon landings peaked at 725,000 pounds in 1890. Because the fish take so long to mature and spawn only sporadically, their population could not withstand such intense fishing pressure. By 1920, landings had fallen to 22,800 pounds.

Sturgeon are an anadromous fish, spawning in freshwater rivers where they spend their first few years before entering the Atlantic where they live until returning to their native river to spawn. As in the Bay, spawning populations in many other East Coast rivers gradually disappeared, or barely exist. With no hint of a recovery in sight, the Atlantic States Marine Fisheries Commission—a state-federal compact that manages migratory species along the East Coast—sought to halt the downward spiral in 1997 by imposing an unprecedented 40-year fishing moratorium on Atlantic sturgeon, an action which in part was responsible for keeping the fish from being listed under the Endangered Species Act.

But a moratorium alone will not allow sturgeon populations to recover in places like Chesapeake Bay, where none are left. And some biologists, including Chapman, believe that the fishing ban may not be enough to save sturgeon in many other East Coast rivers, where populations number in the dozens, or only a few hundred.

"You do not have enough females in the population," said Chapman, a proponent of using stocking programs to bolster the stocks.

Unlike other fish species, where the majority of the female spawning population will reproduce annually, Chapman said only 5–8 percent of adult female sturgeon will produce eggs in any given year.

Because Atlantic sturgeon can live 60 years or more, that wasn't a problem when they numbered in the tens of thousands

in major East Coast rivers. Today, rivers with small sturgeon populations could go for years without seeing any reproduction, Chapman said. Their occasional offspring would keep the population going for a while, but ultimately it could just go, literally, into a death spiral.

“The Atlantic sturgeon is perhaps the most endangered marine species that we have in the world today,” Chapman said.



As early as 1888, a pioneer in fish culture, John Ryder, concluded that “the only means of maintaining and increasing the [sturgeon] industry is through the artificial propagation of this fish, which I have every reason to think may be successfully accomplished at a comparatively insignificant outlay.”

But Ryder and others who worked with sturgeon quickly learned it was a difficult animal to work with. A major problem was trying to simultaneously catch “ripe” females and males, which proved to be more difficult than with other species. In little more than a decade, sturgeon stocking efforts were abandoned.

By the mid-1990s, though, fisheries biologists reached the same conclusion as Ryder had a century before: That many sturgeon stocks were in such bad shape that they were not likely to recover without a stocking program.

Amid growing concern about the status of the fish, federal biologists at the Lamar hatchery in northcentral Pennsylvania pioneered techniques to maintain Atlantic sturgeon in aquaculture and induce females to spawn. “You don’t want to be in a situation where you have a species teetering on the edge of extinction and have no knowledge of it,” said Wade Jodun, a biologist at the hatchery.

At the same time, the ASMFC, recognizing the dire condition of the species, spelled out stocking guidelines recommending that any hatchery program use at least 100 animals of six different ages from an adjacent river system as its brood stock.

That, however, is a lot of big, rare fish to catch. “In order to meet that, we need to bring in more stock,” Lazur said.

That creates problems. Wild fish often don’t adjust well to captivity. Atlantic sturgeon are not easily domesticated when brought to aquaculture facilities from the wild. Some starve to death rather than eat. At his Horn Point laboratory, Lazur and colleagues have been working to perfect feeding techniques for wild fish.

The scientists have been working to develop diets which transition the sturgeon from wild food to commercial, pelletized

feed—a process that can take three months. They have also developed means of force-feeding fish, when necessary.

Maryland actually has about 150 Atlantic sturgeon at Mirant’s aquaculture facility. But those fish are from the Hudson River, and represent only a few year classes. Biologists would like to supplement those fish with sturgeon from the closer Delaware River, which has a small population which is thought to be more genetically similar to what would have been the Chesapeake Bay’s native sturgeon.

By monitoring a large brood stock population in aquaculture, biologists hope to overcome the problems Ryder experienced in trying to simultaneously catch reproductive males and females in the wild. Also, by maintaining ideal conditions, they hope females can be coaxed to produce eggs more frequently than might happen in the wild.

And, with Chapman’s help, the biologists are learning surgical techniques to determine whether a female is producing eggs, and to remove those eggs when the female is nearly ready to spawn. That’s a tough job, too. The primitive reproductive system in sturgeon are unlike those of more modern fish, and the eggs are difficult to remove.

“These animals are very different,” Chapman told the biologists. “We always try to treat it like other fish. And that is why most management has failed.”

In Ryder’s day, when fish were still relatively plentiful, there was little concern about killing a female sturgeon to get her eggs. But today, with the population at an all-time low, each female is a precious commodity. Eggs must be surgically removed and the fish sewn up without rendering the animal sterile—another job for the sturgeon surgeons being trained.



Some question whether Chesapeake Bay’s poor water quality will prevent the restoration of sturgeon. They are more sensitive to low oxygen conditions than many other fish.

The Chesapeake chronically suffers from low dissolved oxygen in bottom areas during the summer, which is a particular problem for sturgeon because they live on worms, clams and other bottom dwellers. Worse, they are sensitive to warm surface temperatures, which tend to force the fish toward the deeper, low-oxygen water. That habitat “squeeze” has caused some to suggest the Bay may no longer have enough suitable habitat to support a fish that hasn’t been around in significant numbers for a century.

Minkinen, though, is optimistic. Follow-up studies after the DNR’s 1996 sturgeon release in the Nanticoke

showed that the fish grew rapidly, doubling in size in about eight months. Further, a surprisingly high number—more than 400—of the tagged fish were captured (and released) in subsequent years as part of a reward program in which fishermen are paid to report sturgeon caught in their nets.

The numbers of tagged fish declined in reports over the years, suggesting they moved into the ocean, as would happen with a natural population. “Real world evidence suggests they may have enough habitat,” Minkkinen said.

Besides, he noted, by the time any fish return to spawn, Chesapeake Bay should be in better condition as cleanup progress is made. And because it is a bottom-feeding fish, the ability of the sturgeon to thrive here would suggest how efforts to restore the Bay are doing. “Sturgeon is a signature species of the Chesapeake Bay, it is an indicator species,” Lazur said.

The biggest hurdle for a sturgeon comeback may not be water quality, but funding. Because it takes so long for sturgeon to mature and reproduce, building a fishable population is a job that will likely take decades. In the best-case scenario, a stocking program that began in the next few years would likely result in adults not returning to spawn before about 2020—and work would have to continue for years after that. “This is a forever thing,” Chapman told the biologists. “It will take you all of your lifetimes, I can assure you of that.”

With no prospect for any quick return on investment, few attempts have been made to rebuild sturgeon populations. Research for the past year, including the workshop and upgrades to the DNR’s Manning Hatchery to make it suitable for sturgeon, has been funded by a \$90,000 state wildlife grant from the USF&WS. It was the first time money was specifically dedicated for sturgeon work in Maryland.

But, Minkkinen said, a full-fledged stocking program would likely cost hundreds of thousands of dollars.

It’s the uniqueness of the sturgeon—a giant, long-lived, fish from the age of dinosaurs—which proponents ultimately hope will sell the public on supporting a restoration program, as there would be no fishery for decades. It’s a massive species, where adults routinely grow more than seven feet in length and have reached sizes as great as 14 feet, and weights of more than 800 pounds.

Even in colonial times, when the fish were common, people marveled at the sturgeon, which were noted for their habit of leaping out of the water—sometimes onto boats. “In going down to Jamestown on board of a sloop, a sturgeon sprang out of the river, into the sloop,” a Dutch traveler reported in the mid-1600s, adding that “we killed it, and it was eight feet long.” (The sturgeon weren’t always the victims. During the Revolutionary War, an American officer rowing across the Potomac was killed after a sturgeon jumped out of the river and landed on him.)

And, biologists note, because of their jumping ability, people can see them—unlike other fish—as they leap out of water. Even people who couldn’t tell a striped bass from a white perch could easily see the difference in the armored, pointy-nosed sturgeon. Young sturgeon, only a foot or so long, are remarkably docile and easily handled.

“They are one of the most charismatic species you can encounter,” said Jodun, of the Lamar hatchery. “You can handle it and view it close up. Most sturgeon biologists form a very passionate bond with these fish.

“I hope this is a species that far outlives me,” he added. “You’re looking at a window into Earth’s past.” 