



'THE GREATEST ECOLOGICAL RESTORATION PROJECT IN THE STATE YET TO BE DONE'

The Blackstone lost its river herring. Now, after decades of frustrated efforts, there is a plan to bring them back.

Alex Kuffner Providence Journal | USA TODAY NETWORK

PAWTUCKET

A double-crested cormorant dives under the dark waters below Pawtucket Falls. The sleek bird surfaces, clutching something glimmering in its beak that disappears down its throat in an instant. A river herring. It's a late April morning, and the silvery, foot-long fish are beginning their migration from the ocean where they spend most of their lives to the rivers, ponds and streams in which they spawn, an annual rite of spring that for thousands of years has sustained animal life in these parts, and, until modern times, humans, too.

The opening of the Slater Mill in Pawtucket in 1793 signaled the eventual demise of river herring and other migratory fish in the Blackstone River. Now, after decades of frustrated efforts, there is a plan to bring them back.

This is the first of two parts into Monday's Providence Journal.

But the herring can go no farther than the falls, the dividing line between the fresh waters of the Blackstone River above and the brackish, tidal waters of the Seekonk River below. The path upstream is blocked by the Main Street Dam, an earth-and-granite wall that stretches across the top of the falls. A stone's throw farther up is another dam at Historic Slater Mill. Not far beyond is the Elizabeth Wetzel Mills Dam and Joe's Dam, that is the Valley Falls Dam, both in Central Falls.



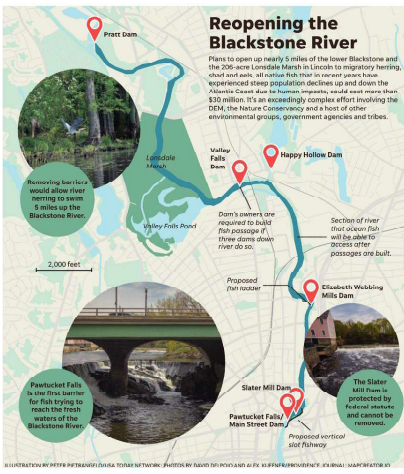
John Torgan, executive director of The Nature Conservancy in Rhode Island, has been fishing the waters in Rhode Island since he was a child. He says he can't see the Gilbert Stuart Stream would be packed with herring on their way from the Narrows River to spawning grounds in Cay River. "No one's dip a net and get all you want," Torgan says.

The work would open up nearly 5 miles of the lower Blackstone and the 206-acre Lonsdale Marsh in Lincoln to migratory herring, shad and eels, all native fish that in recent years have experienced steep population declines up and down the Atlantic Coast due to human impacts. Restoring a connection severed more than 200 years ago between the Atlantic Ocean and Narragansett Bay's longest tributary may finally be within reach.

Many see it as the holy grail for fish passage in Rhode Island. There are obstacles, of course, not least of which is where the money will come from. A plan that could cost upwards of \$30 million. But if the work moves forward, it could help boost numbers for a species that occupies little more than a footnote in history and mark yet another milestone in the continuing recovery of a river that was once considered the most polluted in the nation. "This," says John Torgan, executive director of The Nature Conservancy in Rhode Island, "is the greatest ecological restoration project in the state yet to be done."

A fish that 'everything feeds on'

Of the 22,000 or so fish species on the planet, only around 2% respiratory switch between trout and saltwater environments as part of their life cycles. About a dozen are found on the Atlantic Coast of North America. Waterways from Florida to Newfoundland were once full of these migratory fish that include Atlantic salmon, American shad, sea lamprey, whitefish, smelt, American eels, Atlantic



As early as 1719, the General Assembly passed a law empowering town councils to protect fish passage. Legislators went further in 1735, ordering mill owners to enable passage during the spring runs "forever." But forever wouldn't last long. The laws were largely ignored.

sturgeon, shortnose sturgeon, striped bass and two varieties of river herring, the alewife and the blueback. Known in many collectives as hickies or smelties, river herring are anadromous, meaning they spend most of their adult lives in saltwater but breed only in freshwater. The description comes from the Greek for "running upward" or "ascending," reflecting their habit of swimming upstream to spawn. (Eels are catadromous, or "descending," because they take the reverse route and spawn in the sea.) River herring are unremarkable to look at, undersized and unimpressive with bulging eyes and an unimpressive that evokes a bulldog's visage. But what they lack in stature, they make up for in tenacity and toughness, often arriving at their spawning grounds bloodied and scarred. And they are extraordinary in their ability to tolerate extreme swings in salinity, using their kidneys and gills to compensate, adjusting salt and water levels in their bodies as they cross over from ocean to river and back again. And while more well-known migratory fish such as Pacific salmon switch between fresh and saltwater only twice in their lives, sexually mature herring do so twice a year, sometimes for three or more years. Making these changes is physically taxing, but it's worth it, allowing herring to take advantage of the best of what each type of environment offers. They spawn in ponds and streams, where there are fewer predators and ample places to hide, and return to the ocean where there's more food to eat. Like salmon, individual fish imprint on the place where they hatch, using their homing instinct to return to the vicinity of their natal waters every spring. It's still a mystery to scientists how they do this. It may involve the unique odor or water chemistry of their spawning beds. The adults, depleted from long journeys in which they often forgo eating, soon return to the ocean in search of food after processing. Their young stay behind to grow and strengthen, feeding on microscopic water fleas and other organisms and waiting until the fall to make their inaugural migration to the sea.



River herring at the Gilbert Stuart Dam in North Kingstown, provided by the Nature Conservancy.

River herring help form the foundation of New England's coastal ecosystem. Sitting near the bottom of the food chain, they play a critical role as prey for bigger fish, water birds and all sorts of other animals, returning biomass in such numbers as to provide food for all. "Everything feeds on river herring," says Patrick McGee, principal fisheries biologist with the Rhode Island Department of Environmental Management.

They and bald eagles hunt them from the air. Herons and egrets spear them in shallow waters where currents and herring pull draw for them. From below the ocean's surface, they're gobbled up by striped bass, bluefish, tom cod, halibut, dolphins and seals. In freshwater systems, otters, bass, trout, perch, pickerel and pike feed on them.

And from the water's edge, mink, raccoons and skunks scavenge any remains. In a report on herring run restoration efforts, Timothy C. Voth, a marine resource specialist with the University of Connecticut, describes the havoc that predators wreak upon the fish on their migratory path as a "parade of carnage."

"In the morning, fish spill from the beach where the only remains of the violence that occurred the previous evening," he writes. Humans, too, would come to depend on this bounty from the sea.

Rivers since ran aiver with herring

Author John McPhee called sand America's "bread and butter" in reference to George Washington's reliance on catches of them to feed the Continental Army during the Revolutionary War.

See **HERRING**, Page 20A.



Kayakers on the Blackstone River take a tour of Lunatic Marsh as part of the third annual "fish migration parade" in May to drum up support for restoring fish passage on the river. ALEX KUPFER/THE PROVIDENCE JOURNAL

Herring

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But river herring have lost as much of a claim to the title as their migratory cousin.

It's told that in 1621, Tisquantum, the Patuxet Wampanoag Indian also known as Squanto, taught the Pilgrims the indigenous way to "fish" their corn, pumpkins, squash and beans, that is, to place seaweed with their seeds to enrich the nutrient-poor soil of the region.

The technique would prove crucial to the settlers' survival in the New World. The Colonial Thomas Morton wrote that a single acre planted this way would yield as much as 2 acres without the fish.

The Native American tribes of what would become New England also taught the newcomers the value of eel, salmon, shad and herring as vital sources of nutrition, the latter two of particular benefit because of the timing of their return to freshwater in the spring just as winter stores of food were running low.

The natives would build seasonal villages in places known to have good fishing, including along the banks of the river. The Colonists would soon name the Blackstone, but which the Nipmucs knew as Kituxuck, and the Narragansetts called Mishikittukoskepe. Both translate as "green tidal river."

On the lower part of the river, the Narragansetts settled around Centrals Falls, Valley Falls and Pawtucket Falls. Many years later, their exploits were still vivid in memory.

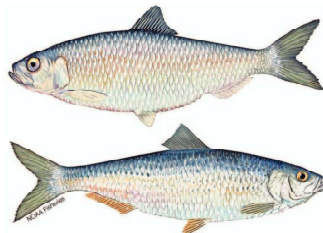
"The Indians used to stand on the rocks below the Pawtucket falls, and with their bows and arrows shoot the salmon as the letter were trying to leap the falls," one fisherman recounted in a 1907 story in *The Journal*.

Further upriver, the Nipmucs were said to have also used spears and scoop nets to catch salmon and herring and built weirs, semi-permanent structures made of sticks or rocks, to corral them in the thousands, according to a history of migratory fish in the Blackstone written by scientists at the University of Rhode Island who found "ample evidence" of salmon, shad and herring in the river at least as far north as modern-day Mendon.

"There was a time when people said you could almost walk across the Blackstone on the backs of herring," said Bruce Curtis, waterways advocate for the Hassanamisco Nipmuc Band. "People could feed their family for months on just one day's catch."

The Colonists were astounded by the unbelievable numbers of fish they witnessed during the spring migration. There were times when rivers were said to be "running silver."

In 1634, William Wood observed eelwives, in such multitudes as to almost incredible, pressing up in such shallow waters as will scarce permit them to swim, leaving likewise such longing desire after the fresh water ponds, that no beatings with poles, or forcive agitations by other devices, will cause them to return to the sea, till they have cast their spawn."



In time, according to DEM calculations, more than 200,000 river herring and nearly 10,000 shad could return to the lower Blackstone. PROVIDED BY NOAA

Horace Keach, in his 1856 history of Burrillville, told of periods when herring were "known to fill the streams at the forcing-places so that it was difficult to cross while the shoal was passing."

The fish were known to travel great distances, sometimes 100, even 200, miles from the coast to find the perfect patch of freshwater to spawn.

In the days before refrigeration, the migrations were miraculous, predictable in their timing and bringing fish that were easy to catch and in plentiful numbers to inland residents who lacked easy access to the ocean. They were the Peapod or Amazon Prime deliveries of the day: a legitimate calorie-rich food, in the words of one former Massachusetts fisheries commissioner, "to the very doors of the poor people."

The fish were smoked, salted, brined and pickled to last families until the following spring.

William Briggs Jr., an early Taunton settler, was succinct in his view of the importance of river herring to the Colonies.

"It seems to be a sort of fish appropriated by Divine Providence to Americans ..." he wrote.

Slater Mill opening begins the decline of herring in the Blackstone

When Samuel Slater opened his water-powered textile mill in Pawtucket in 1793, it signaled the eventual demise of river herring and other migratory fish in the Blackstone River.

Slater chose the location for his cotton-spinning factory in large part because of its proximity to Pawtucket Falls, which was partially dammed for the first time in 1716. With a drop of more than a dozen feet, the bedrock falls were a ready source of much-needed power. In addition, Slater built a second 6-foot-high dam just upriver, adjacent to the mill.

The Blackstone Valley would prove a perfect place for the new industry that Slater planned. On the 2.8-mile course

from headwaters near Worcester, Massachusetts, to its terminus at Pawtucket Falls, the river drops 438 feet. Mill owners would concentrate this natural energy by building more dams, so many that by the 1830s, there was one for every mile of river.

What may have been the first water mill in America was built in 1634 on the Neponset River in Massachusetts. From then on, inhabitants of the region started damming rivers to drive saws to cut lumber and stone wheels to grind grain, but their earlier rudimentary structures were nothing compared with the bigger timber and granite dams built during the Industrial Revolution.

The lower Blackstone was modified in other ways. Before the construction of the Main Street Bridge in Pawtucket in 1773, a channel known as Little River ran alongside the mainstem of the Blackstone, giving herring, which, unlike salmon, are poor jumpers, an alternate route around Pawtucket Falls.

But during construction of the bridge, Little River was filled, narrowing the Blackstone by about 50 feet. The following year, a fishway called Gargent's Trench was dug out in the approximate location of Little River, but it wasn't long before mill owners dammed even this one tributary. Eventually, it would be buried within the west bank of the river.

There was so much filling along that side of the Blackstone that a feature known as Fishing Rock, which in historical illustrations can be seen jutting from the middle of the Seekonk below Pawtucket Falls, is now only partially visible, enclosed within a granite-block wall that lines the riverbank.

As early as 1719, the general Assembly passed a law empowering town committees to give fish passage. Legislators went further in 1735, ordering mill owners to enable passage during the spring runs "forever."

But forever wouldn't last long. The laws, like similar statutes in other states, were largely ignored, leading to conflict with those who depended on the herring fishery. In one infamous in-

cident during what were known as the Herring Wars in Balmouth, protesters stuffed a cannon with herring and attempted to fire it. The cannon, however, exploded, killing the gunner.

Reflecting larger economic changes, industry won out, including on the Blackstone, where the Slater Mill Dam won special protection from lawmakers upon its construction.

Salmon were the first to disappear from the river, probably in the 1700s. They were all but gone from the rest of Rhode Island and most of New England by the middle of the next century.

River herring and shad hung on a little longer in the Blackstone before trickling to nothing. They fared better elsewhere, declining gradually over generations before plummeting over the last half-century.

Overfishing, hatchery losses, habitat destruction, pollution and climate change may have all played a role in pushing their populations to the point that some have argued for protection under the Endangered Species Act.

John Waldman, a biologist at Queens College in New York, writes that dozens of other migratory fish on the Atlantic Coast have also seen their populations plummet because of human impacts.

"Most had reached their lowest levels at the present, and many showed trend lines that sloped slowly toward zero," he writes in his 2003 book "Restoring Silver: Restoring Atlantic Rivers and Their Great Fish Migrations."

Waldman uses the term "ghost fishes" to describe those species that once played an important role in coastal ecosystems but are now absent or in such low numbers as to be practically gone.

"And so their absence resonates as holes, or 'ghosts,' in the ecological machinery of their environments," he writes.

A new plan to bring herring back to the lower Blackstone

From the edge of the Main Street bridge in Pawtucket, John Torgan scans the waters of the Seekonk River.

He calls out when he sees the occasional coarct come up with a herring or when he spots the telltale glint of a striped bass that's also in pursuit of the fish.

Torgan has been fishing the waters in Rhode Island since he was a child. When he was little, his grandfather would take him to the Gilbert Stuart Stream in North Kingstown, which would be packed with herring on their way from the Narrows River to spawning grounds in Carr Pond.

People there would catch the herring to use as bait for everything from stripers to lobster.

"You could dip a net and get all you want," Torgan says.

The Gilbert Stuart run is believed to be the oldest continuous run in the state. Even in Colonial times, settlers lifted herring in buckets over the dam that powered a saw mill. In the 2000s, a fish ladder was built so that herring could swim around the Gilbert Stuart dam.

Continued on next page



A great blue heron takes wing at Lansdale Marsh, one stop during May's annual "fish migration parade" celebrating the Blackstone River and efforts to restore passage for migrating fish. ALEX KUFFNER/PROVIDENCE JOURNAL

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Strawtown like it that allow down the flow of water and give herring places to rest on their upward journey have been constructed all around Rhode Island. The first went up at Pawtucket Falls in Cranston in 1872. In other places, dams have been removed in their entirety. The Nature Conservancy helped lead the largest fish passage project in Rhode Island to date: the reopening in 2008 of the entire 34-mile length of the Wood-

cockville River to herring and other fish, an effort that took decades to complete and encompassed the removal of two dams and the construction of or modification to fishways on three others.

Now the organization has been tasked by the DEM to do something that may be even bigger. Torgan is in Pawtucket on this spring morning with Jason McNamee, deputy director for natural resources at the RIDEM, to explain what's in the works.

Because of its historic status, the Slater Mill Dam is protected. It wouldn't make sense to remove the Main Street Dam either. It's owned by a private company that uses it for hydropower, and even if the dam's taken down, the falls, in their current state, are too high for fish to ascend. The two dams' proximity also makes it impossible to build traditional fish ladders.

The restrictions have forced engineers hired by the Conservancy to be creative. The centerpiece of the new

plan would take a page from the past with the construction of an approximately 10-foot-wide channel that would run alongside the Blackstone, allowing fish to bypass both dams.

"We don't think fish ever came up over the falls at the millstream, but rather went along the edges," says McNamee, a fisheries biologist by training. "What we're going to do is mimic that natural phenomenon."

Fish would enter through a gate on the east bank of the river at a point below Pawtucket Falls and continue upstream through the Apex property, under Main Street and then in an open-air passage across Slater Mill Park, before exiting just above Slater Mill Dam.

Nothing like it has been built before in Rhode Island for fish passage. Current estimates put the cost at anywhere from \$20 million to \$30 million, depending on what gets included in the final proposal. Construction of a more typical highway at Elizabeth webbing mills dam would follow. The DEM bought the dam and its hydropower works in 2000 with the restoration of the Blackstone herring run in mind. The existing power canal would be converted into a rocky passage and the dam would be lowered by 2 feet at a cost of \$2 million to \$4 million.

The third and last piece of the puzzle is the installation of a similar type of fish ladder at Valley Falls Dam. The dam is owned by a private hydropower operation, but under the terms of the license from the federal government, the company must install fish passage if the two other projects are completed.

It's an exceedingly complex effort involving, along with the DEM and the Conservancy, a host of other environmental groups, government agencies and tribes: the National Park Service, Saw The Bay, the Narragansett Bay Research Reserve, the Blackstone River Watershed Council, the Blackstone River Collaborative, the Narragansett Nipmuc Band and the Narragansett Indian Tribe, among others.

But if the entire plan is completed, it would open up what McNamee, Torgan and others describe as a perfect spawning habitat for migratory fish.

In time, according to DEM calculations, more than 200,000 river herring and nearly 10,000 shad could return to the lower Blackstone.

"All the dominoes have to fall," McNamee says. "But if we can start to knock the dominoes down, we can get there."

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