A COMPILATION OF HISTORICAL PERSPECTIVES ON THE NATURAL HISTORY AND ABUNDANCE OF AMERICAN SHAD AND OTHER HERRING IN THE POTOMAC RIVER.

By Jim Cummins, The Interstate Commission on the Potomac River Basin
(Always Draft, Updated: 03/2012)

Gill-net collections of spawning shad in the tidal Potomac with the help of volunteers and Virginia watermen.
Photo Credit: David Hawxhurst

US Fish & Wildlife Service stocking shad fry at Mather Gorge. ICPRB Photo Credit: Jim Cummins

Field stripping and fertilization of shad eggs for delivery to the USFWS's Harrison Lake Hatchery.
Photo Credit: David Hawxhurst

1: The Potomac River American Shad Restoration Project:

The American shad was once one of the east coast's most abundant and economically important fish. By the mid-1970s, water pollution, over-harvest and the blocking of spawning habitat by dams led to their decline, resulting in the imposition of harvest moratoriums which are still in effect. Despite significant improvements in water quality since the 1970s and a river harvest moratorium in effect since 1982, the American shad stocks had not recovered in the Potomac River by the mid-1990s.

In 1995, the Interstate Commission on the Potomac River Basin (ICPRB) began leading an American shad stocking project, with the assistance of local watermen and the cooperation of the U.S. Fish and Wildlife Services' (USFWS) Harrison Lake National Fish Hatchery. The stocking program was designed to imprint shad to the historic spawning and nursery waters and help rebuild Potomac River shad stocks. Since 1995, more than 22-million American shad fry have been stocked in the Potomac River. The number of adult shad returning to spawn has increased tenfold. Young shad also have become substantially more numerous in the Potomac, eclipsing records for nine of the last ten years in Maryland's shore-haulseine surveys which have been performed since 1959. Starting in 2003, ICPRB has been working with the Virginia Department of Game and Inland Fisheries helping to stock the Rappahannock River with over 34 million shad fry.

American shad numbers in the Potomac River should continue to increase over the next five years (foreseeable future). In 2003 the Potomac became the egg-source for American shad restoration efforts in Virginia, Maryland, and Pennsylvania. However, American shad remain in trouble coast-wide, so for now the Potomac must serve as a back-up for these systems. We maintain optimism that these other systems will recover and then the Potomac's harvest moratoriums can be modified so, like our ancestors, anglers can take a self-caught shad home to enjoy on the table. Monitoring and keeping track of restoration progress are more important than ever in order to re-open the commercial and recreational American shad fisheries that were once so valuable to our economy and way of life.

The restoration project reached out to the public in a very large way and has been fortunate to have much public support. Hundreds of volunteers have helped during the late-night hours of spring brood-stock

collections. Thousands of students and dozens of area schools have participated, both on the river and raising shad fry in the classroom through a "Schools-in-Schools" partnership with Living Classrooms of the National Capitol Region and the Anacostia Watershed Society.

Students participating in the Schools-in-Schools program, in cooperation with the Chesapeake Bay Foundation and others, stocking their shad-fry near Old Anglers Inn. Photo Credit:Jim Cummins

Through the student's efforts an estimated 300,000 additional fry have also been released. Interest in angling for American shad is growing rapidly thanks in large part to this strong public outreach and participation component.

2. A Description of Shad and River Herring: These fish have brilliant silver-colored bodies, highlighted with yellow (American shad), green (Alewife herring) blue (Blueback herring) or steel blue (Hickory shad) with a dark dorsal area and a spot or spots running just above their midline. The American shad grows the largest, averaging about 5 pounds but can grow to 15 pounds (but 11 lbs - 4 oz. is the current IGFA record) and almost a meter (3') in length ((the Maryland record is 8 lbs., 2 oz). They are anadromous fishes, meaning they spend their adult lives (average = 5 yrs, can live to 22 yrs) in the ocean and return to freshwater rivers to spawn. As adults, they capture plankton for food using modified gill rakers. They are distributed worldwide in temperate regions and the North American Atlantic Coast representatives range along the east coast from Florida to Nova Scotia.

The American Shad ICPRB Photo

As we work to restore this fish, we should remember that shad (and other herrings) are important ecologically as well as economically. Shad provide a critical conversion of plankton to fish food. The annual Spring spawning runs of shad were once major food sources for many animals, everything from bears, bald eagles (who time the hatching of their young to the run) ospreys, to striped bass, catfish, minnows (great predators of shad eggs and fry), crabs (who consume shad which die of spawning stress) and, eventually, back again to plankton.

This importance is easier to understand if we conceptualize the Chesapeake Bay and the Potomac River as a machine, in this case as a sort of giant grandfather clock, a special ecological clock so to speak. The clock's frame is the river habitat, i.e., the bay/river bottoms and edges. All of the plants and animals make the various wheels, pulleys, levers, cogs, gears, etc, inside the clock. The American shad, and other migratory fishes in the herring family, make a major part of the clock's main spring. After spending years growing to adults in the ocean, they bring tremendous amounts of food (energy!) into this machine each Spring when they return to spawn. They, like the salmon out west, provide the power for the clock. Thus they are what I call "clock-spring" species. They are tremendously important in driving the clock and keeping it running correctly. The Chesapeake Bay's clockwork will only run smoothly when the clock-spring functions correctly. To restore the bay and the Potomac River, we must restore this integral component. In addition, shad values, both economic and ecologic, are year-round, providing that food conversion to many oceanic species, including the cod[1] and the bottle-nose dolphin[2].

[1] Spencer F. Baird "..the reduction of cod and other fisheries, so as to become a failure, is due to the decrease off our coast in the quantity, primarily, of alewife, and secondarily of shad.., more than any other cause." US Commission of Fish and Fisheries. *Report of the Commissioner for 1886.* Washington Government Printing Office. 1889. Page 203.

[2] Shad are quite unique fish because they have sound reception skills which key in on the very high frequency sound waves, echolocation, emitted by dolphins (see Dennis T. T.Plachta and Arthur N. Popper, 2002.

It is a common public convention, but somewhat of a misnomer, to differentiate "shad" from herring. The migratory fish we call "shad" in the Potomac; the American (*Alosa sapidissima*) and hickory shad (*Alosa mediocris*), are both herring in the order Clupeiformes. They are close relatives to the Potomac's two species of river herring; the alewife (*Alosa pseudoharengus*) and blueback (*Alosa aestivalis*), all four are in the family Clupeidae, genus Alosa. These four "herrings" currently share the Potomac River with more distant herring cousins, as evident by their genera; the Atlantic menhaden (*Brevoorita tyrannus*), the non-migratory gizzard shad (*Dorosoma cepedianum*), also called winter or mud shad, and the even more distant relative, the bay anchovy (*Anchoa mitchelli*) of the family Engraulidae. The herrings appeared fairly early on the fish evolutionary tree, the oldest forms coming from the early Cretaceous geologic period, about 140 million years ago (the oldest jawed fishes appeared around 400 million years ago and the more primitive jawless fishes appeared more than 500 million years ago).

The species name of the American shad, *sapidissima*, means "delicious." Shad are not like tilapia or catfish, both noted for their subtle flavor. Shad have a much sweeter flavor and have been a highly renowned food fish throughout human history (In Iran, shad, or hilsa, is an important symbolic food for Navroze. In East Bengal, jora-ilish is a traditional food on Vasant Panchami Day). In 1867, Thomas De Voe noted in "The Market Assistant, Containing a Brief Description of Every Article of Human Food Sold in the Public Markets of the Cities of New York, Boston, Philadelphia, and Brooklyn" that the American shad " well-known fish is a general favorite among all classes of persons, as its flesh is considered among the best, sweetest, the most delicate, as well as being the most plentiful in season. Nothing but its numerous bones can be said against it."

George Washington loved to eat shad. From Philadelphia we find him writing[3] to his manager about a fish merchant's offer; "I am at this moment paying six shillings apiece for every shad that I buy." Back at Mount Vernon, he usually tried to get twelve shillings for every hundred shad he sold. In Philadelphia, he was buying shad prepared for the table, and six shillings would be worth approximately $30 today.[4] George was frugal, and his spending such a sum shows his acclaim for the fish.

George Washington, and many people until the 1970s, grew up eating shad and could deal with the bones. However, the bones of the shad do present a problem for those just learning about this delicious fish. How do you deal with 769 bones[5], most of which are small "Y" shaped bones which are found in shad where most fish fillets would be bone-free. Shad can be de-boned, oddly termed "boning," but removal of these "y" bones from shad is a real skill, if not art, indeed, some boning methods are closely guarded secrets. Count yourself lucky if you know a market which sells boned shad.

The hickory shad's species name, *mediocris*, roughly translates to "common or ordinary,"as it has less culinary esteem, with exceptions. The alewife's *pseudoharengus* means "false" and the blueback's *aestivalis* means "of the summer," and both of these fish are rated as good to eat.

Evasive responses of American shad(Alosa sapidissima) to ultrasonic stimuli. Acoustic Research Society of America, Acoustic Research Online (ARLO 4(2), April 2003)). The shad's avoidance of these dolphin sounds is interpreted as evolutionary development due to predator-prey interactions. The use of dolphin sound is being employed at fishways to try to repel shad to certain areas of the dams. Dolphin are a major shad predators and should benefit greatly from shad recovery.

[3] Tilp, Frederick. 1978. "This Was Potomac River" Library of Congress Catalog Number 78-61374.

[4] In order to convert value after 350 yrs, I used "How Much Is That in Today's Money?" By Ed Crews, in Colonial Willamsburg Journal, Summer 2002.

[5] Chris Letts, Hudson River Foundation

3. The History of Shad in the Potomac River:

A. The early People: Shad were important but seasonal components of native peoples diets. Arriving at the time of year when foods stocks were at their lowest, shad and river herring were more than welcome treats, they were often life savers. The boney nature of the shad became part of Indian legend. "Tatamaho" was the Algonquin name for the American shad. According to legend, an unhappy porcupine asked the Great Spirit to change it into another form. The Great Spirit's wisdom was to turn the porcupine inside out as a fish (the shad) that would forever have to swim and make the long journey to the sea and back to spawn . Tatamaho roughly translates to "inside-out porcupine." Anyone who has ever eaten this highly esteemed fish with 769 bones understands the meaning. But those who prize this fish are not put off by the bones. Warren Cook, a vice chief of the Pamunky tribe of Virginia, contends that "part of the enjoyment of shad is the bones."

1893 - Shad Planking at Marshall Hall, MD

B. The European colonist learned from these People the various methods to capture shad and herring, using weirs, traps and nets, and how to cook and prepare them, primarily through smoking and drying[6]. Shad "plankings," so politically and socially steeped in Virginia and other areas, are adaptations of one of these methods which incorporates attaching the fish to wooden planks which are propped in front of a fire pit and slowly baked/smoked. Modern adaptations include basting with highly-prized and often well-guarded watermen's family recipes.

C. Early 1600's: From "LIFE ON THE POTOMAC RIVER" (1968)

By: Edwin W. Beitzell of St. Mary's County, Maryland
Chapter VI, FISHING AND CRABBING
(Individual credits to Beitzell's text researched and added by J. Cummins)

"Captain John Smith[7] of Virginia was the first to record the fabulous quantities of fish of many sorts to be found in the Potomac, in his exploratory journey in June[8], 1607, to the Great Falls above the present city of Washington (i.e., one of Smith's often quoted passages notes that fish were '...lying so thicke with their heads above water, as for want of nets we attempted to catch them with frying pans'). His report was subsequently confirmed by Henry Spelman, Captain Samuel Argoll[9], Henry Fleet[10], and Father Andrew

[6] A European method, salt pickling, became the primary method for preservation until the age of refrigeration. Smoking and pickling are still favorite ways of preparing shad.

[7] Smith, John. *General Historie of Virginia*. London. 1608.

[8] Comment by Jim Cummins: The month of May is currently the peak spawning time for shad, but the June, 1607, trip of John Smith may have been witness to a later American shad migration. The migratory season may have been later due to water temperature differences caused by the "Little Ice Age" which was occurring during the early Jamestown settlement era. The fish that John Smith and his crew were trying to capture may have been American shad.

[9] Purchas: His Pilgrimes. 1625, Vol. IV, p. 1765. "A letter of Sir Samuel Argoll touching on his Voyage to Virginia, and actions there. Written to Master Nicholas Hawes, June, 1613.

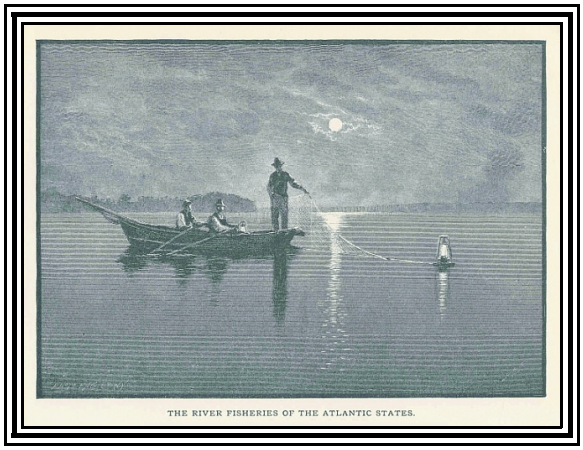
[10] Fleet, Henry. *A Brief journal of a voyage made on the bark "Warwick" to Virginia and other parts of the continent of America.* Printed in Neill, E.D. *The English Colonization of America during the Seventeenth Century.* London, 1871, pp. 221-237

White, S.J[11]., the first chronicler of the Maryland colony. Fleet recorded in his journal of a trip in 1631, 'This place [the site of Washington] without question is the most pleasant and healthful in all this country. It aboundeth in all manner of fish. The Indians in one night will commonly catch thirty sturgeons in a place where the river is not above twelve fathom broad.'"

1612 - "Shad, great store, of a yard long and for sweetness and fatness a reasonable food fish." Observation of William Strachey (underline added for emphasis). "Though the records of the average weight of shad in those days (colonial period) are lacking seven pounds is a fair estimate, and it may have been greater. The weights now (1978) seldom exceed three or four pounds, because in the more recent years of intensive fishing, shad have been widely caught up as they returned from the ocean to spawn for the first time."[12]

D. The 1700's: Andrew Burnaby[13], in speaking of the Potomac River, remarked as follows. "These waters are stored with incredible quantities of fish,... Sturgeon and shad are in such prodigious numbers that one day, within the space of two (2) miles only, some gentlemen in canoes caught above 600 of the former with hooks which they let down to the bottom and drew up at a venture when they perceived them to rub against a fish; and of the latter, above 5,000 have been caught at one single haul of the seine."

E. Early 1800's: "Chapman's Point has been the location of an important shad fishery since colonial times; only in recent years has shad fishing been discontinued there. The original record books of George Chapman, Esq., haul seine fisherman for American shad in the Potomac River during the period 1814-1824, include the numbers of shad and herring caught and sold each day. Shad catches from Chapman's fishery amounted to 955,615 shad (and 116 million herring) for the 11-year period. If only 100 fisheries were operating on the Potomac River in the early 1800's and if they were as successful in the capture of shad as George Chapman, prodigious quantities of shad must have been captured. Chapman's catches were equal to about one-third of the catch of shad by all gears from the entire Potomac River during the 11-year period from 1946 to 1956. There is little doubt, if Chapman's records have been interpreted correctly, that the abundance of shad in the early 1800's was considerably greater that at the present time. These reports also suggest that reports by early historians concerning the tremendous quantities of fishes found may not have been exaggerated.[14]"


THE RIVER FISHERIES OF THE ATLANTIC STATES.

F. 1830's: In the 1830's it was not uncommon for fishermen to pull 4,000 shad or 300,000 herring in one seine haul. One documented haul had 450 rockfish with an average weight of 60 lbs each. Hundreds of sturgeon were captured on a single night near the U.S. Arsenal in Washington, D.C. at the mouth of the Anacostia River.

---

[11] White, Andrew, S.J.. *A Brief Relation of Maryland*. London. 1635

[12] Tilp, F. *This Was Potomac*, Alexandria VA: 1978, pgs 13-14

[13] Burnaby, Andrew *Travels through the Middle Settlements of North America in the years 1759 and 1760*. London, 1775. 106 pp.

[14] Massman, William H. A Potomac River Shad Fishery, 1814-1824. Contribution No. 98, Virginia Fisheries Laboratory, Gloucester Point, Virginia. Reprinted from CHESAPEAKE SCIENCE, Vol 2., No. I-2, March-June 1961.

1. Spencer F. Baird, first Director of the US Fish Commission[15], in 1889: "No better illustration of the numbers in which anadromous fish enter the rivers can be given.... than a presentation of the case as it relates to the Potomac River in the short distance between its mouth and the Great Falls of the Potomac, only twelve miles above Washington. Although this stretch of water is even now very productive, many years will elapse, if ever, before it gets up to the measure of yield mentioned by (Joseph) Martin[16] in his History of Virginia, a work published in 1835. I give, however, the statement, allowing it to speak for itself:

'...of the Potomac, it may be well to mention that in the spring of the year quantities of shad and herrings are taken which may appear almost incredible. The number of shad frequently obtained at a haul is 4,000 and upwards, and of herrings from 100,000 to 300,000. In the spring of 1832 there were taken in one seine at one draught a few more than 950,000 accurately counted. The shad and herrings of the Potomac are transported by land to all parts of the county to which there is a convenient access from the river, and they are also shipped to various ports in the United States and West Indies.'"

Baird also notes, "It is proper to say that the accuracy of Martin's figures has been disputed by some recent writers. Even if they are, however, twice as large as the fact would justify, the general argument would not be invalidated"

Although the season lasted but about eight weeks, during this time (the 1830's) as many as 22,500,000[17] shad were taken and 750,000,000 herring. In curing the fish for later consumption, 995,000 barrels[18] of salt were used. S.F. Baird continues in his 1886 report (page 167): "For the 750,000,000 actually captured we may suppose that this was not more than one-fourth of the total number in the river during the season, which would give 3,000,000,000 for the Potomac River only". " ....the fishery on the Potomac during the period referred to equaled the total yield of the Scottish salmon fisheries in 1873, prosecuted through-out the year, and employing 15,000 boats and 45,594 men, and equaled nearly twice the entire number of barrels of the sea herring put up in Canada in 1876."

Shad Haul Seine Fishing in the 1890s.

2. The Metropolitan, a Georgetown newspaper, in its April 25, 1836 issue stated: "We were not fully aware of the immense importance of the Potomac fisheries and their value, .. until this spring. Besides the larger supplies shipped daily by the canal[19], every night the long length of Bridge street and High street,

---

[15] US Commission of Fish and Fisheries. *Report of the Commissioner for 1886.* Washington Government Printing Office. 1889

[16] Martin, Joseph. *History of Virginia*. Published by Joseph Martin, Moseley & Tompkins, printers. 1835, p. 480.

[17] Comments by J. Cummins: These runs were massive - to illustrate: If the harvested 22,500,000 shad averaged 5 lbs each they would be equal the mass of 750,000 150 lb humans, or a huge army marching up the Potomac each Spring.

[18] These "barrels" are likely British 36 gallon barrels, and 995,000 of them would = 5,721,000 ft^3, equals a pyramid with a base the size of a football field from goalpost to goalpost and a height of 298', or a city block (300'x300') 192' high .

[19] Harland D. Unrau, Harland. 2007 "Chesapeake & Ohio Canal Historic Resource Study." National Park Service. The C & O Canal reported hauling upstream over 2 million lbs/year barreled shad and herring between 1845 to 1856, with over 3 million pounds in 1853 alone. That would be about 10,000 barrels/yr. The C&O Canal was just one conduit for these fish, they were also transported out of the Potomac watershed to Philadelphia, Baltimore, New York City, and to the Caribbean.

besides many other places, is crowded[20] with heavy four and six horse wagons from the most remote parts of Pennsylvania, Maryland and Virginia, even to the confines of Ohio, which exchange the produce they bring down, for the delicious fish which this noble stream affords in an exhaustless abundance, and return with a year's supply of these grateful delicacies to the far-off homestead of the inland farmer. Activity and enterprise are only wanting to make the fish trade a source of immense and permanent wealth to the town."

G. Early 1900's: SHAD FISHING ON THE POTOMAC AT NIGHT (Wilstach[21]):

"But one has not seen the most picturesque feature of the Potomac fisheries who has not seen shad fishing at night. The nets are laid for every run of the tide, by night as well as day. By day the lines of huge corks sustaining the nets across the channel are easily seen and avoided by passing steamers. At night these same reaches of nets would be invisible were it not for the "gillers," as fishermen are called on the Potomac, who have extra-large floaters at both ends of each net and on them make fast lighted lanterns. To look across the broad waters of the river on nights when the shad are running is to mistake the vision for a bit of Venice, a fairy city twinkling in the darkness."

H. The Mid 1900s: The nadir came during the late 1950's to the early 1970s, the upper freshwater tidal Potomac in the Washington metropolitan area, which receives the river's largest wastewater and stormwater inputs, was often lethal to most fishes, and was particularly so to migratory fishes returning to that area to spawn. In 1962 thousands of striped bass and white perch died in the Potomac in Washington from water quality problems. In September of that same year, 3,180,000 menhaden die and form a huge ugly mat on the Anacostia.

Top left: 1960s Fish Kills.
Above The dock at Mount Vernon.
Left: Factory discharges, North Branch, 1970s.

Major migratory fish kills which occurred in the early 1960s are one of the major reasons that President Lyndon Johnson declared the Potomac River a "national disgrace." Migratory fishes were also subject to over-harvest and loss of spawning habitat, the latter principally through the construction of dams. In the 1970s and 1980s the American shad fishery collapses. It is closed in Maryland in 1980, the Potomac in 1982, and Virginia , with it's politics historically steeped in shad plankings of Wakefield, reluctantly in 1993.

Compounding already compromised reproductive capacity, huge numbers of predators further hampered recruitment. While the word "predator" usually conjures up the image of something big and toothy, in this case the predators are minnows, such as large schools of spottailed shiners, that prey on the eggs and larvae of the shad (This is likely a major reason the planktivorous shad, which doesn't really eat while spawning, bite at lures which resemble minnows. They are not trying to eat minnows, they are trying to keep these predators away from their spawning activities.).

I. 1990's: Light again seen in the tunnel. In the early and mid-1990s, American shad stocks in particular remained depressed in the Potomac River despite significant improvements in water quality made over the last several decades and a river harvest moratorium that has been in effect since 1982. From a Washington Post, 5/25/95, Letter to the Editor, Jim Fearson of Herndon, Virginia, writes:

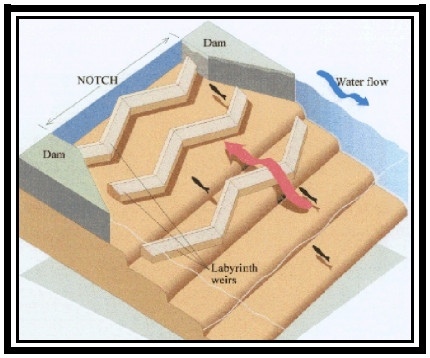
---

[20] Comments by J. Cummins: I can't help but ask "Did shad produced the first case of Washington gridlock? ...or perhaps more properly, wagonlock?

[21] Wilstach, Paul. *Approaching Washington by Tidewater Potomac.* National Geographic Magazine, March, 1930.

"Louis Harley, Fairfax County's last commercial fisherman, is the closing chapter in what was once the largest industry in the area [Netting a Profit on the Muddy Potomac, Washington Post Metro, May 15, 1995)]. Since colonial times landowners have operated fisheries along the Potomac shores, as well as leasing the fishing "rights." According to the Gazetteer of Virginia (1835), "In 1832, there were 158 such fisheries on the local Potomac shoreline requiring a work force of 6,550 laborers at the landings and another 1,350 men on board the 450 vessels engaged in the haul."

Perhaps the most industrious fisherman on the Potomac at the beginning of the 20th century was Capt. Neitzey, who had fisheries at Freestone Point, Stony Point and Ferry Landing and, as described in an article in the 1991-92 Historical Society of Fairfax yearbook, was owner of the largest fishing net in the world. The net proper was 9,600 feet in length and the hauling ropes at the ends 22,400 feet long, giving 32,000 feet of total sweep. During fishing season, Neitzey made two hauls with this net every 24 hours, taking seven hours per haul using eight horses and about 100 men. He claimed to have caught as many as 500,000 herring and 10,000 shad in one haul. This is the same waters that now support only Mr. Harley and his two helpers." (Editors Note: Mr. Harley passed away in 2009. His sons; Mike, Brad and Tim, still ply the family vocation, but as part-time watermen.)



A conceptual design of the notch and "W" shaped weirs of the new fishway at Little Falls. The three weirs slow the water down through the 28' wide notch and provide rest areas for migrating fish.

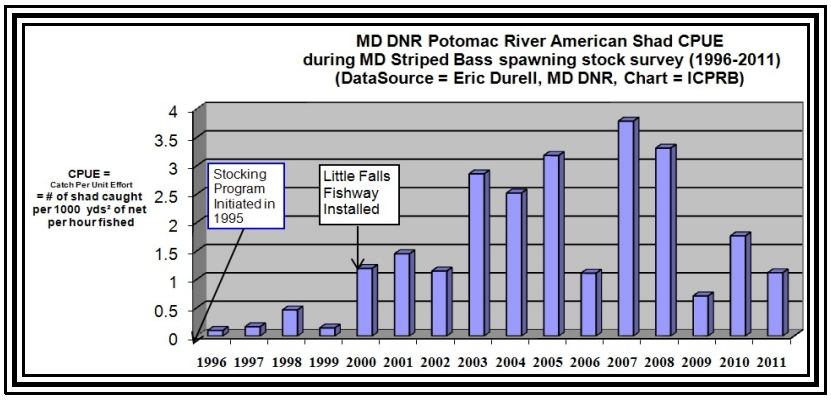
By the late 1990s things were also beginning to change. In 1995 an effort began by a coalition of federal, state, regional and local agencies and nonprofit groups, organized as a Task Force[22], to open historic spawning and nursery habitat for native and anadromous fishes in the Potomac River. An eight-year American shad stocking project began that same year which was designed to imprint shad to the historic spawning and nursery waters and to help rebuild Potomac River shad stocks. The stocking of one million shad fry was the annual goal.


The two dams at Little Falls. The curved dam is Dam #1, a feeder dam for the C & O Canal, the first dam built across the Potomac River. The straight dam is the Brookmont Dam, for water supply in Washington, DC, Arlington and parts of Falls Church, Va. The new fishway is located near the Virginia shore (left to viewer) on the Brookmont dam. Dam #1 is a rubble dam that does not block fish migration.

J. The Early 2000s. An important milestone for the fish passage restoration project was accomplished in January of 2000 with the completion of the fishway at the Little Falls (Brookmont) Dam by the US Army Corps of Engineers. However, the fishway alone was not enough; migratory fishes had been excluded from the ten mile area from Little Falls upstream to Great Falls for over fifty years and they needed to be re-imprinted to

[22]Members of the Little Falls Fish Passage Task Force came from Virginia, Maryland, the District of Columbia, the Interstate Commission on the Potomac River Basin, the Potomac River Fisheries Commission, the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, the National Biological Survey, the U.S. Environmental Protection Agency, the National Park Service, the National Marine Fisheries Service, Montgomery County, Maryland, the Chesapeake Bay Foundation, and The Potomac Conservancy. The Fish and Wildlife Service's document entitled *A Strategic Plan for the Restoration of American Shad to the Potomac River Upstream of Little Falls Dam* (Odom, 1995), endorsed and adopted by the Little Falls Task Force, recommended the eight year restoration stocking effort for American shad will be necessary to sufficiently augment and imprint the Potomac River's stocks.

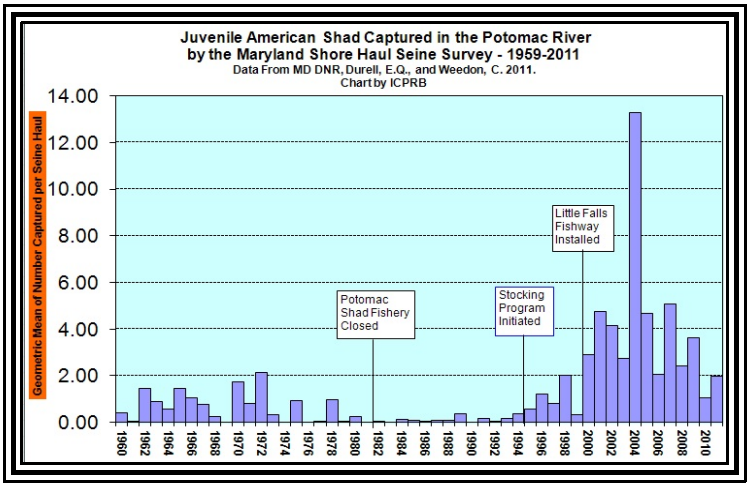
that area to help them return. By 2002, after an eight year stocking program, almost 16 million shad fry were stocked into the Potomac River at Great Falls. The ICPRB, the U.S. Fish & Wildlife Service (USFWS), the Maryland Department of Natural Resources and the Virginia Department of Game and Inland Fisheries monitor the progress of the project. Since the project started in 1995, the number of adult American shad returning to spawn has increased tenfold (top figure). At Great Falls, their return brought so much visitor attention and questions that a special kiosk on shad was installed by the National Park Service (middle figure). Young shad also have become substantially more numerous in the Potomac, eclipsing records for nine of the last ten years in Maryland's shore monitoring surveys that have been conducted since 1959 (bottom figure).



The new American Shad kiosk at Great Falls, VA.

The Potomac River American shad population is rebounding well, stocks are in apparent recovery, restoration stocking of the Potomac has been completed. The project's current focus is monitoring restoration progress and assisting the Virginia Department of Game and Inland Fisheries American shad recovery efforts for the Rappahanock River.

But these improvements are part of a larger story. As with most trends in the natural world, the reasons for the shad's rebound are multiple;



For ten of the past twelve years, young American shad in the Potomac have exceeded pre-restoration records kept since the 1950s.

First, the Potomac potential for producing shad is extremely high. It historically was a remarkably productive river, and still is. This almost intangible point is a very important one, one which is not yet fully appreciated. Many of the historic accounts in this compilation seem unbelievable. They have been disputed several times over the past 100 years as mere boast. They are not. They were probably best confirmed by William H. Massman's "A Potomac River Shad Fishery, 1814-1824." Please refer back to section 1-E for a quotation from his findings.

Second, water quality improvements over the last several decades have helped reset the Potomac's ecological functioning. The clean-up of the Potomac River is a national showcase for successful programs to restore highly polluted waters. The upper freshwater tidal Potomac is now an extremely

popular recreational fishing and boating area. Every year for over a decade, those same waters eluded to by President Johnson have hosted national bass fishing tournaments, including the $409,450 Kmart Top 150, with a grand prize of $100,000. The Potomac in the Washington metropolitan area has been rated as one of the ten best areas to fish for bass and catfish in the United States. Each year there are over 30 tournaments with at least 100 boats each, from one location alone, Maryland's Smallwood State Park. Charles County, Md., now lists bass fishing as its No. 1 tourist attraction.

Third, the shad harvest moratoriums, in both our rivers and ocean, were very necessary. We over-harvested what we didn't kill with pollution. But harvest moratoriums that had been in place for 15 years were not producing the desired effect.

Fourth, the return of submerged aquatic grasses, one of the ecological resets, strengthening the chain reaction of water quality improvements and improved habitat tremendously. Shad would be not be doing so well in the Potomac without these grass beds. However, SAV beds were thick in the Potomac since the early 1980s and the shad had not rebounded by the mid-1990s, when restoration stocking was initiated.

Fifth, the fishway at Little Falls. This structure restored roughly ten miles of important spawning habitat. It is important because the gorge area upstream from Little Falls is a zone of high energy which does not support beds of SAVs or the high numbers of minnow predators that we find in the tidal portions. This was true in the 1800s as well as today. The low numbers of predators (minnows) are what makes the area important to shad, providing the time for the eggs and larvae to develop in a predatorily reduced environment.

Sixth, the ICPRB/USFWS's shad stocking program. While the stocking effort was designed primarily to restore shad to the river between Little Falls and Great Falls, it also gave an extra shove, a jump-start, to a shad population which was reduced to such low numbers that they were marginally self-sustaining. The jump-start analogy is an apt one. A battery that won't start a vehicle is rarely entirely dead, it usually has some juice, often quite a bit, just not enough to start the engine and then self-maintain its power. The stocking effort provided that extra juice. As little as three to five percent increase can mean a whole lot. Ask any athlete, from high jumpers to marathon runners.

Hanbin Lee, Waples Mill Elementary, and a shad pal.

However, attributing the success solely to any one factor is a mistake. SAVs had been doing well in the upper-freshwater tidal Potomac for almost twenty years, more than a decade before the stocking effort began. No return of the shad. The moratorium was in effect in the Potomac for 13 years before we started stocking and nothing was happening. That the shad had not returned despite these improvements was number two of the reasons the stocking effort was initiated. But the stocking effort itself could not have restored the shad. The other improvements set the stage, the stocking program merely entered it on cue. Interest in angling for American shad is growing rapidly thanks to the strong public outreach and participation component.

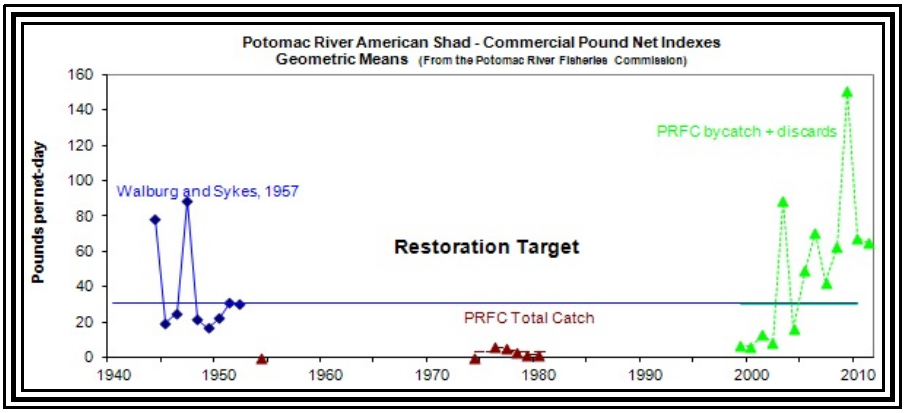
K. What is next? It is important that monitoring continue to maintain our knowledge of the pulse of this recovery. We also need to take the unique opportunity that the stocking and hatchery tagging program provided to enhance out understanding of the Potomac American shad population. The millions of shad with hatchery marks will only be around for a limited time, roughly five to eight years. Valuable information on growth

and habitat preferences can be gained by following these fish over time.

Another important but subtle issue to consider is that restoring this fishery is a different task from restoring the fish. As stated earlier, the fishery has been closed in the Potomac since 1982, in MD since 1980, and interest in the fish, while strong in some sectors, has been out-of-mind for a generation and of limited attention for years before that as the fish became so scarce prior to closures. Just about the only people you encounter with a memory of shad and the linked interest in eating them are 60 + years old. This is one of the reasons that the school stocking component is critical, i.e., it imprints both fry; the fish and humans. These young people, and their families, know the American shad once again.

American shad populations are again strong in the Potomac River and fishing for them is growing increasingly popular, but they must be released unless harvest moratoriums can be lifted.
Photo Credit: Mike Bailey, of Greg Wilson with shad near Fletchers Boathouse, D.C.

Commercial by-catch data from pound-net fisheries also reflect the recovery, indicating the population is returning to 1940s-50s era levels. In 2007, the Atlantic States Marine Fisheries Commission set the recovery threshold for increased harvest to be a 10 year geometric mean (average) of 31.1 lbs/net-day (straight blue line in the graph to right). In 2011, a 13 year (green line) geometric mean of 32.0 lbs/net-day exceeded that threshold.



The great news is that the American shad population in the Potomac is once again strong. For the foreseeable future (at least the next five-seven years) there should be enough shad in the Potomac to open wider the doors for harvest. We do not want to repeat past problems with over-harvest, but it is time to begin permitting and encouraging additional limited-entry commercial and recreational harvest.

In the interim, anglers can practice catch-and-release fishing for shad (See section III, below). This is a good way to re-learn about the shad; how much fun and challenge they can be to catch on hook and line, how pretty they are, how important to the ecosystem they are. Perhaps the most spectacular settings for this is the stretch of river from Great Falls down to Little Falls, which was re-opened to shad migration with in 2000 with the construction of the fishway at the Brookmont dam. Hopefully, in the not too distant future, we can also take a shad home and enjoy the fish on the table as our ancestors once did.

L. Recognition

The project received the 2006 "Future of Fishing" award from the American Sportsfishing Association and was one of Field and Stream Magazine's top six "Heroes of Conservation" projects. Restoring Rivers

recognized it as one of the top restoration projects in the United States for its wide range of groups which work together and for the monitoring used to assess its progress. A book by Sandy Burk on the project's environmental educational component entitled "Let the River Run Silver Again' was awarded the Isaak Walton Leagues Conservation Book of the Year for 2005 and the Green Earth Book Award for 2006. RestoringRivers.org names the project as one of the Nation's top 25 restoration projects because "a wide range of groups worked together towards the goal of reestablishing migratory fish populations." Since 2000 the project has been part of the Jim Range National Casting Call held at the Boat House at Fletcher's Cove. Beginning in 2006, this event serves as a template for the National Fish Habitat Action Plan of the U.S. Fish and Wildlife Service (USFWS) and a host of its partners. This initiative seeks to enhance large-landscape scale efforts to restore and improve fish populations and habitat through partnerships at the federal, state, local and private levels. The Potomac's shad restoration partnership, under the leadership of ICPRB, was cited as a great example of the type of partnership the USFWS would like to see established across the country.

II. SHAD INFLUENCES ON THE OUTCOME OF HISTORY:

A. George Washington was one of the first watermen on the Potomac and his fishery helped keep Mount Vernon viable[23]. Many know the story about how shad saved George and the Continental Army at Valley Forge in 1778, as their "delivery" saved his troops from starvation. According to the 1938 account of Harry Emerson Wildes[24] "dramatically, the famine completely ended. Countless thousands of fat shad, swimming up the Schuylkill to spawn, filled the river....Soldiers thronged to the river bank....the netting continued day after day...until the army was thoroughly stuffed with fish.." However, according to Joseph Lee Boyle , historian for the National Park Service, Valley Forge National Historical Park, this is a 60 year-old fish story[25]. In an act of early sabotage, British soldiers occupying Philadelphia prevented shad from going up the Schuylkill river. Fortunately, the preceding February, an insightful "Committee of Congress at Camp (Valley Forge)" recommended "large Supplies of Fish laid up from the Rivers of Virginia particularly the Potowmack in the ensuing spring..." and on May 18, the Maryland Council ordered a slop to "Mr. Magruders Fishery on Broad Creek Potowmack River" to load 280-300 barrels of fish. These were taken "with all Expedition" to be forwarded on to Valley Forge. Thus it was Potomac River shad, as well as shad from the Elk and Delaware rivers, not the blocked Schuylkill River shad, that saved the Continental army from starvation. Boyle goes on with "It should be noted that the descendants of the shad not eaten by the Continental soldiers, have not migrated up the Schuylkill for over 180 years. The construction of the dams for the Schuylkill Navigation Company have blocked the upstream migration since 1818[26].

B. Shad influenced the American Civil War, when, at "the decisive battle at Five Forks (Va). On April 1, 1865 (CSA General) Rosser had paused to scoop up some succulent shad from the Nottoway River. He invited George Pickett and Fitz Lee to join him for lunch. ...it may be that the prospect of a feast unbalanced all three of them; when Sheridan smashed into the Confederate line at Five Forks, the entire confederate high command was secretly at lunch, unavailable to their subordinates, out of touch with the front until it was too late to do anything but retreat[27]."

For a long time I interpreted this Five Forks outcome to be relatively insignificant. While decisive it came at the end of the war and one of minor proportions when compared to much larger engagements such as Antietam, Gettysburg, and Petersburg which preceded it, in the later case, immediately preceded.

---

[23] Warton, James. *Washington's Fisheries at Mount Vernon.* From *The Commonwealth*, August 1952.

[24] Wildes, Harry Emerson. *Valley Forge* (New York: The Macmillan Co., 1938), 174-175.

[25] Boyle, Joseph Lee. *The Valley Forge fish story*. Shad Journal, Volume 4, Number 2, 1999. The Shad Foundation, Seattle, Washington..

[26] Heydinger, Earl J. "Transportation on the Schuylkill River Before 1825," Master's Thesis, Lehigh University. 1954, 12.

[27] Lewis, Thomas A., *The Guns of Cedar Creek*. 1988. Dell Publishing, N.Y., N.Y., p. 298.

However, I now consider this event a critical one of the war and to this nation. This defeat enabled Union forces to disorganize, overrun and swiftly capture the westward retreating force's under General Lee and the blocking of his retreat to the south. Lee's subsequent surrender at Appomadox and the terms negotiated with Grant greatly enhanced the nation's ability to deal with the end of the war, and to heal from it's emotional wounds. If, on the other hand, the northern victory at Five Forks had taken longer, the southern forces likely would have made it to the Appalachian mountains, where they could have dispersed and pursued a guerrilla-type of warfare. Without Lee's noble surrender, the war might have gone on far longer with more lasting consequences.

One odd tidbit from the Civil War newspaper clippings of the 168th Regiment, NY Volunteer Infantry reads: "They shoot shad down in Dixie. The cook of Co. H, 168th, while in the woods the other day, saw a hawk flying over with a large fish in his talons, and r shot caused him to drop a fine large shad, which cook took into camp in triumph, as about the first specimen shot in the woods."

III. CURRENT STATUS OF FISHING FOR SHAD.

I am often asked "What is the current rule on fishing for shad?' and/or "Is recreational catch-and-release fishing for shad allowed, or is it totally banned, and even if allowed, does it hurt the fish?"

At the time of this writing, for the Potomac River, both hickory and American shad are illegal for recreational anglers to catch and keep. There are times when there are special exceptions. In past years I have obtained DC scientific collection permits for several volunteers who fish a Fletcher's Boat House, in order for them to capture, by hook and line, a sample of American shad that were used for analysis, principally for evidence of hatchery origin.

Commercial watermen in the mainstem tidal Potomac downstream from the Woodrow Wilson Bridge, predominantly pound-netters but also stake gill-netters, are once again permitted one bushel of shad /day culled from mortality by-catch from their fishing activities. I support this limited harvest of what was formerly discarded because the Potomac's shad population is strong enough, it is providing locally caught shad, and it is helping to re-acquaint the public with this delicious fish.

How catch-and-release by recreational anglers comes into play is complicated and merits a long answer.

First, keep in mind that there are five regulatory entities (at least) for migratory fishes in the Potomac; MD, VA, DC, the Potomac River Fisheries Commission, and the National Park Service (the latter as adjacent land-owners/fishing-access regulators and fishing law enforcers). Differences between their regulations can occur, sometimes just due to various timetables upon which regulations are modified, although they generally try to communicate to minimize differences.

However, all appear to me to handle the "catch & release" situation about the same, as it is a gray area in terms of the law. Law enforcement tends to look the other way as long as shad are released immediately after capture whenever they are "accidentally caught," as they do when other fish species, like striped bass, are similarly released when caught out-of-season or out-of-size requirements. Functionally, they basically have to, as any angler can accidentally capture a fish out of season or undersized, etc. It is considered by-catch. It happens to me frequently (but not frequently enough). So if you accidentally catch something that is illegal to possess, but do your best to release it with haste and least-harm, you are arguably keeping with the spirit of a law designed to protect the fish.

Of course, whether one goes out and actively "accidentally catches and releases" fish that are by statutes protected, of concern, or just-generally-in-trouble-but-not-regulated, becomes a graduated-scale question of personal morals. For instance, both species of sturgeon in the Potomac are illegal to fish for and possess and anyone who targets them, under the guise of "accidentally catching and releasing" is, in my eyes, a bad person because sturgeon are in such dismal shape they should not be subject to such harassment and

potential harm. But in the eyes of the law they would be hard to prosecute ("Your honor, I was fishing for catfish, not sturgeon."). On the other extreme, I have not eaten oysters for over a decade although they are legal to eat. I love eating oysters, but I do not because I feel that the population in the Bay are too stressed. Others eat them for a variety of reasons, most probably not aware of any concern, and they should not be faulted.

Now I am probably, as I am so prone to do, rambling a bit, but I am trying to illustrate the shades of gray.

For the American shad shade of gray (actually a brilliant silver, with spots along the midline and highlighted with yellow and blue on the dorsal side), I encourage people to catch and release them in the Potomac river. This is part of a process of re-learning about the shad; how much fun and challenging they can be to catch on hook and line, how pretty they are, how important they are to the ecosystem. Hopefully, in the next few years we can also catch and take one home and, for many, find that they are wonderfully sapid and did not erroneously earn their species name "sapidissima."

VI. Recently Uncovered References Regarding Shad from;

A. Report of a Commissioner of Fisheries of Maryland, January 1876. By T.B. Ferguson. (Note, this MD Commission was created in 1874, and this is from their first report, **bolding** is by the author for emphasis):

> Page 5, regarding the fisheries declines which led to the creation of the Maryland Fish Commission, it's "Shad" section begins "**This being the most important of the food fishes of our waters**, your Commissioners immediately sought for means of their increase...".

B.) In 1898, in "The Shad Fisheries of the Atlantic Coast of the United States, Report of Commissioner of Fish and Fisheries" Charles H. Stevenson relates on page 203;

"At Great Falls there are a few bow nets used each spring from the last week in April to the first or second week of June. These nets are operated from a point known as **"Shad Rock,"** which projects into the water on the Virginia shore just below the principal falls. Three bow nets were reported from that locality in 1896, the yield numbering 360 roe shad and 240 bucks."

This rock is the same rock used during the dip-net surveys for this project. Therefore, not only did the project bring shad back to Great Falls, it is also bringing back the "Shad Rock."

Monitoring for shad at Great Falls:
Mike Odom, USFWS, with one of the first shad captured at Great Falls after the fishway was opened in 2000.

IV. A few closing words about sturgeon

This huge Atlantic sturgeon was captured around the turn of the last century in the Potomac River. Courtesy Library of Congress.

Atlantic and Shortnose sturgeons were also once numerous and important commercial and recreational fish of the Potomac River and the Chesapeake Bay. Atlantic sturgeon can live over a century and grow to over 800 lbs and nearly 15 ft in length, arguably the kings of the river. The shortnose sturgeon is currently listed as an endangered species. As large benthic feeders, both are important but lacking components of the bay and riverine ecosystems. In addition, they are sensitive to low dissolved oxygen and high temperatures and are thus good indicator species for water quality and measuring the success of Bay and river restoration efforts.

By the early 1900s both species all but disappeared from these waters primarily due to over-harvest. Poor water quality and loss of spawning habitat hampered recovery. Stocks are currently at such low numbers that natural recovery appears unlikely.

In 1830, Jonathan Elliot published a work entitled "Historical Sketches of the Ten Miles Square forming the District of Columbia" which includes several details relating to fishes of the Potomac River. Of particular note are his comments about the leaping ability of sturgeon, which, judging from his size estimates (150 pounds) presumably focused upon the Atlantic sturgeon. He describes an event during the Revolutionary war when one large sturgeon leaped into a ferry boat at Georgetown, coming down on the lap of an American officer with such violence as to break his thigh, the injury later resulted in death! (Underlining added by editor. Fact can be stranger than fiction. My editorial comment regarding the medical care of the time is: "If not the sturgeon, perhaps the surgeon got him.")

From his diaries, George Washington “went a dragging for Sturgeon” when he could, and he is probably referring to a type of fishing were a snag hook was dragged along the bottom to catch these fish. Typically, this was done from a small skiff. Imagine George Washington, holding onto a line attached to a 300 lb sturgeon, being towed around the river on a “Anacostine sleigh ride.” I wonder what he hollered.

Between 1997 to present, through the new US Fish and Wildlife Service's Sturgeon recovery program, several shortnose and Atlantic sturgeon have been captured in the Potomac River. In 2006, a shortnose sturgeon which had been radio-tagged and followed by US FWS scientist was found to go as far upriver as

the Fletcher's Boat House/Chain Bridge area. Prior to these exciting encounters, the last reported capture of sturgeon in the Potomac River was a 170 pound, 7 foot long female Atlantic sturgeon taken in a net off of Gunston Cove, near Mason Neck, Fairfax County, Virginia on April 18, 1970, by two brothers Joseph and John Harley (see photo below). Even at that point they were exceedingly rare, and that sturgeon was reportedly the first sturgeon captured in the Potomac since 1948.

Sturgeon restoration efforts in the Potomac River are much needed. A cooperative partnership is underway between the Maryland Department of Natural Resources, the University of Maryland, Mirant Mid-Atlantic and U.S. Fish & Wildlife Service to conduct Atlantic sturgeon restoration in Maryland. As part of this partnership, a pilot Atlantic sturgeon culture project was started in 2006 at the Mirant's Potomac River Generating Station. Currently the sturgeon culture facility cultures larval and juvenile sturgeon. The primary goal of the Potomac River sturgeon culture facility is to investigate steamside culture for imprinting purposes. Hopefully these fish will eventually be stocked into the Potomac River.

This needs to be a long-term project, much as the planting of walnut trees, begun so that future generations will fully enjoy the benefits. However, just having the Atlantic sturgeon back in the river is a benefit that we could appreciate in the much shorter term, possibly within a few years.