

Potomac River American Shad Monitoring Survey, 2014 Summary Report
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ICPRB Report # ICP14-7
 Prepared by: Jim Cummins
 The Interstate Commission on the Potomac River Basin

Introduction and Background

The Potomac River, once one of the most polluted rivers in the country, is now one of the nation's showcases for successful programs to restore water quality. A notable benefit of that recovery is the rebound of the Potomac's American shad population which was closed to fishing in 1982. In concert with the cleaner river, a multi-agency American shad recovery program coordinated by the Interstate Commission on the Potomac River Basin was initiated in 1995. That program proved very successful. In 2011 the Potomac River American shad population was again designated as a sustainable fishery by the Atlantic States Marine Fisheries Commission (Figure 1), the agency with regulatory oversight on migratory marine fishes. In order to help document the shad's rebound, evaluate its relationship to water quality improvements, and assess its status in the Chesapeake Bay as part of regional restoration efforts, the Interstate Commission on the Potomac River Basin conducts gill-net collections and maintains catch-per-unit-effort information. This is an annual report on the results of ICPRB's shad work funded by the US. EPA in 2014.

Gill Net Brood-Stock Collections and Monitoring Survey

American shad are collected in an ecologically and historically important section of their spawning habitat in the Potomac River during spawn runs, which in the section usually commences at the beginning of April and typically runs into mid-May. The project's research vessel is a 24' Carolina skiff captained by Virginia waterman Brad Harley. Two drifting gill nets, sequentially deployed, are fished along the river-right side of the main channel (the west or "Virginia side") at the mouth of Dogue Creek and along Fort Belvoir. The drift nets are rigged in the traditional manner for this section of the Potomac, i.e., a method used since the late 1880s. The nets are approximately 91 meters (300 feet) long, 7 meters (23 feet) deep, 14 centimeter (5 1/2") stretch mesh, made of either

#69 twine cotton or monofilament equivalent, with top line suspended below the surface approximately 1.5 meters (5 feet) from floating 16 centimeter (6 inch) diameter corks rigged approximately every 4.5 meters (15 feet). The bottom line is very lightly weighted, rigged with 16 centimeter (6 inch) diameter 9 gauge galvanized metal rings set about 4.8 meters (16 feet) apart. A ring is rigged below each cork, the difference in spacing between the corks and rings is done because the bottom line is a little longer than the top line to help provide the necessary slack in the nets. A light, usually a glow-stick in a 2-liter soda bottle, is attached to the channel side of the net to help other boats see the nets at night and to aid in our own visual surveillance.

The nets are fished at evening slack-water, at either the high or low tidal shift, for a duration of approximately two hours. Continuously tended, fishing is performed roughly between 4:00 p.m. to midnight, depending on the tide, with the best fishing at slack-tides near dusk. It is imperative that collections are made during slack tides so that the nets will drift slowly, hang loosely and shad-fish properly. Otherwise the currents in the Potomac River will be so strong that the nets will go taught, catch few shad but many non-target fish species (by-catch), drift rapidly and considerable distances (miles), subjecting them to potential snags, damage and, worst of all, loss.

At the end of the drift the corks tend to close up and run together, the whole net was taken up, starting at one end, and all fish are removed, culling out the ripe female shad and attempting to keep roughly an equal number of males, during which the net is gathered up and placed into a large tub or bucket. Captured shad are examined when brought on board for sex and maturity. Care is taken to release non-ripe (“green”) females, extra males (“bucks”) shad, or any by-catch species. Females judged ripe (“roes”) and kept bucks are placed in an oval-shaped 100 gallon stock tank, or equivalent, which is 2/3rds filled with river water. The tank has a submerged bilge pump, modified with a large intake filter, that re-circulates and aerates the water while providing a circular current which helps the shad orient correctly in the tank. Typically any green female shad which does not have eggs running fairly freely from her is released back into the river. However, some of the females are found to produce few eggs at egg-stripping. They are noted as “Green Females Kept” on our datasheet. All fish are measured for total length, which is recorded along with sex determination.

Results

American shad collected during the ICPRB 2014 spring gill-net collections are provided in Table 1 (page 3). The number of shad captured, fry stocked and comparisons with previous years of the project are available in Appendix I, due to that table’s landscape format necessary to capture twenty years of data. The Catch Per Unit Effort in 2014 was 987 shad captured in 36 net sets, or 27.4 shad/net, which is less than the 20 year average of 40.3. However, even with the lower catch we stocked 4.5 million shad fry, once again exceeding the annual stocking goal of 4 million.

The 2014 shad spawning season was delayed but calm. Similar to 2013, shad started spawning in earnest about two weeks behind their average. April was very cool and dry, therefore water temperatures remained cool (13°-15° C, 55°-59° F), relatively constant and the river was clear until a small storm which occurred the first week of May. At the conclusion of collections the water temperatures did not advance into the normal end-of-spawn temperatures (the mid-20’s C or 73°-79°F). We only had two cancellations (4/25 and 5/10) due to widespread rain, but normally we have 3-4 due to weather related factors. Contrary to most years and especially the previous (2013), wind caused us very few problems in 2014.

Table 1: Dates of Collections¹, Number of American Shad Captured by ICPRB in 2014

Date	4/14	4/18	4/19	4/20	4/21	4/26	4/27 ²	4/28	5/2	5/3	5/4 ²	5/5	5/6	5/9	5/11	5/12	5/13	5/14	Totals
Shad Captured	21	47	45	65	78	42	48	75	15	59	66	62	44	72	57	51	69	71	987
Nets Used																			
Total Females	16	34	20	48	58	21	34	27	12	17	55	54	21	61	45	47	57	48	675
Total Males	5	13	15	17	20	21	14	48	3	42	11	8	23	11	12	4	12	23	302
Ripe Females Used	11	18	12	18	20	14	24	18	0	9	22	19	13	6	17	2	38	14	275
Males Used	5	13	15	13	15	16	14	17	0	13	9	8	14	6	11	4	12	22	207
Green Released	0	2	0	12	7	0	2	1	12	0	16	13	2	30	16	8	6	9	136
Green Females Kept	5	14	8	18	10	7	8	8	0	6	14	15	6	16	6	14	10	19	184
Spent Females	0	0	0	0	1	0	0	0	0	2	3	7	0	9	6	3	3	6	40
Surface Temp.	17	13	14	13	14	14	14	14	14	15	15	14	16	18	20	20	19	22	
Tidal Stage Time	High 20:45	Low 17:30	Low 18:20	Low 19:10	Low 20:05	High 18:50	High 19:45	High 20:30	Low 17:30	Low 18:10	Low 18:50	Low 19:32	Low 20:15	High 17:05	High 18:45	High 19:30	High 20:20	High 21:10	

¹ April 27th and May 4th were Sunday evening collections for DC, MD and VA schools' Hatching Shad In The Classroom Programs.

Chesapeake Bay Indicator

The author of this report co-chairs the EPA Chesapeake Bay Program's American Shad Indicator Action Team. In 2014 this multi-agency team continued to update the Bay Shad indicator, adding the Rappahannock and lower James Rivers as well as increasing the accuracy of Virginia's recovery targets. As of 2013, the last year of bay-wide available data, the Chesapeake Bay shad population was at 41% of the 100% recovery goal and continues to increase (Figure 1).

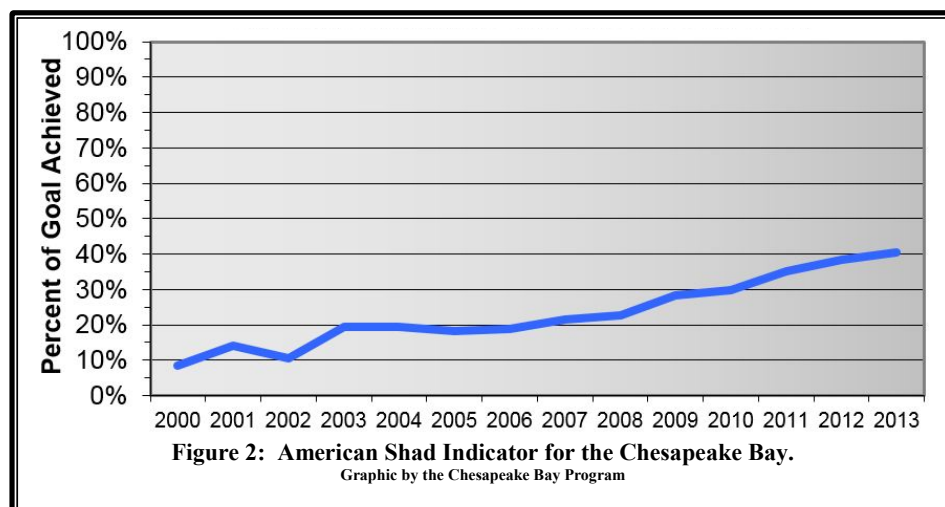


Figure 2: American Shad Indicator for the Chesapeake Bay.
Graphic by the Chesapeake Bay Program

The Potomac American shad population is a strong driver in this trend. The Atlantic States Marine Fisheries Commission's 2007 Shad Stock Assessment Report assigned a restoration target benchmark for the Potomac River: a running geometric mean (GM) of 31.1 pounds/net-day.

That ASMFC benchmark goal was exceeded in 2011 and the trend continues to climb. The Potomac's shad population has reached nearly 130% of the goal. River specific components of the Chesapeake Bay's American shad indicator can be seen in Figure 2. Five rivers are currently used to calculate the American Shad Indicator. Collectively they account for an estimated 90% of the Chesapeake Bay's total shad population. The Potomac River trend can be seen in the upper left. Individual river indices are proportionally weighted, based on each river's watershed flow, and summed to calculate the indicator value for the Chesapeake Bay.

The team intends to add remaining river systems when their data becomes sufficiently robust. More information on the Chesapeake Bay's American shad Indicator can be found at chesapeakebay.net/indicators.

There are two additional indicators of the relative strength of American shad spawning runs and their reproductive success in the Potomac River which help document their recovery. The first is the Maryland Bay-Wide Shore Haul Seine Survey which incorporates an index for juvenile American Shad in the Potomac (Figure 3). This juvenile American shad index has increased substantially since restoration stocking was initiated and a fishway was installed in the dam at Little Falls. It has also remained fairly robust, with 12 out of the last 15 years exceeding the pre-closure peak which occurred in 1972.

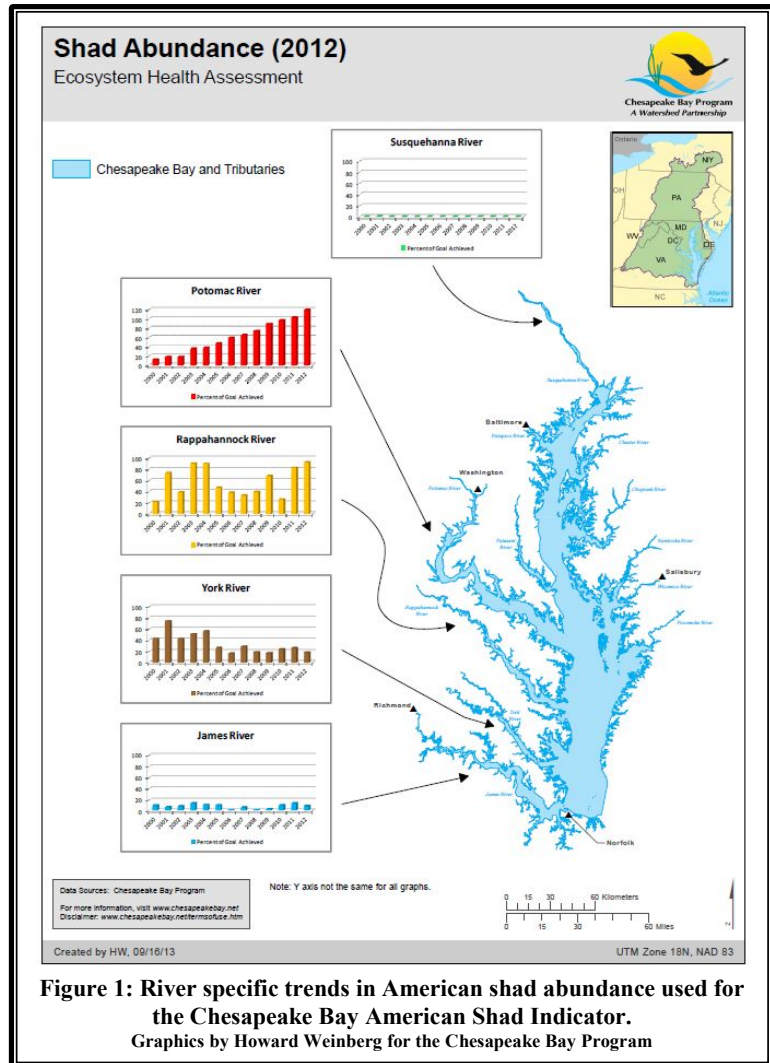
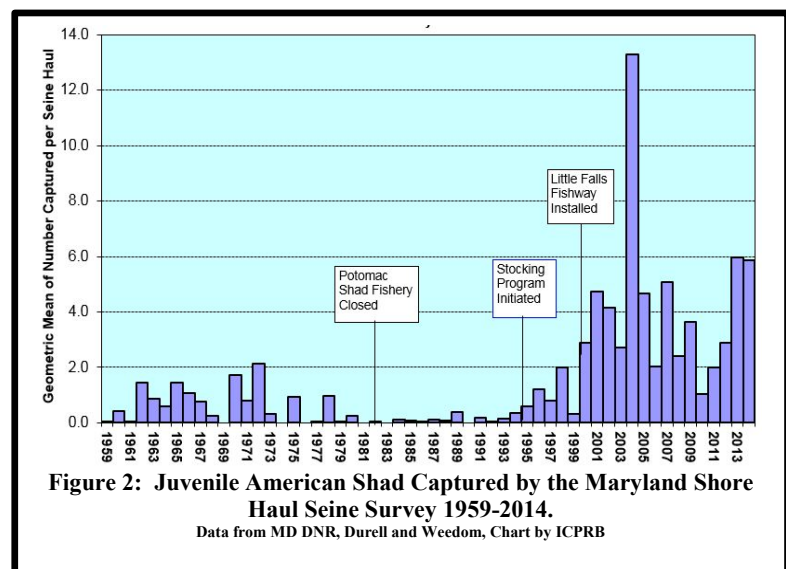
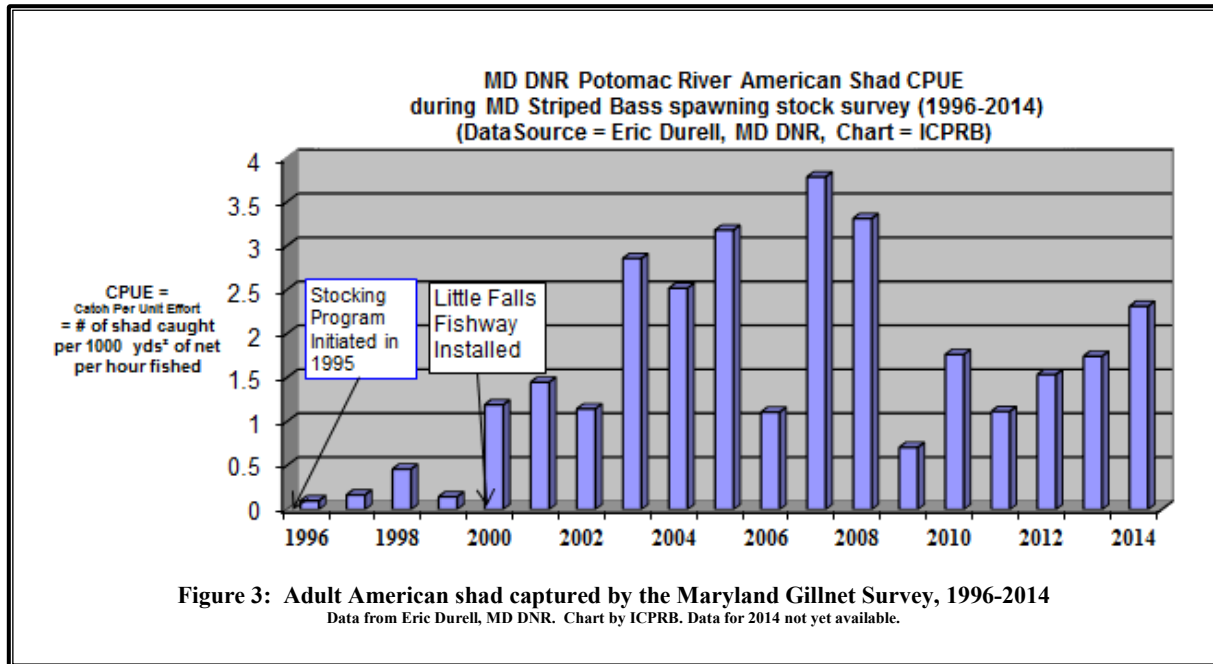


Figure 1: River specific trends in American shad abundance used for the Chesapeake Bay American Shad Indicator.
Graphics by Howard Weinberg for the Chesapeake Bay Program



Similar increases in returning adult American shad has been documented by the Maryland Department of Natural Resources during their annual striped bass spawning stock surveys which have been conducted since 1996 (Figure 4). This survey uses random multiple-mesh size nets and likely produces a better representation of the full range of year classes in the population than shad brood stock collections which deploy 5"-5 ½" stretch mesh nets specifically to target mature female shad.



Public Participation and Publicity

ICPRB incorporates a significant public involvement component into this project through the use of volunteers and schools. In 2014, 48 volunteers helped collect adult shad and over 1,000 students from 27 Washington metropolitan area schools hatched shad in their classrooms and stocked them into the Potomac and Anacostia rivers. The student component, which is partnered with Living Classrooms of the National Capitol Region, is separately funded but enabled by the EPA’s support of this project.

This report is available online, saved as file number ICP14-7_Cummins.pdf at www.PotomacRiver.org.

Disclaimer

The opinions expressed in this report are those of the author and should not be construed as representing the opinions or policies of the United States government or the signatories or Commissioners to the Interstate Commission on the Potomac River Basin.

Appendix I:
Summary of the Number of American Shad Captured, Eggs Collected, Fry Released, and Catch-Per-Unit-Effort (CPUE)
For the Project Period 1995-2014, Including Estimates of Shad Returns¹

	1995	1996	1997	1998	1999	2000	2001	2002	2003 ²	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Totals	Avg.
# Ripe females	135	166	245	105	119	373	338	245	240	387	246	316	441	349	183	379	244	418	239	275	5,443	272
# Green (unripe) Females	78	51	92	50	44	93	135	141	120	127	49	72	93	150	48	226	122	418	212	320	2,641	132
# Post-spawn (spent) Females	3	1	0	8	10	9	27	25	15	27	2	11	118	43	29	31	31	47	21	40	498	25
# Males	78	157	207	153	116	282	235	247	240	435	209	283	397	191	102	460	235	249	239	302	4,817	241
# Total Shad (Used)	294	375	544	316	289	757	735	658	615	976	506	682	1049	733	333	890	409	858	556	482	12,057	603
# Total Shad (Captured)								1801	1494	1852	1101	1010	1858	903	444	1096	789	1129	711	987	15,175	1168
# Shad Released								1143	879	896	595	328	809	170	111	206	380	271	155	505	6,448	496
# Eggs Collected x 1000	2,405	4,353	5,744	2,626	2,594	6,383	6,565	5,943	5,327	5,773	8,129	NA ³	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
# Collections/# nets set	11/27	11/22	12/24	14/28	15/30	11/22	16/32	18/36	10/16	14/25	13/25	16/32	17/34	16/31	16/32	16/32	17/35	19/38	18/36	18/36	298/593	15/30
Shad Used/net-set CPUE⁴	10.9	17.0	22.7	11.3	9.6	34.4	22.9	18.3	35.9	39.0	20.2	21.3	30.9	23.6	10.4	27.8	11.7	22.6	15.4	13.4	419.4	21.0
Total shad/net-set CPUE								50.0	93.4	74.1	44.0	31.6	54.6	29.1	13.9	34.3	22.5	29.7	19.8	27.4	524.4	40.3
# Eggs/Ripe-female	17,800	26,200	23,400	25,000	24,400	17,100	19,400	24,260	22,195	14,917	24,783	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	21,769
# Fry Stocked Pot. R.	1,175	1,989	1,535	1,589	1,304	3,176	3,336	1,531	200	400	919	1,158	728	884	528	510	488	537	406	350	22,743	1,137
# Fry stocked Rapp. R. (x									1,200	3,100	3,400	6,265	4,453	4,832	2,718	3,943	4,116	5,995	4,265	4,156	48,443	2,422
Total # Fry Stocked (x 1000)	1,175	1,989	1,535	1,589	1,304	3,176	3,336	1,531	1,400	3,500	4,319	7,423	5,181	5,716	3,246	4,453	4,604	6,532	4,671	4,506	71,186	3,559
# Fry Stocked Each Shad Collected	4,000	5,300	2,800	5,000	4,500	4,200	4,500	2,326	2,435	3,586	5,690	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4031
Est. # of Shad Returning¹	3,487	5,902	4,555	4,715	3,869	9,424	9,674	4,444	4,060	10,150	11,300	22,027	15,430	16,961	9,632	13,215	14,080	19,383	13,861	13,371	209,540	10,477
Est. # Shad Returning Each Shad Collected	11.9	15.7	8.4	14.9	13.4	12.4	13.5	6	5.9	10.6	14.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	11.6

¹Monitoring at the Conowingo Dam fish lifts (Hendricks 2000) found, on average, that it takes 337 hatchery fry stocked in the Susquehanna River to get one returning adult shad. Subsequent results have modified that number slightly, but in order to have a consistent estimate the 1 shad returning per 337 stocked fry ratio has been used since 2001 as an assumed Potomac return rate.

²The Potomac Restoration Stocking Program for American Shad was conducted from 1995 until 2002, at which time recovery was considered sufficient for natural reproduction. In 2003, restoration stocking of the Rappahannock River began, using Potomac River origin shad eggs through a partnership between ICPRB, the Virginia Department of Game and Inland Fisheries, and the US Fish and Wildlife Service's Harrison Lake National Fish Hatchery. Stocking of the Potomac continues, but now as a "replacement stocking" to account for the Potomac shad sacrificed for another river systems. In 2014 we stocked approximately 4,506,000 shad fry. About 350,000 of those were stocked into the Potomac to replace sacrificed adult shad, which roughly 8% of our total shad fry stocked (10% replacement is the goal). Since 2003 we have used 8,089 shad.

³ NA, for Not Applicable, is used after 2005 because these values could no longer be derived. Starting in 2006, we switched from using 1 boat to 2-3 boats for our collections (Watermen involved: Louis Harley (1995-2008), Mike Harley (starting in 2006), Brad Harley (starting in 2008), and Randy Kirby (2006-2007). Since 2005, shad from all boats are pooled together during the collection process, and it became too difficult to separate or accurately estimate egg or fry production for each individual boat. This table only reports shad caught in the ICPRB boat.

⁴CPUE, or Catch-Per-Unit-Effort, is calculated by two methods in this project. The first CPUE (Shad used/ net-set) is based upon the number of shad used for egg collections and re-stocking of the Potomac and, starting in 2003, the Rappahannock Rivers. It does not include shad which were netted but released, i.e., the unripe or green females, spent females no longer spawning, or surplus males (we try to keep a 1/1 ratio of males to females). Starting in 2002, all shad netted were counted and a second CPUE (Total shad/net-set) has been calculated this time using all shad brought to the boat, even those released.