



"The Washington Navy Yard with Shad Fishers in the foreground, 1861"
(Library of Congress Image #NH 51928-KN)

The Potomac River 2011 American Shad Monitoring Surveys Task 5 Summary Report for the US Environmental Protection Agency

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The Interstate Commission on the Potomac River Basin

Introduction and Background

In large part due to water quality problems, the American shad, once one of the east coast's most abundant and economically important fish, became so rare that fishing for them was closed in Maryland in 1980, in the Potomac in 1982, and in Virginia in 1993.

The clean-up of the Potomac River is one of the national showcases for successful programs to restore highly polluted waters. A notable example of that recovery is the Potomac's American shad population which has rebounded such that in 2011 it officially reached restored status, as defined by the Atlantic States Marine Fisheries Commission. In order to document the rebound and evaluate its relationship to water quality improvements, the Interstate Commission on the Potomac River Basin conducts gill-net collections to maintain the catch-per-unit-effort information that has been compiled since 1995 as part of the regional effort to assess the status of the Potomac River stock and restore the American shad. This is a report on the results of ICPRB activities in 2011.

Gill Net Brood-Stock Collections and Monitoring Survey Methods

The research vessel is a 24' Carolina skiff captained by Virginia waterman Brad Harley. Two drifting gill nets, sequentially deployed, are fished together along the river-right side of the channel (also could be called the west or Virginia side) along the mouth of Dogue Creek and near 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 ½") 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 about every 4.5 meters (15 feet). The bottom line was 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 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 were fished at evening slack-water, at either the high or low tidal shift, for a duration of approximately two hours and continuously tended as described in the following paragraph. Fishing was performed roughly between 4:00 p.m. to midnight, depending on the tide, with the best fishing being slack tide near dusk. It is imperative that collections are made during slack tides because otherwise the currents in

the Potomac River are too strong for the nets to fish properly, they need to hang loosely, and the nets will drift considerable distances (miles), subjecting them to snags, potential damage and loss. The nets were tended, i.e., as the nets were drifting our boats would pull up to the net when bobbing of corks indicated that fish had become entangled, that section of the net was lifted, fish were removed from the net, and the section of net was dropped and allowed to keep fishing. At the end of the drift, the net was taken up, starting at one end, and all fish were removed, culling out the ripe females and attempting to keep roughly an equal number of males, and the net put in a large bucket or tub. Captured shad were examined as brought on board for sex and maturity. Care was taken to release non-ripe (green) females, extra male (buck) shad, or any by-catch. Females judged ripe (roes) and kept bucks were placed in an oval-shaped 100 gallon stock tank partially filled with river water. The tank had a submerged bilge pump, modified with a large intake filter, that re-circulated and aerated the water while providing current which helped the shad orient correctly in the tank. Typically any female shad which did not have roe running from them, termed green shad, were released back into the river. However, some of the females judged ripe and kept were the result of false positive decisions, i.e., they appeared as running ripe females when captured but at stripping they only produced a few eggs. Due to their condition, these non-ripe females were not able to be released alive. They are noted as “Green Females Kept” in our data.

Results

American shad collected¹ during the ICPRB 2011 spring gill-net collections are provided below in Table 1. The number of fry stocked and comparisons with previous years of the project are in Table 2 (page 3). There was a decent shad run and we stocked almost 4.1 million shad fry, exceeding our annual stocking goal of 4 million. This year, as in 2010, we experienced a truncated shad spawning season due to weather. From early April until late May the weather was unusually cool and wet. Water temperatures never reached 20C during our entire collection period, while normally the river temperatures are above 20C by the first week of May. Storms were pervasive. Five collections (4/16, 4/18, 4/22, 4/24, 5/15) were cancelled due to storms. Flood flows carried much debris, caused shad to alter their normal channel pathways due to the force of the flow, and made collections difficult. Seven tides were off their predicted times by over ½ hour (indicated by an asterisk). We experienced a cool February, which appears to be good for the timing of shad coastal migration into the Chesapeake Bay and Potomac River - the shad arrived on schedule - but river temperatures remained unseasonably cool throughout the shad season and peak spawning was delayed.

Table 1
Dates of Collections, Number of American Shad Captured by ICPRB in 2011

Date	4/15	4/17	4/21	4/23	4/25	4/28	4/29	4/30	5/01	5/02	5/06	5/07	5/08	5/09	5/10	5/13	5/14	Totals
Shad Captured/net	30/2	26/2	56/2	53/2	53/2	73/2	28/2	43/2	71/2	35/2	35/2	66/2	81/2	57/2	32/2	9/2	41/3	789/35
Total Females	10	12	33	43	35	63	26	26	40	23	25	54	65	40	<u>28</u>	6	25	554
Total Males	20	14	23	10	18	10	2	17	31	12	10	12	16	17	4	3	16	235
Ripe Females Used	6	4	13	17	6	27	7	11	20	9	16	26	36	26	10	2	8	244
Males Used	6	5	7	10	7	10	2	13	26	7	10	12	16	17	4	3	15	165
Green Females Kept	3	5	9	5	7	17	5	10	10	3	6	10	9	7	6	0	10	122
Spent Females	0	0	0	0	1	1	3	2	0	1	0	5	5	2	6	2	3	31
Surface Temp.	14	14	14	14	18	19	19	19	18	19	18	18	18	18	19	19	19	
Tidal Stage/Time	H:6.0	H:7.0*	L:6.5*	L:7.5*	L:9.3*	H:5.7	H:6.5	H:7.3*	H:8.0	H:8.7	L:5.3	L:6.7*	L:7.5*	L:7.5	L:8.3	H:5.0	H:6.0	

¹The numbers reported are for one boat, captained by Brad Harley, so that ICPRB catch-per-unit-effort is consistent over time with data through the project record, from 1995 to present. Only one boat was used for the project from 1995 until 2005.

Table 2: Summary of the Number of American Shad Used, Eggs Collected, Fry Released, and Catch-Per-Unit-Effort (CPUE) of Shad Used for Project Period 1995-2011, Including Estimates of Shad Returns²

	1995	1996	1997	1998	1999	2000	2001	2002	2003 ³	2004	2005	2006	2007	2008	2009	2010	2011	Totals
# Ripe females	135	166	245	105	119	373	338	245	240	387	246	316	441	349	183	379	244	4,328
# Green (unripe) Females	78	51	92	50	44	93	135	141	120	127	49	72	93	150	48	226	122	1,643
# Spent (post-spawn) Females	3	1	0	8	10	9	27	25	15	27	2	11	118	43	29	31	31	361
# Males	78	157	207	153	116	282	235	247	240	435	209	283	397	191	102	460	235	3,925
# Total Shad (Used)	294	375	544	316	289	757	735	658	615	976	506	682	1049	733	333	890	409	9,675
# Total Shad (Captured)								1801	1494	1852	1101	1010	1858	903	444	1096	789	11,904
# Shad Released								1143	879	896	595	328	809	170	111	206	380	5,517
# 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 ⁴	NA	NA	NA	NA	NA	NA
# Collections/# nets set	11/22	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	224/430
CPUE⁵ (# Shad Used/net-set)	13.4	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	̄=21.9
CPUE (Total # shad/net-set)								50.0	93.4	74.1	44.0	31.6	54.6	29.1	13.9	34.3	22.5	̄=44.7
# 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
# Fry Stocked Pot. R.(x 1000)	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	21,451
# Fry stocked Rapp. R. x 1000									1,200	3,100	3,400	6,265	4,453	4,832	2,718	3,943	4,116	34,027
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	55,478
# 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
Estimated # 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	152,845
<u>Est. # Shad Returning Each Shad Collected</u>	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

² Monitoring 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 the 1shad returning per 337 stocked fry ratio has been used since 2001 as an assumed Potomac return rate in order to provide a consistent estimate.

³ The 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 using Potomac River origin shad eggs was started 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 "replacement stocking" to account for the Potomac shad sacrificed for another river system.

⁴ 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 totals for each individual boat contribution.

⁵ CPUE, 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.

The ICPRB Catch-Per-Unit-Effort (CPUE), is calculated as the total American shad used for brood stock divided by the number of nets set. This CPUE has been used since 1995 and allows the longest time period to evaluate the strength of the shad run. For 2011, this CPUE was 409 shad-used/35 nets-set = 11.7. Based upon ICPRB's 17 year record, 2011 had a relatively weak spawning run of American shad, below the 21.9 long-term average.

This is similar to the findings of the Maryland American Shad CPUE derived from their striped bass spawning stock surveys which have been conducted since 1996 (Figure 1). This Maryland 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 1/2" stretch mesh nets specifically to target mature female shad.

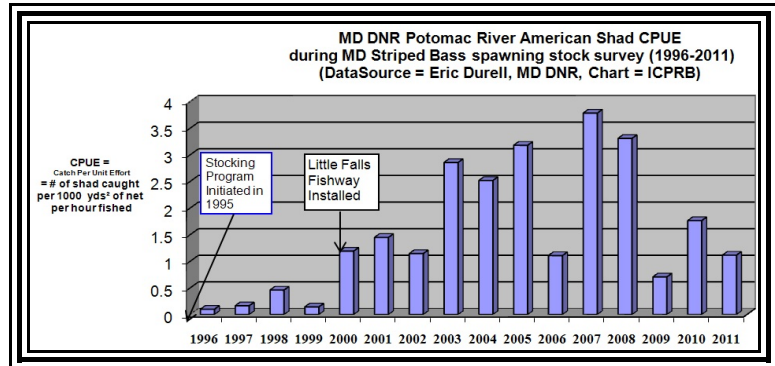


Figure 1. Maryland Department of Natural Resources' Catch-Per-Unit-Effort for American shad captured during their annual Striped Bass Survey.

However, while recent years have been somewhat subdued, the overall trend is still very good. This is evidenced in the commercial fisheries pound net catches as reported by the Potomac River Fisheries Commission (Figure 2). The Atlantic States Marine Fisheries Commission's 2007 Shad Stock Assessment Report included a Potomac River benchmark restoration goal; A ten-year running geometric mean (GM) of 31.1 pounds/net-day. This became the restoration target for the Potomac River. The GM for the years 1999 - 2011 reported by the Potomac River Fisheries Commission is 32.0 pounds/net-day. For the first time the GM has exceeded the benchmark goal and restoration target.

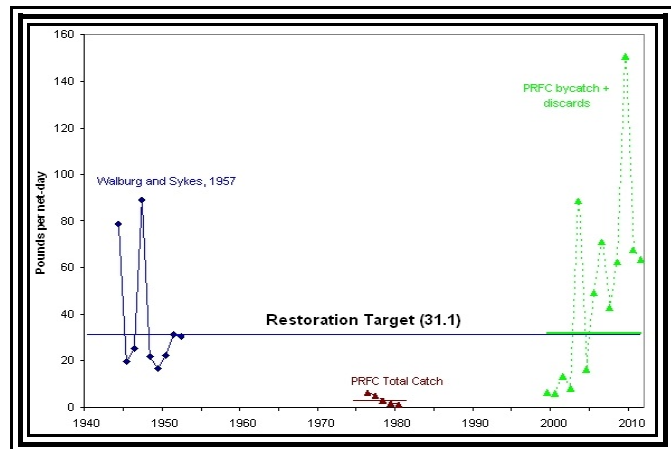


Figure 2. Commercial Pound Net Indexes for the Potomac River Geometric Means (From the Potomac River Fisheries Commission).

In addition, the Maryland Shore Haul Seine Survey's index for juvenile American Shad in the Potomac (Figure 3) has remained fairly robust, with 10 out of the last 12 years exceeding the pre-closure peak in 1972. 2011 was just shy of that peak.

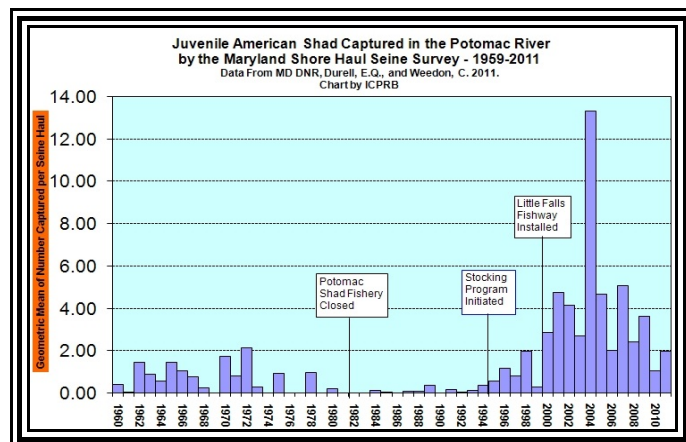


Figure 3. For ten out of the last twelve years the index has exceeded pre-restoration levels which go back to the 1950s.