



"Seining the Potomac" by C B Hudson, *Cosmopolitan Magazine*, 1894,  
Vol XVIII, pg. 460. Courtesy Smithsonian Collection.

**The Potomac River**  
**2012 American Shad Monitoring Surveys**  
**Task 5 Summary Report for the US Environmental Protection Agency**  
**ICPRB Report # ICP12-08, Grant # I-98339411**  
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## **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 surface water quality. A notable benefit of that recovery is the Potomac's American shad population which has rebounded such that in 2012 it officially designated as a sustainable fishery 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 and maintains 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 2012.

## **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 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 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 collected during the ICPRB 2012 spring gill-net collections are provided below in Table 1. The number of shad captured, fry stocked and comparisons with previous years of the project are in Table 2 (page 3). The 2012 shad spawning season was unusually early, long and productive. March was especially warm in the eastern US and American shad started spawning late in that month in the Potomac River, which is about three weeks ahead of the average starting date of April 15th. We were initially concerned that the spawn would be short due to the March weather pattern. Fortunately, April was cool and very dry, water temperatures were very cool and stable, and the river was always clear. The run was a good one. Three collections (4/10, 4/11, 4/22) were cancelled due to storms, which is a little below normal. The Catch Per Unit Effort was 1129 shad captured in 38 net sets, or 29.7 shad/net, which is above the 17 year average of 21.8. On April 4, the project reached a milestone - we boated our 10,000th shad. The most important milestone this year, however, was the designation of the Potomac shad population as a sustainable fishery by the Atlantic States Marine Fisheries Commission. The Potomac shad fishery had been closed since 1982.

**Table 1**  
**Dates<sup>1</sup> of Collections, Number of American Shad Captured by ICPRB in 2012**

| Date               | 3/29    | 3/30    | 4/3     | 4/4     | 4/5     | 4/6     | 4/9     | 4/12    | 4/13    | 4/16    | 4/17    | 4/18    | 4/19    | 4/20    | 4/24    | 4/25    | 4/26    | 4/27    | 4/29    | Totals  |
|--------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Shad Captured/net  | 68/2    | 37/2    | 70/2    | 22/2    | 54/2    | 38/2    | 88/2    | 73/2    | 52/2    | 58/2    | 61/2    | 64/2    | 74/2    | 44/2    | 68/2    | 56/2    | 75/2    | 62/2    | 65/2    | 1129/38 |
| Total Females      | 45      | 25      | 57      | 14      | 39      | 19      | 72      | 40      | 30      | 43      | 56      | 58      | 65      | 39      | 50      | 41      | 57      | 50      | 43      | 843     |
| Total Males        | 23      | 12      | 13      | 7       | 15      | 19      | 16      | 33      | 22      | 15      | 5       | 6       | 9       | 5       | 18      | 15      | 18      | 12      | 22      | 283     |
| Ripe Females Used  | 24      | 20      | 18      | 7       | 29      | 10      | 28      | 19      | 15      | 23      | 21      | 26      | 27      | 11      | 20      | 20      | 42      | 40      | 18      | 418     |
| Males Used         | 11      | 12      | 13      | 7       | 12      | 13      | 16      | 31      | 12      | 15      | 5       | 6       | 9       | 5       | 15      | 15      | 18      | 12      | 22      | 249     |
| Green Released     | 17      | 5       | 27      | 5       | 5       | 5       | 30      | 16      | 10      | 14      | 25      | 9       | 15      | 15      | 19      | 10      | 7       | 40      | 0       | 274     |
| Green Females Kept | 4       | 0       | 11      | 2       | 4       | 4       | 13      | 5       | 5       | 3       | 5       | 15      | 20      | 7       | 8       | 4       | 6       | 6       | 22      | 144     |
| Spent Females      | 0       | 0       | 1       | 0       | 1       | 0       | 1       | 0       | 0       | 3       | 5       | 8       | 3       | 6       | 3       | 7       | 2       | 4       | 3       | 47      |
| Surface Temp.      | 16      | 15.5    | 15      | 15      | 14.5    | 14      | 14      | 13      | 14      | 16.5    | 17      | 16      | 17.5    | 17.5    | 16      | 15.5    | 15.5    | 15.5    | 15.0    |         |
| Tidal Stage/Time   | L:19:30 | L:20:15 | H:17:50 | H:18:45 | H:19:45 | H:20:30 | L:17:30 | L:20:00 | L:21:00 | H:17:10 | H:18:20 | H:19:20 | H:19:50 | H:20:30 | L:17:10 | L:17:50 | L:18:20 | L:19:30 | L:20:30 |         |

**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 1995-2012, Including Estimates of Shad Returns<sup>1</sup>**

| Year   | 1995         | 1996         | 1997         | 1998         | 1999         | 2000         | 2001         | 2002         | 2003 <sup>2</sup> | 2004          | 2005            | 2006          | 2007          | 2008          | 2009         | 2010          | 2011          | 2012          | Totals         |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-------------------|---------------|-----------------|---------------|---------------|---------------|--------------|---------------|---------------|---------------|----------------|
| # Ripe females                                   | 135          | 166          | 245          | 105          | 119          | 373          | 338          | 245          | 240               | 387           | 246             | 316           | 441           | 349           | 183          | 379           | 244           | 418           | 4,746          |
| # Green (unripe) Females                         | 78           | 51           | 92           | 50           | 44           | 93           | 135          | 141          | 120               | 127           | 49              | 72            | 93            | 150           | 48           | 226           | 122           | 418           | 2,061          |
| # Spent (post-spawn) Females                     | 3            | 1            | 0            | 8            | 10           | 9            | 27           | 25           | 15                | 27            | 2               | 11            | 118           | 43            | 29           | 31            | 31            | 47            | 408            |
| # Males  | 78           | 157          | 207          | 153          | 116          | 282          | 235          | 247          | 240               | 435           | 209             | 283           | 397           | 191           | 102          | 460           | 235           | 249           | 4,174          |
| # Total Shad (Used)                              | <b>294</b>   | <b>375</b>   | <b>544</b>   | <b>316</b>   | <b>289</b>   | <b>757</b>   | <b>735</b>   | <b>658</b>   | <b>615</b>        | <b>976</b>    | <b>506</b>      | <b>682</b>    | <b>1049</b>   | <b>733</b>    | <b>333</b>   | <b>890</b>    | <b>409</b>    | <b>858</b>    | <b>9,675</b>   |
| # Total Shad (Captured)                          |              |              |              |              |              |              | 1801         | 1494         | 1852              | 1101          | 1010            | 1858          | 903           | 444           | 1096         | 789           | 1129          | 11,904        |                |
| # Shad Released                                  |              |              |              |              |              |              | 1143         | 879          | 896               | 595           | 328             | 809           | 170           | 111           | 206          | 380           | 380           | 271           | 5,517          |
| # Eggs Collected x 1000                          | 2,405        | 4,353        | 5,744        | 2,626        | 2,594        | 6,383        | 6,565        | 5,943        | 5,327             | 8,129         | NA <sup>3</sup> | 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         | 224/435        |
| CPUE <sup>4</sup> (# Shad Used/net-set)          | <b>10.9</b>  | <b>17.0</b>  | <b>22.7</b>  | <b>11.3</b>  | <b>9.6</b>   | <b>34.4</b>  | <b>22.9</b>  | <b>18.3</b>  | <b>35.9</b>       | <b>39.0</b>   | <b>20.2</b>     | <b>21.3</b>   | <b>30.9</b>   | <b>23.6</b>   | <b>10.4</b>  | <b>27.8</b>   | <b>11.7</b>   | <b>22.6</b>   | <b>21.8</b>    |
| CPUE (Total # shad/net-set)                      |              |              |              |              |              |              | <b>50.0</b>  | <b>93.4</b>  | <b>74.1</b>       | <b>44.0</b>   | <b>31.6</b>     | <b>54.6</b>   | <b>29.1</b>   | <b>13.9</b>   | <b>34.3</b>  | <b>22.5</b>   | <b>29.7</b>   | <b>22.5</b>   | <b>44.7</b>    |
| # 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             |
| # 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           | 537           | 21,988         |
| # Fry stocked Rapp. R. x 1000                    |              |              |              |              |              |              |              |              | 1,200             | 3,100         | 3,400           | 6,265         | 4,453         | 4,832         | 2,718        | 3,943         | 4,116         | 5,995         | 34,027         |
| <b>Total # Fry Stocked (x 1000)</b>              | <b>1,175</b> | <b>1,989</b> | <b>1,535</b> | <b>1,589</b> | <b>1,304</b> | <b>3,176</b> | <b>3,336</b> | <b>1,531</b> | <b>1,400</b>      | <b>3,500</b>  | <b>4,319</b>    | <b>7,423</b>  | <b>5,181</b>  | <b>5,716</b>  | <b>3,246</b> | <b>4,453</b>  | <b>4,604</b>  | <b>6,532</b>  | <b>62,010</b>  |
| # 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             |
| <b>Estimated # of Shad Returning<sup>1</sup></b> | <b>3,487</b> | <b>5,902</b> | <b>4,555</b> | <b>4,715</b> | <b>3,869</b> | <b>9,424</b> | <b>9,674</b> | <b>4,444</b> | <b>4,060</b>      | <b>10,150</b> | <b>11,300</b>   | <b>22,027</b> | <b>15,430</b> | <b>16,961</b> | <b>9,632</b> | <b>13,215</b> | <b>14,080</b> | <b>19,383</b> | <b>172,227</b> |
| 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             |

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

<sup>2</sup>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 began, using Potomac River origin shad eggs through a partnership between ICRPB, 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 system. In 2012 we stocked approximately 537,000 fry in the Potomac, or roughly 8% of our total shad fry stocked (10% replacement is the goal). Since 2003 we have used 7,051 shad. Replacement stocking totals 6,352,000 shad fry (2003-2012) for an average of about 635,000 stocked fry/yr. Based upon the Susquehanna return rate, as per footnote #1 above, we estimate an average of about 1884 shad returning/year. The 10 year total would be about 18,840 shad returning which would translate to about 2.7 shad returning for every shad used with replacement stocking.

<sup>3</sup>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. All results in this table are from one boat.

<sup>4</sup>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.

