

# GRANT F-48-R

## Investigations and Management of New Jersey's Freshwater Fisheries Resources

### FINAL REPORT

#### JOB I-5

### American Shad Restoration in the Raritan River

January 2013

New Jersey Department of Environmental Protection  
Division of Fish and Wildlife  
Bureau of Freshwater Fisheries

*This grant was paid for by fishing license sales and  
matching Dingell-Johnson/Wallop-Breaux funds  
available through the Federal Sportfish Restoration Act.*



# STATE OF NEW JERSEY

Department of Environmental Protection  
Division of Fish and Wildlife  
Bureau of Freshwater Fisheries

## Federal Aid to Sportfish Restoration

### FINAL REPORT

Grant Number: F-48-R

Grant Title: Investigations and Management of New Jersey Freshwater Fisheries Resources

Project No. I: Investigations and Management of Anadromous Fisheries

Project Objective: To gather basic fisheries information for development of appropriate management procedures for anadromous species found within the inland waters of New Jersey.

Job I-5: American Shad Restoration in the Raritan River

Job Objective: To confirm adult American shad returnees and natural reproduction in the Raritan River.

Period Covered: November 1, 1995 – October 31, 2012

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Date Submitted: January 31, 2013

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Dave Chanda, Director

## **Background**

The Raritan River historically supported a spawning run of American shad. In the early 1980's, adult male and gravid female Delaware River American shad were stocked in the South Branch Raritan River in an attempt to reestablish a spawning run. Subsequent to that, the Island Farm Weir (a dam at the confluence of the Millstone and Raritan rivers) was constructed by the Elizabethtown Water Company to improve the ability of a major water purveyor to collect water for potable water use. The weir was completed in October, 1995 and the adjacent vertical slot fish ladder, with an underground viewing chamber, opened on April 9, 1996.

## **Materials and Methods**

Monitoring the passage of fish through the ladder first commenced on April 22, 1996 using a high resolution, black & white video camera, time lapse VCR, and infrared lighting system powered by two deep cycle 12-volt batteries. In 2011 and 2012 a new digital recorder (instead of the antiquated VHS recorder) was used to record fish passage. The operation of the camera was labor intensive, requiring visits to the ladder to replace batteries and video tapes/SD cards. The video tapes and SD cards were then viewed (also labor intensive) at a later date in the office and individual fish passage data recorded. Fish passage was routinely monitored in this manner during the spring (typically mid-March to mid-June) from 1996 – 2003, and in 2005, 2011, and 2012. Other parameters (water temperature and discharge) were monitored by other agencies.

## **Results**

During the 11 years that fish passage was monitored, a total of 866 days were recorded. Upon viewing the footage, it was determined that only 690 of those days were viewable. A total of 63,829 fish were observed migrating through the ladder and 3,752 of these were American shad (Table 1). The greatest number of American shad passed through the fish ladder in 2002, with 989 individuals observed (Table 1, Figure 1). In 2012, the final year for this Job, the fish passage was monitored and considerable effort was expended reviewing video (684 days of fish passage, spanning 1996 – 2003, 2005, 2011, and 2012 was reviewed).

## **Discussion**

Other studies have demonstrated that hatching and survival of shad are at a maximum when water temperatures are between 15.5°C and 26.5°C, and the temperature-regulated migrations of shad bring individual populations to their home rivers at times when the river temperatures are approaching the level that is best for spawning (Leggett 1973). As an example, this appeared to be the case on the Delaware River in 2007, as shad passage appeared to begin in earnest toward the end of April and continued through May, peaking on May 5 as water temperatures were increasing and approaching 15°C (PACE Environmental Services, 2001 -2007). The Raritan River American shad tended to travel through the ladder during a similar time period, April 15 – May 29 (Figure 2), and at similar water temperatures, between 10°C and 25°C (Figure 3).

In the Raritan River the American shad favored migrating during relatively low water flow (250 – 1,500 cfs, Figure 4). Studies on the Delaware River, too, have shown that major shad passage events generally occurred at times of relatively low discharge, especially, when flows were waning following periods of elevated water levels. The trigger flow for the major shad passage events on the Delaware River was approximately 30,000 cfs (personal communication Eric Guilfoos BWEC / PACE Environmental Services). On the Raritan River the trigger flow appeared to be approximately 500 cfs. Unfortunately, high turbidity associated with higher flows made it more difficult to see the fish in the video on those days. So, it is not implausible that shad may have passed by the viewing window undetected. Additionally, at higher flow rates shad can swim over the weir, thus avoiding the ladder all together.

Two of the lowermost fish passage impediments on the Raritan River have been recently removed. The last dam downstream of the Island Farm Weir, the Calco dam, was removed during the summer of 2011. Upstream of the weir, the Robert Street Dam, in the town of Raritan, was removed during the summer of 2012. The Nevius Street Dam, also in Raritan (between the weir and the now removed Roberts Street dam), is scheduled for removal in 2013. These dam removals are part of a settlement through NJDEP's Natural Resource Damages fund. Two additional upstream impediments remain: on the mainstem the Head Gates Dam at Duke Island Park (Bridgewater) and on the South Branch Raritan River the Rockafellows Mill Dam (near Flemington).

### **Recommendations**

As more upstream impediments are removed, and when funding and staffing permits, the passage of American shad in the Raritan River should continue to be monitored to evaluate the recovery of the population. Under the next five-year grant agreement (Segments 26-30) activities related to fish restoration will be conducted under Project II "Protection and Restoration of Inland Fisheries and Aquatic Habitats."

### **Literature Cited**

Leggett, W. C. 1973. The migrations of the shad. *Scientific American* 228(3): 92-98.

PACE Environmental Services. 2001, 2002, 2003, 2004, 2005, 2006, 2007. American shad spawning migration hydroacoustic monitoring studies at the Interstate 202 toll bridge on the Delaware River at Lambertville, New Jersey.

TABLE 1.— Summary of annual fish passage data at the Island Farm Weir fish ladder located immediately downstream of the confluence of the Raritan and Millstone Rivers, New Jersey. Data typically collected from mid-March to mid-June. Parentheses around fish number denote net movement downstream.

Fish species	Year (Number of viewable days)											Total
	1996 (52)	1997 (66)	1998 (84)	1999 (83)	2000 (71)	2001 (75)	2002 (45)	2003 (78)	2005 (40)	2011 (42)	2012 (87)	
	Number of fish											
Am. shad	49	73	136	545	440	592	989	364	22	77	465	3,752
Bass sp.	242	352	314	302	77	337	742	293	200	81	104	3,044
Largemouth	32	40	46	86	75	36	29	23	5	3	35	410
Smallmouth	15	10	33	83	183	118	27	87	11	(3)	126	690
Carp	335	198	311	341	136	268	168	129	124	157	160	2,327
Catfish	80	100	79	152	198	360	469	69	17	58	177	1,759
Crappie sp.	16	0	1	4	12	7	3	2	0	3	17	65
Am. eel	5	2	3	34	1	3	15	9	0	(5)	27	94
<i>Esox</i> sp. <sup>a</sup>	1	7	2	4	2	9	0	5	4	0	1	35
Gizzard shad	152	1,437	757	8,287	3,999	1,514	3,984	1,146	58	68	728	22,130
Golden shiner	0	0	0	2	1	6	26	2	0	0	0	37
Herring sp.	0	72	2	54	119	63	17	12	0	61	30	430
Lamprey	155	257	51	60	101	176	857	39	94	59	55	1,904
Quillback	52	874	455	630	772	528	1223	617	403	57	304	5,915
Rock bass	142	68	30	48	164	36	48	27	8	62	80	713
Striped bass	5	(2)	0	11	25	77	3	8	2	(6)	33	156
Sucker	184	349	752	691	1,236	1,052	855	279	135	137	460	6,130
Sunfish sp.	665	396	265	205	323	296	496	64	60	228	447	3,445
Trout sp.	16	55	42	111	79	95	79	139	200	116	133	1,065
Walleye	1	34	6	14	18	17	22	9	1	7	44	173
White perch	81	420	20	257	59	91	147	38	5	7	105	1,230
Yellow perch	7	6	1	3	10	9	1	27	1	(1)	3	67
Unidentified	505	1,281	618	2,283	307	378	520	218	21	518	1,599	8,248
Total	2,740	6,029	3,924	14,207	8,347	6,068	10,720	3,606	1,371	1,684	5,133	63,829

<sup>a</sup> pickerel, pike, and muskellunge

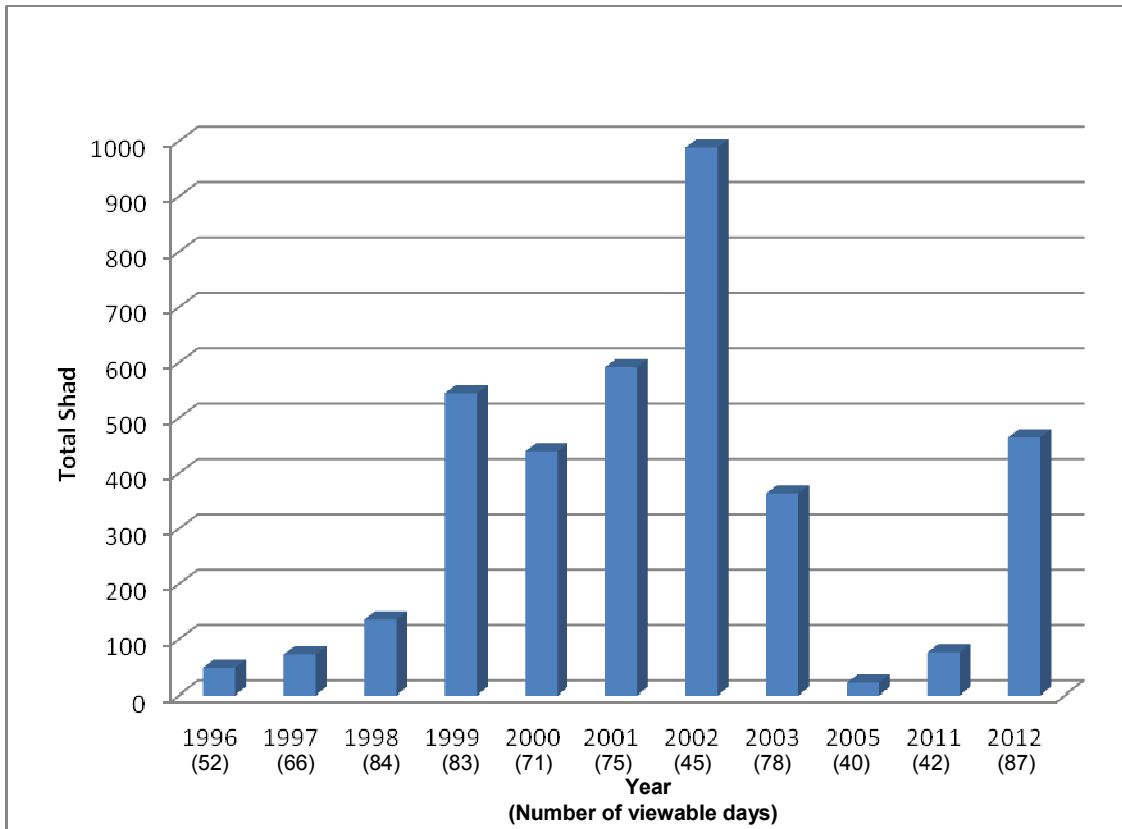


FIGURE 1.— Number of American shad observed passing through the Island Farm Weir fish ladder annually in the spring (1996 – 2003, 2005, 2011, and 2012).

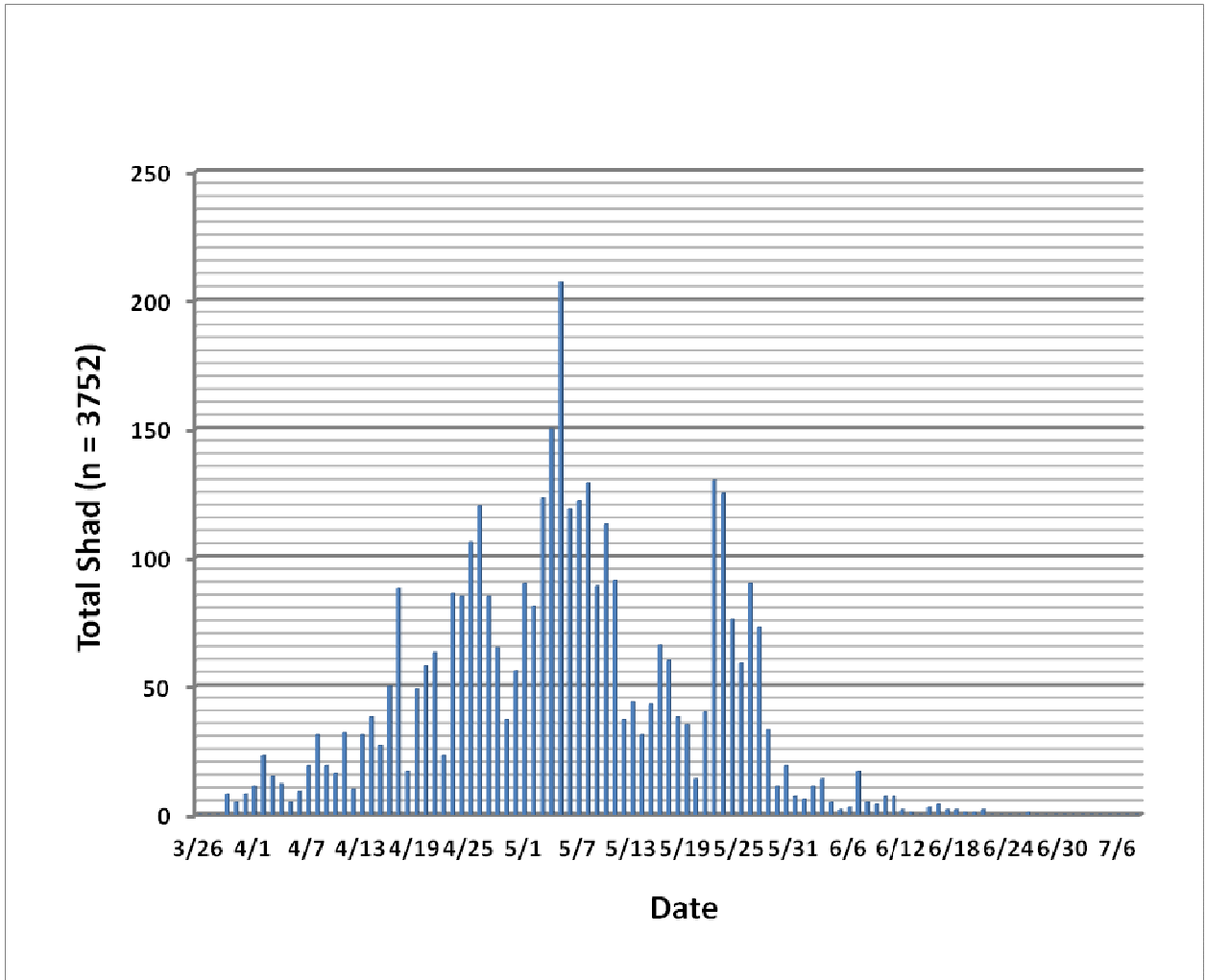


FIGURE 2.— Number of American shad observed passing through the Island Farm Weir fish ladder daily during the spring (1996 – 2003, 2005, 2011, and 2012).

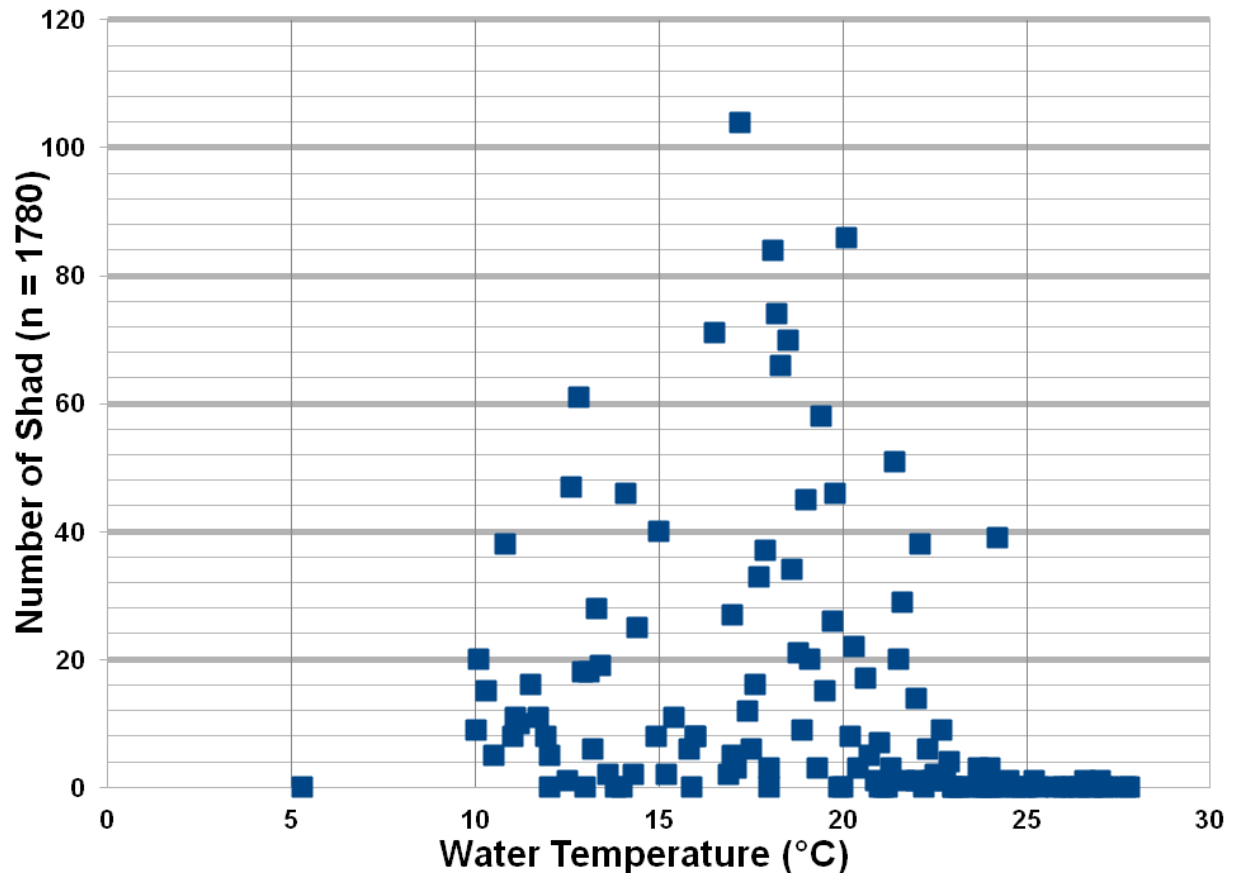


FIGURE 3.— Number of American shad observed passing through the Island Farm Weir fish ladder in relation to available water temperature data (1996 – 2003, 2005, 2011, and 2012).



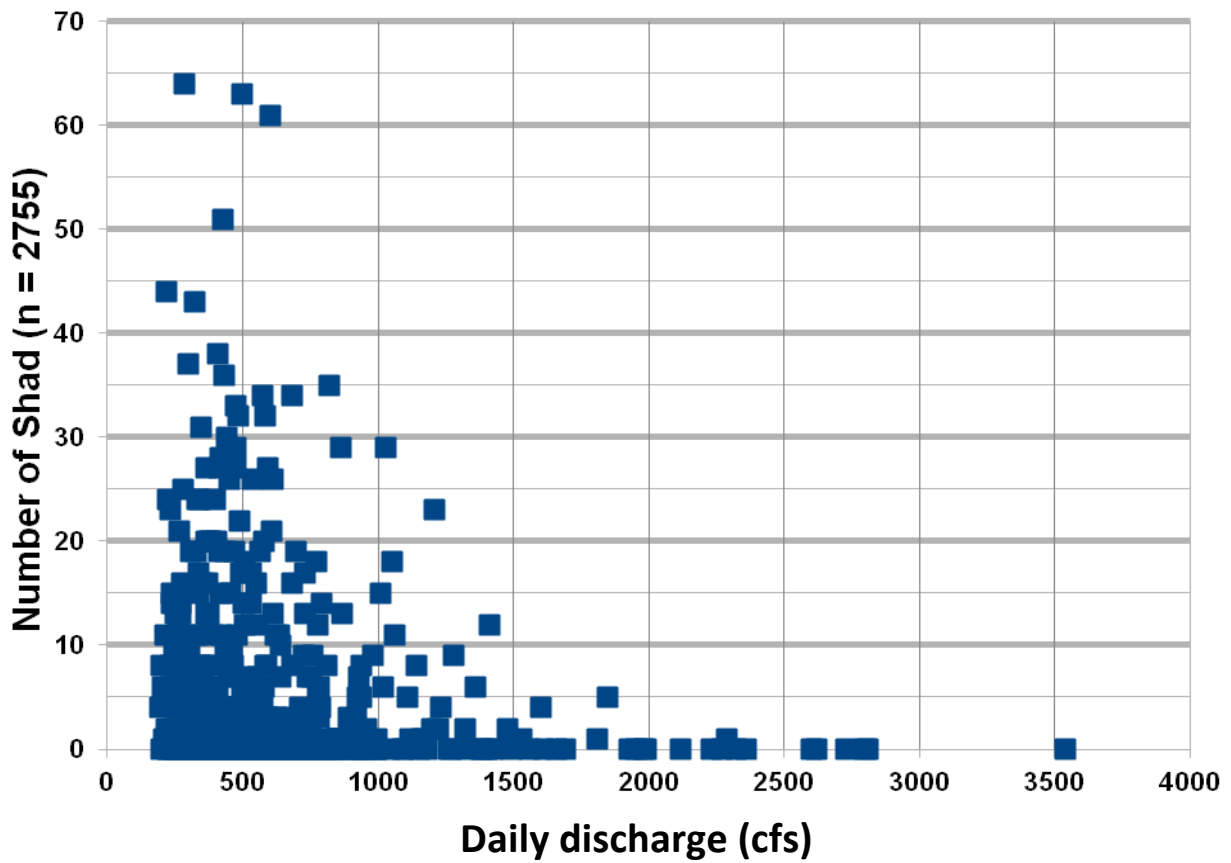


FIGURE 4.— Number of American shad observed passing through the Island Farm Weir fish ladder in relation to available daily discharge data (1996 – 2003, 2005, 2011, and 2012).