Pennsylvania Fish & Boat Commission Biologist Report

Lehigh River

Northampton County

American shad spring spawning monitoring, 2013

The Pennsylvania Fish and Boat Commission (PFBC) historically monitored American Shad passage into the Lehigh River by video surveillance of fishes successfully passing the vertical slot fishways installed in the Easton (RM 0.0) and Chain (RM 3.0) dams. This effort was discontinued at the Chain Dam fishway in 2011 due to its inability to successfully pass shad. Furthermore, due to the loss of Federal funding, monitoring at the Easton Dam fishway was not accomplished for the 2013 spawning run.

Biological data is annually collected from shad composing the Lehigh River run. This effort characterizes size and age distributions, origin (i.e., hatchery stocked fry), repeat spawning, and spawning readiness. With assistance from Area 6, shad were collected from the Palmerton Township Riverview Park pool (RM 2.55) and Chain Dam plunge pool (RM 2.99) using boat electrofishing techniques near the end of the spawning run during a single day's effort in 2013.

A total of 76 shad (20 females, 56 males) were collected. The total length (TL) by sex ranged from 19.7 to 22.1 inches for females, and 14.5 to 20.5 inches for males, with an average TL of 20.8 and 19.1 inches, respectively. The spawning run into the Lehigh River was supported by multiple age classes (Figure 1). The majority of females (>90%) were either 5 or 6 years-old, with oldest recorded age being 8 years. Females in the 4 and 7 year old cohort were not present in the 2013 Lehigh River catch. Only one female shad, Age 5, exhibited a single repeat spawning mark, the remaining female shad were first-time spawners. Ovarian stage of collected shad indicated most females were gravid (had not spawned yet), but two had fully hydrated eggs. Male shad ages ranged from 4 to 7 year-olds, with most being Age 5 (63%), followed by ages 6 (23%), 4 (8.9%), and 7 (1.8%). Three male shad, one Age 5 and two Age 6, all exhibited a single repeat spawning mark. The low occurrence of repeat spawning marks suggests that shad generally do not return to the Lehigh River for spawning. Thus, the Lehigh River shad run remains principally composed of first-time spawning shad.

The PFBC continued with its restoration program in 2013, with the goal of returning a self-sustaining American shad spawning run into the Lehigh River. Broodstock were collected from the Delaware River and the resultant fertilized eggs were then hatchery reared/marked, with the fry eventually released into the Lehigh River above the Cementon Dam (RM 24.0). Captured shad from the 2013 electrofishing survey was principally composed of hatchery marked shad (74%; Table 1). The relatively low occurrence of wild shad suggests a self-sustaining spawning run of shad into the Lehigh River has not been fully realized, through the PFBC restoration program.

Catch-per-unit-of-effort (CPUE: shad/hour) generated from electrofishing was highly correlated (Spearman's Rank correlation: $r_s = 0.81$, $P < 0.001$) to total shad passage through Easton Dam fishway (Figure 2). A catchability coefficient, q, can be calculated using the historic annual count data of shad passage through Easton Dam fishway and the one-day electrofishing CPUE (shad/hr), over the time series (1996 – 2012). Thus, passage into the Lehigh River can be

estimated from the electrofishing CPUE eliminating the need for a labor intensive video surveillance at the Easton Dam fishway.

Catch-per-unit-of-effort in 2013 was 161.3 shad/hour, ranking 5th highest in the time-series (1996-2013). The total number of shad passed into the Lehigh River was estimated to be 2,288 – 2,462 shad. Estimated total passage suggests an increasing trend since 2011, yet passage based abundance remains below the peak observed in 2001.

Table 1. Total catch, total catch-per-unit-effort (CPUE) and percent occurrence of wild American shad recaptured from the Palmer Township Riverview Park fishing (RM 2.55) and the Chain Dam plunge (RM 2.99) pools, Lehigh River.

Year	Total No. Shad Collected	Total Time (Hours)	CPUE	Easton Passage	Total No. Hatchery Shad	Total No. Wild Shad	Percent Wild Shad
1995	33			873	24	9	26.4
1996	39	0.30	130.00	1141	36	3	7.7
1997	55			1428	52	3	5.4
1998	53			3293	52	1	1.9
1999	104	0.60	173.33	2346	96	8	7.6
2000	100	0.60	166.66	2094	91	9	9.0
2001	**109**	**0.29**	**344.82**	**4740**	**96**	**13**	**11.9**
2002	100	0.41	243.24	3314	86	14	14.0
2003				422			
2004	62	0.57	109.14	754	50	12	19.4
2005	13			675	8	5	38.5
2006	55	0.62	89.23	2023	40	15	27.3
2007	40	1.32	30.28	1397	23	17	42.5
2008	42	1.14	36.88	408	21	20	47.6
2009	27	1.93	13.97	425	17	10	37.0
2010	97	1.01	96.51	1935	32	64	65.9
2011	16	1.04	15.36	558	9	7	43.7
2012	62	1.10	55.91	2096	26	35	57.3
2013	76	0.47	161.3	2288*	56	20	26.3
* Estimated total passage from one-day electrofishing							

Figure 1. Age distribution of American shad by gender estimated from scale and otolith microstructures of fish collected from the Lehigh River.

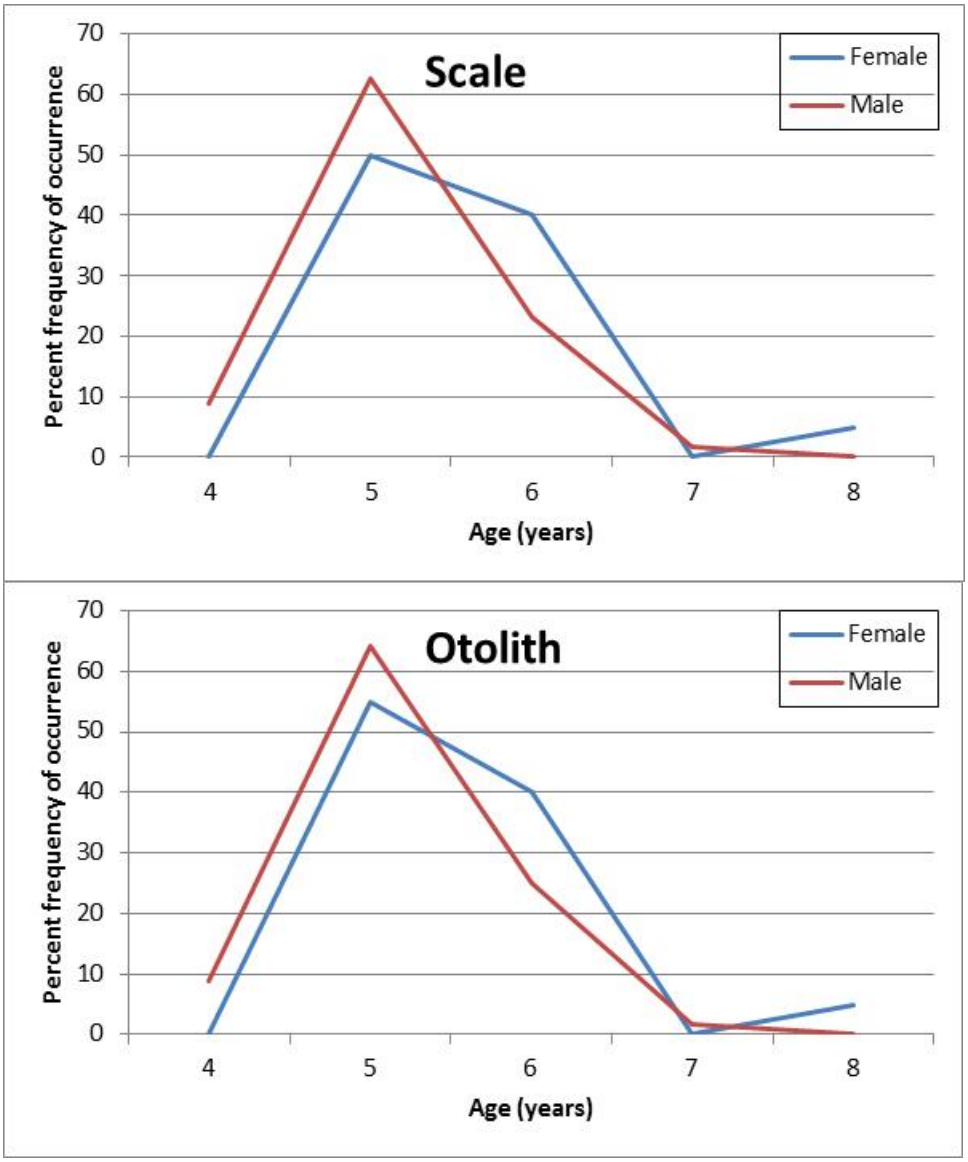
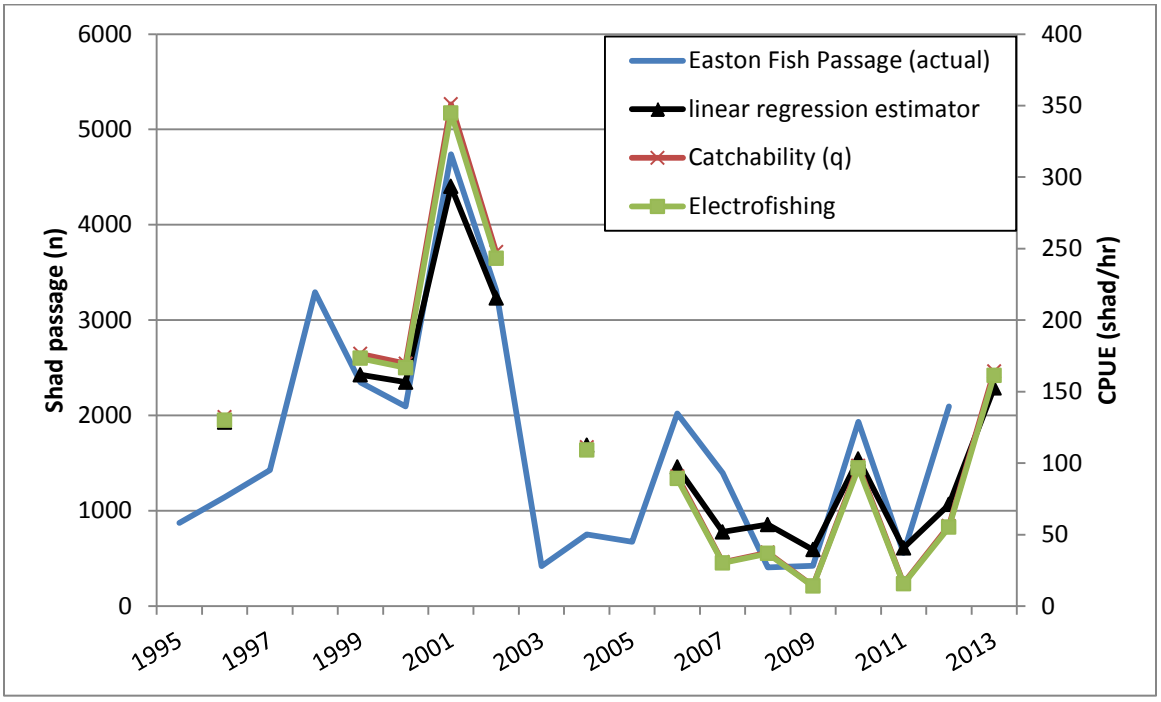


Figure 2. Annual estimation of the American shad spawning run into the Lehigh River.



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