STATE OF CONNECTICUT
DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION

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Commissioner

Bureau of Natural Resources
Marine Fisheries Division
www.ct.gov/deep/fishing

A STUDY OF MARINE RECREATIONAL FISHERIES IN CONNECTICUT

Federal Aid in Sport Fish Restoration
F-54-R-31 Annual Performance Report
March 1, 2011 – February 29, 2012

Job 3: Inshore Survey

State of Connecticut
Department of Energy and Environmental Protection
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Hartford, CT 06106-5127
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Federal Aid in Sport Fish Restoration
F-54-R-31
Annual Performance Report

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Period Covered: March 1, 2011 - February 29, 2012

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Cover: A wonderful moment with family enjoying a great catch of summer flounder (fluke).

JOB 3: INSHORE SURVEY

JOB 3: INSHORE SURVEY

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JOB 3: AMERICAN SHAD MONITORING AND INSHORE SEINE SURVEYS

STUDY PERIOD AND AREA

This report contains information on adult American shad monitoring and two seine studies conducted in the Connecticut and Thames Rivers on American shad, blueback herring, menhaden and common nearshore marine species in 2011. Areas of the Connecticut River sampled range from Holyoke, MA to Essex, CT. The Thames River seine survey begins just south of Norwich Harbor and ends in Uncasville, CT. Time series data collected under a separate funding source are also included.

GOAL

To monitor relative abundance and distribution of American shad and other fish in Connecticut's nearshore waters.

OBJECTIVES

Provide:
1) Information on the adult American shad spawning population: commercial catch, age structure, sex ratio and size.
2) Annual indices of relative abundance for juvenile shad, blueback herring and common nearshore marine species.

INTRODUCTION

Annual spawning migrations of American shad (*Alosa sapidissima*) in the Connecticut River have supported both recreational and commercial fisheries in the State of Connecticut, as well as recreational fisheries in upriver states, for generations. There is currently a commercial driftnet fishery that occurs in the lower CT River. Connecticut requires an annual commercial shad license for the Connecticut River. The fishery is managed through area, gear, and season restriction as well as rest days. The Connecticut River is the state's only occurrence of a commercial shad fishery. American shad were once one of Connecticut's top five most economically important commercial finfish species in terms of landings. The commercial fishery occurs in the main stem of the Connecticut River south of the Putnam Bridge in Glastonbury, CT. The recreational fishery occurs north of Hartford, Connecticut (RKM 83) and south of the Holyoke Dam in Massachusetts (RKM 139).

The Connecticut Department of Energy and Environmental Protection (CT DEEP) has conducted annual research studies on adult American shad in the Connecticut River since 1974, to monitor annual changes in stock composition. Data is collected from mandatory annual reporting of commercial landings. Landings information is compiled and used to estimate the maximum losses to the spawning stock from fishing. The Massachusetts Division of Fish and Wildlife monitors fish passage which includes adult American shad passage at the first main stem dam on the Connecticut River in Holyoke, Massachusetts. Data on the recreational fisheries are monitored periodically by a roving creel survey. Juvenile shad are monitored by CT DEEP through an annual seine survey conducted since 1978.

Sampling for American shad was expanded to the Thames River system after 1996 to monitor the effect of the operation of the Greenville Dam fishway. The fishway was constructed to aid in the enhancement of American shad in the system. CT DEEP initiated the seine survey in the Thames River to estimate juvenile production of shad. Sites were chosen based on previous work conducted by the department. The survey has documented few shad and river herring, but is continued to monitor catches of forage fish and juvenile fish of recreationally important species such as menhaden, tautog, winter flounder and bluefish.

METHODS

American shad adults:

Commercial fishermen are required by regulation to report daily landings and fishing effort for American shad. Landings information is compiled and used to estimate the maximum losses to the spawning stock from fishing. Once reports were received, the harvest was tallied by pounds and number of shad landed by sex. This information is collected from the commercial fishermen who submit their logbook catch data annually to CT DEEP.

The adult American shad age structure and sex ratio were calculated from samples collected at the Holyoke Dam fishlift at Holyoke, MA. Information on the number of fish lifted daily, the number of lift days (days the lift is in operation) and the daily sex ratio at Holyoke were obtained from the Massachusetts Division of Fisheries. The annual sex ratio was calculated by weighting the daily sex ratios by the number of fish lifted that day. A subset of daily fish lifted are sampled for scales

To determine the age structure of the fishery, CT DEEP staff collected biological samples with drift gill nets with a mesh size similar to the commercial fishery and in a similar fashion to that used by commercial operators to assist in characterizing the fishery. Gill nets were fished during daylight hours to avoid interfering with commercial efforts; research nets were shorter in length and drift times were shorter than those employed by commercial netters. One hundred and fifty five scale samples were collected.

Age structure was derived from scale samples collected at the Holyoke Fishlift in Holyoke, MA and were used to characterize the population. Adult shad were sexed, measured to fork length (mm) and 15-25 scales removed. All scale samples collected were separated by sex and stratified into 1 cm length groups. Scale samples were processed by cleaning with an ultrasonic cleaner and pressed onto acetate for aging. Age determinations were made as the consensus of two or more readers of projected images (43x) counting annuli and spawning scars according to the criteria of Cating (1953). Repeat spawners were noted by the presence of spawning scar(s) at the periphery of the scale. The age and repeat spawning frequency were extrapolated to the entire population by direct proportion.

Juvenile Surveys:

Connecticut River Seine Survey

A single seine haul was conducted at seven fixed locations one day a week from July 6th through October 12, 2011. Seine haul locations and techniques were identical to those used in past

Connecticut River seine surveys. The sampling sites were previously chosen based on location, physical conditions and accessibility (Marcy 2004, Crecco et. al. 1981, Savoy and Shake 1993). The seven stations were sampled during daylight hours with an 18.3 m nylon bag seine (0.5 cm delta mesh) and 30.5 m lead ropes. The seine was fished with the aid of a boat to deploy it upstream and offshore to sweep down through the site. Using the lead ropes, the seine was towed in a downstream arc to the shore and beached. All fish species other than family clupeidae, (American shad, blueback herring, alewife and menhaden) were identified, quantified or estimated and released. Invertebrate species are either counted or noted as presence/absence.

Thames River Seine Survey

Eight fixed stations were sampled twice a month from July 10 through October 15. The method of seine deployment and gear used in the Thames River was identical to what is used for the Connecticut River seine survey.

For both surveys, clupeids (*Alosa sapidissima*, *A. aestivalis*, *A. pseudoharengus*, and *Brevoortia tyrannus*) were returned to the laboratory for measurement and identification. All other fish were identified and counted (subsampling large catches as necessary) and returned to the water. In the laboratory, juvenile clupeids were identified to species by the criteria of Lippson and Moran (1974) and counted. For each sample, up to 40 randomly selected clupeids of each species were measured to total length (mm).

A relative abundance index was calculated for both the arithmetic and geometric mean catch per haul among all stations and dates combined. Arithmetic mean catch per haul is presented for American shad and blueback herring because it has been the preferred index when looking at year to year changes. Geometric mean is the preferred method when reporting to the Atlantic States Marine Fisheries Commission for annual compliance reports. See job 2, part 1 methods section for calculating geometric mean (Gottschall 2009 Job 2.1).

RESULTS

Connecticut River Adult American shad:

The Holyoke fishlift was open for fish passage from April 11 through July 15, 2011 except for closings due to high water or operational factors. Total lift numbers of American shad at the Holyoke Dam were obtained from the Massachusetts Division of Fisheries and Wildlife.

The number of shad passed at Holyoke in 2011 (244,189), was the highest since 2003 (287,000) and was an increase of 33% from 2010 (164,000) (Figure 3.3). The number of American shad lifted upstream annually at the Holyoke Dam has been variable through the time series and remains below the long term average of 299,730 (range 114,137 to 721,764). The sex ratio of the 2011 shad run was derived from information collected at the Holyoke fishlift which is located at River kilometer 140, upstream of both the commercial and sport fisheries. The combined impact of these small fisheries is not thought to be significant enough to affect the composition of the run. The weighted sex ratio of shad sampled at Holyoke provided by Mass Wildlife was 70% for males and 30% females (Figure 3.5).

American shad were sampled for scales on 28 days during lift operation. The shad age structure

from scale samples was expanded based on the number of fish lifted at Holyoke Dam. Four hundred eighty five scale samples collected from shad at the Holyoke Dam fishlift were examined for age determination.

Length frequency of American shad collected at the Holyoke lift ranged from 31.0 to 47.0 cm FL for male shad and 36.0 to 54.0 cm FL among female shad. Length frequencies of both sexes were fairly normally distributed (Figure 3.5). Average size among males was 40.36 cm FL and among females was 45.69 cm FL.

The 2011 male population of spawning adult shad was from the 2005-2008 year classes. Forty one percent of male shad scales examined were from 4 year old fish. Twenty three percent of male shad scales examined were from five year old fish. Three year old males comprised 30 percent of the age structure and lastly 5 percent of males were 6 year old fish (Table 3.3).

The majority of female shad sampled in 2011 were made up of the 2007 year class. Forty seven percent of female scale samples examined were 4 year old fish. Five year old fish contributed 38 percent to the annual run and fifteen percent were 6 year old fish. The incidence of overall repeat spawning remains low. The percentage of repeat spawners for males is 10.3% and 6.4% among females (Table 3.3). Combining both sexes gives a total repeat rate of 9.2%. The shad spawning population continues to rely on a few age classes and low rates of repeat spawners.

Landings/Commercial Fishery

Fifteen commercial shad licenses were sold in 2011 and eight boats reported landings. The number of licenses sold is comparable to recent years (Table 3.1, Figure 3.2). The number of shad boats fishing annually continues to remain low as few new participants enter the fishery.

The Connecticut River American shad commercial fishery continues to have a small impact on the stock as the size of the fishery remains at low levels. The annual 2011 shad commercial harvest was the third lowest recorded since 1990. The 2011 commercial landings were 32,183 pounds in 218 trips by 8 boats (Figure 3.1). The catch is reported as number of fish by sex (Table 3.1).

Shad age ranged from 3 to 7 year olds among males and from age 4 to 7 year olds among females in the commercial fishery. Age frequencies were dominated by five year old fish in the catches in both sexes with 45% of the males and 46% of the females being from the 2006 year class. Among males, 38% of the catch was 4 year olds and 11% were age six. Among females, 28% were four year olds and 24% were age six. The sex ratio of the samples collected was 64% females to 36% males comparable to the sex ratio at the lift indicating that the commercial fishery in the lower river is having a minimal effect on the stock composition (Figure 3.6).
While reported landings in mandatory Catch Reports were skewed towards females (90%), with males accounting for 10% of the landings (Table 3.1). The difference in sex ratios could be due to underreporting of males. The repeat spawning rates were similar between males and females in 2011 (9% and 7%, respectively).

Seine Survey:
The seine survey experienced an unusual weather event during 2011 survey. The Connecticut River Basin was severely affected by Tropical Storm Irene. The storm produced strong winds and heavy amounts of rainfall causing river height and flow speed during that period well above typical averages of late summer and early fall (Figure 3.8). Large volumes of sediment were also transported down river having a large effect on turbidity (Figure 3.7). For two weeks sampling was cancelled due to dangerous conditions. After river levels dropped, sampling was resumed and catches of alosines, as well as all other species declined (Table 3.4, Table 3.5, Figure 3.9).

Estimates of river flow at the USGS water gaging station in Thompsonville, CT reached 128,000 cubic feet per second on August 30, which is nearly 64 times the usual flow for early fall and the highest flow rate since May 1984 (Figure 3.8) . Rainfall levels within the CT River watershed received 6-10 inches. Turbidity measured in Essex, CT at the USGS gaging station, was 50 times higher than before the storm (Figure 3.7).

Juvenile collections in the Connecticut River were conducted from July 6 through October 12, 2012. In the 83 hauls completed in 2011, over 20,000 fish representing 32 species or taxonomic groups (Table 3.7). To minimize mortality and to facilitate returning large catches of fish quickly to the water, some fish were identified only to the family or genus level (e.g. sunfish, catfish, killifish). Large catches of common species were sometimes quantified with a visual estimate to minimize handling and processing time. Estimated catches are noted as such in the database. In 2011, the most abundant species collected were spottail shiners, blueback herring, *Fundulus spp.* and American shad. Spottail shiners, American shad, *Fundulus spp.* and sunfish also had a high frequency of occurrence in the catches (Table 3.7).

A total of 1,815 juvenile American shad were collected for the season (Table 3.4). The geometric mean catch of juvenile American shad from all stations and all dates was 3.08 (Figure 3.12). The geometric mean in 2011 was the 5th lowest in the time series and was the lowest value since 2006 (Table 3.6). The annual index of juvenile abundance (geometric mean catch/haul) varies without trend. The highest catch for 2011 was 636 shad collected during the 3rd week of sampling upriver at the Wilson site and represents 35% of the catch for the season (Table 3.4). Two stations (Holyoke and Wilson) accounted for 78% of the total 2011 catch.

Annual catches of American shad by station over time has been variable with Holyoke and Wilson typically being the sites with the largest annual catches of juvenile shad (Figure 3.11). In 2011 91% of the shad were collected before the storm. The incidence of positive catches was lower than the previous year (64% vs. 73%) with the Enfield and Glastonbury sites providing the lowest catches of the season. The Enfield station produced the highest number of zero catches and lowest catch of the season

A total of 4,522 blueback herring were collected in 2011 (Table 3.5). Blueback herring catches for 2011 were 2.5 times larger than American shad and accounted for 60% percent of the two *Alosa* species collected (Figure 3.9). Historically the ratio of shad to bluebacks has varied with up of 90% bluebacks in early years. The 2011 *Alosa spp.* catches were both well below average and the blueback CPUE is the 4th lowest geometric mean in the time series with the last

comparable low value occurring in 2004. The three southernmost stations (Salmon River, Deep River, Essex) accounted for 98% of the total juvenile blueback catches in 2011 (Figure 3.12)

Thames River Seine Survey

The 2011 Thames River survey was conducted from June 30th until October 6th and completed 56 seine hauls. Over 5,000 fish were collected representing 28 groups or species (Table 3.8). Atlantic silversides had the highest presence in the catch (98%), followed by *Fundulus spp*, bluefish and sticklebacks. In past years, menhaden were typically caught in higher abundance, however only 418 were collected in 2011 with a geometric mean cpue of 0.58. Juvenile menhaden catches have been variable with the lowest CPUE in 2010 (0.18) and a peak geometric mean cpue of 117.46 in 2002 (Table3.9). Two juvenile winter flounder, 19 juvenile blackfish and 191 bluefish were also among the total catches for the 2011 season.

Data Requests and Sample Collections:

Data requests and sample requests are fulfilled for a number of different government and non-government organizations. Requests fulfilled in 2011 are listed in table 3.10.

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Table 3.1. Annual American shad commercial fishery harvest. Landings are reported by weight (lbs.) and counts, by sex, 1990-2011.

Year	Total lbs.	# Male	Male Wt (lbs.)	Mn Wt Male	# Female	Female Wt (lbs.)	Mn Wt Female	# of Boats	Total Trips
1990	259,425	8,568			21,142			20	402
1991	149,300	9,174			23,112			21	416
1992	144,300	7,171			26,768			16	410
1993	96,660	5,173			17,790			15	332
1994	104,000	1,812			19,400			16	312
1995	61,576	1,862	5,893	3.16	12,299	55,682	4.53	19	352
1996	66,757	2,298	6,941	3.02	13,660	59,816	4.38	13	264
1997	91,003	2,812	10,275	3.65	18,743	80,728	4.31	11	271
1998	89,342	2,983	9,440	3.16	18,529	79,902	4.31	12	280
1999	44,574	872	3,373	3.87	9,506	41,201	4.33	11	195
2000	107,416	2,342	7,491	3.2	21,228	99,925	4.71	11	210
2001	59,234	1,469	3,980	2.71	13,074	55,254	4.23	13	193
2002	108,099	7,153	22,555	3.15	20,653	85,544	4.14	11	248
2003	111,127	5,176	17,518	3.38	21,244	93,609	4.41	14	249
2004	66,328	2,456	8,000	3.26	13,436	58,328	4.34	14	226
2005	69,333	1,873	6,136	3.28	15,336	67,070	4.37	12	218
2006	38,547	1,864	5,445	2.92	7,372	33,102	4.49	12	185
2007	51,572	1,688	5,701	3.38	9,888	43,497	4.4	13	199
2008	28,419	858	2,637	3.07	6,486	25,782	3.97	10	203
2009	40,680	1156	4,045	3.5	6,437	32,187	5	13	182
2010	24,641	855	2,994	3.5	4,238	21,192	5	7	202
2011	32,183	953	3,334	3.5	5,772	28,849	5	8	218

Table 3.2. Fishery dependent spawning history and age distribution of American shad in the Connecticut River, 2011

	Age					
Females	**3**	**4**	**5**	**6**	**7**	**Total**
Pop		8,159	13,405	6,994	291	28,849
% shad at age		28.28%	46.46%	24.24%	1.01%	
Repeat			291	1,748		2,040
% Repeats			2.17%	25.00%		7.07%
Males	**3**	**4**	**5**	**6**	**7**	**Total**
Pop	179	1,250	1,488	357	60	3,334
% shad at age	5.36%	37.50%	44.64%	10.71%	1.79%	
Repeat			179	60	60	298
% Repeats			12.00%	16.67%	100%	8.93%

Table 3.3. Fishery independent spawning history and age distribution of American shad in the Connecticut River, 2011

	Age				
Females	**3**	**4**	**5**	**6**	**Total**
Pop		34,777	27,907	10,734	73,418
% shad at age		47.37%	38.01%	14.62%	
Repeat		1,288	2,147	1,288	4,723
% Repeats			7.69%	12.00%	6.43%
Males	**3**	**4**	**5**	**6**	**Totals**
Pop	51,231	71,063	40,214	8,263	170,771
% shad at age	30.00%	41.61%	23.55%	4.84%	
Repeat		3,856	10,467	3,305	17,628
% Repeats		5.43%	26.03%	40.00%	10.32%

Table 3.4. Catch (C), effort (E) and catch per effort (C/E) of juvenile American shad from the 2011 CT River seine survey.

Date	Holyoke	Enfield	Wilson	Glastonbury	Salmon River	Deep River	Essex	Catch	Effort
7/6/2011	481	0	7	0	12	6	9	515	7
7/13/2011	0	0	5	0	16	2	0	23	7
7/20/2011	1	0	636	15	38	5	6	701	7
7/27/2011	0	0	233	0	2	6	0	241	7
8/4/2011	0	0	20	0	25	41	0	86	7
8/10/2011	0	0	5	0	8	21	0	34	7
8/17/2011	0	0	2	0	33	0	3	38	7
8/24/2011	1	1	5	0	13	7	0	27	7
8/31/2011	No sampling due to high water								
9/7/2011	No sampling due to high water								
9/15/2011		8	7	9	22	15	3	64	6
9/21/2011	10	0	1	3	6	1	3	24	7
9/30/2011				1	2	2	5	10	4
10/5/2011					10	27	3	40	3
10/12/2011	0	0	3	4	0	0	5	12	7
Total	493	9	924	32	187	133	37	1815	83

Table 3.5. Catch (C), effort (E) and catch per effort (C/E) of juvenile blueback herring from the 2011 CT River seine survey.

Date	Holyoke	Enfield	Wilson	Glastonbury	Salmon River	Deep River	Essex	Catch	Effort
7/6/2011	0	0	0	5	7	13	1260	1285	7
7/13/2011	0	0	0	45	25	640	520	1230	7
7/20/2011	0	0	0	20	30	25	14	89	7
7/27/2011	0	0	0	3	46	47	88	184	7
8/4/2011	0	0	0	0	155	82	0	237	7
8/10/2011	0	0	0	0	70	111	0	181	7
8/17/2011	0	0	0	0	246	0	0	246	7
8/24/2011	0	0	0	0	943	9	3	955	7
8/31/2011	No sampling due to high water								
9/7/2011	No sampling due to high water								
9/15/2011		0	0	1	25	2	3	31	6
9/21/2011	0	0	0	1	12	1	62	76	7
9/30/2011				1	2	0	1	4	4
10/5/2011					1	0	2	3	3
10/12/2011	0	0	0	0	0	1	0	1	7
Total	0	0	0	76	1562	931	1953	4522	83

Table 3.6. Geometric mean relative abundance index (CPUE) of juvenile American Shad and blueback herring,1978-2011.

Year	Juv Shad	Juv BBH
1978	5.89	
1979	7.84	24.8
1980	9.21	26.75
1981	6.05	11.49
1982	1.81	6.09
1983	4.99	16.47
1984	3.37	11.57
1985	7.14	18.23
1986	6.29	13.61
1987	9.89	21.58
1988	5.68	17.04
1989	4.85	7.52
1990	10.39	14.41
1991	3.92	11.36
1992	7.21	9.87
1993	9.49	14.43
1994	12.22	13.92
1995	1.34	5.03
1996	6.5	5.91
1997	6.75	9.66
1998	3.65	4.39
1999	5.47	5.57
2000	4.42	4.17
2001	2.73	3.83
2002	5.55	3.95
2003	6.88	5.88
2004	5.62	2.36
2005	10.08	4.1
2006	1.82	3.5
2007	8.15	6.61
2008	5.06	2.2
2009	3.4	1.77
2010	10.23	12.82
2011	3.08	2.93

Table 3.7. List of fish species or group and percent frequency of occurrence of fish collected in Connecticut River seine survey, 2008-2011. **includes more than one species*

Species	2008	2009	2010	2011
alewife	6.98	9.28	7.77	12.05
American eel	13.95	19.59	17.48	8.43
American shad	61.63	60.82	72.82	63.86
Atlantic silverside	3.49	5.15	14.56	2.41
bay anchovy	2.33	2.06	0.97	4.82
black crappie	13.95	6.19	20.39	20.48
blue crab		7.22	17.48	6.02
blueback herring	46.51	36.08	60.19	45.78
bluefish	1.16	6.19	11.65	6.02
carp	4.65	5.15	19.42	12.05
catfish*	16.28	11.34	27.18	10.84
crevalle jack			3.88	
fallfish	4.65	3.09	3.88	2.41
gizzard shad			4.85	
goby		1.03		
golden shiner	15.12	12.37	28.16	15.66
hickory shad	4.65	3.09		
hogchoker	2.33	8.25	15.53	18.07
killifish & mummichog*	43.02	27.84	37.86	55.42
largemouth bass	26.74	18.56	25.24	19.28
menhaden	3.49	11.34	13.59	4.82
northern kingfish			0.97	
northern pike	13.95	5.15	1.94	9.64
chain pickerel	1.16		0.97	4.82
pipefish			4.85	1.20
rock bass	19.77	5.15	25.24	13.25
smallmouth bass	39.53	14.43	20.39	30.12
spottail shiner	73.26	59.79	64.08	65.06
stickleback	4.65	5.15	13.59	1.20
striped bass			2.91	2.41
summer flounder	1.16			
sunfish*	52.33	38.14	59.22	53.01
tessellated darter	33.72	26.8	31.07	30.12
white perch	22.09	7.22	18.45	16.87
white sucker	11.63	12.37	27.18	12.05
winter flounder			0.97	
yellow perch	47.67	29.9	44.66	50.60

Table 3.8. List of fish species or group and percent frequency of occurrence of fish collected in Thames River seine survey, 2005-2011. **includes more than one species.*

Species	2005	2006	2007	2008	2009	2010	2011
alewife	6.67	1.56	17.86	1.59	8.06	1.77	5.36
American eel		6.25		1.59	4.84	0.71	1.79
American shad			5.36		6.45		1.79
Atlantic herring					3.23		
Atlantic needlefish	6.67	1.56					
Atlantic silverside	80		82.14	74.6	80.65	21.63	98.21
bay anchovy		10.94	7.14	14.29	9.68	3.55	10.71
blueback herring			1.79	1.59	1.61	0.35	
bluefish	60	45.31	44.64	31.75	46.77	15.25	41.07
brown trout							1.79
butterfish	3.33			1.59	4.84	1.06	1.79
carp		1.56	1.79			0.35	
catfish*				1.59			
crevalle jack	23.33	12.5	5.36	1.59	11.29	3.55	
cunner					1.61		
darter				1.59			1.79
golden shiner							1.79
hogchoker							17.86
horseshoe crab	3.33						
killifish & mummichog*	43.33	25	32.14	42.86	20.97	6.03	69.64
largemouth bass		1.56					
lizardfish		6.25	5.36				
menhaden	20	35.94	42.86	12.7	22.58	2.13	17.86
naked goby		3.13	8.93	9.52		1.77	16.07
northern kingfish	3.33						7.14
northern pike	3.33						3.57
oyster toadfish						0.35	
pipefish	13.33	15.63	26.79	11.11	9.68	1.42	
scup	6.67		14.29				
sheepshead minnow	3.33		3.57	3.17			1.79
spot			1.79	1.59			
spottail shiner	6.67	9.38	3.57	6.35	3.23	1.06	7.14
stickleback*	16.67	12.5	5.36	36.51	32.26	2.13	42.86
striped bass	3.33	6.25	21.43	11.11	8.06	1.77	7.14
striped sea robin			3.57				
summer flounder		4.69	5.36	15.87	4.84	0.35	3.57
sunfish*		1.56					7.14
tautog	20	6.25	21.43	12.7	1.61	1.77	3.57
tomcod			3.57	4.76	3.23	0.35	1.79
white mullet		4.69		3.17	1.61	3.9	1.79
white perch	13.33	3.13	8.93	1.59	1.61	0.35	1.79
windowpane flounder			7.14				1.79
winter flounder	23.33	10.94	37.5	26.98	9.68	1.77	3.57

Table 3.9. Number collected, number of seine hauls and geometric mean catch per haul of Thames River juvenile menhaden, 1998-2011.

Year	Menhaden	Seine Hauls	G Mn
1998	429,209	151	12.63
1999	594,724	144	20.61
2000	1,020,000	112	50.25
2001	5,458	119	2.13
2002	840,458	55	117.46
2003	248,984	80	12.78
2004	30,274	56	3.91
2005	3,118	30	1.19
2006	129,719	64	6.08
2007	100,082	56	6.39
2008	195	63	0.37
2009	39,909	62	2.11
2010	212	64	0.18
2011	418	56	0.58

Table 3.10. Data and sample requests for 2011.

Organization	**Type of Request**
Massachussetts Division of Fisheries and Wildlife	Data
U.S. Fish and Wildlife Service	Data
U.S. Geological Survey	Sample
Montery Bay Aquarium	Data
University of Connecticut (Graduate Student)	Data
Dominion Millstone Power Station	Data
LISTS	Sample
Diadromous Species Restoration Research Network (DSRRN)	Data
Old Dominion University	Sample
KleinSchmidt	Data

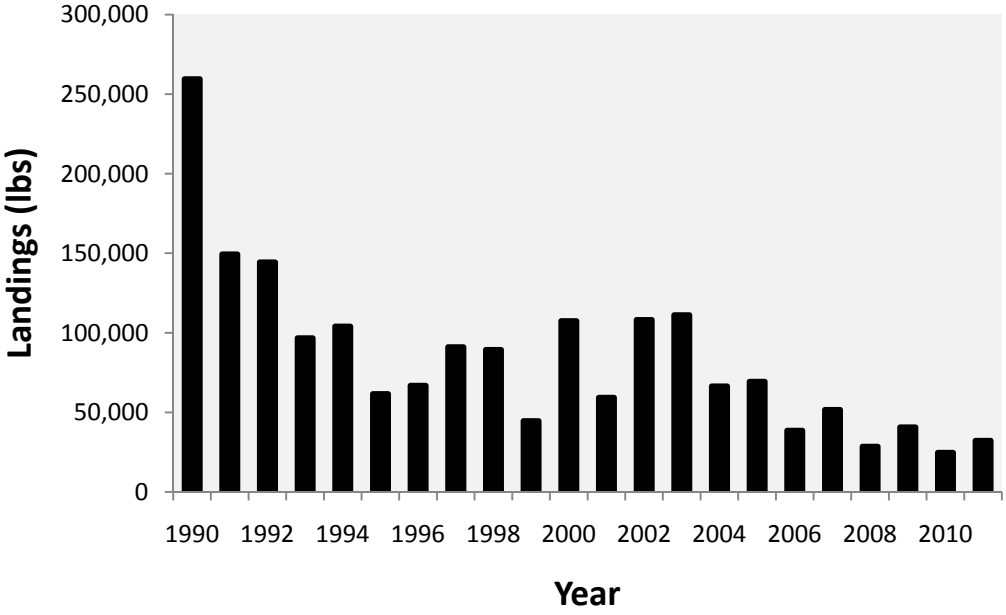

Figure 3.1 Commercial Landings for Adult American shad, 1990-2011

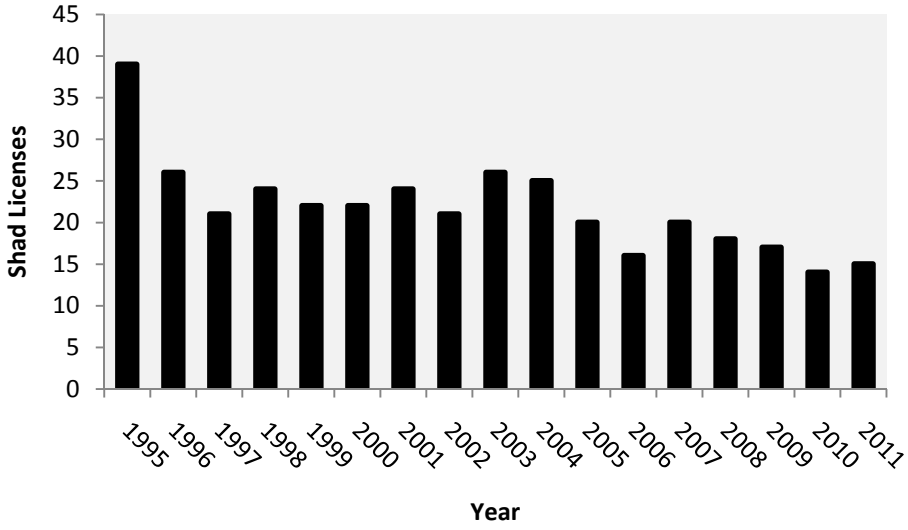

Figure 3.2. Number of Commercial shad license sales, 1995-2011.

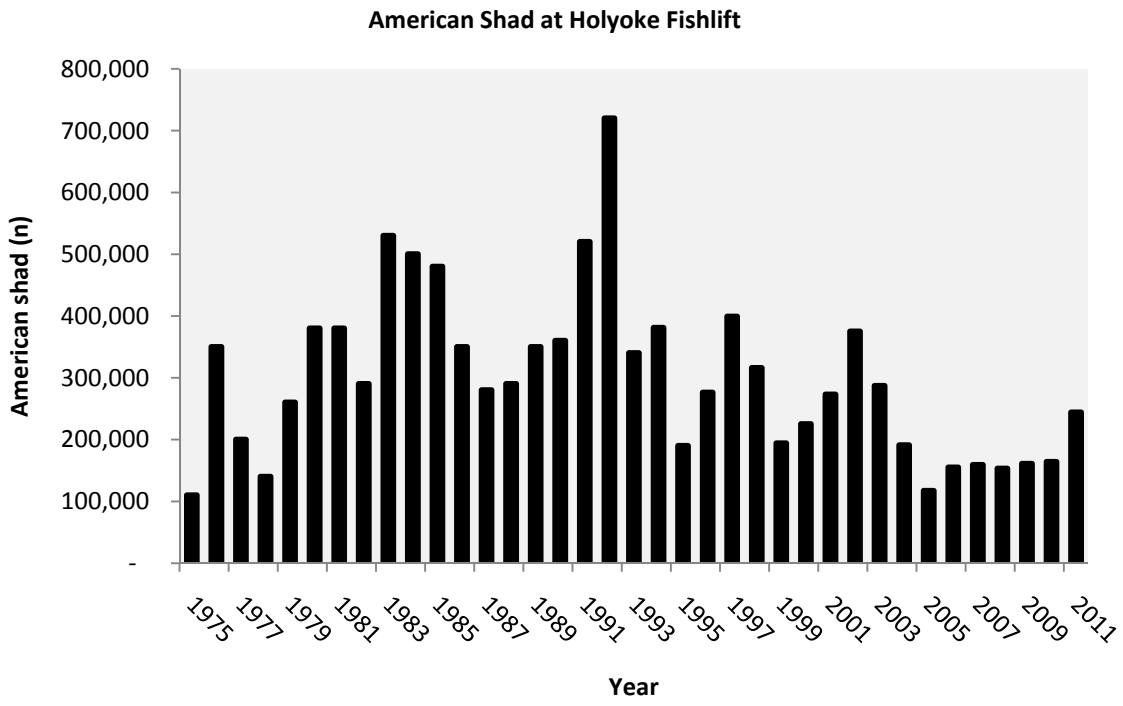

Figure 3.3. Number of adult shad lifted at the Connecticut River Holyoke Dam (Rkm 140), 1975-2011.

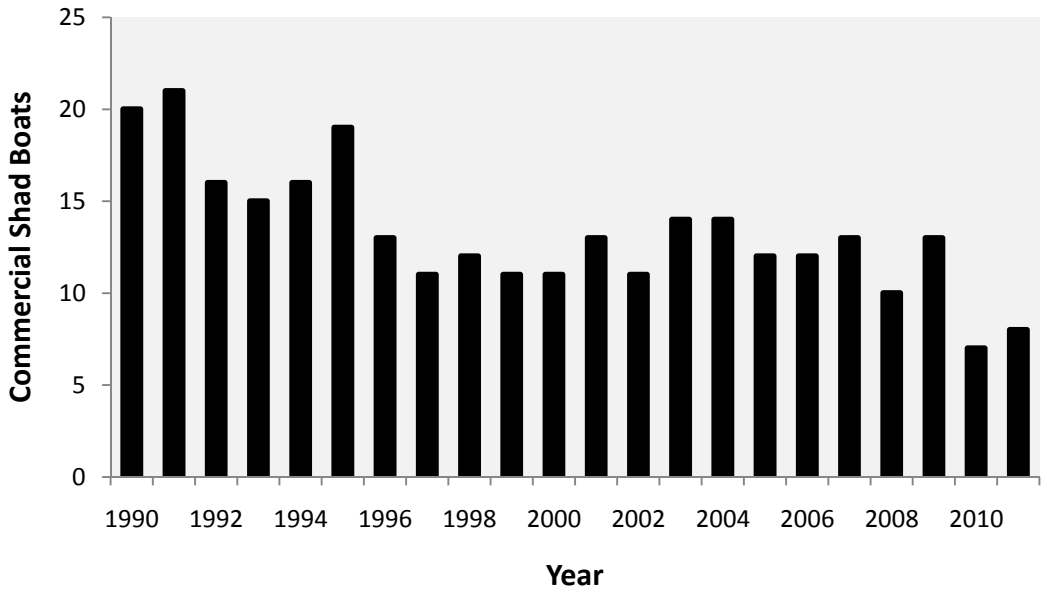

Figure 3.4. Annual number of boats participating in the commercial shad fishery, 1990-2011..

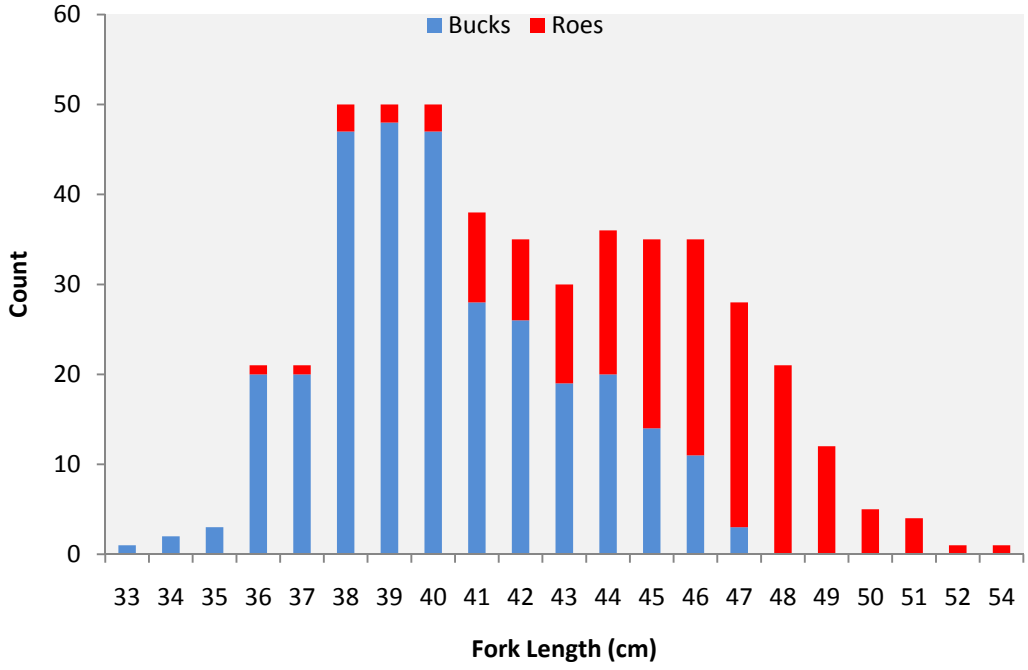

Figure 3.5 American shad length frequencies (FL, cm), by sex, at the Holyoke Lift, 2011.

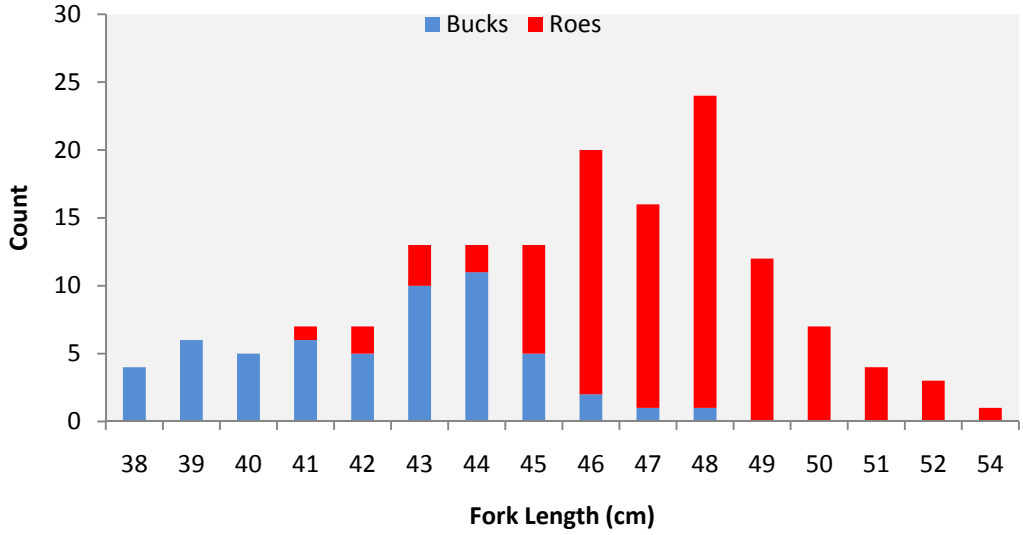

Figure 3.6. American shad length frequencies (FL, cm), by sex, collected in the lower river by gillnet, 2011.

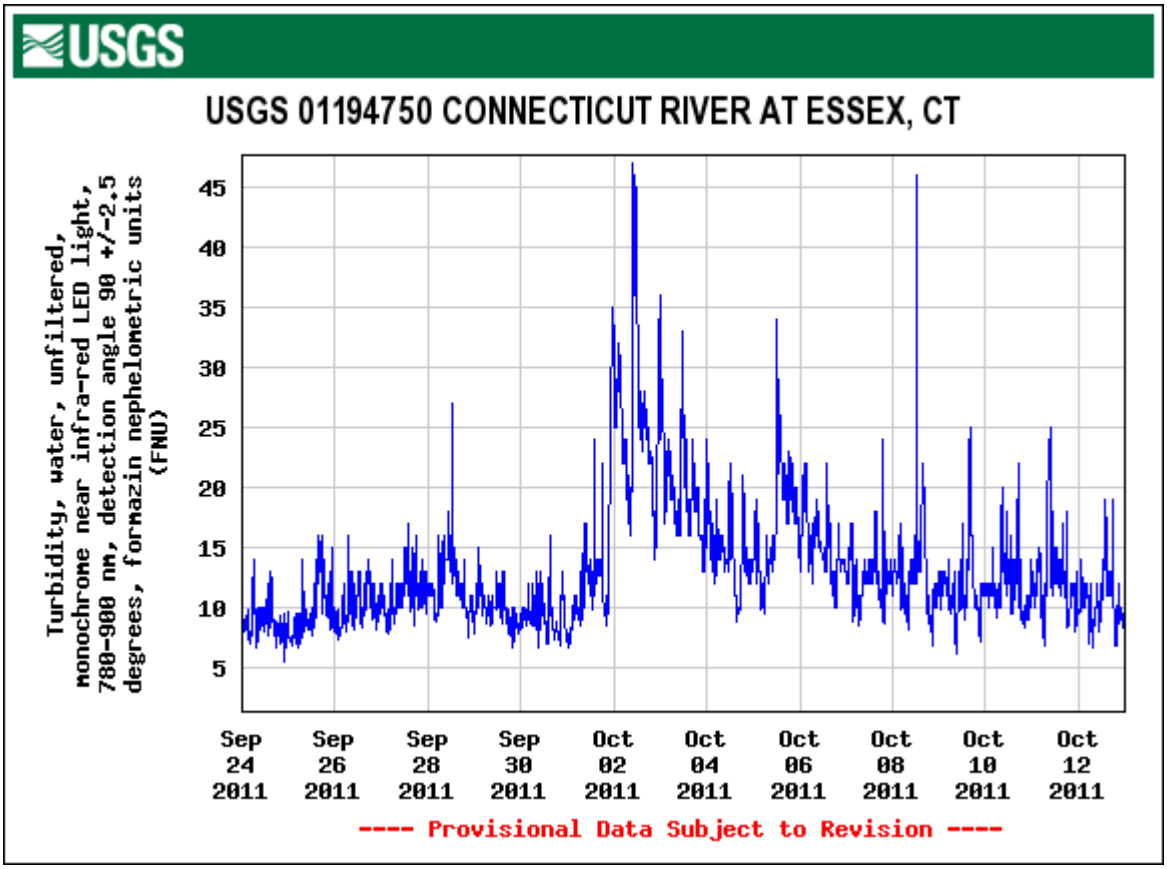

Figure 3.7. Turbidity levels measured at the USGS Essex, CT gaging station during Tropical Storm Irene, Sept. 24-Oct 12, 2011.

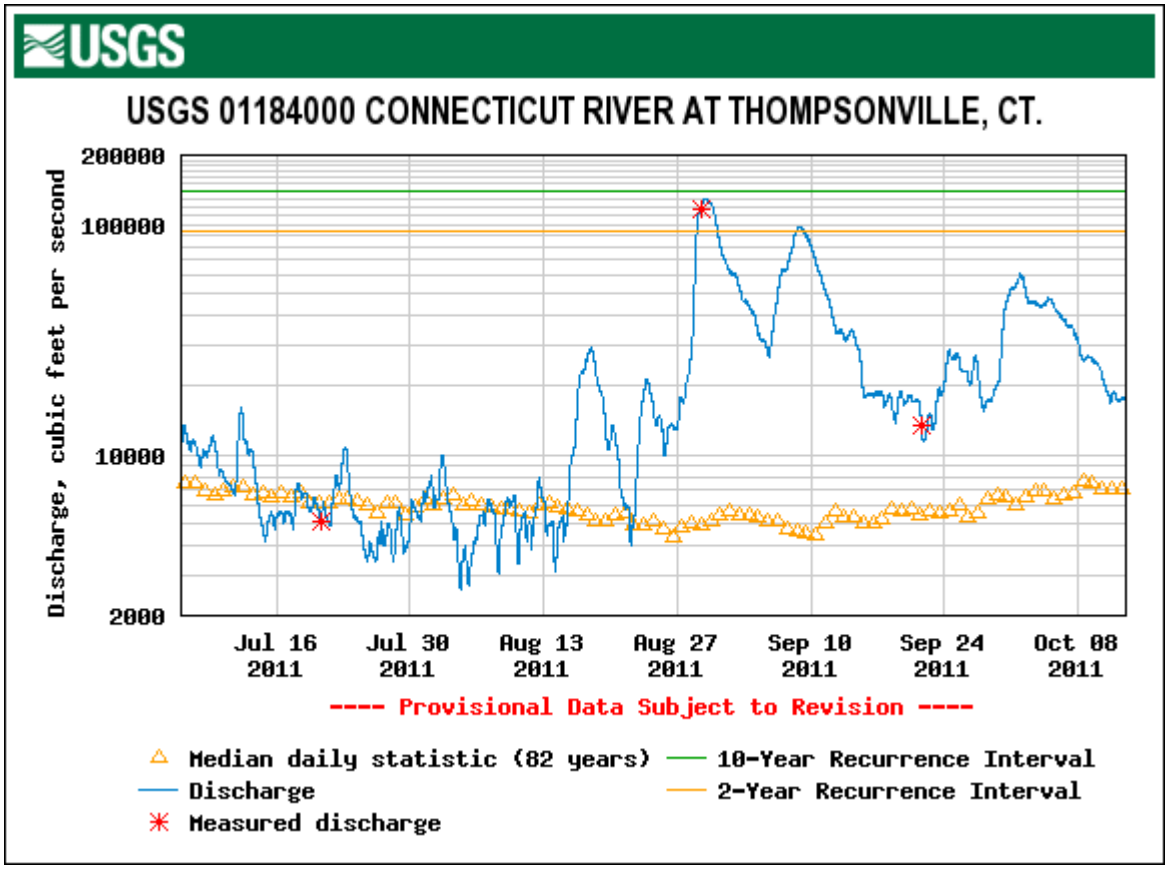

Figure 3.8. Provisional average daily Connecticut River Flows provided by USGS at Thompsonville, CT station. Time frame shows seine sampling period flows (cfs) 2011.

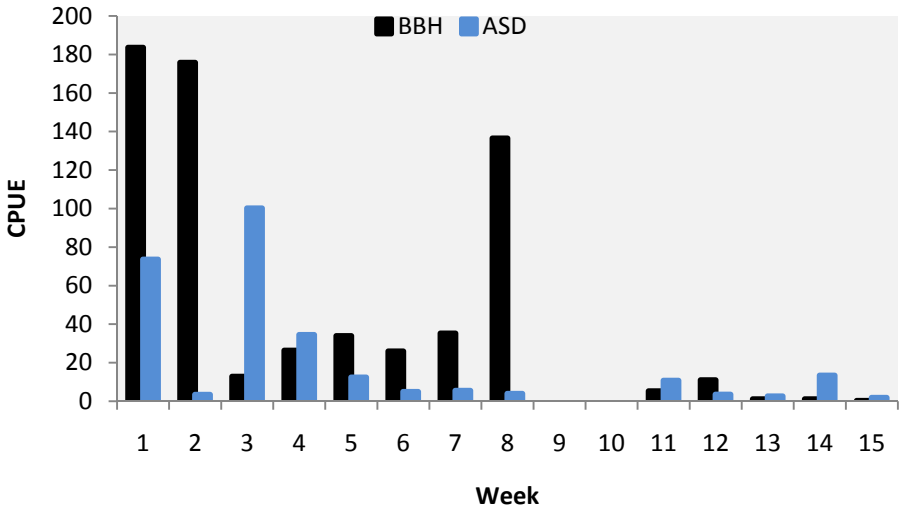

Figure 3.9. Weekly catch per unit effort of juvenile alosines, 2011.

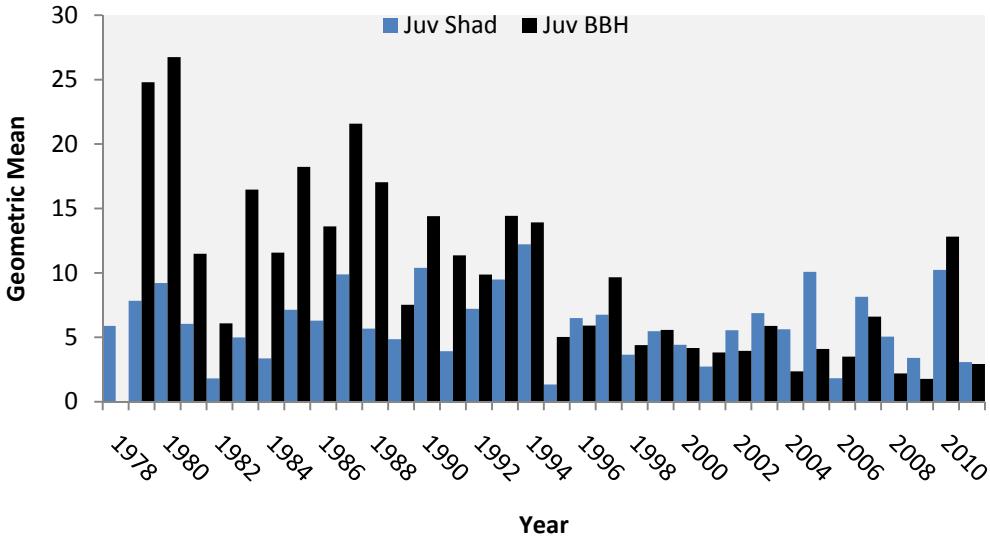

Figure 3.10 Annual cpue of juvenile shad and blueback herring, 1979-2011.

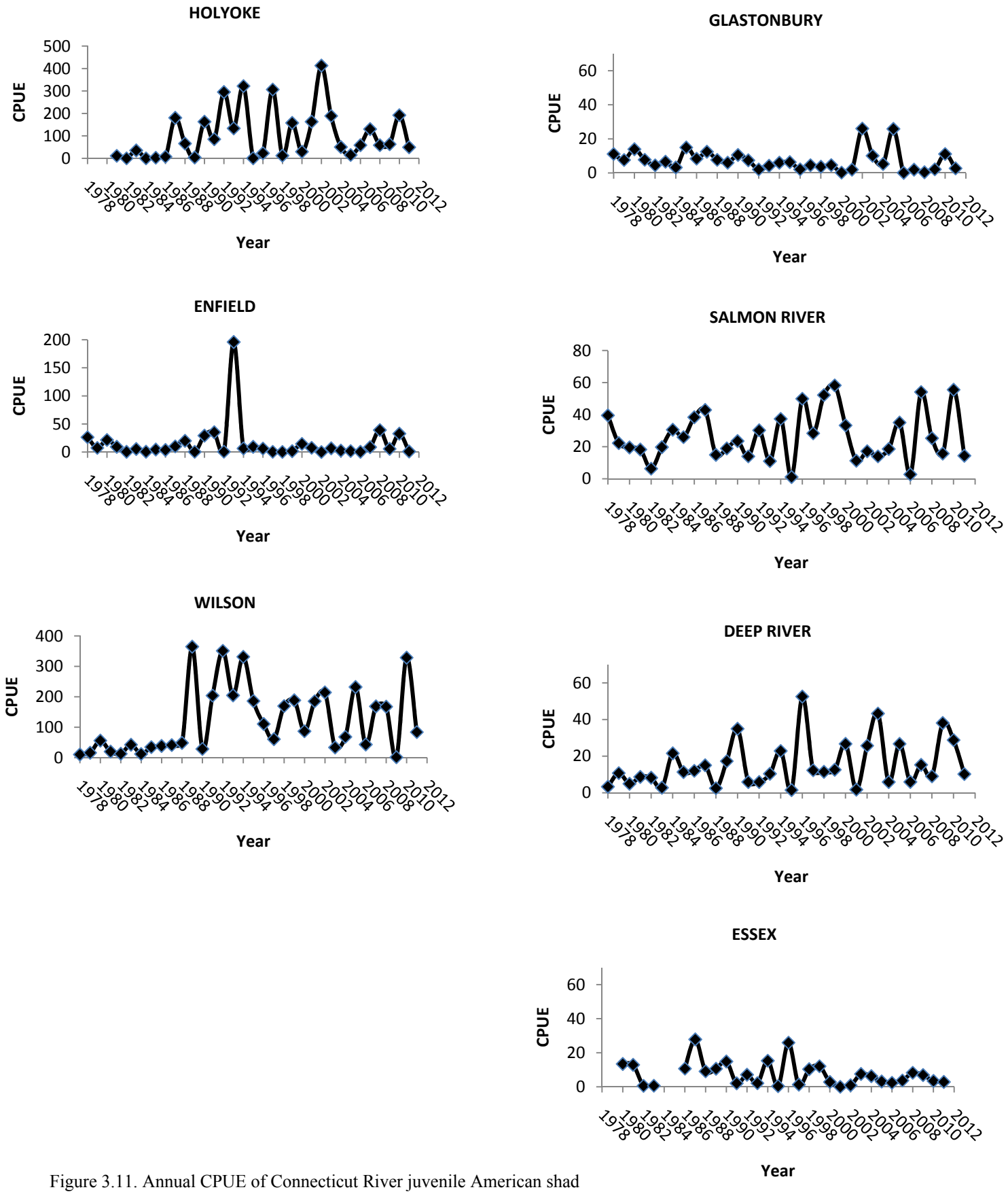

Figure 3.11. Annual CPUE of Connecticut River juvenile American shad by station, 1978-2011.

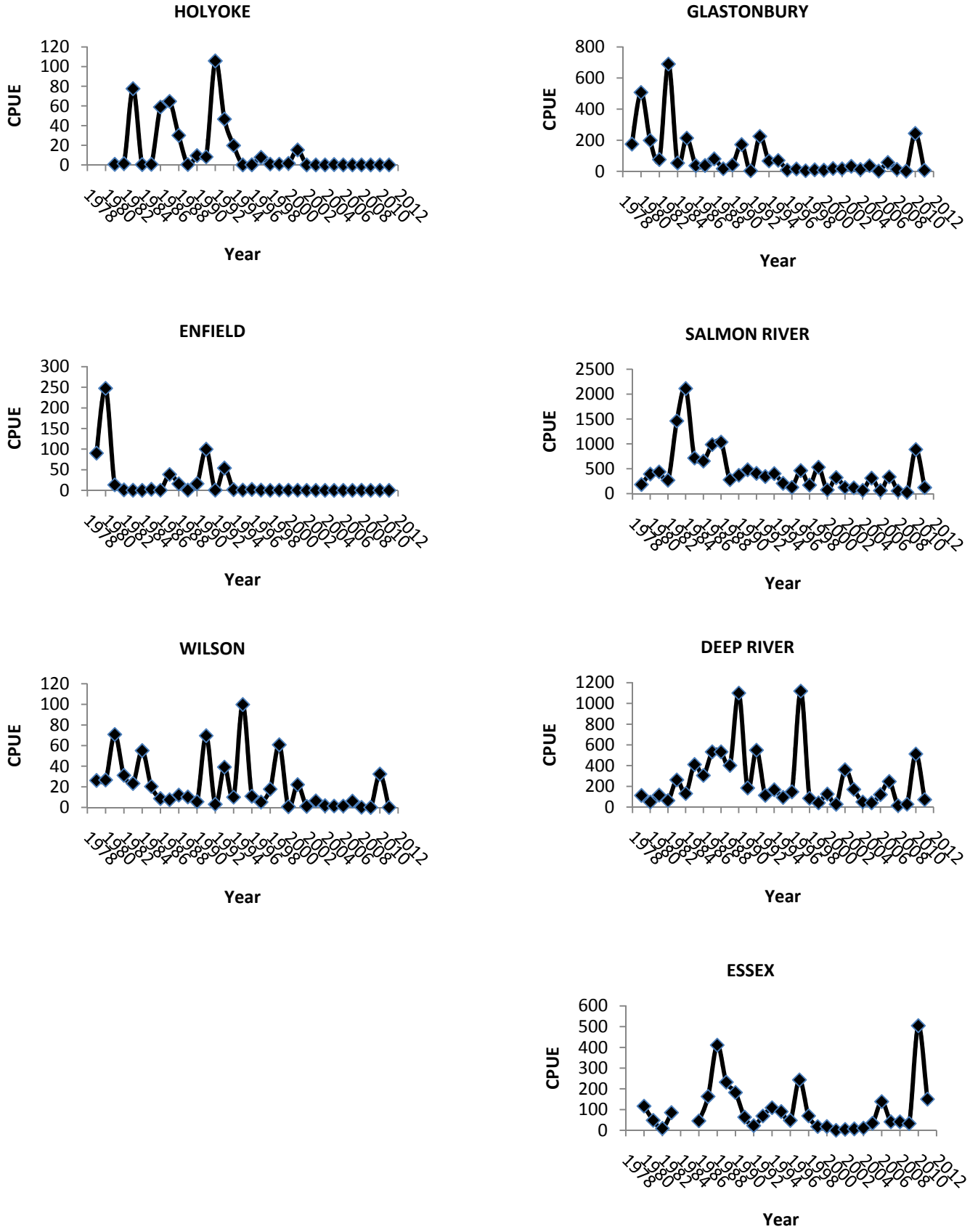

Figure 3.12. Annual CPUE of Connecticut River juvenile blueback herring by station, 1978-2011.