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Annual Progress Report
January 1, 2009 - December 31, 2009
Connecticut Anadromous Fish Investigations

Job 1 Connecticut River Shad Studies

Methods

Objective A. Monitor the commercial fishery for American shad in the Connecticut River.

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 DEP.

Objective B. Examine the age structure of American shad in the Connecticut River.

Information on the number of shad lifted daily at the Holyoke Fishlift in Holyoke, MA, the sex ratio of those fish and the number of days the lift operated was obtained from Massachusetts Division of Fisheries and Wildlife staff. Massachusetts Division of Fish and Wildlife collected scale samples from a subsample of adult shad in the Holyoke Fishlift which were used to characterize the sex ratio and age structure of the 2009 population. CT DEP pressed and aged the scale samples collected.

All shad sampled were weighed and measured to fork length (mm). Sex determination was accomplished by visual inspection of the gonads of sacrificed fish. Approximately 25 scales were removed from above the lateral line anterior to the dorsal fin of each fish. Sex ratio of the population was determined by Massachusetts's staff from daily samples that were weighted by the number of fish lifted during the period since the last sample.

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. Representative numbers of scale samples per length group by sex were randomly selected 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.

Objective C. Measure the relative abundance of juvenile shad in the Connecticut.

Collections of juvenile shad were made weekly from July 15 - October 15 at selected stations from Holyoke MA to Essex CT. The techniques and sites were similar to those used from 1978 to 2008 by CT DEP (Crecco et. al. 1981, Marcy 2004, Savoy and Shake 1993). Collections were made with a 15.2 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. All (or in the case of large catches, a representative subsample) of the clupeids collected were returned to the laboratory for identification and enumeration, while all other species were be quantified and released.

In the laboratory, alosines were separated (American shad, blueback herring, and alewives) based on the criteria of Lippson and Moran (1974). The annual juvenile abundance index (JAI) was derived as the mean catch per unit of effort among all stations and dates combined. Juvenile catches are reported to ASMFC as geometric mean catch per haul, which is also presented.

Results

Objective 1A. Monitor the commercial fishery for American shad in the Connecticut River.

Seventeen commercial shad licenses were sold in 2009 (Figure 1). Annual catch reports have been received from 13 fishermen. The logbook reporting form was changed and for 2009 shad landings information is being entered into SAFIS (Standard Atlantic Fisheries Information System). There are still some reports to be entered into the SAFIS database. As a result, the 2009 shad catches are to be considered preliminary. The number of licenses sold in 2009 has decreased slightly from 2008 (Figure 1). The number of licenses sold since 1979 continues to remain at low levels compared to the overall time series. The number of shad licenses issued annually has remained under 25 since 2005 when a regulation was passed so that assistants no longer were required to purchase a shad license. The number of boats since 1996 has remained at 13 or less (Table 1.).

Preliminary landings of shad harvested in 2009 (27,283 lbs.), have declined from the previous year (41,102) and have continued to stay well below 100,000 lbs. since 2003. The estimated number of fish with sexes combined for 2009 is 5,685 shad captured over 147 days of effort (Table 1). Once all catch information is received, there is no reason to expect the 2009 catch and effort will increase from 2008. There are a small number of participants remaining in the fishery and it is believed this trend will continue as few new participants enter the fishery.

Objective 1B. Examine the age structure of American shad in the Connecticut River.

Total lift numbers of American shad at the Holyoke Dam received from the MassWildlife in 2009 (160,669) were 5% higher than 2008 (153,149) (Figure 2). The 2009 lift total is well below

the long term average from 1978-2008 of 296,867. The lift was opened in early April, with the first shad passage on April 23. The lift continued to operate through July 24 for a total of 102 days with five days of closings for high water or operational factors. The weighted sex ratio of shad sampled at Holyoke provided by Mass Wildlife was 48% for males and 52% females.

The shad age structure from scale samples was expanded based on the number of fish lifted at Holyoke Dam. Four hundred thirty seven scale samples collected from shad at the Holyoke lift were examined for age determination. In 2009, the male population was comprised of shad from the 2003-2006 year classes. Forty three percent of male shad scales examined were from 4 year old fish. Slightly lower in abundance were 5 year old males at 42 percent. Three year old males had a smaller contribution to the age structure at 11 percent and only 3 percent were 6 year old fish (Table 2). The majority of the 2009 female spawners were made up of the 2004 year class. Fifty eight percent of female scale samples examined were 5 year old fish. Four old fish contributed 24 percent to the annual run and seventeen percent were 6 year old fish. The incidence of repeat spawning remains low. The percentage of repeat spawners for males is 5.8% versus 3.3 % among females (Table 2). The trend of fewer younger and older fish with low rates of repeat spawners continues for the Connecticut River stock.

Objective 1C. Measure the relative abundance of juvenile American shad in the Connecticut River.

Juvenile collections in the Connecticut River were conducted from July 15 through October 14, 2009. Ninety seven seine hauls were made and a total of 1,790 juvenile American shad were collected (Table 3). The 2009 juvenile shad catch is the 11th lowest catch in the time series and the 9th lowest arithmetic mean catch per haul (Table 5). Two stations (Holyoke and Deep River) accounted for 75% of the total 2009 catch. The maximum catch was 306 fish collected in mid-August at the Holyoke site, but only represented 17% of the total catch for the season. The low catches indicate a poor year class with an average (arithmetic mean) catch per unit effort of 18.45 (Table 3). The geometric mean catch from all stations and dates sampled was 3.40, the 6th lowest in the time series (Table 5). Catches of American shad by station over time has been variable. Typically the Holyoke and Wilson sites are the largest contributors of shad juvenile catches (Figure 3). In 2009 overall catches were low at most stations, particularly the northern sites. The incidence of zero counts was moderately high within the year at 41% and was primarily the result of the Enfield, Wilson and Glastonbury stations.. The Enfield station produced most of the zero catches. The Wilson station also had unusually low catches and accounted for only 1 % of the total catch in 2009. (Figure 3).

Blueback herring catches for 2009 were lower than those for American shad. and accounted for 38% percent collected of the two *Alosa* species. Historically catches were comprised of up of 90% bluebacks. The three southernmost stations was 99% of the catch in 2009 (Table 4).

Job 2. Sturgeon Studies

Methods

Objective 2A. Monitor the population and distribution of shortnose sturgeon in the Connecticut River during coldwater periods.

Sturgeon were collected during the reporting period January 1-December 31, 2009 in the Connecticut River. Small bottom trawls and gill nets were used depending upon location fished. Gill nets were multifilament nylon gill nets (single mesh size per net of 10.0, 12.7, 15.2 or 17.8 cm stretch mesh and 30.5 m long by 1.8 m deep). Gill nets were fished in anchored sets. Anchored nets were set parallel to the river flow to fish the bottom 1.8m of the water column throughout the mainstem of the Connecticut River. One to five nets were set for 1 to 3 hours per location, depending upon water temperature. Bottom trawls (8cm mesh, 10m headrope) will be towed at approximately 2.5 knots for 5 to 15 minutes. Tow duration is variable but the trawl is fished as long as possible in various reaches. The relatively short tow time ensures minimal impacts to the animals.

All fish species collected were identified and enumerated. Sturgeon captured were examined for previous tags and biological information was collected (general health, length, weight). All untagged sturgeon were implanted with a PIT tag into the musculature below the dorsal fin on the left side. All conditions and requirements were followed as outlined in Endangered Species Act (ESA) Section 10 Permit authorizing research on shortnose sturgeon (Permit # 1516 issued on May 15, 2006 and expiring on May 15, 2011).

Results

Objective 2A. Monitor the population and distribution of shortnose sturgeon in the Connecticut River during coldwater periods.

Twenty two sturgeon were collected in the Connecticut River during coldwater months in 2009. (Table 7, Figure 5a). The first shortnose sturgeon collections for 2009 occurred in May with 3 fish collected in the estuary by skiff trawl. Six shortnose sturgeon were collected upriver in November. Thirteen shortnose sturgeon were collected in the Hartford area in December. Ten trips were made during coldwater months in 2009 to collect shortnose sturgeon. The first trip in late March caught no sturgeon, a second trip in April was also unsuccessful and two trips in May collected two sturgeon in the lower river. Three trips were made during the late fall & winter months. Two trips in November collected six shortnose sturgeon up river and the third trip in December upriver collected 13 shortnose sturgeon.

Seventy seven sturgeon were also collected during warm water months in a companion study on Atlantic sturgeon. Their information has been included in order to provide total catches for the year under Endangered Species Permit no. 1516. Eighty two of all shortnose collected were tagged and seventeen sturgeon were recaptures. The total number of shortnose sturgeon collected since research efforts began in 1988 is 1,323 (Table 6). The total number of recaptures

from 1988-2009 is 370. There have been no shortnose sturgeon mortalities since 1998 when 2 were accidentally killed in gillnets. Adoption of Sturgeon Netting Protocols which dictate short soak times of less than 12 hours when water temperatures exceed 20 C are relatively effective, with no mortalities occurring since 1998. Total catches for the year occurred during the summer in the lower river (Figure 5). The majority of fish collected in 2009 were in the 600-699 mm fork length range and weighed less than 5 kg (Figure 6). Capture by gear type was 91 shortnose collected by trawl and eight were collected by gillnets.

References:

- Cating, J.P. 1953. Determining the age of Atlantic shad from their scales. Fish Bull. U.S. 85(54):187-199.
- Crecco, V., Savoy, T., Gunn, L. 1981. Population dynamics studies of American shad in the Connecticut River, 1981-1983. Final Report AFC-13. Connecticut Dept. Environ. Protect. 76p.
- Crecco, V., and T. Savoy. 1985. Density dependent catchability and its potential causes and consequences on Connecticut River shad, *Alosa sapidissima*. Can. J. Fish. Aquat. Sci. 42:1649-1657.
- Lippson, A.J., and R.L. Moran. 1974. Manual for the identification of early developmental stages of fishes of the Potomac River estuary. Maryland Dept. of Nat. Res. PPSP-MP-13. 282 p.
- Marcy, B.C., Jr. 2004. Early life history studies of American shad in the lower Connecticut river and the effects of the Connecticut yankee plant. Pages 155-180 in P.M. Jacobson, D.A. Dixon, W.C. Leggett, B.C. Marcy, Jr., and R.R. Massengill, editors. The Connecticut River Ecological Study (1965-1973) revisited: ecology of the lower Connecticut River 1973-2003. American Fisheries Society, Monograph 9, Bethesda, Maryland.
- Moser, M.L., M. Bain, M.R. Collins, N. Haley, B. Kynard, J.C. O'Herron, G. Rodgers, and T. S. Squiers. 2000. A protocol for use of shortnose and Atlantic sturgeons. NOAA Tech. Memo NMFS-OPR-18.
- Savoy, T. 1996. Anadromous Fish Studies in Connecticut Waters. Progress Report AFC-24. Connecticut Dept. Environ. Protect. 62p.
- Savoy, T. and D. Shake. 1993. Anadromous Fish Studies in Connecticut Waters. Progress Report AFC-21-1. Connecticut Dept. Environ. Protect. 44p.

Table 1. Reported landings (lbs.), number of shad by sex, number of fishermen and boats used by the commercial fishery, 1990-2009.
 *2009 landings and effort are preliminary

Year	Total lbs.	#Males	# Female	#Boats	Days Fished
1990	259425	8568	21142	20	402
1991	149300	9174	23112	21	416
1992	144300	7171	26768	16	410
1993	96660	5173	17790	15	332
1994	104000	1812	19400	16	312
1995	61575	1862	12299	19	352
1996	66757	2298	13660	13	264
1997	91003	2812	18743	11	271
1998	89342	2983	18529	12	280
1999	44574	872	9506	11	195
2000	107416	2342	21228	11	210
2001	59234	1469	13074	13	193
2002	108099	7153	20653	11	248
2003	111127	5176	21244	14	249
2004	66328	2456	13436	14	226
2005	69333	1873	15336	12	218
2006	38547	1864	7372	12	185
2007	51572	1688	9888	13	199
2008	41102	1492	9186	9	173
2009*	27283	761	4924	9	147

Table 2. Age distribution and repeat spawning rate of American shad in the Connecticut River in 2009 based on a subsample of shad collected at Holyoke Dam.

	Age Group				
Female Shad	3	4	5	6	Totals
Lift		20,586	48,700	14,253	83,540
% shad at age		24.64	58.29	17.06	
Repeat			396	2,376	2,771
% Repeats			0.81	16.67	3.32
Male Shad	3	4	5	6	Totals
Lift	8,530	33,787	32,422	2,391	77,129
% shad at age	11.1	43.81	42.04	3.1	
Repeat		683	2730	1025	4,437
% Repeats		2.02	8.421	42.86	5.75

Table 3. Catch, effort and catch per effort of juvenile American shad from the 2009 seine survey. C=Total catch, E=Number of seine hauls.

Date	HOLYOKE	ENFIELD	WILSON	GLASTONBURY	SALMON R.	DEEP R.	ESSEX	Catch By Week	Effort	C/E
7/15	0	0	0	0	43	85	24	152	7	21.71
7/22	0	0	6	0	33	242	12	293	7	41.86
7/29	5	1	0	14	24	43	22	109	7	15.57
8/5		3	2	0	0	11	12	28	6	4.67
8/12	306	61	6	2	24	50	0	449	7	64.14
8/19	91	0	0	0	1	31	13	136	7	19.43
8/26	233	12	3	8	4	20	1	281	7	40.14
9/2	34	0	0	1	3	22	6	66	7	9.43
9/10	108	0	0	0	35	14	0	157	7	22.43
9/16	39	0	0	4	11	4	5	63	7	9.00
9/23	0	0	0	1	27	4	1	33	7	4.71
9/30	0	0	0	0	9	6	0	15	7	2.14
10/7	0	0	1	0	4	1	0	6	7	0.86
10/14	0	0	0	0	2	0	0	2	7	0.29
Catch by Station	816	77	18	30	220	533	96	1,790	97	18.45

Table 4. Catch, effort and catch per effort of juvenile blueback herring from the 2009 seine survey. C=Total catch, E=Number of seine hauls.

Date	HOLYOKE	ENFIELD	WILSON	GLASTONBURY	SALMON R.	DEEP R.	ESSEX	Catch By Week	Effort	C/E
7/15	0	0	0	0	10	7	131	148	7	21.14
7/22	0	0	0	2	35	75	170	282	7	40.29
7/29	0	0	0	4	11	20	53	88	7	12.57
8/5		0	0	0	0	3	14	17	6	2.83
8/12	0	0	0	0	49	37	0	86	7	12.29
8/19	0	0	0	0	2	22	36	60	7	8.57
8/26	0	0	0	0	12	4	0	16	7	2.29
9/2	0	0	0	1	11	36	47	95	7	13.57
9/10	0	0	0	0	45	41	0	86	7	12.29
9/16	0	0	0	0	66	0	0	66	7	9.43
9/23	0	0	0	0	35	4	0	39	7	5.57
9/30	0	0	0	0	22	119	0	141	7	20.14
10/7	0	0	0	0	5	6	0	11	7	1.57
10/14	0	0	0	0	1	1	0	2	7	0.29
Catch by Station	0	0	0	7	304	375	451	1,137	97	11.72

Table 5. Arithmetic and geometric mean relative abundance indices (CPUE) of juvenile American shad from the 1978-2009 year classes.

Year	Arithmetic Mean	Geometric Mean
1978	18.59	5.89
1979	12.25	7.10
1980	21.19	9.21
1981	12.57	6.05
1982	4.77	1.81
1983	16.57	4.99
1984	11.20	3.37
1985	15.88	7.14
1986	17.01	6.29
1987	44.73	9.89
1988	23.60	5.68
1989	61.44	4.85
1990	42.61	10.39
1991	51.24	3.92
1992	97.42	7.21
1993	79.56	9.49
1994	105.80	12.22
1995	29.42	1.34
1996	38.85	6.50
1997	59.16	6.75
1998	38.21	3.65
1999	61.45	5.47
2000	27.68	4.42
2001	53.50	2.73
2002	100.30	5.55
2003	36.86	6.88
2004	22.55	5.62
2005	50.74	10.08
2006	15.80	1.82
2007	54.97	8.15
2008	41.17	5.06
2009	18.45	3.40

Table 6. Number of shortnose sturgeon collected in the Connecticut River annually, 1988-2009

Year	Collected	Recaptures	Mortalities
1988	48	1	2
1989	80	11	5
1990	59	7	3
1991	74	14	0
1992	50	13	0
1993	14	7	1
1994	20	7	0
1995	11	2	0
1996	22	7	0
1997	34	9	0
1998	52	16	2
1999	35	3	0
2000	117	22	0
2001	126	41	0
2002	153	51	0
2003	56	26	0
2004	117	47	0
2005	54	26	0
2006	28	14	0
2007	27	13	0
2008	47	16	0
2009	99	17	0
Total	1323	370	13

Table 7. Number of shortnose sturgeon collected by location and month in 2009.

# Fish	Location	Month
3	Estuary	May
76	Estuary	June
1	Portland	September
4	Portland	November
2	Hartford	November
13	Hartford	December

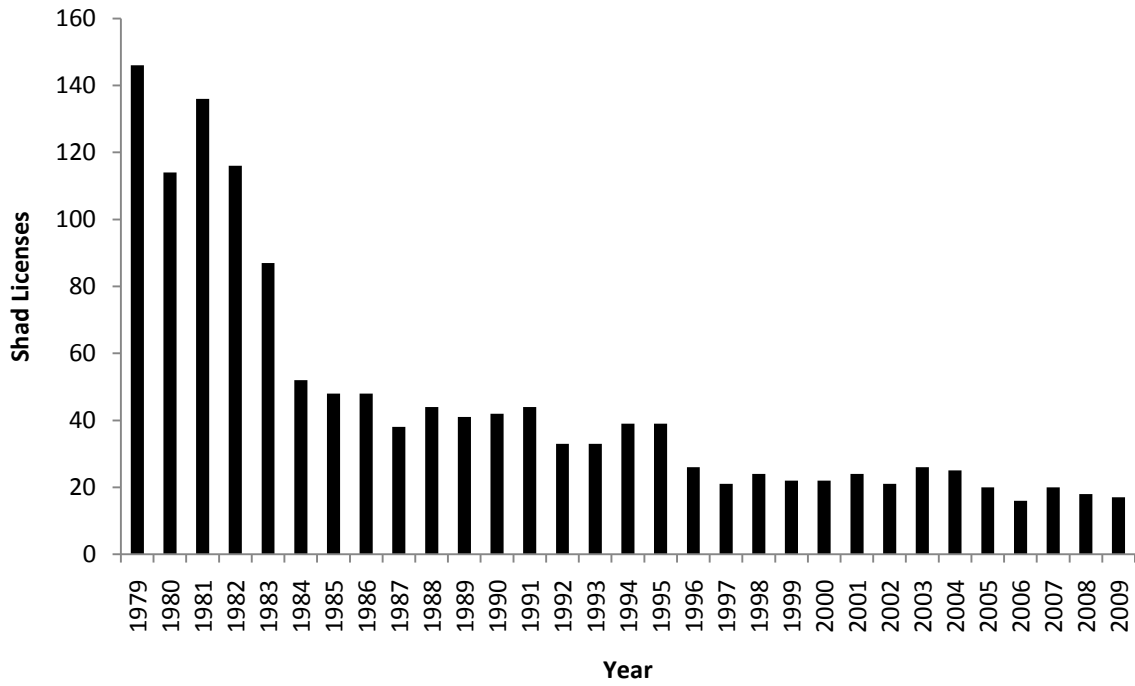


Figure 1. Number of shad licenses sold, 1979-2009. Note that after 2004, assistants were no longer required to purchase a license.

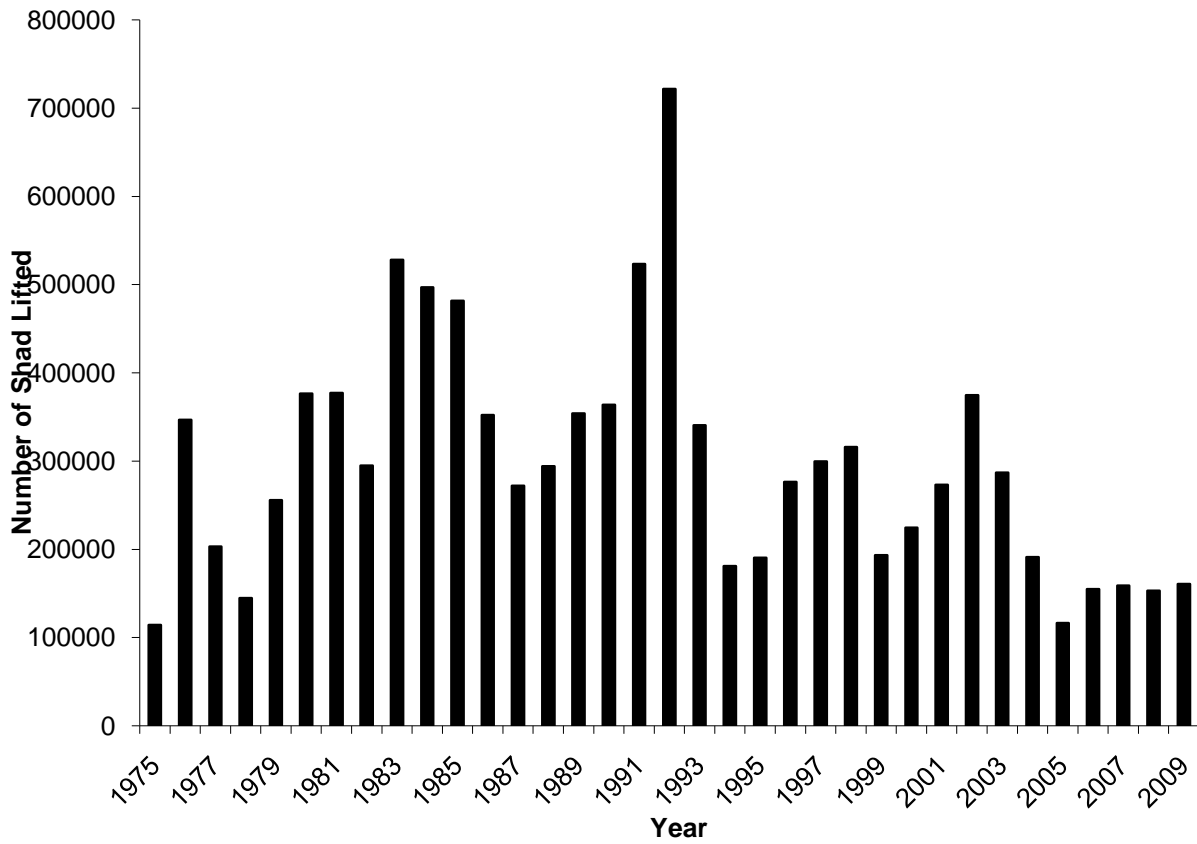


Figure 2. Number of adult shad lifted annually at the Holyoke Dam, 1975-2009.

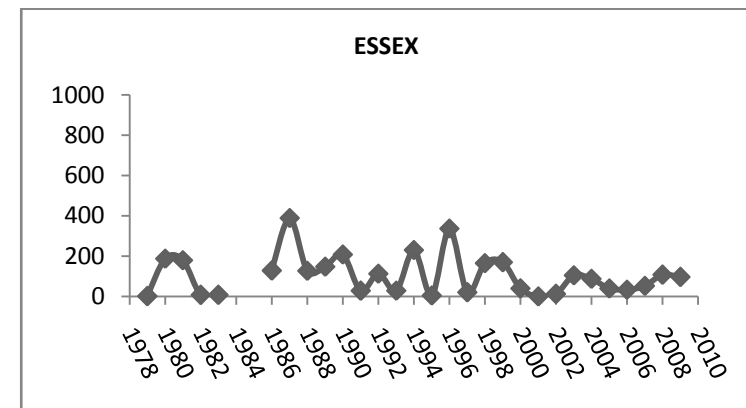
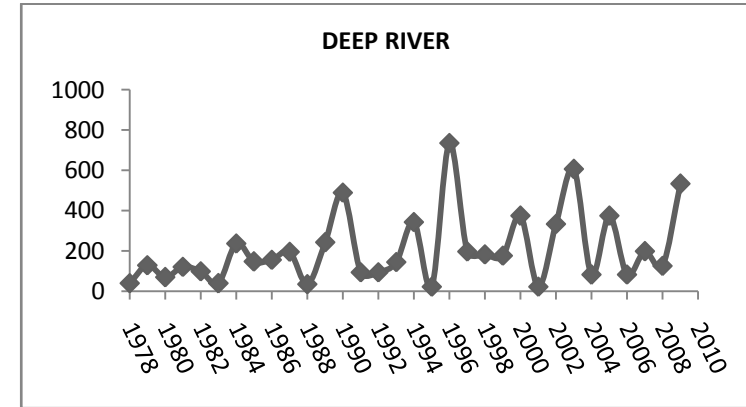
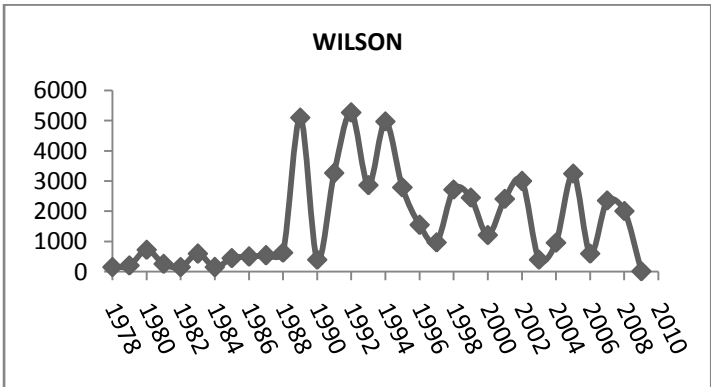
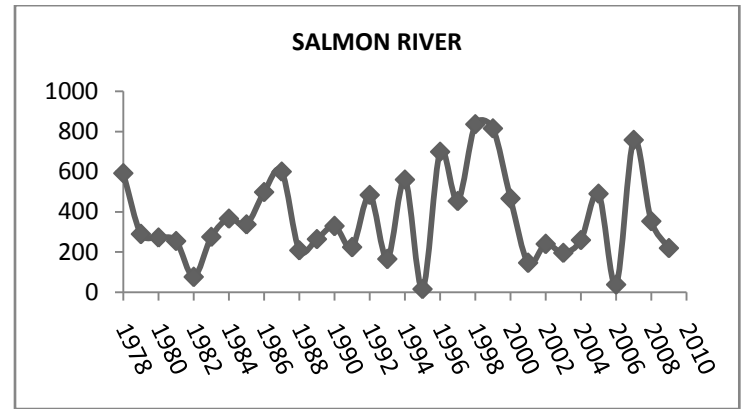
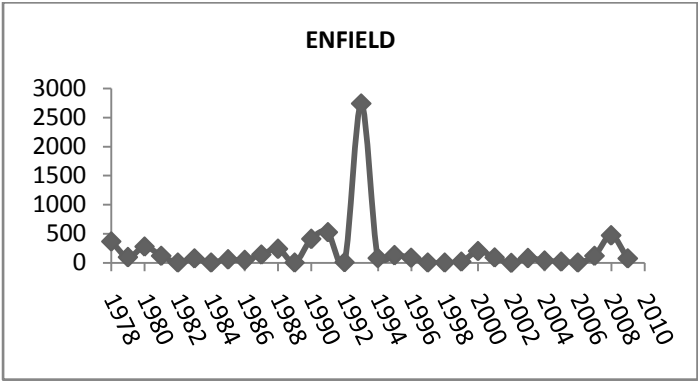
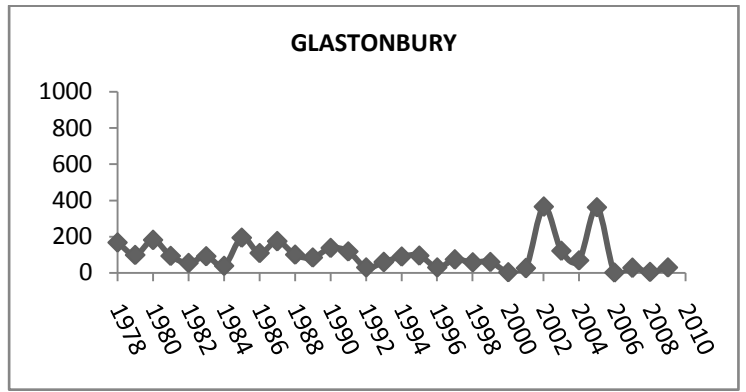
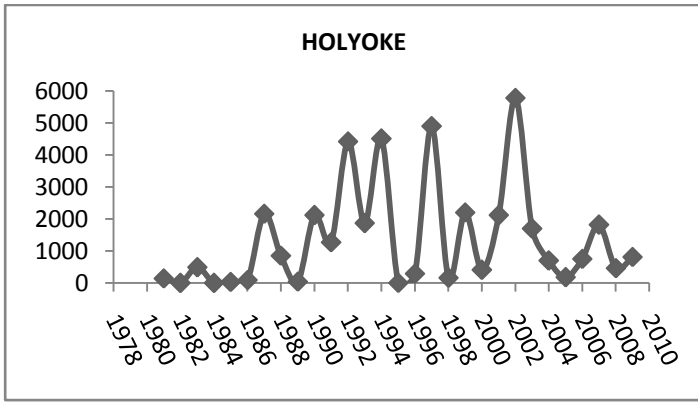


Figure 3. Total shad collected annually by site, 1978-2009.

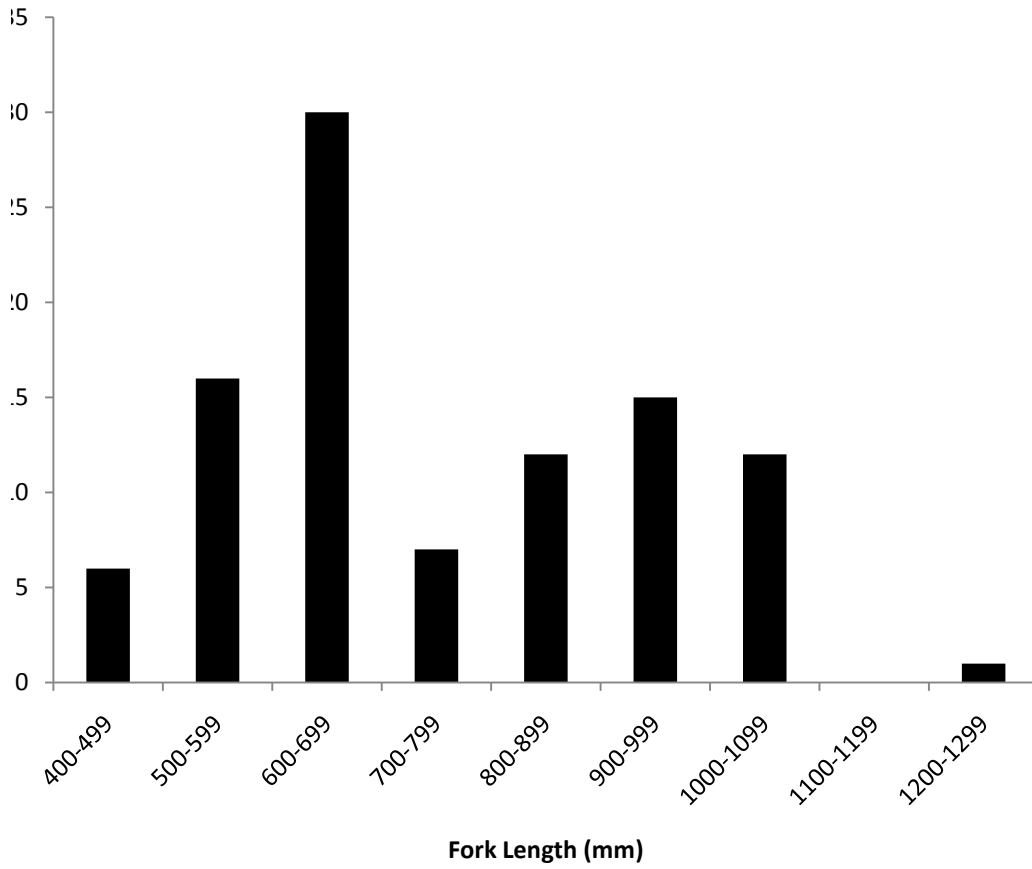


Figure 4. Length frequency (Fork Length, mm) of shortnose sturgeon collected in 2009.

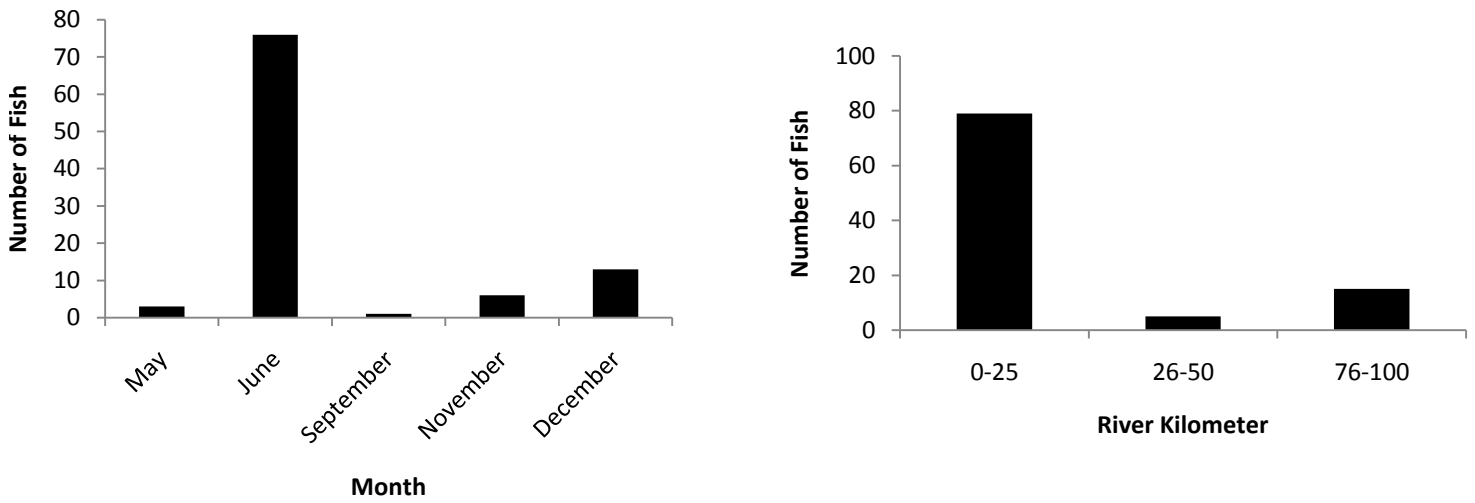


Figure 5. Number of shortnose sturgeon collected by month and River Kilometer.

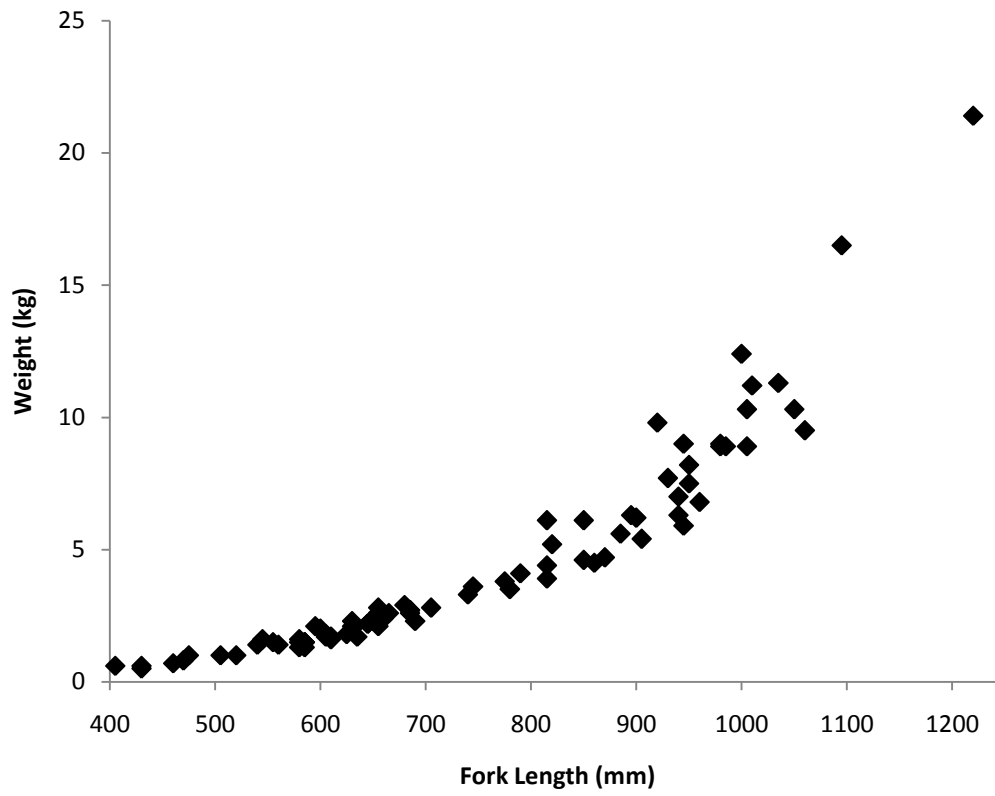


Figure 6. Lengths and weights of shortnose sturgeon collected in 2009.