SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY SPRING 2013

August 2013

SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY SPRING 2013

Prepared for

EXELON GENERATION COMPANY, LLC
2569 Shures Landing Road
Darlington, Maryland 21034-1503

Prepared by

NORMANDEAU ASSOCIATES, INC.
1921 River Road
Drumore, Pennsylvania 17518

Normandeau Associates' Project Number 22755.001

August 2013

EXECUTIVE SUMMARY

Operation of the Conowingo East Fish Lift (EFL) began April 1, 2013 although the water temperature was below the season start trigger value of 50°F (47.1°F actual water temperature on April 1). The first two American shad were passed on April 11 at a water temperature of 57.2°F. The EFL operated for 60 days in 2013 with everyday operation starting on April 8 and continuing to the end of the season. EFL operations were terminated on June 3 in concurrence with the resource agencies. The 2013 fish passage season marks the twenty-third season of overall operation and the seventeenth year of volitional passage operation at the Conowingo EFL.

The EFL passed 1,094,526 fish of 27 species. Gizzard shad (1,076,048), American shad (12,733), quillback (2,725) and channel catfish (1,594), dominated the catch, and comprised nearly 100% of the total fish collected and passed. Gizzard shad alone accounted for 98% of the total fish collected and passed.

A total of 12,733 American shad were passed. The highest daily passage of American shad occurred on May 2 when 1,758 shad were passed upstream. On 4 of the 60 days of operation, American shad passage exceeded 1,000 fish. On a daily basis, overall shad passage was strongest through the fishway between 1400 hours and 1859 hours during which 76% of all shad passage occurred.

Fishway operations were conducted at water temperatures ranging from 46.9°F to 75.6°F and river flows between 20,700 and 98,100 cfs. Spillage occurred on 1 of the 60 days of operation, (April 15). Generally, river flows declined and remained stable after April 23.

In 2013, the EFL was not shut down due to spill. Based on information gained in previous years, the standard operating procedure when spill conditions are in effect is to cease operation of the EFL if more than two spill gates are open. This SOP was not put into effect because of the limited nature of the one spill event.

Prior to the start of EFL operations in 2013, and in addition to routine preseason maintenance activities, the operating system for the hopper door (air hoses, pneumatic cylinder, etc.) was re-engineered to improve reliability of the facility and minimize any fish passage delays due to mechanical issues. The hopper door performed flawlessly and decreased the number of mechanical issues specific to the hopper air hoses addressed in 2013 as compared to those that occurred during the 2012 fish passage season.

For most of the season, water clarity was adequate, allowing the viewing technicians to identify American shad with attached Maryland DNR floy tags. The number of floy tags observed at the Conowingo EFL in 2013 was 23 pink tags (all from this year's tagging efforts).

Future operations of the EFL will build on the past seventeen years of operation experience.

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1.0 INTRODUCTION

Exelon Generation Company, LLC, formerly the Susquehanna Electric Company (SECO), has operated a fish passage facility (West lift) at its Conowingo Hydroelectric Station since 1972. Lift operations are part of a cooperative private, state, and federal effort to restore American shad (*Alosa sapidissima*) and other migratory fishes to the Susquehanna River. In accordance with the restoration plan, the operational goal had been to monitor fish populations below Conowingo Dam and transport pre-spawned migratory fishes upriver.

In 1988, the former PECO Energy Company negotiated an agreement with state and federal resource agencies and private organizations to enhance restoration of American shad and other anadromous species to the Susquehanna River. A major element of this agreement was for PECO Energy Company to construct an East Fish Lift Passage Facility (EFL) at Conowingo Dam. Construction of the EFL commenced in April 1990 and it was operational by spring 1991.

With the completion of fishways at Holtwood, Safe Harbor, and York Haven dams, the EFL has been operated to pass fish directly into Conowingo Pond since spring 1997.

Objectives of 2013 operation were: (1) monitor passage of migratory and resident fishes through the fishway; and (2) assess fishway and trough effectiveness and make modifications as feasible.

2.0 CONOWINGO OPERATION

2.1 Project Operation

The Conowingo Hydroelectric Station, built in 1928, is located at river mile 10 on the Susquehanna River (RMC 1992). The powerhouse has a peaking generating capacity of 549.5 MW and a hydraulic capacity of approximately 85,000 cfs. Flows in excess of station draft are spilled through two regulating and 50 crest gates. The powerhouse contains seven vertical Francis (numbered 1 through 7) and four Kaplan (numbered 8 through 11) turbines. The seven Francis units have been equipped with aeration systems that permit a unit to draw air into the unit (vented mode) or operate conventionally (unvented mode). The four original Kaplan turbines installed in 1964 were replaced over a period of four years (1992 to 1996), with more efficient mixed-flow Kaplan type turbines.

Minimum flow releases from the station during the spring spawning and fishway operating season follow the schedule outlined in the settlement agreement. Minimum flows of 10,000 cubic feet per second (cfs) or natural river flow, whichever is less, as measured at the United States Geological Survey (USGS) gauge at Marietta, PA were maintained for the period 1 to 30 April. A minimum flow of 7,500 cfs or natural river flow (as previously noted) was maintained for the period 1 to 31 May. A minimum flow of 5,000 cfs or natural river flow (as previously noted) is maintained when fish lift operations occur in June.

2.2 Fishway Operation

The start of operation for the EFL in 2013 began on April 1, 2013. The first American shad (2) were passed on April 11(Table 1). Every other day operation was in effect until April 8 with everyday operation beginning on April 9, and continued through June 3. On June 3, operations were terminated with concurrence from the Resource Agencies. The EFL operated a total of 60 days during the 2013 season.

Daily operation times were planned during optimal fish passage parameters. This year, operational methodologies were influenced by natural river flow, water temperature, generation and spill conditions, and daily/hourly fish passage numbers. EFL operation was conducted by a staff of three people: a lift operator, a supervising biologist, and a biological technician.

The mechanical aspects of EFL operation in 2013 were similar to those described in RMC (1992) and Normandeau Associates, Inc. (1999). Fishing time and/or lift frequency was determined by fish abundance, but the hopper was generally cycled once an hour throughout the day. The method of lift operation was also influenced by fish abundance. When a large number of fish were in the fishing channel, the crowder was not operated; instead the crowder screen was raised and then lowered trapping fish over the hopper. This mode of operation, called "fast fish", involved leaving the crowder in the normal fishing position and raising the hopper frequently to remove fish that accumulated in the holding channel.

The specific entrance(s) used to attract fishes was dictated by the station discharge and which turbine units were operating. For example, when Kaplan turbine units 8, 9, 10, and 11 or any combination of Kaplan turbines were operating, entrance C was the primary entrance used to attract fishes. Under these conditions the attraction flow through the other entrances is negated or disrupted. Depending on river flow and/or generation, entrance A or C was utilized throughout the 2013 season to attract fishes.

2.3 Fish Counts

Fish that were lifted and sluiced into the trough were guided by a series of fixed screens. The fixed screens directed the fish to swim up and through a 3 ft wide channel and past a 4 ft by 10 ft counting window located on the west wall of the trough. Fish passing the counting window were identified to species and enumerated by a biologist and/or technician. Passage of fish by the window and out of the trough system was controlled by a set of gates located downstream of the counting window. During periods of peak passage, two people were used to identify and count fish.

At the end of each hour, fish passage data were recorded on data sheets and entered into a Microsoft Excel worksheet on a Personal Computer. Data processing and reporting were PC based and accomplished by program scripts, or macros, created within Microsoft Excel software. After the technician verified the correctness of the raw data, a daily summary of fish passage was produced and distributed in hard copy to plant personnel. Each day's data were backed up to a diskette and stored off site. Daily reports and weekly summaries of fish passage were electronically distributed to plant personnel and other cooperators.

3.0 RESULTS

3.1 Relative Abundance

The number of fishes collected and passed by the Conowingo Dam EFL is presented in Table 1. A total of 1,094,526 fish of 27 species passed upstream into Conowingo Pond. Gizzard shad (1,076,048), American shad (12,733), quillback (2,725) and channel catfish (1,594), dominated the catch, and comprised nearly 100% of the total fish collected and passed. Gizzard shad alone accounted for 98% of the total fish collected and passed. Peak passage occurred on 13 May when 65,438 fish, (99% gizzard shad), were passed.

3.2 American Shad Passage

The EFL collected and passed 12,733 American shad (Table 1). The first 2 American shad passed on April 11. Collection and passage of shad varied daily with 0.3% (43) of the shad passed from 1 April to 19April, 58% (7,384) passed from 20 April to 4 May, 29.4% (3,738) passed from 5 May to 19 May, and 12.3% (1,568) passed from 20 May to 3 June (Figures 1and 2). On 4 of the 60 days of operation, American shad passage exceeded 1,000 fish. The largest number of American shad passed at the EFL in 2013 occurred on May 2 (1,758).

American shad were collected and passed at water temperatures ranging from 57.2°F to 75.6°F and river flows between 20,700 and 93,800 cfs (Table 2, and Figure 1). The average daily river flow on

those days when American shad passage exceeded 1,000 fish was approximately 36,925 cfs. The average daily river flow during the operational season was 40,595 cfs.

The hourly passage of American shad at the EFL is given in Table 3. On a daily basis, overall shad passage was strongest through the fishway between 1400 hours and 1859 hours during which 76% of shad passage occurred. The highest hourly passage rate occurred from 1500 to 1559 hours.

3.3 Gizzard Shad Passage

The EFL collected and passed 1,076,048 Gizzard shad in 2013 (Tables 1 and 4). Gizzard shad accounted for 98% of the total fish collected and passed. On 11 of 60 days of operation, Gizzard shad passage exceeded 30,000 fish. Table 4 provides the ratio of American shad to Gizzard shad for the years of volitional passage (1997-2013). In years when American shad passage exceeds 50,000 fish, the ratio ranges from 1:2 – 1:14 (Am. shad/gizzard shad). For those years when American shad passage is less than 50,000 fish, the ratio ranges from 1:16 – 1:85. The year 2011 is an exception to this because of the agency requested shutdown on May 19, 2011 which ended EFL operations earlier than previous years.

3.4 Alosids

A small number of river herring, (7 blueback herring) were passed during the 2013 season. One hickory shad was also passed in spring 2013.

3.5 Maryland tag-recapture

During the 2013 season, the EFL passed American shad that were captured, floy-tagged and released downstream of Conowingo dam by the Maryland DNR. This year, the Maryland DNR tagged a total of 297 American shad (246 from boat angling; 51 from shoreline anglers). The number of floy tags observed at the Conowingo EFL in 2013 was 23 pink tags (all from this year's tagging efforts).

4.0 SUMMARY

EFL operation was initiated on April 1 although river water temperature was less than 50°F (47.1°F). The first 2 American shad passed on April 11 at a water temperature of 57.2°F. The EFL passed 12,733 American shad from April 11 through June 3. The total number of American shad passed during the 2013 season was the lowest passage value recorded since volitional passage began in 1997, (Tables 4, 5, and 6). It is also the seventh consecutive year in which the EFL passed less than 50,000 American shad.

Modifications made to the fish trough, particularly the valve grating and hopper trough chute since 1999 have diminished the potential for the valve grating to clog with various types of debris and have decreased the number of American shad lift mortalities observed throughout the last several fish passage seasons. Since the valve grating was modified prior to the start of the 2000 season, loss of water flow in the trough has not occurred, particularly during high river flow periods when large amounts of debris may enter the trough through the fish exit area. An aeration system was also installed prior to the 2000 passage season to diminish low dissolved oxygen levels when the American shad population is heavy in the trough. Prior to fishway operations in 2002, a 30 inch diameter fiberglass elbow was attached to the hopper extension chute, which had been installed in 2001. The modification allows fish to enter the trough center stream, instead of being directed toward the east

trough wall. A decrease in lift mortalities has also been observed since the fiberglass elbow was installed. A total of 136 American shad lift mortalities, (1% of the total shad passed), was observed in 2013, within the range observed in recent years (0.2% to 1.0%) and less than values observed during trap and transport operations (1.5% to 10.5%).

Prior to the start of EFL operations in 2013, and in addition to routine maintenance activities, the operating system for the hopper door (air hoses, pneumatic cylinder, etc.) was re-engineered to improve reliability of the facility and minimize any fish passage delays due to mechanical issues. The hopper door performed flawlessly and decreased the number of mechanical issues specific to the hopper air hoses addressed in 2013 as compared to those that occurred during the 2012 fish passage season.

5.0 RECOMMENDATIONS

1) Continue to operate the EFL at Conowingo Dam per annual guidelines developed and approved by the Susquehanna River Technical Committee. Lift operation should adhere to the guidelines; however, flexibility must remain with operating personnel to maximize fishway performance and fish passage.

2) Continue the use of two fish counters during periods of increased fish passage to accurately reflect the number of fish that pass through the EFL.

3) Continue to inspect cables, limit switches, and lift components to enhance season operability, and continue to evaluate effectiveness of fish trough and hopper door modifications.

6.0 LITERATURE CITED

RMC. 1992. Summary of the operations of the Conowingo Dam fish passage facilities in spring 1991. Prepared for Susquehanna Electric Company, Darlington, MD.

Normandeau Associates, Inc. 1999. Summary of the operations at the Conowingo Dam East fish passage facility in spring, 1998. Prepared for Susquehanna Electric Company, Darlington, MD.

TABLES AND FIGURES

Table 1

Summary of the daily number of fish passed by the Conowingo Dam East Fish Passage Facility in 2013.

Date:	*4/1*	*4/2*	*4/3*	*4/4*	*4/5*	*4/6*	*4/7*	*4/8*
Start Fishing Time:	8:00		9:00		10:00			9:00
End Fishing Time:	16:00		17:00		18:00			17:00
Hours of Operation:	8.0		8.0		8.0			8.0
Number of Lifts:	9		9		8			8
Water Temperature (°F):	47.1		46.9		49.1			50.2
AMERICAN SHAD	0		0		0			0
BLUEBACK HERRING	0		0		0			0
GIZZARD SHAD	2		62		51			190
HICKORY SHAD	0		0		0			0
STRIPED BASS	0		0		0			0
SEA LAMPREY	0		0		0			0
RAINBOW TROUT	0		0		0			0
BROWN TROUT	0		0		0			0
MUSKELLUNGE	0		0		0			0
CARP	0		0		0			0
QUILLBACK	0		0		0			0
WHITE SUCKER	0		0		0			0
S. REDHORSE	1		0		0			1
BROWN BULLHEAD	0		0		0			0
CHANNEL CATFISH	0		0		0			0
WHITE PERCH	0		0		0			0
ROCK BASS	0		0		0			0
REDBREAST SUNFISH	0		0		0			0
BLUEGILL	0		0		0			1
SMALLMOUTH BASS	0		0		0			0
LARGEMOUTH BASS	2		0		0			0
YELLOW PERCH	0		0		0			0
WALLEYE	0		0		0			0
AMERICAN EEL	0		0		0			0
COMELY SHINER	16		2		0			0
SPOTTAIL SHINER	0		0		0			0
BROOK TROUT	0		0		0			0
Total	21	0	64	0	51	0	0	192

Table 1

Continued.

Date:	*4/9*	*4/10*	*4/11*	*4/12*	*4/13*	*4/14*	*4/15*	*4/16*
Start Fishing Time:	8:00	8:00	8:00	8:00	7:50	8:00	8:00	8:00
End Fishing Time:	16:00	16:00	17:00	16:00	16:00	16:00	16:00	16:00
Hours of Operation:	8.0	8.0	9.0	8.0	8.2	8.0	8.0	8.0
Number of Lifts:	8	8	9	8	8	9	10	11
Water Temperature (°F):	51.4	53.1	57.2	57.7	58.1	60.3	57.9	55.9
AMERICAN SHAD	0	0	2	34	6	1	0	0
BLUEBACK HERRING	0	0	0	0	0	0	0	0
GIZZARD SHAD	12	28	129	719	3,602	7,035	18,807	11,344
HICKORY SHAD	0	1	0	0	0	0	0	0
STRIPED BASS	0	0	0	0	0	0	0	0
SEA LAMPREY	0	0	0	0	0	0	0	0
RAINBOW TROUT	0	0	0	0	0	0	0	0
BROWN TROUT	0	0	0	0	0	0	0	0
MUSKELLUNGE	0	0	0	0	0	0	0	0
CARP	0	0	1	0	0	1	1	0
QUILLBACK	2	1	337	151	37	25	0	0
WHITE SUCKER	0	0	12	8	0	2	1	0
S. REDHORSE	0	0	14	1	19	8	3	2
BROWN BULLHEAD	0	0	0	0	0	0	0	0
CHANNEL CATFISH	0	0	0	0	3	4	51	46
WHITE PERCH	0	0	0	0	0	0	0	0
ROCK BASS	0	0	0	0	0	0	0	0
REDBREAST SUNFISH	0	0	0	0	0	0	0	0
BLUEGILL	0	0	0	0	0	0	1	0
SMALLMOUTH BASS	1	2	3	7	7	11	15	0
LARGEMOUTH BASS	0	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0	0
WALLEYE	0	0	1	2	1	5	14	12
AMERICAN EEL	0	0	0	0	0	0	0	0
COMELY SHINER	0	0	0	0	0	0	0	0
SPOTTAIL SHINER	0	2	0	0	0	0	0	0
BROOK TROUT	0	0	0	0	0	0	0	0
Total	15	34	499	922	3,675	7,092	18,893	11,404

Table 1

Continued.

Date:	*4/17*	*4/18*	*4/19*	*4/20*	*4/21*	*4/22*	*4/23*	*4/24*
Start Fishing Time:	8:00	9:00	8:00	8:00	8:00	8:00	8:00	8:00
End Fishing Time:	16:00	17:00	16:00	16:00	16:00	16:00	16:00	16:30
Hours of Operation:	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.5
Number of Lifts:	9	9	9	9	10	13	11	12
Water Temperature (°F):	56.3	56.3	56.3	56.5	56.3	56.3	56.3	56.3
AMERICAN SHAD	0	0	0	0	1	0	11	2
BLUEBACK HERRING	0	0	0	0	0	0	0	0
GIZZARD SHAD	10,700	7,709	8,586	10,197	8,946	11,998	12,771	13,580
HICKORY SHAD	0	0	0	0	0	0	0	0
STRIPED BASS	0	0	0	0	0	0	0	0
SEA LAMPREY	0	0	1	0	0	0	0	1
RAINBOW TROUT	0	0	0	0	0	0	0	0
BROWN TROUT	1	0	0	0	0	0	0	0
MUSKELLUNGE	0	0	0	0	0	0	0	0
CARP	1	0	1	0	0	0	1	0
QUILLBACK	0	0	0	0	0	0	0	0
WHITE SUCKER	0	0	0	0	0	0	0	0
S. REDHORSE	5	0	3	0	0	2	3	1
BROWN BULLHEAD	0	0	0	0	0	0	0	0
CHANNEL CATFISH	157	2	1	0	0	1	2	4
WHITE PERCH	0	0	0	0	0	0	0	0
ROCK BASS	0	0	0	0	0	0	0	0
REDBREAST SUNFISH	0	0	0	0	0	0	0	0
BLUEGILL	1	0	1	1	0	0	0	0
SMALLMOUTH BASS	1	0	2	1	0	3	2	2
LARGEMOUTH BASS	0	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0	0
WALLEYE	8	2	0	3	3	0	3	1
AMERICAN EEL	0	0	0	0	0	0	0	0
COMELY SHINER	0	0	0	0	0	0	0	0
SPOTTAIL SHINER	0	0	0	0	0	0	0	0
BROOK TROUT	0	0	0	0	0	0	0	0
Total	10,874	7,713	8,595	10,202	8,950	12,004	12,793	13,591

Table 1

Continued.

Date:	*4/25*	*4/26*	*4/27*	*4/28*	*4/29*	*4/30*	*5/1*	*5/2*
Start Fishing Time:	8:00	8:00	8:00	8:00	9:30	8:00	8:00	8:00
End Fishing Time:	16:30	18:30	19:30	19:00	19:00	19:00	18:30	20:00
Hours of Operation:	8.5	10.5	11.5	11.0	9.5	11.0	10.5	12.0
Number of Lifts:	14	23	23	22	21	24	21	32
Water Temperature (°F):	57.2	58.1	59.2	61.2	61	60.3	61.2	61.7
AMERICAN SHAD	92	1,724	1,247	830	755	65	7	1,758
BLUEBACK HERRING	0	0	0	0	4	0	0	1
GIZZARD SHAD	15,504	26,067	25,609	16,750	23,361	29,864	39,659	36,162
HICKORY SHAD	0	0	0	0	0	0	0	0
STRIPED BASS	0	0	2	0	1	4	1	1
SEA LAMPREY	0	0	1	0	0	2	2	9
RAINBOW TROUT	0	0	0	0	0	1	0	0
BROWN TROUT	0	0	1	0	0	0	0	0
MUSKELLUNGE	1	0	0	0	0	0	0	0
CARP	3	3	0	2	2	1	0	3
QUILLBACK	0	2	9	53	2	0	2	9
WHITE SUCKER	0	0	0	0	0	5	0	0
S. REDHORSE	0	3	12	24	0	23	3	2
BROWN BULLHEAD	0	0	0	0	0	0	0	0
CHANNEL CATFISH	7	8	2	2	17	11	1	3
WHITE PERCH	0	0	0	0	0	0	0	1
ROCK BASS	0	0	0	0	0	0	0	1
REDBREAST SUNFISH	0	0	0	0	0	0	0	0
BLUEGILL	3	0	0	3	2	0	0	0
SMALLMOUTH BASS	2	6	5	1	3	17	3	8
LARGEMOUTH BASS	0	0	0	0	0	0	0	1
YELLOW PERCH	0	0	0	0	0	0	0	0
WALLEYE	4	0	0	1	2	14	2	1
AMERICAN EEL	0	0	0	0	0	0	1	0
COMELY SHINER	3	0	0	0	0	0	0	3
SPOTTAIL SHINER	0	0	0	10	0	0	0	0
BROOK TROUT	0	0	0	0	0	0	0	0
Total	15,619	27,813	26,888	17,676	24,149	30,007	39,681	37,963

Table 1

Continued.

Date:	*5/3*	*5/4*	*5/5*	*5/6*	*5/7*	*5/8*	*5/9*	*5/10*
Start Fishing Time:	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00
End Fishing Time:	19:30	19:00	19:00	19:40	19:00	19:00	19:00	19:00
Hours of Operation:	11.5	11.0	11.0	11.7	11.0	11.0	11.0	11.0
Number of Lifts:	23	23	22	23	18	20	22	21
Water Temperature (°F):	63.9	64.4	64.4	65.3	65.5	65.3	66.2	68.9
AMERICAN SHAD	551	341	606	1,207	350	436	285	147
BLUEBACK HERRING	1	0	0	0	0	0	0	0
GIZZARD SHAD	21,123	24,908	24,331	24,288	24,326	32,393	39,130	38,264
HICKORY SHAD	0	0	0	0	0	0	0	0
STRIPED BASS	1	0	1	2	0	2	5	6
SEA LAMPREY	3	2	3	2	2	0	1	5
RAINBOW TROUT	1	0	0	0	0	0	0	0
BROWN TROUT	0	0	0	0	0	1	3	0
MUSKELLUNGE	0	0	0	0	0	0	0	0
CARP	4	1	1	3	0	1	6	23
QUILLBACK	78	40	34	32	12	18	11	89
WHITE SUCKER	0	0	2	0	0	0	2	0
S. REDHORSE	6	5	25	5	0	2	4	3
BROWN BULLHEAD	0	0	0	0	0	0	0	0
CHANNEL CATFISH	2	1	9	9	12	7	3	15
WHITE PERCH	0	0	0	0	0	0	0	0
ROCK BASS	0	0	0	0	0	0	0	0
REDBREAST SUNFISH	0	0	0	0	0	0	0	0
BLUEGILL	0	0	0	0	0	0	0	0
SMALLMOUTH BASS	5	6	1	0	5	4	7	0
LARGEMOUTH BASS	0	1	4	1	0	0	0	0
YELLOW PERCH	1	0	0	0	0	0	0	0
WALLEYE	1	1	2	4	5	6	5	5
AMERICAN EEL	0	0	0	1	0	0	0	0
COMELY SHINER	0	0	1	0	0	0	0	1
SPOTTAIL SHINER	0	0	0	0	0	0	0	0
BROOK TROUT	0	0	0	0	1	0	0	0
Total	21,777	25,306	25,020	25,554	24,713	32,870	39,462	38,558

Table 1

Continued.

Date:	*5/11*	*5/12*	*5/13*	*5/14*	*5/15*	*5/16*	*5/17*	*5/18*
Start Fishing Time:	8:00	8:00	8:00	8:00	9:30	8:00	8:00	8:00
End Fishing Time:	19:00	19:00	18:00	18:00	19:00	18:00	18:00	18:00
Hours of Operation:	11.0	11.0	10.0	10.0	9.5	10.0	10.0	10.0
Number of Lifts:	19	25	26	15	17	19	18	15
Water Temperature (°F):	68.9	67.5	68.4	66.9	65.3	65.3	63.5	65.3
AMERICAN SHAD	421	135	6	4	7	23	20	60
BLUEBACK HERRING	0	0	1	0	0	0	0	0
GIZZARD SHAD	32,107	51,156	65,413	32,815	18,950	29,748	28,492	21,437
HICKORY SHAD	0	0	0	0	0	0	0	0
STRIPED BASS	3	2	2	5	4	5	3	2
SEA LAMPREY	0	0	0	1	0	0	4	0
RAINBOW TROUT	0	0	0	0	0	0	0	1
BROWN TROUT	1	0	0	0	0	0	0	1
MUSKELLUNGE	0	0	0	0	0	0	0	0
CARP	25	21	5	2	1	2	1	0
QUILLBACK	32	52	0	0	2	1	0	2
WHITE SUCKER	0	0	0	0	0	0	0	0
S. REDHORSE	1	0	1	4	0	1	0	0
BROWN BULLHEAD	0	0	0	0	0	0	2	0
CHANNEL CATFISH	108	16	5	41	17	11	16	4
WHITE PERCH	0	0	0	0	1	0	0	0
ROCK BASS	0	0	0	0	0	1	0	0
REDBREAST SUNFISH	0	0	0	0	0	0	0	0
BLUEGILL	0	0	0	18	0	1	0	0
SMALLMOUTH BASS	4	6	1	1	1	0	0	1
LARGEMOUTH BASS	0	0	0	0	1	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0	0
WALLEYE	7	0	4	4	8	1	0	7
AMERICAN EEL	0	0	0	1	0	0	0	0
COMELY SHINER	225	0	0	0	0	0	1	0
SPOTTAIL SHINER	0	0	0	0	0	0	0	0
BROOK TROUT	0	0	0	0	0	0	0	0
Total	32,934	51,388	65,438	32,896	18,992	29,794	28,539	21,515

Table 1

Continued.

Date:	*5/19*	*5/20*	*5/21*	*5/22*	*5/23*	*5/24*	*5/25*	*5/26*
Start Fishing Time:	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00
End Fishing Time:	18:00	19:00	18:00	19:00	18:00	18:00	18:00	18:00
Hours of Operation:	10.0	11.0	10.0	11.0	10.0	10.0	10.0	10.0
Number of Lifts:	19	21	18	20	17	16	14	13
Water Temperature (°F):	65.3	65.8	68.2	69.3	72.5	72.5	69.3	68
AMERICAN SHAD	31	459	88	93	191	75	73	33
BLUEBACK HERRING	0	0	0	0	0	0	0	0
GIZZARD SHAD	20,573	32,451	21,492	30,470	22,954	5,597	6,762	8,404
HICKORY SHAD	0	0	0	0	0	0	0	0
STRIPED BASS	7	5	10	7	12	6	5	1
SEA LAMPREY	2	1	1	0	1	2	1	1
RAINBOW TROUT	0	0	0	0	2	0	0	0
BROWN TROUT	0	0	0	0	0	0	0	0
MUSKELLUNGE	0	0	0	0	0	0	0	0
CARP	5	11	6	22	4	7	4	0
QUILLBACK	9	64	109	84	111	831	4	1
WHITE SUCKER	1	0	0	0	0	0	0	0
S. REDHORSE	0	7	0	3	4	1	0	0
BROWN BULLHEAD	2	0	0	2	0	0	0	0
CHANNEL CATFISH	13	26	44	96	51	141	27	14
WHITE PERCH	0	0	0	0	0	0	0	0
ROCK BASS	0	0	0	0	0	0	0	0
REDBREAST SUNFISH	0	0	0	0	0	0	1	0
BLUEGILL	0	0	0	1	3	7	5	0
SMALLMOUTH BASS	1	0	0	2	3	0	0	0
LARGEMOUTH BASS	0	0	0	0	0	0	0	0
YELLOW PERCH	0	0	0	0	0	0	0	0
WALLEYE	3	1	1	8	9	4	1	0
AMERICAN EEL	0	0	0	0	0	0	0	0
COMELY SHINER	0	0	0	0	0	0	0	0
SPOTTAIL SHINER	0	0	0	0	0	0	0	0
BROOK TROUT	0	0	0	0	0	0	0	0
Total	20,647	33,025	21,751	30,788	23,345	6,671	6,883	8,454

Table 1

Continued.

Date:	*5/27*	*5/28*	*5/29*	*5/30*	*5/31*	*6/1*	*6/2*	*6/3*	***Season***
Start Fishing Time:	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	***Total***
End Fishing Time:	18:45	18:00	18:00	18:00	18:00	18:00	18:00	14:00	
Hours of Operation:	10.8	10.0	10.0	10.0	10.0	10.0	10.0	6.0	***575.6***
Number of Lifts:	12	13	12	11	14	13	11	8	***925***
Water Temperature (°F):	67.5	70.5	71.2	70.7	72.5	73.4	75.2	75.6	
AMERICAN SHAD	113	72	56	56	44	176	25	14	***12,733***
BLUEBACK HERRING	0	0	0	0	0	0	0	0	***7***
GIZZARD SHAD	7,813	10,108	18,783	13,655	12,578	9,047	3,865	3,171	***1,076,048***
HICKORY SHAD	0	0	0	0	0	0	0	0	***1***
STRIPED BASS	4	15	15	5	23	7	20	6	***200***
SEA LAMPREY	0	0	1	0	1	1	0	0	***51***
RAINBOW TROUT	0	0	0	0	0	1	0	0	***6***
BROWN TROUT	0	0	0	0	0	0	0	0	***8***
MUSKELLUNGE	0	0	0	0	0	0	0	1	***2***
CARP	1	1	3	0	0	0	0	0	***180***
QUILLBACK	74	277	11	18	6	1	30	62	***2,725***
WHITE SUCKER	0	0	0	0	0	0	0	0	***33***
S. REDHORSE	0	0	0	0	0	0	1	0	***203***
BROWN BULLHEAD	0	0	0	0	4	0	3	4	***17***
CHANNEL CATFISH	7	77	64	75	141	111	85	24	***1,594***
WHITE PERCH	0	0	0	0	0	0	0	0	***2***
ROCK BASS	0	0	0	0	0	0	0	0	***2***
REDBREAST SUNFISH	0	0	0	0	0	1	0	0	***2***
BLUEGILL	1	0	0	0	0	9	0	0	***58***
SMALLMOUTH BASS	0	1	0	0	0	0	0	0	***151***
LARGEMOUTH BASS	0	0	0	0	0	0	0	0	***10***
YELLOW PERCH	0	0	0	0	0	0	0	0	***1***
WALLEYE	2	5	1	7	10	13	18	2	***224***
AMERICAN EEL	0	0	0	0	0	0	0	0	***3***
COMELY SHINER	0	0	0	0	0	0	0	0	***252***
SPOTTAIL SHINER	0	0	0	0	0	0	0	0	***12***
BROOK TROUT	0	0	0	0	0	0	0	0	***1***
Total	8,015	10,556	18,934	13,816	12,807	9,367	4,047	3,284	***1,094,526***

Table 2.

Summary of American shad catch, Maryland DNR recaptures, daily average river flow, water temperature, turbidity (secchi), unit operation, entrance gates utilized, attraction flow, and project water elevations during operation of the Conowingo Dam East Fish Passage Facility in 2013.

Date	American Shad Catch	MD DNR Recaptures*	Marietta River Flow (cfs)	Water Temp. (°F)	Secchi (in)	Maximum Units in Operation	Entrance Gates Utilized	Attraction Flow (cfs)	Tailrace Elevation (ft)	Forebay Elevation (ft)	Crest Gates
4/1	0		34,400	47.1	33	9	C/A	310	20.8	106.4	
4/2	0		35,900								
4/3	0		39,400	46.9	33	10	C/A	310	21.1	105.8	
4/4	0		44,600					310			
4/5	0		47,900	49.1	36	11	C/A	310	20.9	107.0	
4/6	0		44,500					310			
4/7	0		40,600					310			
4/8	0		37,600	50.2	36	11	C/A	310	20.0	106.5	
4/9	0		35,500	51.4	36	11	C/A/C	310	21.3	107.7	
4/10	0		34,000	53.1	36	8	C	310	22.8	106.3	
4/11	2		33,400	57.2	36	9	A/C	310	21.6	108.0	
4/12	34		38,100	57.7	36	11	C/A/C	310	21.2	107.7	
4/13	6		60,700	58.1	36	11	C	310	22.6	106.2	
4/14	1		93,800	60.3	36	11	C	310	24.2	108.3	
4/15	0		98,100	57.9	30	11	C	310	24.5	108.5	1 Gate Open
4/16	0		87,100	55.9	18	11	C	310	24.0	107.0	
4/17	0		74,900	56.3	20	11	C	310	23.4	105.7	
4/18	0		65,200	56.3	20	11	C	310	23.2	106.1	
4/19	0		60,500	56.3	26	11	C	310	21.6	107.2	
4/20	0		61,900	56.5	26	11	C	310	23.5	107.4	
4/21	1		65,600	56.3	26	11	C	310	23.0	106.7	
4/22	0		67,500	56.3	26	11	C	310	24.0	106.8	
4/23	11		64,500	56.3	26	10	C	310	23.3	105.7	
4/24	2		57,800	56.3	28	11	C	310	22.6	106.7	
4/25	92		51,200	57.2	24	11	C/A/C	310	22.3	106.5	
4/26	1724		47,200	58.1	30	11	C/A/C	310	23.5	106.2	
4/27	1247		44,200	59.2	30	11	C/A	310	20.9	106.3	
4/28	830		41,400	61.2	32	11	C/A/C	310	20.5	107.6	
4/29	755		38,900	61.0	25	11	C/A	310	20.9	107.2	
4/30	65		36,400	60.3	28	10	C/A	310	21.5	106.5	
5/1	7		34,700	61.0	30	8	C/A	310	20.5	107.3	
5/2	1758		32,200	61.7	30	7	C/A/A	310	21.4	108.5	
5/3	551		29,800	63.9	30	11	C/A	310	20.3	106.7	
5/4	341		28,000	64.4	30	11	A/C/A/C	310	20.1	106.6	
5/5	606		26,300	64.4	30	11	A/C/A/C	310	20.7	106.3	
5/6	1207	*3 pink*	24,100	65.3	28	9	A/C/A/C	310	20.6	106.6	
5/7	350	*1 pink*	22,700	65.5	27	7	A/C/A/C	310	18.2	106.8	

Table 2.

Continued.

Date	American Shad Catch	MD DNR Recaptures*	Marietta River Flow (cfs)	Water Temp. (°F)	Secchi (in)	Maximum Units in Operation	Entrance Gates Utilized	Attraction Flow (cfs)	Tailrace Elevation (ft)	Forebay Elevation (ft)	Crest Gates
5/8	436	*1 pink*	22,000	65.30	26	11	A/C/A/C	310	20.9	108.4	
5/9	285	*1 pink*	26,000	66.20	30	7	C/A	310	20.2	106.5	
5/10	147		32,600	68.9	30	7	A/C	310	21.3	107.4	
5/11	421	*3 pink*	36,500	68.9	34	11	C/A/C	310	19.8	107.1	
5/12	135		40,200	67.5	34	11	C/A/C	310	21.4	107.4	
5/13	6		47,200	68.4	27	11	C	310	23.4	107.5	
5/14	4		48,000	66.9	33	11	C	310	23.0	107.8	
5/15	7		43,600	65.3	24	11	C	310	22.9	107.5	
5/16	23		38,900	65.3	24	11	A/C	310	21.8	108.0	
5/17	20		34,900	63.5	24	11	A/C	310	21.5	107.3	
5/18	60		31,500	65.3	27	10	A/C	310	21.3	107.7	
5/19	31		28,300	65.3	28	6	A/C	310	20.2	107.8	
5/20	459	*4 pink*	25,900	65.8	28	10	A/C	310	20.9	107.8	
5/21	88	*2 pink*	23,800	68.2	36	10	A/C	310	20.7	107.5	
5/22	93			69.3	36	10	A/C	310	20.8	107.2	
5/23	191	*1 pink*	20,900	72.5	28	5	A/C	310	19.3	106.6	
5/24	75	*1 pink*	20,700	72.5	34	6	A/C	310	20.6	107.3	
5/25	73	*1 pink*	21,700	69.3	29	7	A/C	310	18.2	108.2	
5/26	33		20,700	68.0	30	5	A/C	310	19.4	108.1	
5/27	113	*1 pink*	21,900	67.5	28	7	A/C	310	18.0	108.2	
5/28	72		24,100	70.5	28	11	A/C	310	20.6	107.7	
5/29	56	*2 pink*	23,300	71.2	30	11	A	310	21.0	108.3	
5/30	56	*1 pink*	23,000	70.7	24	11	A/C	310	20.0	107.8	
5/31	44		27,500	72.5	30	11	A/C	310	21.0	108.0	
6/1	176	*1 pink*	29,100	73.4	29	11	A/C	310	21.3	108.3	
6/2	25		30,300	75.2	30	11	A/C	310	21.4	108.3	
6/3	14		34,300	75.6	28	11	A/C	310	21.0	108.1	

Table 3

Hourly summary of American shad passage at the Conowingo Dam East Fish Passage Facility in 2013.

Date:	1-Apr	2-Apr	3-Apr	4-Apr	5-Apr	6-Apr	7-Apr	8-Apr	9-Apr	10-Apr	11-Apr	12-Apr
Observation Time-Start:	8:00		10:00		11:00			9:30	8:00	8:10	8:00	8:00
Observation Time-End:	16:10		17:15		18:15			17:15	16:15	16:15	17:15	16:20
Military Time (hrs)												
0600 to 0659												
0700 to 0759												
0800 to 0859	0								0	0	0	0
0900 to 0959	0							0	0	0	0	1
1000 to 1059	0		0					0	0	0	0	0
1100 to 1159	0		0		0			0	0	0	0	0
1200 to 1259	0		0		0			0	0	0	0	0
1300 to 1359	0		0		0			0	0	0	0	2
1400 to 1459	0		0		0			0	0	0	0	5
1500 to 1559	0		0		0			0	0	0	0	25
1600 to 1659	0		0		0			0	0	0	2	1
1700 to 1759			0		0			0				
1800 to 1859					0							
1900 to 1959												
2000 to 2059												
Total	0	0	0	0	0	0	0	0	0	0	2	34

Date:	13-Apr	14-Apr	15-Apr	16-Apr	17-Apr	18-Apr	19-Apr	20-Apr	21-Apr	22-Apr	23-Apr	24-Apr
Observation Time-Start:	8:00	8:10	8:00	8:15	8:00	9:00	8:00	8:00	8:00	8:00	8:00	8:20
Observation Time-End:	16:15	16:20	16:15	16:20	16:15	17:00	16:20	16:20	16:15	16:15	16:15	16:45
Military Time (hrs)												
0600 to 0659												
0700 to 0759												
0800 to 0859	4	0	0	0	0		0	0	0	0	0	0
0900 to 0959	2	0	0	0	0	0	0	0	0	0	0	0
1000 to 1059	0	0	0	0	0	0	0	0	0	0	0	0
1100 to 1159	0	0	0	0	0	0	0	0	0	0	1	0
1200 to 1259	0	0	0	0	0	0	0	0	0	0	0	0
1300 to 1359	0	0	0	0	0	0	0	0	0	0	1	1
1400 to 1459	0	0	0	0	0	0	0	0	0	0	1	0
1500 to 1559	0	1	0	0	0	0	0	0	1	0	5	1
1600 to 1659	0	0	0	0	0	0	0	0	0	0	3	0
1700 to 1759												
1800 to 1859												
1900 to 1959												
2000 to 2059												
Total	6	1	0	0	0	0	0	0	1	0	11	2

Table 3 Continued.

Date:	25-Apr	26-Apr	27-Apr	28-Apr	29-Apr	30-Apr	1-May	2-May	3-May	4-May	5-May	6-May
Observation Time-Start:	8:00	8:00	8:05	8:00	9:00	8:10	8:00	8:00	8:15	8:00	8:00	8:10
Observation Time-End:	16:45	18:45	19:45	19:15	19:30	19:20	19:00	20:15	19:50	19:15	19:15	20:00
Military Time (hrs)												
0600 to 0659												
0700 to 0759												
0800 to 0859	1	8	53	14		17	2	0	102	5	8	14
0900 to 0959	0	2	21	4	2	6	0	1	49	2	31	18
1000 to 1059	0	1	2	8	25	1	0	2	4	3	0	24
1100 to 1159	5	0	13	5	3	7	1	2	2	8	4	7
1200 to 1259	18	1	1	1	5	1	0	9	13	155	1	15
1300 to 1359	9	1	15	55	4	4	0	77	3	78	4	10
1400 to 1459	13	30	406	289	192	6	0	201	112	26	217	14
1500 to 1559	30	514	240	219	300	10	2	345	148	19	157	20
1600 to 1659	16	653	278	100	135	6	1	365	64	23	123	32
1700 to 1759		336	136	52	66	3	0	206	27	14	41	600
1800 to 1859		178	55	58	20	3	1	233	14	8	15	407
1900 to 1959			27	25	3	1		257	13	0	5	46
2000 to 2059								60				
Total	92	1,724	1,247	830	755	65	7	1,758	551	341	606	1,207

Date:	7-May	8-May	9-May	10-May	11-May	12-May	13-May	14-May	15-May	16-May	17-May	18-May
Observation Time-Start:	8:00	8:15	8:00	8:15	8:00	8:00	8:00	8:00	9:15	8:00	8:00	8:00
Observation Time-End:	19:15	19:20	19:15	19:20	19:15	19:15	18:10	18:20	19:15	18:15	18:15	18:15
Military Time (hrs)												
0600 to 0659												
0700 to 0759												
0800 to 0859	4	18	10	3	17	12	3	0		0	2	0
0900 to 0959	9	5	0	11	7	4	2	0	1	11	5	19
1000 to 1059	14	13	2	1	3	2	0	0	0	6	0	6
1100 to 1159	8	4	1	4	0	6	0	0	2	3	2	1
1200 to 1259	6	10	0	7	1	0	1	0	2	0	1	9
1300 to 1359	4	1	1	3	97	0	0	0	0	0	4	11
1400 to 1459	85	10	42	9	184	42	0	0	0	0	2	8
1500 to 1559	149	24	165	16	76	52	0	1	0	0	1	3
1600 to 1659	28	224	47	27	12	6	0	2	0	1	2	2
1700 to 1759	25	110	10	24	5	2	0	1	0	1	1	1
1800 to 1859	14	12	4	24	17	9		0	1	1	0	0
1900 to 1959	4	5	3	18	2	0			1			
2000 to 2059												
Total	350	436	285	147	421	135	6	4	7	23	20	60

Table 3 Continued

Date:	19-May	20-May	21-May	22-May	23-May	24-May	25-May	26-May	27-May	28-May	29-May	30-May
Observation Time-Start:	8:00	8:00	8:00	8:00	8:00	8:00	8:10	8:00	8:00	8:00	8:00	8:00
Observation Time-End:	18:15	19:20	18:15	19:15	18:15	18:15	18:15	18:15	19:00	18:15	18:15	18:15
Military Time (hrs)												
0600 to 0659												
0700 to 0759												
0800 to 0859	3	16	8	9	7	1	6	5	3	4	8	1
0900 to 0959	6	68	15	7	73	3	7	4	2	22	10	0
1000 to 1059	3	184	11	6	28	9	4	0	4	6	4	1
1100 to 1159	3	65	4	8	12	28	3	0	3	10	2	6
1200 to 1259	0	43	8	25	12	13	0	3	1	1	9	0
1300 to 1359	6	49	7	18	16	2	5	5	9	6	8	0
1400 to 1459	3	12	9	12	12	8	7	0	11	4	4	6
1500 to 1559	4	12	13	1	22	4	6	12	20	1	6	26
1600 to 1659	0	4	9	3	7	3	4	2	33	8	1	7
1700 to 1759	1	3	3	3	0	0	26	1	9	4	3	5
1800 to 1859	2	3	1	1	2	4	5	1	18	6	1	4
1900 to 1959		0		0								
2000 to 2059												
Total	31	459	88	93	191	75	73	33	113	72	56	56

Date:	31-May	1-Jun	2-Jun	3-Jun	*Season*
Observation Time-Start:	8:00	8:00	8:00	8:00	*Total*
Observation Time-End:	18:15	18:15	18:15	14:30	
Military Time (hrs)					
0600 to 0659					**0**
0700 to 0759					**0**
0800 to 0859	6	0	0	0	**374**
0900 to 0959	9	102	9	6	**556**
1000 to 1059	2	51	4	1	**435**
1100 to 1159	4	11	0	1	**249**
1200 to 1259	5	3	5	3	**388**
1300 to 1359	3	2	3	1	**525**
1400 to 1459	9	3	0	2	**1,996**
1500 to 1559	5	3	2		**2,661**
1600 to 1659	0	1	0		**2,235**
1700 to 1759	1	0	1		**1,721**
1800 to 1859	0	0	1		**1,123**
1900 to 1959					**410**
2000 to 2059					**60**
Total	44	176	25	14	**12,733**

Table 4.

Summary Information for Conowingo EFL Volitional Passage, 1997 through 2013.

Year	#Days of Ops	#Hrs of Ops	Total # of Lifts	# Fish passed	# Am. shad	# Gizzard shad	# Herring	Avg.#fish/lift	Ratio A.S./Gizz
1997	64	640	652	719,297	90,971	344,332	242,815	1,103	1/4
1998	50	433	460	712,993	39,904	654,575	706	1,550	1/16
1999	52	467	610	1,184,101	69,712	950,500	130,639	1,941	1/14
2000	45	368	570	493,955	153,546	317,753	14,965	866	1/2
2001	43	360	559	921,916	193,574	429,461	292,379	1,649	1/2
2002	49	440	560	656,894	108,001	513,794	2,111	1,173	1/5
2003	44	416	645	589,177	125,135	459,634	551	913	1/4
2004	44	390	590	715,664	109,360	602,677	190	1,212	1/6
2005	52	434	541	377,762	68,926	305,378	4	698	1/4
2006	61	430	619	714,918	56,899	655,990	0	1,154	1/12
2007	39	335	479	539,203	25,464	508,627	889	1,125	1/20
2008	51	409	483	943,838	19,914	919,975	5	1,954	1/46
2009	57	495	618	915,417	29,272	876,412	231	1,481	1/30
2010	59	526	685	857,263	37,757	813,429	5	1,251	1/22
2011	15	142	259	289,453	20,571	257,522	19	1,117	1/13
2012	62	633	1,230	1,109,911	22,143	1,070,672	52	902	1/48
2013	**60**	**575.6**	**925**	**1,094,526**	**12,733**	**1,076,048**	**7**	**1,183**	**1/85**

Table 5

Summary of selected operation and fish catch statistics at the Conowingo Dam East Fish Passage Facility, 1991 to 2013.

Year	Number of Days Operated	Number of Lifts	Operating Time (hrs)	Catch (millions)	Number of Species	American shad	Blueback herring	Alewife	Hickory shad
1991	60	1168	647.2	0.651	42	13,897	13,149	323	0
1992	49	599	454.1	0.492	35	26,040	261	3	0
1993	42	848	463.5	0.530	29	8,203	4,574	0	0
1994	55	955	574.8	1.062	36	26,715	248	5	1
1995	68	986	706.2	1.796	36	46,062	4,004	170	1
1996	49	599	454.1	0.492	35	26,040	261	3	0
1997	64	652	640.0	0.719	36	90,971	242,815	63	0
1998	50	652	640.0	0.713	33	39,904	700	6	0
1999	52	610	467.0	1.184	31	69,712	130,625	14	0
2000	45	570	367.8	0.494	30	153,546	14,963	2	0
2001	43	559	359.8	0.922	30	193,574	284,921	7,458	0
2002	49	560	440.7	0.657	31	108,001	2,037	74	6
2003	44	645	416.6	0.589	25	125,135	530	21	0
2004	44	590	390.3	0.716	30	109,360	101	89	0
2005	52	541	434.3	0.378	30	68,926	4	0	0
2006	61	619	429.8	0.715	32	56,899	0	0	4
2007	39	479	335.3	0.539	31	25,464	460	429	0
2008	51	483	407.0	0.944	29	19,914	1	4	0
2009	57	618	495.6	0.915	30	29,272	71	160	0
2010	59	685	526.2	0.857	38	37,757	4	1	0
2011	15	259	142.4	0.021	24	20,571	17	2	20
2012	62	1230	633.7	0.022	35	22,143	25	27	0
2013	**60**	**925**	**575.6**	**0.013**	**27**	**12,733**	**7**	**0**	**1**

Table 6

Summary of American shad passage counts and percent passage values at Susquehanna River dams, 1997-2013.

	Conowingo	Holtwood		Safe Harbor		York Haven	
	East	Number	% of C.E.L.	Number	% of Holt.	Number	% of S.H.
1997	90,971	28,063	30.8%	20,828	74.2%	-	-
1998	39,904	8,235	20.6%	6,054	73.5%	-	-
1999	69,712	34,702	49.8%	34,150	98.4%	-	-
2000	153,546	29,421	19.2%	21,079	71.6%	4,687	22.2%
2001	193,574	109,976	56.8%	89,816	81.7%	16,200	18.0%
2002	108,001	17,522	16.2%	11,705	66.8%	1,555	13.3%
2003	125,135	25,254	20.2%	16,646	65.9%	2,536	15.2%
2004	109,360	3,428	3.1%	2,109	61.5%	219	10.4%
2005	68,926	34,189	49.6%	25,425	74.4%	1,772	7.0%
2006	56,899	35,968	63.2%	24,929	69.3%	1,913	7.7%
2007	25,464	10,338	40.6%	7,215	69.8%	192	2.7%
2008	19,914	2,795	14.0%	1,252	44.8%	21	1.7%
2009	29,272	10,896	37.2%	7,994	73.4%	402	5.0%
2010	37,757	16,472	43.6%	12,706	77.1%	907	7.1%
2011	20,571	21	0.1%	8	38.1%	0	0.0%
2012	22,143	4,238	19.1%	3,089	72.9%	224	7.3%
2013	**12,733**	**2,503**	**19.7%**	**1,927**	**77.0%**	**202**	**10.5%**

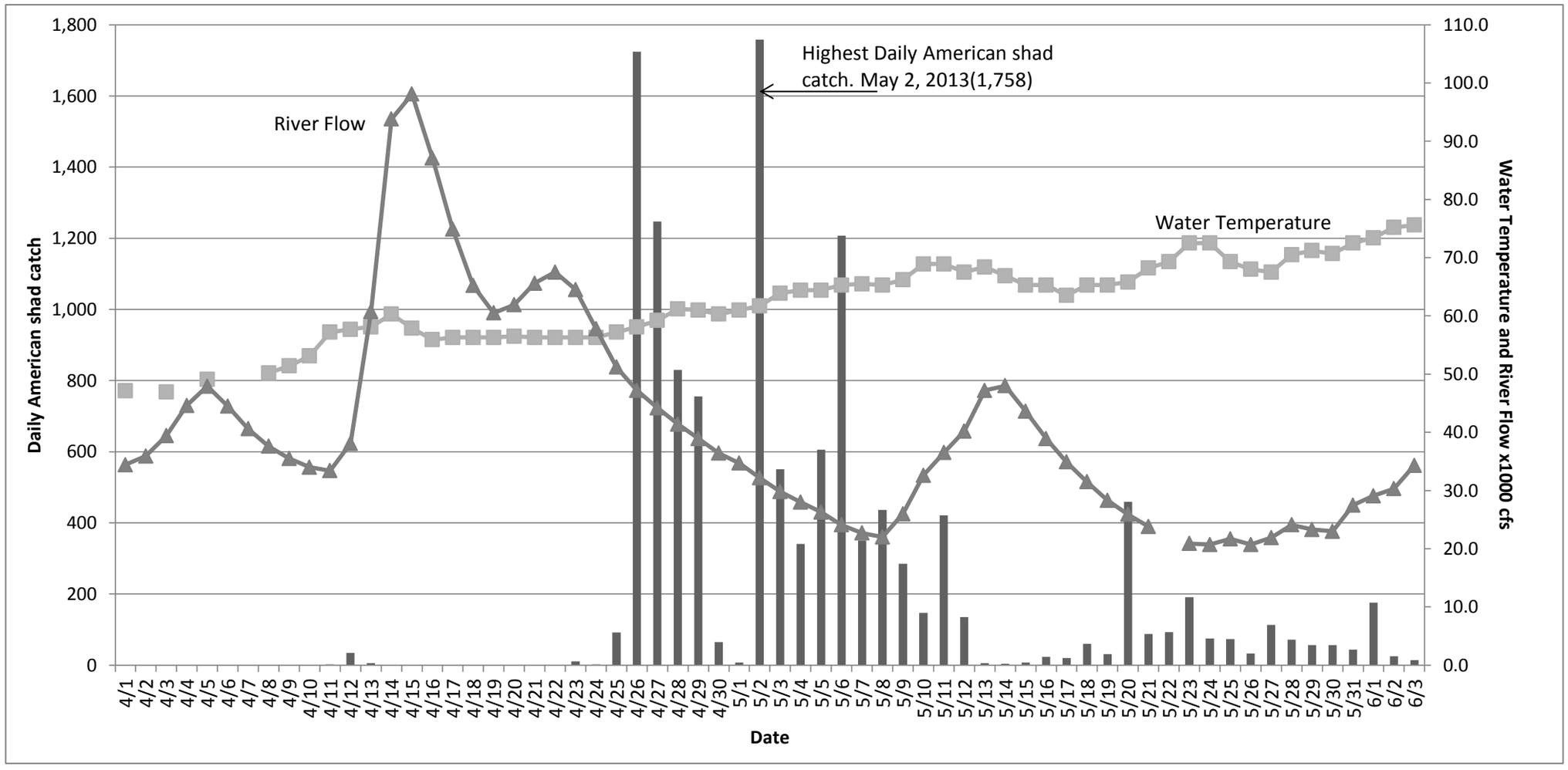

Figure 1

A plot of river flow (x 1000 cfs) (Marietta Gauge) and water temperature (°F), in relationship to the daily American shad catch at the Conowingo East Fish Lift, spring 2013.

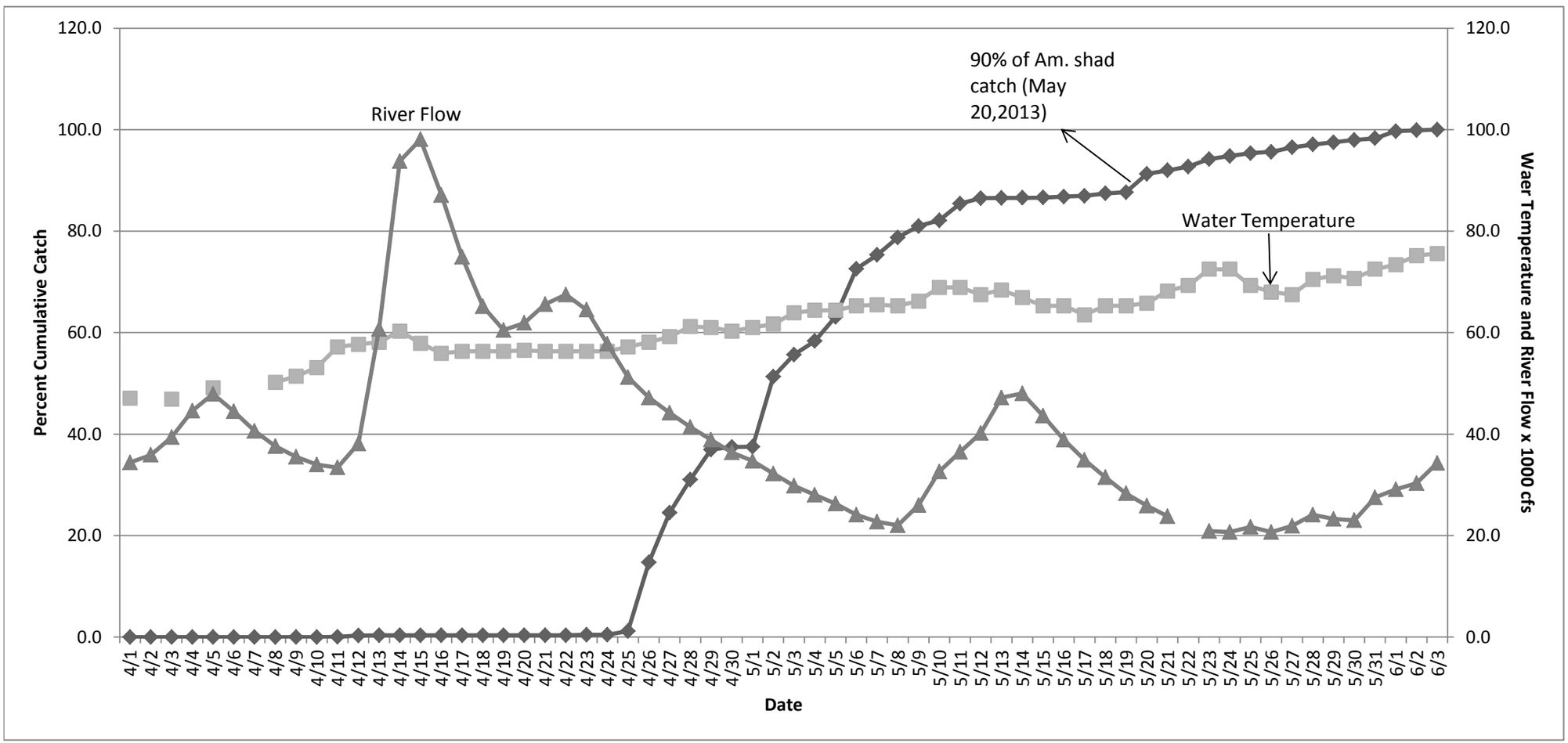

Figure 2

A plot of river flow (x 1000 cfs) (Marietta Guage) and water temperature (°F), in relationship to the percent cumulative American shad catch at the Conowingo East Fish Lift, spring 2013.