1.0 JOB 1, PART 1: SUMMARY OF OPERATIONS AT CONOWINGO DAM EAST FISH PASSAGE FACILITY, 2008

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1.1 INTRODUCTION

Susquehanna Electric Company (SECO), a subsidiary of Exelon Generation, 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 Passage Facility (East lift) at Conowingo Dam. Construction of the East lift 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 East lift has been operated to pass fish directly into Conowingo Pond since spring 1997.

Objectives of 2008 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.

1.2 CONOWINGO OPERATION

1.2.1 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) gage at Marietta, PA were maintained for the period 1 to 30 April. A minimum flow of 7,500 cfs or natural river (as previously noted) was maintained for the

period 1 to 31 May. A minimum flow of 5,000 cfs or natural river (as previously noted) is maintained when fish lift operations occur in June.

1.2.2 Fishway Operation

The start of operation for the East Fish Lift in 2008 was delayed by cold river temperatures during the first ten days of April. Operation of the lift began on 16 April with the first 71 American shad passed that same day. This passage triggered everyday operation which continued to the end of the season on 6 June. The season ended, when a combination of high water temperatures, dwindling shad numbers, and the late season condition of the shad ultimately required operations to cease. The lift operated a total of 51days during the 2008 season. Mechanical problems associated with the hopper during the 2008 season accounted for the loss of twenty-two hours of operation and two days with only counting/passage operations performed, (no lifts conducted).

Daily operation times were planned during optimal fish passage parameters. This year, operational methodologies were influenced by natural river flows, water temperatures, generation schedules, fish population numbers and the conduction of a radio-telemetry study reliant on American shad captured at the East lift. Fishway operation was conducted by a staff of three people: a lift operator, a supervising biologist, and a biological technician.

The mechanical aspects of East lift operation in 2008 were similar to those described in RMC (1992) and Normandeau Associates, Inc. (1999). Fishing time and/or lift frequency was determined by fish abundance, or requirements of the radio-telemetry study, but the hopper was cycled at least hourly throughout the day. The method of lift operation was also influenced by fish abundance. When a great 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 turbine units 8, 9, 10, and 11 or any combination of large 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 flow, and or generation, entrance C or A was utilized throughout the 2008 season to attract fishes.

1.2.3 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.

1.3 RESULTS

1.3.1 Relative Abundance

The number of fishes collected and passed by the Conowingo Dam East fish lift is presented in Table 1. A total of 943,838 fish of 26 species and one hybrid was passed upstream into Conowingo Pond. Gizzard shad (919,975), American shad (19,914), and walleye (2,088), were the dominant species passed. Gizzard shad and American shad comprised 97% and 2.1% respectively of the season total; the two species together accounted for 99% of the total fish passed. Other common fishes included channel catfish (496), quillback (400), white perch (388), and carp (199). Alosids, (American shad, and river herring comprised 2.1% of the total catch. Peak passage occurred on 22 April when 45,823 fish, (99.5% gizzard shad), were passed.

1.3.2 American Shad Passage

The East lift collected and passed 19,914 American shad (Table 1). The first shad was passed on 16 April. Collection and passage of shad varied daily with 22.8% (4,543) of the shad passed from 16 to 30 April, 42.7% (8,506) passed from 1 to 15 May, 29.3% (5,840) passed from 16 to 31May, and 5.1% (1,025) passed from 1 to 6 June (Figures 1 and 2). On 9 of the 51 days of operation, American shad passage exceeded 1,000 fish. Peak passage occurred on 11 May when 1,943 American shad were passed.

American shad were collected at water temperatures of 57.2 to 76.1°F and at natural river flows of 20,400 to 66,400 cfs (Table 2 and Figure 1). The natural river flow and water temperature during the six highest days of shad passage, (24 April, and 3, 4,10, 11, and 26 May), ranged from 38,900 cfs to 45,500 cfs and 60.7°F to 65.3°F, respectively. The average daily river flow on those days when American shad passage exceeded 1,000 fish was approximately 43,077 cfs. The average daily river flow during the operational season was 44,000 cfs.

The hourly passage of American shad for the East lift is given in Table 3. Consistent numbers of American shad passed between 0800 and 1759 h (98% of total shad passage). The highest hourly shad passage rate, (3,112), was recorded from 1400 to 1459 h. Generally, shad passage increased after 0900 hours, peaked in mid-afternoon, and sharply declined after 1800 hrs.

1.3.3 Alosids

An extremely small number of Alewife (4) and blueback herring (1) were passed during the 2008 season. No hickory shad were collected and passed in spring 2008.

1.3.4 Maryland tag-recapture

During the 2008 season, the East fish lift passed a total of 10 American shad that were captured, floy-tagged and released downstream of Conowingo dam by the MDDNR. Of these floy-tagged fish, 7 tags were pink (2007 hook and line) and 3 were green (2008 hook and line).

1.4 SUMMARY

East fish lift operation was initiated on 16 April and resulted in the passage of seventy-one American shad. The East fish lift passed 19,914 American shad from 16 April through 6 June. The total number of American shad passed during the 2008 season was the lowest total collected by East lift operations since 1993, and the lowest number of American shad passed into Conowingo Pond since passage operations started in 1997, (Tables 4 and 5). It is also the fourth consecutive year in which the East lift did not surpass the 70,000 mark.

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 211 American shad lift mortalities, (1.0% of the total shad passed), was observed in 2008, similar to lift mortalities observed in recent years (0.2% to 1.0%) and less than values observed during trap and transport operations (1.5% to 10.5%).

1.5 RECOMMENDATIONS

Continue to operate the East lift 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.

Continue the use of two fish counters during periods of increased fish passage to accurately reflect the number of fish that pass through the East lift.

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

1.6 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.

1.7 TABLES AND FIGURES

Table 1: Summary of the daily number of fish passed by the Conowingo Dam East Fish Passage Facility in 2008.

Date:	*4/16*	*4/17*	*4/18*	*4/19*	*4/20*	*4/21*	*4/22*	*4/23*
Start Fishing Time:	*10:00*	*9:30*	*9:15*	*9:20*	*7:50*	*8:00*	*10:30*	*8:00*
End Fishing Time:	*17:15*	*17:20*	*17:20*	*18:05*	*17:00*	*16:15*	*16:45*	*15:45*
Hours of Operation:	*7.3*	*7.8*	*8.1*	*8.8*	*9.2*	*8.3*	*6.3*	*7.8*
Number of Lifts:	*8*	*9*	*7*	*13*	*10*	*11*	*15*	*11*
Water Temperature (°F):	*57.8*	*57.6*	*60*	*59.4*	*60*	*62.6*	*62.6*	*64.3*
American Shad	71	230	108	1165	759	64	145	0
Blueback herring	0	0	0	0	0	0	0	0
Alewife	0	0	0	0	0	0	3	0
Gizzard shad	6,899	9,230	11,357	22,000	4,954	30,883	45,621	28,570
Hickory Shad	0	0	0	0	0	0	0	0
Striped bass	0	0	0	0	0	0	0	0
Hybrid striped bass	0	0	0	0	0	0	0	0
White perch	0	0	0	0	0	0	6	5
Sea lamprey	1	1	0	0	0	0	0	0
Brook trout	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	1	1	0	0	0	0	0
Spottail shiner	2	0	0	0	0	0	0	0
Quillback	0	0	0	3	0	0	0	0
Shorthead redhorse	0	0	0	2	0	12	1	0
Brown bullhead	0	0	0	0	0	0	0	0
Channel catfish	1	0	0	0	0	1	2	0
Rock bass	0	0	0	0	0	0	0	0
Redbreast sunfish	0	0	0	0	0	0	0	0
Pumpkinseed	1	0	0	0	0	0	0	0
Bluegill	2	0	5	0	1	0	0	0
Smallmouth bass	3	2	1	0	1	15	2	2
Largemouth bass	0	0	0	0	0	0	0	0
Yellow perch	0	0	0	0	0	0	0	0
Walleye	9	7	5	15	0	26	43	34
Atlantic needlefish	0	0	0	0	0	0	0	0
TOTAL	6,989	9,471	11,477	23,185	5,715	31,001	45,823	28,611

Table 1: Summary of the daily number of fish passed by the Conowingo Dam East Fish Passage

Facility in 2008 (continued).

Date:	*4/24*	*4/25*	*4/26*	*4/27*	*4/29*	*4/30*	*5/1*	*5/2*
Start Fishing Time:	*7:30*	*7:30*	*7:45*	*11:00*	*7:45*	*8:30*	*7:45*	*7:45*
End Fishing Time:	*18:00*	*16:00*	*16:10*	*11:01*	*12:30*	*16:00*	*15:30*	*15:30*
Hours of Operation:	*10.5*	*8.5*	*8.4*	*2.0*	*4.8*	*7.5*	*7.8*	*7.8*
Number of Lifts:	*13*	*11*	*13*	*0*	*6*	*9*	*7*	*6*
Water Temperature (°F):	*65.3*	*65.3*	*66.2*	*65.3*	*64.4*	*62.6*	*62.5*	*60*
American Shad	1,222	76	686	1	15	1	11	1
Blueback herring	0	0	0	0	0	0	0	0
Alewife	0	0	0	0	0	0	0	0
Gizzard shad	30,670	24,249	22,544	123	11,979	17,028	24,143	9,317
Hickory Shad	0	0	0	0	0	0	0	0
Striped bass	0	0	0	0	0	0	0	0
Hybrid striped bass	0	0	0	0	0	0	0	0
White perch	10	2	15	0	0	11	59	12
Sea lamprey	0	1	2	0	0	0	0	0
Brook trout	0	0	0	0	0	0	0	0
Rainbow trout	0	1	0	0	0	1	9	0
Brown trout	0	0	1	0	0	0	0	0
Muskellunge	0	0	0	0	0	0	0	0
Carp	0	0	70	5	0	0	0	1
Spottail shiner	0	0	0	0	0	0	0	0
Quillback	0	1	0	0	0	0	0	0
Shorthead redhorse	0	0	0	0	0	0	0	2
Brown bullhead	0	0	0	0	0	0	9	0
Channel catfish	2	0	4	0	19	16	76	10
Rock bass	0	0	0	0	0	0	0	0
Redbreast sunfish	0	0	0	0	0	0	0	0
Pumpkinseed	0	0	0	0	0	0	0	0
Bluegill	0	1	0	0	0	1	0	0
Smallmouth bass	9	0	1	0	2	1	0	1
Largemouth bass	1	0	1	0	0	0	0	0
Yellow perch	0	0	3	0	0	0	0	0
Walleye	27	4	13	1	70	27	27	14
Atlantic needlefish	0	0	0	0	0	0	0	0
TOTAL	31,941	24,335	23,340	130	12,085	17,086	24,334	9,358

Table 1: Summary of the daily number of fish passed by the Conowingo Dam East Fish Passage Facility in 2008 (continued).

Date:	*5/3*	*5/4*	*5/5*	*5/6*	*5/7*	*5/8*	*5/9*	*5/10*
Start Fishing Time:	*7:30*	*8:15*	*8:30*	*7:30*	*7:45*	*7:15*	*7:45*	*8:20*
End Fishing Time:	*17:00*	*16:15*	*16:15*	*15:45*	*15:45*	*19:00*	*16:30*	*18:11*
Hours of Operation:	*9.5*	*8.0*	*7.8*	*8.3*	*8.0*	*11.8*	*8.8*	*9.9*
Number of Lifts:	*12*	*12*	*10*	*8*	*8*	*14*	*10*	*17*
Water Temperature (°F):	*60.7*	*61.7*	*60.8*	*61.7*	*62.6*	*66.2*	*66.4*	*64.4*
American Shad	1,868	1,232	325	33	40	1,011	269	1,691
Blueback herring	0	0	0	0	0	0	0	0
Alewife	0	0	0	0	0	0	0	0
Gizzard shad	27,763	32,840	33,865	8,802	16,604	17,264	22,809	30,300
Hickory Shad	0	0	0	0	0	0	0	0
Striped bass	0	0	0	0	0	1	0	0
Hybrid striped bass	0	0	0	0	0	0	0	0
White perch	4	2	9	24	8	15	4	5
Sea lamprey	1	1	3	0	0	0	0	0
Brook trout	0	0	0	0	0	0	0	0
Rainbow trout	0	0	0	4	2	0	0	2
Brown trout	0	1	0	0	0	0	0	0
Muskellunge	0	1	0	0	0	0	1	1
Carp	0	1	0	0	1	36	4	8
Spottail shiner	0	0	0	0	0	0	0	0
Quillback	1	0	3	2	3	14	0	0
Shorthead redhorse	0	0	19	3	3	4	0	0
Brown bullhead	1	0	0	1	1	3	0	0
Channel catfish	1	2	2	3	2	6	2	2
Rock bass	0	0	0	0	0	0	2	0
Redbreast sunfish	0	0	0	0	0	0	0	0
Pumpkinseed	0	0	0	0	1	0	0	0
Bluegill	0	0	0	3	0	1	5	0
Smallmouth bass	1	1	4	4	1	5	0	0
Largemouth bass	0	0	1	0	0	0	0	3
Yellow perch	0	0	0	0	0	0	0	0
Walleye	4	1	19	7	18	22	41	23
Atlantic needlefish	0	0	0	0	0	0	0	0
TOTAL	29,644	34,082	34,250	8,886	16,684	18,382	23,137	32,035

Table 1: Summary of the daily number of fish passed by the Conowingo Dam East Fish Passage Facility in 2008 (continued).

Date:	*5/11*	*5/12*	*5/13*	*5/14*	*5/15*	*5/16*	*5/17*	*5/18*
Start Fishing Time:	*7:00*	*7:45*	*7:45*	*7:30*	*7:40*	*8:00*	*8:00*	*6:45*
End Fishing Time:	*16:20*	*15:40*	*15:30*	*15:15*	*15:25*	*15:30*	*15:30*	*15:45*
Hours of Operation:	*9.3*	*7.9*	*7.8*	*7.8*	*7.8*	*7.5*	*7.5*	*9.0*
Number of Lifts:	*15*	*10*	*8*	*7*	*8*	*8*	*10*	*13*
Water Temperature (°F):	*64.3*	*64.4*	*62.6*	*60.8*	*60.7*	*61.7*	*62.3*	*62.8*
American Shad	1,943	55	14	9	4	25	34	1,058
Blueback herring	0	0	0	0	1	0	0	0
Alewife	0	0	0	0	0	0	0	0
Gizzard shad	27,625	17,679	16,870	16,537	14,945	14,327	32,234	23,040
Hickory Shad	0	0	0	0	0	0	0	0
Striped bass	0	1	1	2	0	0	0	0
Hybrid striped bass	1	0	0	0	0	0	0	0
White perch	0	11	3	1	5	6	2	1
Sea lamprey	0	0	0	0	0	0	0	0
Brook trout	0	0	0	0	0	0	0	1
Rainbow trout	1	1	0	2	0	3	0	0
Brown trout	0	0	0	0	1	0	0	0
Muskellunge	0	0	0	1	0	0	0	0
Carp	3	4	0	1	0	0	0	1
Spottail shiner	0	0	0	0	0	0	0	0
Quillback	0	0	0	7	1	0	0	0
Shorthead redhorse	1	2	0	0	0	0	2	0
Brown bullhead	0	0	0	0	0	0	0	0
Channel catfish	1	8	1	0	3	14	3	1
Rock bass	1	0	0	0	0	0	0	0
Redbreast sunfish	0	0	0	0	0	0	0	0
Pumpkinseed	0	0	0	0	0	0	0	0
Bluegill	0	0	0	1	0	0	0	0
Smallmouth bass	2	2	2	0	0	0	0	1
Largemouth bass	0	0	0	0	0	0	0	0
Yellow perch	0	0	0	0	0	0	0	0
Walleye	12	115	29	10	35	64	5	12
Atlantic needlefish	0	0	0	0	0	0	0	0
TOTAL	29,590	17,878	16,920	16,571	14,995	14,439	32,280	24,115

Table 1: Summary of the daily number of fish passed by the Conowingo Dam East Fish Passage Facility in 2008 (continued).

Date:	*5/19*	*5/20*	*5/21*	*5/22*	*5/23*	*5/24*	*5/25*	*5/26*
Start Fishing Time:	*7:30*	*7:35*	*7:30*	*7:40*	*7:30*	*7:30*	*7:00*	*7:00*
End Fishing Time:	*15:15*	*16:00*	*15:15*	*15:30*	*15:30*	*15:30*	*17:00*	*16:15*
Hours of Operation:	*7.8*	*8.4*	*7.8*	*7.8*	*8.0*	*8.0*	*10.0*	*9.3*
Number of Lifts:	*9*	*9*	*8*	*7*	*8*	*8*	*11*	*12*
Water Temperature (°F):	*61*	*59.4*	*59.4*	*59*	*57.2*	*59*	*60*	*62.6*
American Shad	20	22	2	0	1	88	831	1,462
Blueback herring	0	0	0	0	0	0	0	0
Alewife	1	0	0	0	0	0	0	0
Gizzard shad	31,737	19,068	16,632	12,035	8,277	15,323	14,838	19,747
Hickory Shad	0	0	0	0	0	0	0	0
Striped bass	1	2	0	1	0	1	0	0
Hybrid striped bass	0	0	0	0	0	0	0	0
White perch	22	59	11	18	2	0	1	2
Sea lamprey	0	0	1	0	0	0	0	0
Brook trout	0	0	0	0	0	0	0	0
Rainbow trout	0	0	2	0	0	0	0	0
Brown trout	0	0	1	0	0	0	0	0
Muskellunge	0	0	0	0	0	0	1	0
Carp	0	0	0	0	2	0	2	2
Spottail shiner	0	0	0	0	0	0	0	0
Quillback	4	0	3	0	1	0	2	1
Shorthead redhorse	5	3	1	0	0	0	0	0
Brown bullhead	1	4	2	0	0	0	1	0
Channel catfish	5	254	10	10	2	0	1	3
Rock bass	8	0	0	0	0	0	0	0
Redbreast sunfish	0	0	0	0	0	0	0	0
Pumpkinseed	0	0	0	0	0	0	0	0
Bluegill	17	0	0	0	0	0	2	0
Smallmouth bass	6	9	1	1	0	4	1	4
Largemouth bass	0	1	1	0	0	1	0	0
Yellow perch	0	0	0	0	0	0	0	0
Walleye	236	325	30	88	0	4	9	6
Atlantic needlefish	0	0	0	0	0	0	0	0
TOTAL	32,063	19,747	16,697	12,153	8,285	15,421	15,689	21,227

Table 1: Summary of the daily number of fish passed by the Conowingo Dam East Fish Passage Facility in 2008 (continued).

Date:	*5/27*	*5/28*	*5/29*	*5/30*	*5/31*	*6/1*	*6/2*	*6/3*
Start Fishing Time:	*7:30*	*7:30*	*7:30*	*8:00*	*7:20*	*7:30*	*7:45*	*7:30*
End Fishing Time:	*15:15*	*16:00*	*16:00*	*16:00*	*16:00*	*16:00*	*16:00*	*15:30*
Hours of Operation:	*7.8*	*8.5*	*8.5*	*8.0*	*8.7*	*8.5*	*8.3*	*8.0*
Number of Lifts:	*8*	*11*	*12*	*9*	*11*	*10*	*9*	*8*
Water Temperature (°F):	*65.2*	*64.4*	*68*	*68.9*	*70.4*	*71.6*	*73.4*	*74.8*
American Shad	344	380	675	151	747	451	210	243
Blueback herring	0	0	0	0	0	0	0	0
Alewife	0	0	0	0	0	0	0	0
Gizzard shad	17,960	28,129	14,956	11,208	17,505	9,721	16,622	4,375
Hickory Shad	0	0	0	0	0	0	0	0
Striped bass	1	0	0	1	2	1	1	0
Hybrid striped bass	0	0	0	0	0	0	0	0
White perch	2	20	15	11	3	0	1	0
Sea lamprey	0	0	0	0	0	0	0	0
Brook trout	0	0	0	0	0	0	0	0
Rainbow trout	1	2	0	0	0	0	0	1
Brown trout	0	0	0	0	1	0	1	0
Muskellunge	0	0	0	0	0	0	0	0
Carp	2	6	0	5	3	23	11	1
Spottail shiner	0	0	0	0	0	0	0	0
Quillback	1	0	0	2	35	142	80	8
Shorthead redhorse	0	4	0	1	0	0	0	0
Brown bullhead	0	0	0	0	0	0	2	0
Channel catfish	1	2	0	4	2	1	12	1
Rock bass	0	1	1	1	0	0	0	0
Redbreast sunfish	0	0	0	0	0	0	2	1
Pumpkinseed	0	0	0	0	0	1	1	0
Bluegill	6	2	0	4	0	0	7	3
Smallmouth bass	2	3	1	1	0	0	0	0
Largemouth bass	2	1	1	0	0	0	0	2
Yellow perch	0	0	0	0	0	0	1	0
Walleye	42	259	164	76	55	15	4	7
Atlantic needlefish	0	0	0	0	0	0	1	0
TOTAL	18,364	28,809	15,813	11,465	18,353	10,355	16,956	4,642

Table 1: Summary of the daily number of fish passed by the Conowingo Dam East Fish Passage Facility in 2008 (continued).

Date:	*6/4*	*6/5*	*6/6*	***Season***
Start Fishing Time:	*7:45*	*7:30*	*7:45*	***Total***
End Fishing Time:	*15:30*	*15:30*	*11:00*	
Hours of Operation:	*7.8*	*8.0*	*3.3*	***409***
Number of Lifts:	*7*	*7*	*0*	***483***
Water Temperature (°F):	*75.4*	*76.1*	*76*	
American Shad	104	17	0	**19,914**
Blueback herring	0	0	0	**1**
Alewife	0	0	0	**4**
Gizzard shad	1,350	7,396	25	**919,975**
Hickory Shad	0	0	0	**0**
Striped bass	1	1	2	**20**
Hybrid striped bass	0	0	0	**1**
White perch	1	0	0	**388**
Sea lamprey	0	0	0	**11**
Brook trout	0	0	0	**1**
Rainbow trout	0	0	0	**32**
Brown trout	0	0	0	**6**
Muskellunge	0	0	0	**5**
Carp	5	0	0	**199**
Spottail shiner	0	0	0	**2**
Quillback	8	78	0	**400**
Shorthead redhorse	1	0	0	**66**
Brown bullhead	1	1	0	**27**
Channel catfish	2	3	1	**496**
Rock bass	0	0	0	**14**
Redbreast sunfish	0	0	0	**3**
Pumpkinseed	0	0	0	**4**
Bluegill	0	4	0	**65**
Smallmouth bass	0	0	0	**96**
Largemouth bass	0	0	0	**15**
Yellow perch	0	0	0	**4**
Walleye	12	17	0	**2,088**
Atlantic needlefish	0	0	0	**1**
TOTAL	1,485	7,517	28	**943,838**

Table 2: Summary of American shad catch, Maryland DNR recaptures, Holtwood 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 2008.

Date	American Shad Catch	MD DNR Recaptures*	Holtwood 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
16-Apr	71	*0*	46,300	*57.8*	25	11	C/A	310	21.0-23.0	107.4	0
17-Apr	230	*0*	42,000	*57.6*	26	11	C/A	310	21.0-23.0	107.4	0
18-Apr	108	*0*	39,300	*60.0*	27	11	C/A	310	20.5-23.0	106.4	0
19-Apr	1,165	*0*	35,200	*59.4*	30	7	C/A	310	19.0-22.0	106.1	0
20-Apr	759	*0*	34,500	*60.0*	26	7	C/A	310	19.0-21.0	108.6	0
21-Apr	64	*0*	41,800	*62.6*	26	7	C/A	310	19.3-23.0	107.0	0
22-Apr	145	*0*	49,300	*62.6*	26	7	C	310	22.0-22.5	108.0	0
23-Apr	0	*0*	45,500	*64.3*	28	7	C	310	22.4-22.9	107.5	0
24-Apr	1,222	*0*	40,300	*65.3*	28	7	C/A	310	18.1-23.6	106.0	0
25-Apr	76	*0*	35,100	*65.3*	24	7	C/A	310	19.5-23.5	108.2	0
26-Apr	686	*1P*	33,200	*66.2*	30	5	C/A	310	18.5-21.0	107.9	0
27-Apr	1	*0*	35,900	*65.3*	30	8		310		108.5	0
29-Apr	15	*0*	61,900	*64.4*	25	11	C	310	22.5-23.0	105.5	0
30-Apr	1	*0*	59,700	*62.6*	23	10	C	310	23.0-23.6	106.5	0
1-May	11	*0*	53,000	*62.5*	10	10	C	310	23.1-23.5	106.5	0
2-May	1	*0*	50,500	*60.0*	15	11	C	310	20.9-23.5	107.0	0
3-May	1,868	*0*	44,500	*60.7*	26	11	C/A	310	17.0-23.3	106.3	0
4-May	1,232	*1P, 1G*	45,500	*61.7*	30	4	A/C	310	17.0-22.0	108.6	0
5-May	325	*1P*	50,500	*60.8*	30	11	C	310	23.4-23.6	107.5	0
6-May	33	*0*	52,600	*61.7*	20	11	C	310	23.0-23.2	106.5	0
7-May	40	*0*	47,700	*62.6*	30	11	C	310	23.0-23.6	106.7	0
8-May	1,011	*1P*	43,300	*66.2*	28	11	A/C	310	19.6-23.6	106.5	0
9-May	269	*0*	39,800	*66.4*	26	8	C	310	21.5-23.0	107.2	0
10-May	1,691	*1P, IG*	41,500	*64.4*	30	5	C/A	310	19.8-23.0	106.1	0
11-May	1,943	*0*	39,200	*64.3*	30	6	A	310	17.5-22.0	108.0	0
12-May	55	*0*	47,300	*64.4*	24	11	C	310	23.4-23.5	106.8	0

Table 2: Summary of American shad catch, Maryland DNR recaptures, Holtwood 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 2008 (continued).

Date	American Shad Catch	MD DNR Recaptures*	Holtwood 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
13-May	14	*0*	62,600	*62.6*	24	11	C	310	23.5-23.6	107.2	0
14-May	9	*0*	64,600	*60.8*	26	11	C	310	23.4-23.6	105.9	0
15-May	4	*0*	54,800	*60.7*	25	11	C	310	23.5-23.7	107.5	0
16-May	25	*0*	52,700	*61.7*	24	11	C&A	310	20.5-23.5	106.7	0
17-May	34	*0*	55,100	*62.3*	26	11	C	310	20.6-23.6	106.5	0
18-May	1,058	*1P*	59,300	*62.8*	25	8	A/C	310	17.0-23.0	107.7	0
19-May	20	*0*	63,900	*61.0*	20	11	C	310	23.2-23.4	107.4	0
20-May	22	*0*	66,400	*59.4*	16	11	C	310	23.0	106.0	0
21-May	2	*0*	66,100	*59.4*	28	11	C	310	213.60	108.1	0
22-May	0	*0*	62,800	*59.0*	25	11	C	310	23.8-23.9	107.0	0
23-May	1	*0*	56,900	*57.2*	25	11	C	310	22.0-23.5	107.0	0
24-May	88	*0*	49,300	*59.0*	25	7	C	310	20.8-22.5	107.8	0
25-May	831	*0*	43,400	*60.0*	28	8	A/C	310	17.0-22.5	108.2	0
26-May	1,462	*1G*	38,900	*62.6*	29	4	A	310	19.0	108.2	0
27-May	344	*0*	36,300	*65.3*	28	11	A/C	310	20.0-23.6	108.3	0
28-May	380	*1P*	35,500	*64.4*	29	8	C	310	19.4-22.8	107.7	0
29-May	675	*0*	29,700	*68*	36	11	C	310	17.0-23.5	107.3	0
30-May	151	*0*	27,600	*68.9*	25	11	A	310	17.0-23.0	107.9	0
31-May	747	*0*	28,100	*70.4*	26	8	A&C	310	16.9-23.0	107.8	0
1-Jun	451	*0*	24,200	*71.6*	30	5	A	310	16.5-20.2	108.0	0
2-Jun	210	*0*	22,500	*73.4*	30	8	A/C	310	16.5-23.0	108.5	0
3-Jun	243	*0*	20,400	*74.8*	30	8	A/C	310	16.5-23.0	107.7	0
4-Jun	104	*0*	21,700	*75.4*	25	8	A	310	16.5-23.0	107.8	0
5-Jun	17	*0*	21,900	*76.1*	25	8	A/C	310	16.5-23.0	108.3	0
6-Jun	0	*0*	24,800	*76*	18	5	C	310	16.5	108.7	0

* Tag color: P = pink, G = green.

Table 3: Hourly summary of American shad passage at the Conowingo Dam East Fish Passage Facility in 2008.

Date:	*4/16*	*4/17*	*4/18*	*4/19*	*4/20*	*4/21*	*4/22*	*4/23*	*4/24*	*4/25*	*4/26*	*4/27*
Observation Time-Start:	*10:40*	*9:30*	*9:20*	*9:15*	*8:00*	*8:15*	*10:30*	*8:00*	*8:30*	*8:00*	*7:30*	*11:00*
Observation Time-End:	*18:00*	*18:00*	*18:00*	*18:35*	*17:25*	*16:35*	*17:15*	*16:30*	*18:20*	*16:30*	*17:00*	*13:00*
Military Time (hrs)												
0700 to 0759											4	
0800 to 0859					27	4		0		28	1	
0900 to 0959		10	28	9	48	2		0	3	26	1	
1000 to 1059	0	7	18	3	62	0	37	0	10	4	4	
1100 to 1159	0	1	8	0	43	0	75	0	94	2	1	0
1200 to 1259	1	2	21	22	71	0	17	0	250	0	55	1
1300 to 1359	0	16	16	74	118	0	1	0	454	2	43	
1400 to 1459	2	5	0	205	328	0	8	0	291	6	268	
1500 to 1559	3	89	0	232	49	2	2	0		6	257	
1600 to 1659	24	34	3	388	13	56	5	0	47	2	46	
1700 to 1759	41	66	14	165	0		0		63		6	
1800 to 1859				67					10			
1900 to 1959												
Total	71	230	108	1165	759	64	145	0	1222	76	686	1

Date:	*4/29*	*4/30*	*5/1*	*5/2*	*5/3*	*5/4*	*5/5*	*5/6*	*5/7*	*5/8*	*5/9*	*5/10*
Observation Time-Start:	*7:45*	*8:30*	*8:00*	*7:45*	*8:00*	*9:00*	*9:00*	*7:30*	*8:00*	*8:00*	*9:30*	*8:10*
Observation Time-End:	*13:50*	*16:30*	*16:00*	*15:45*	*17:40*	*16:30*	*16:45*	*16:00*	*16:10*	*19:30*	*16:45*	*18:32*
Military Time (hrs)												
0700 to 0759				1				0				
0800 to 0859	5	0	1	0	0			4	6	4		35
0900 to 0959	3	0	0	0	0	178	98	6	2	24	25	7
1000 to 1059	2	0	2	0	2	156	88	5	8	60	44	0
1100 to 1159	5	0	0	0	2	213	44	3	10	173	19	4
1200 to 1259		0	1	0	95	159	19	1	4	58	79	0
1300 to 1359		0	0	0	255	326	12	2	8	81	39	1
1400 to 1459		0	4	0	559	131	35	3	0	20	12	161
1500 to 1559		1	3	0	406	39	15	6	1	116	34	518
1600 to 1659		0			320	30	14	3	1	148	17	501
1700 to 1759					229					241		376
1800 to 1859										76		88
1900 to 1959										10		
Total	15	1	11	1	1868	1232	325	33	40	1011	269	1691

Table 3: Hourly summary of American shad passage at the Conowingo Dam East Fish Passage Facility in 2008 (continued).

Date:	*5/11*	*5/12*	*5/13*	*5/14*	*5/15*	*5/16*	*5/17*	*5/18*	*5/19*	*5/20*	*5/21*	*5/22*
Observation Time-Start:	*7:30*	*8:10*	*8:00*	*7:40*	*7:30*	*8:00*	*8:15*	*7:15*	*7:30*	*8:05*	*7:30*	*8:00*
Observation Time-End:	*16:30*	*16:00*	*16:00*	*15:30*	*15:40*	*16:00*	*15:55*	*16:20*	*15:30*	*16:20*	*15:30*	*16:00*
Military Time (hrs)												
0700 to 0759	87			0	1			8	0		0	
0800 to 0859	510	14	4	0	0	0	8	76	11	12	1	0
0900 to 0959	239	19	2	3	0	0	6	202	4	2	0	0
1000 to 1059	229	5	2	0	0	2	8	149	2	1	0	0
1100 to 1159	225	7	1	1	1	2	1	412	1	0	0	0
1200 to 1259	258	4	1	0	0	5	1	107	0	0	0	0
1300 to 1359	226	1	3	1	0	4	2	46	1	0	0	0
1400 to 1459	130	2	1	3	0	4	2	32	1	5	1	0
1500 to 1559	27	3	0	1	2	8	6	15		1	0	0
1600 to 1659	12							11		1		
1700 to 1759												
1800 to 1859												
1900 to 1959												
Total	1943	55	14	9	4	25	34	1058	20	22	2	0

Date:	*5/23*	*5/24*	*5/25*	*5/26*	*5/27*	*5/28*	*5/29*	*5/30*	*5/31*	*6/1*	*6/2*	*6/3*
Observation Time-Start:	*7:30*	*8:00*	*7:30*	*8:00*	*9:00*	*8:00*	*8:00*	*8:00*	*8:00*	*8:00*	*8:00*	*7:30*
Observation Time-End:	*15:45*	*16:00*	*17:15*	*16:30*	*15:30*	*16:20*	*16:30*	*16:15*	*16:20*	*16:15*	*16:20*	*15:45*
Military Time (hrs)												
0700 to 0759	0		0									0
0800 to 0859	0	1	75	61		24	30	3	140	82	27	10
0900 to 0959	0	0	103	34	144	53	71	11	211	127	107	62
1000 to 1059	0	1	127	33	62	79	336	19	236	62	58	86
1100 to 1159	1	1	62		68	49	113	5	93	54	11	38
1200 to 1259	0	6	76	27	16	37	55	0	32	50	2	32
1300 to 1359	0	7	71	349	15	24	21	22	5	42	2	7
1400 to 1459	0	28	140	540	18	54	23	57	11	12	2	6
1500 to 1559	0	44	107	295	21	46	20	31	14	21	0	2
1600 to 1659			55	123		14	6	3	5	1	1	
1700 to 1759			15									
1800 to 1859												
1900 to 1959												
Total	1	88	831	1462	344	380	675	151	747	451	210	243

Table 3: Hourly summary of American shad passage at the Conowingo Dam East Fish Passage Facility in 2008 (continued).

Date:	*6/4*	*6/5*	*6/6*	***Season***
Observation Time-Start:	*7:30*	*8:00*	*7:30*	***Total***
Observation Time-End:	*15:45*	*16:00*	*11:30*	
Military Time (hrs)				
0700 to 0759	0		0	**101**
0800 to 0859	3	0	0	**1207**
0900 to 0959	1	0	0	**1,871**
1000 to 1059	40	6	0	**2,055**
1100 to 1159	31	6	0	**1,880**
1200 to 1259	15	4		**1,584**
1300 to 1359	12			**2,309**
1400 to 1459	2			**3,112**
1500 to 1559	0	1		**2,444**
1600 to 1659				**1,884**
1700 to 1759				**1,216**
1800 to 1859				**241**
1900 to 1959				**10**
Total	104	17	0	**19,914**

Table 4: Summary of selected operation and fish catch statistics at the Conowingo Dam East Fish Passage Facility, 1991 to 2008.

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	0.53	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**	**409.0**	**0.944**	**26**	**19,914**	**1**	**4**	**0**

Table 5: Summary of American shad passage counts and percent passage values at Susquehanna River dams, 1997-2008

	Conowingo	Holtwood		Safe Harbor		York Haven	
	East	Number	Passed	Number	Passed	Number	Passed
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%**

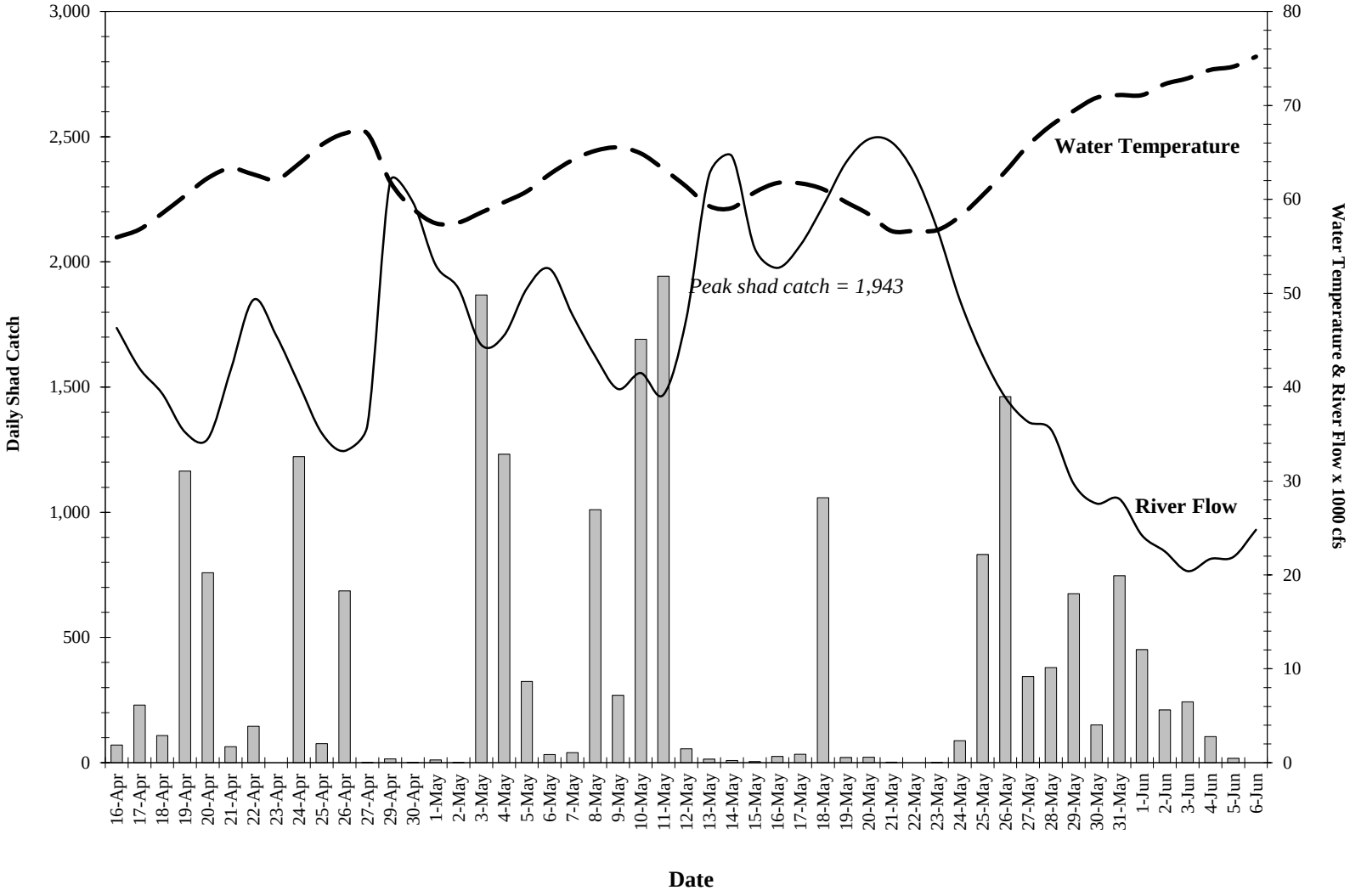

Figure 1: A plot of river flow (x 1000 cfs) and water temperature (°F) as measured at Holtwood Dam, in relationship to the daily American shad catch at the Conowingo East Fish Lift, spring 2008.

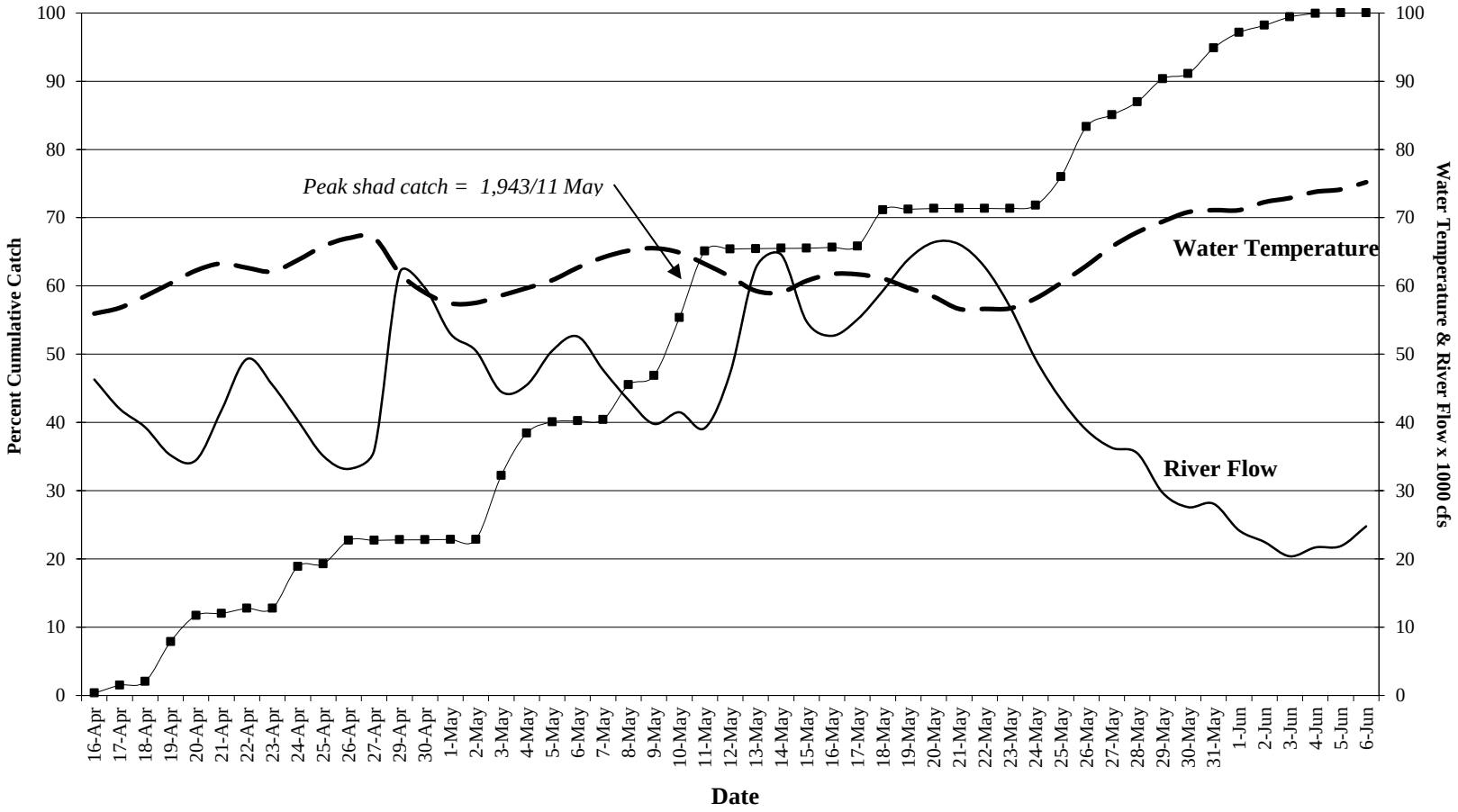

Figure 2: A plot of river flow (x 1000 cfs) and water temperature (°F) as measured at Holtwood Dam, in relationship to the percent cumulative American shad catch at the Conowingo East Fish Lift, spring 2008.