

## Summary of Operations at the Conowingo Dam East Fish Passage Facility Spring 2018

Draft

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## Executive Summary

Operation of the Conowingo East Fish Lift (EFL) began April 2, 2018. The water temperature was 47.1° F and river flow was 61,700 cfs during the first day of operation. The first two American Shad were passed on April 21, 2018 the tenth day of alternate day operation. The EFL operated for 48 days in 2018; with alternate day operation from April 2 through April 23, 2018 followed by daily operation from April 24 through June 3, 2018. The EFL did not operate May 19, 20, and 25, 2018 due to river flows ranging between 102,000 cfs and 126,000 cfs or on May 7, 2018 due to hopper cable replacement resulting from a hopper cable failure that occurred during operations on May 6, 2018. The EFL was operated twelve (12) days when 1 to 4 spill gates were open due to river flows greater than station capacity (86,000 cfs). EFL operation was terminated on June 3, 2018 as requested by the Resource Agencies. The 2018 fish passage season experienced higher river flows on average than those observed in 2016 and 2017, which may have impacted the number of American Shad passed at the EFL this season. The 2018 fish passage season marks the twenty-eighth season of overall operation and the twenty-second year of volitional fish passage at the Conowingo EFL.

The EFL passed 1,040,789 fish of 25 species and one hybrid. Gizzard Shad (1,022,819), channel catfish (9,236), and American Shad (6,992) dominated the catch, and comprised 99.8% of the total fish collected and passed. Gizzard Shad alone accounted for 98% of the total fish collected and passed. We also noted a decline in species composition this season (25 species observed in 2018 compared to 33 species observed in 2017), which may have resulted from the above average river flows experienced this season. No invasive species other than 2 flathead catfish were observed during operation of the EFL this spring.

A total of 6,992 American Shad was passed. The highest daily passage of American Shad occurred on May 4 when 1,061 shad were passed upstream. American Shad passage exceeded 1,000 fish on only 1 of the 48 days of operation. On a daily basis, overall shad passage was relatively steady from 1000 hrs through 1659 hrs with the highest overall hour of shad passage (1,049) between 1200 and 1259 hours.

Fishway operations were conducted at water temperatures ranging from 44.4°F to 75.5°F and river flows between 36,700 and 144,000 cfs. High river flow events in 2018 interrupted EFL operations on May 19, 20, and 25, 2018; spillage occurred during EFL operations on 12 days between April 4 and May 26, 2018.

Prior to the start of EFL operations in 2018, routine pre-season maintenance activities were conducted and included testing of the fish collection equipment (crowder, crowder screen hoist, hopper hoist motor, and hopper door along with inspection of associated air hoses, pneumatic cylinders, etc.). On May 6 (late afternoon), as the hopper was being raised, the west-side hopper cable snapped, resulting in the immediate shutdown of the facility. The malfunction was reported immediately to Exelon personnel at the Station, and a repair crew was called in to assess the damage. Conowingo station personnel reacted quickly and replaced both hopper cables on May 7, minimizing the amount of lost fishing time (11.25 hours). The Resource Agencies, (USFWS, PA DEP, and MDNR) were informed of the situation by emails on May 7, 2018, and again on May 8, 2018 when the EFL was placed back in service. Approximately 2,200 Gizzard Shad and 1 smallmouth bass perished due to the hopper malfunction. These fish were removed from the EFL and disposed of properly.

On 26 of the 49 days when viewing occurred, water clarity was excellent (20-36 inches of visibility at viewing window), 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 2018 was 5 blue tags from this year's tagging efforts conducted in the Conowingo tailrace along with 1 yellow tag from 2017.

Future operations of the EFL will build on the past twenty-eight years of operation experience.

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## 1.0 Introduction

Exelon Generation Company, LLC, formerly the Susquehanna Electric Company (SECO), has operated a fish passage facility (West Fish 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.

According to the 1988 negotiated 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 the agreement was construction of the East Fish Lift Passage Facility (EFL) at Conowingo Dam (Settlement Agreement 1988). Construction of the EFL commenced in April 1990 and it was operational by spring 1991.

Upon completion of the fishways at the Holtwood, Safe Harbor, and York Haven Dams, the EFL has been operated as a volitional fish passage facility since spring 1997.

Objectives of 2018 operation were: (1) monitor passage of migratory and resident fishes through the fishway; (2) assess fishway and trough effectiveness and make modifications as feasible; (3) assist the Muddy Run and Holtwood Hydro stations with their adult American Shad radio-telemetry studies by providing American Shad from the EFL trough for radio-tagging efforts; and (4) attempt to prevent the passage of Northern snake head and blue catfish (invasive species) upstream into Conowingo Pond.

## 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 Mixed-Flow (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 current 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 2018 began on April 2, 2018, with the passage of the first American Shad on April 21, 2018 (Tables 1 and 2). The EFL operated for 48 days in 2018 with alternate day operation occurring from April 2 through April 23, 2018. Daily operation of the EFL occurred from April 24 through June 3, 2018 with the exception of May 7, 19, 20, and 25, 2018 due to high river flows and a hopper cable failure (Table 2). On May 6 (late afternoon), as the hopper was being raised, the west-side hopper cable snapped, resulting in the immediate shutdown of the facility. The malfunction was reported immediately to Exelon personnel at the Station, and a repair crew was called in to assess the damage. Conowingo station personnel reacted quickly and replaced both hopper cables on May 7, minimizing the amount of lost fishing time (11.25 hours). The Resource Agencies, (USFWS, PA DEP, and MDNR) were informed of the situation by emails on May 7, 2018, and again on May 8, 2018 when the EFL was placed back in service, (Appendix 1). Operation of the EFL was stopped after receiving emails from Sheila Eyler (USFWS) and Jeremy Miller (PA DEP) on June 1, 2018 stating that the proposed shutdown scenario was acceptable to the Resource Agencies, (Appendix 2).

Daily operation times were planned during optimal fish passage parameters. This year, operational methodologies were influenced by natural river flow, water temperature, station generation, daily/hourly fish passage numbers, and American Shad tagging events for the Holtwood and Muddy Run Tier II radio-telemetry studies. During American Shad tagging events, EFL operation was modified. The attraction water and the appropriate entrance gates were opened at the regular start time (0800 hrs) to attract fish into the facility. As per the Lockout/Tag out procedure, the hopper was de-energized to ensure the safety of the tagging crew while working in the trough. Upon completion of the tagging event, the Lock out/Tag out was lifted, and the hopper was placed back in service to initiate the hopper cycle time. The 10 tagging events ranged from 20 to 61 minutes in duration, with 1 to 50 American Shad tagged per event (Appendix 3). The first lift of the day after completion of a tagging event usually occurred between 0930 hrs and 1000 hrs. EFL operation was conducted by a staff of three personnel: a lift operator, a supervising biologist, and a biological technician.

The mechanical aspects of EFL operation in 2018 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 twice per 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, either entrance A or C is utilized to attract fishes. Throughout the 2018 season, Entrance Gate A was used infrequently due to the above average river flows preventing the station from generating solely with the smaller Francis turbines when the EFL was operating.

## 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, the biologist and technician identified and counted the 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 (PC). 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 electronically to plant personnel. Each day's data were backed up and stored off site. Daily reports and weekly summaries of fish passage were electronically distributed to plant personnel and Resource Agencies.

## 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 1,040,789 fish of 25 species and one hybrid passed upstream into Conowingo Pond. Gizzard Shad (1,022,819), channel catfish (9,236), and American Shad (6,992), dominated the catch, and comprised 99.8% of the total fish collected and passed. Gizzard Shad alone accounted for 98% of the total fish collected and passed. Peak passage occurred on May 8 when 84,024 fish, (99.5% Gizzard Shad along with 292 American Shad), were passed. We also noted a decline in species composition this season (25 species observed in 2018 compared to 33 species observed in 2017), which may have resulted from the above average river flows experienced this season.

### 3.2 Invasive Species

No invasive species other than 2 flathead catfish were observed during operation of the EFL this spring. Flathead catfish have been established in the lower Susquehanna River for approximately eighteen years, thus Exelon is not required to report them except for in the annual summary report. However, due to increased sightings and reports of Northern Snakehead and Blue Catfish downstream of Conowingo Dam, the Resource Agencies requested that Exelon implement measures (at least temporarily) to decrease the risk that invasive species, specifically Northern Snakehead and Blue Catfish, would pass through the Conowingo EFL and WFL. The actions to be taken by Exelon during the 2018 fish passage season are listed in Appendix 4.

### **3.3 American Shad Passage**

The EFL collected and passed 6,992 American Shad (Table 1). The first two American Shad passed on April 21, 2018 (tenth day of alternate day operation). Collection and passage of shad varied daily with 2.9% (201) of the shad passed from April 2 to April 30, 2018, 87.6% (6,123) passed from May 1 to May 15, 2018, and 9.5% (668) passed from May 16 to June 3, 2018 (Figures 1 and 2). American Shad passage exceeded 1,000 fish on only 1 of the 48 days of operation. The largest number of American Shad passed at the EFL occurred on May 4, 2018 (1,061).

American Shad were collected and passed at water temperatures ranging from 44.4°F to 75.5°F and river flows between 36,700 and 144,000 cfs (Table 2, and Figure 1). The average daily river flow on May 4, 2018 when American Shad passage exceeded 1,000 fish was 39,900 cfs. The average daily river flow during the operational season was 70,350 cfs.

The hourly passage of American Shad at the EFL is provided in Table 3. On a daily basis, overall shad passage was strongest through the fishway between 1100 and 1259 hours and 1500 to 1659 hours during which nearly 50% of the total American Shad passage occurred. The highest hourly passage rate occurred from 1200 to 1259 hours. The highest number of American Shad passed in one hour (283) occurred from 1800 to 1859 hrs on May 5, 2018.

### **3.4 Gizzard Shad Passage**

The EFL collected and passed 1,022,819 Gizzard Shad in 2018 (Tables 1 and 4). Gizzard Shad accounted for 98% of the total fish collected and passed. Gizzard Shad passage exceeded 80,000 on 1 day, and 40,000 and 30,000 fish on 7 and 5 days, respectively. Table 4 provides the ratio of American Shad to Gizzard Shad for the years of volitional passage (1997-2018). 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 – 1:146. 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.

### **3.5 Alosids**

A small number of Blueback herring, (2) and Alewife (58) were passed during the 2018 season (Table 5). No Hickory shad were passed in spring 2018.

### **3.6 Maryland Tag-Recapture**

During the 2018 season, the EFL passed American Shad that were captured, floy-tagged and released downstream of Conowingo dam by the Maryland DNR. On 26 of the 49 days when viewing occurred, water clarity was excellent (20-36 inches of visibility at viewing window), allowing the viewing technicians to identify American Shad with attached Maryland DNR floy tags. This year, the Maryland DNR caught 177 American Shad and floy-tagged a total of 156. The number of floy tags observed at the Conowingo EFL in 2018 was 6; 1 yellow tag from the 2017 tagging effort and 5 blue tags from this year's tagging efforts in the Conowingo tailrace.

### 3.7 Fish Mortality in EFL

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. A total of 264 American Shad lift mortalities, (3.7% of the total shad passed), was observed in 2018, within the range of values observed during the 1991 through 1996 trap and transport operations (1.5% to 10.5%). Normandeau and Exelon staff work closely during the season, and pre- and post-season to assess areas of concern that may cause injury or mortality. Close attention is directed towards hopper alignment at the trough/slucice area as well as the function of the hopper door during the sluicing operation.

On May 6 (late afternoon), as the hopper was being raised, the west-side hopper cable snapped, resulting in the immediate shutdown of the facility. This mechanical failure resulted in the loss of approximately 2,200 Gizzard Shad and 1 smallmouth bass. These fish were removed from the EFL and disposed of properly.

### 4.0 Summary

EFL operation was initiated on April 2, 2018 on an alternate day operating schedule. The first two (2) American Shad passed on the tenth day of alternate day operation (April 21, 2018). The EFL passed 6,992 American Shad from April 21, 2018 through June 3, 2018. The total number of American Shad passed during the 2018 season was much lower than observed in 2017, possibly due to the above average river flows experienced this spring. Fish passage operations were suspended three (3) days with operations conducted during spill conditions on twelve (12) days. The average daily river flow during the 2018 operational season was 70,350 cfs compared to 57,465 cfs observed in 2017. Water temperature reached 70.0° F on May 8, 2018 but dropped to 62.5°F on May 19, 2018 due to a high flow event that started on May 15, 2018. Water temperature did not appear to be a limiting factor to American Shad passage in 2018 as temperatures greater than 70°F were not regularly observed until May 29, 2018 to season end on June 3, 2018. This year marks the second year since 2015 in which the EFL passed less than 10,000 American Shad (Table 6).

Prior to the start of EFL operations in 2018, routine preseason maintenance activities were conducted, and included testing of the fish collection equipment (crowder, crowder screen hoist, hopper hoist motor, and hopper door along with inspection of associated air hoses, pneumatic cylinders, etc.). These maintenance activities, along with the quick response and repair of the hopper hoist cables by Conowingo station personnel on May 7, 2018 resulted in a minimal amount of lost fishing time (11.25 hours) due to mechanical issues.

### 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 make “on the spot” decisions for maximizing 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 any modifications to the EFL.

## 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.

Settlement Agreement. 1988. Philadelphia Electric Power Company and the Susquehanna Power Company, AND the United States Department of Interior, Fish and Wildlife Service; Pennsylvania Fish Commission; Susquehanna River Basin Commission; Maryland Department of Natural Resources; the Commonwealth of Pennsylvania, Department of Environmental Resources; the Upper Chesapeake Watershed Association; and the Pennsylvania Federation of Sportsmen's Clubs. August 26, 1988.

Modified Prescription. 2016. U. S. Department of the Interior's Modified Prescription for Fishways Pursuant to Section 18 of the Federal Power Act (Modified Prescription) for the Federal Energy Regulatory Commission Project No. 405 Conowingo Hydroelectric Project.

## Figures

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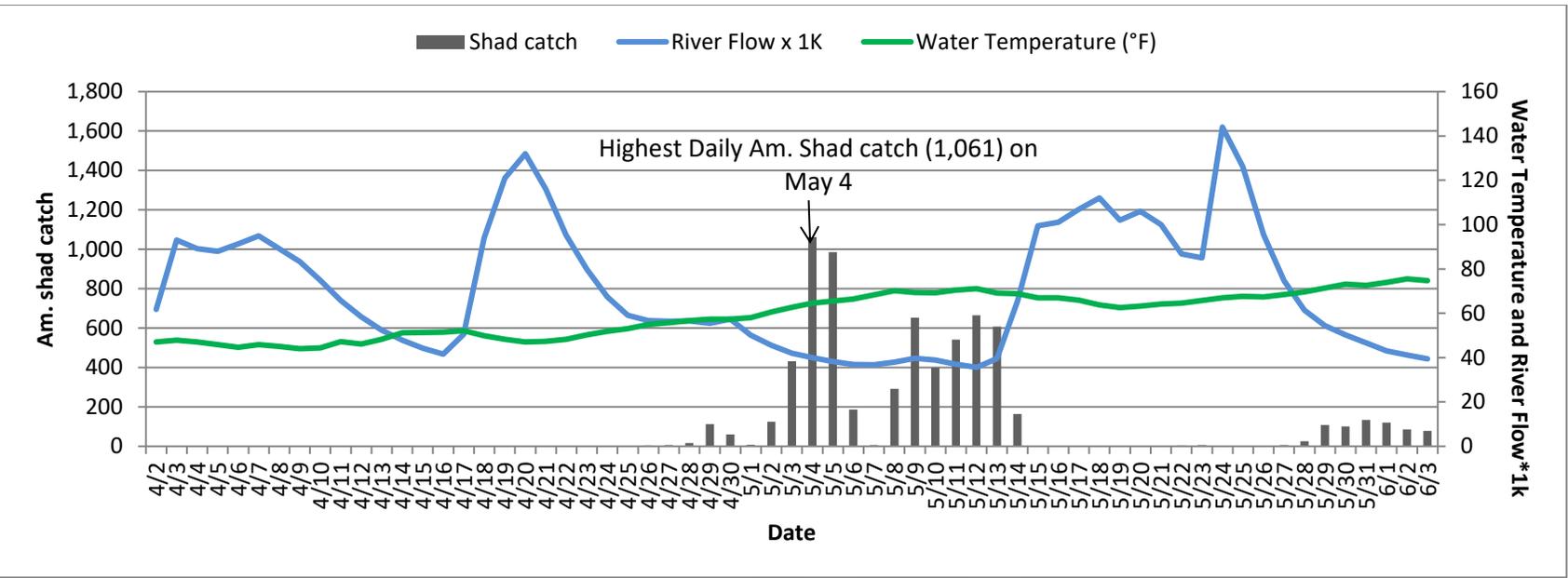


Figure 1. A plot of river flow (x 1000 cfs) (USGS Marietta Gauge) and water temperature (°F) in relation to daily American Shad passage at the Conowingo EFL, spring 2018.

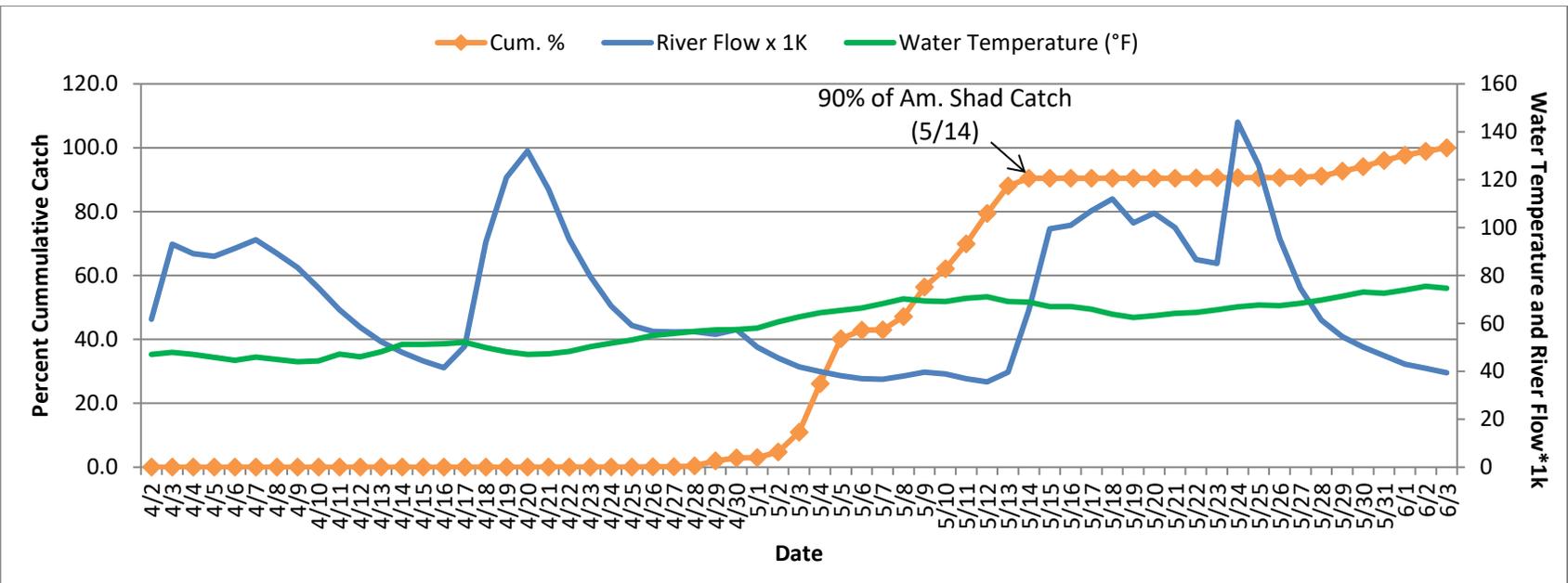


Figure 2. A plot of river flow (x 1000 cfs) (USGS Marietta Gauge) and water temperature (°F) in relation to the percent cumulative American Shad passage at the Conowingo EFL in spring, 2018.

Tables

Table 1. Summary of the daily number of fish passed by the Conowingo Dam East Fish Passage Facility in 2018.

Date	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12
Start Fishing Time	8:00		8:00		8:00		8:00		8:00		8:00
End Fishing Time	15:45		15:45		15:40		15:45		15:45		15:45
Elapsed Fishing Time	7.8		7.8		7.7		7.8		7.8		7.8
Viewing Hours	8.0		8.0		8.0		8.0		8.0		8.0
Lifts Per Day	10		10		10		9		10		10
Water Temperature (°F)	47.1	47.9	47.1	45.8	44.6	45.9	45	44	44.4	47.2	46.1
American Eel	0		0		0		0		0		0
American Shad	0		0		0		0		0		0
Hickory Shad	0		0		0		0		0		0
Blueback Herring	0		0		0		0		0		0
Alewife	0		0		0		0		0		0
Gizzard Shad	94		110		268		56		1,322		1,852
Rainbow Trout	0		0		0		0		0		0
Brown Trout	1		0		0		0		0		0
Muskellunge	0		0		0		0		0		0
Carp	0		0		0		0		0		0
Spottail Shiner	0		0		0		0		0		0
Quillback	0		0		0		0		0		0
White Sucker	0		0		0		0		0		0
Shorthead Redhorse	1		1		0		0		0		0
Yellow Bullhead	0		0		0		0		0		0
Brown Bullhead	0		0		0		0		0		0
Channel Catfish	0		0		1		0		0		0
Flathead Catfish	0		0		0		0		0		0
White Perch	0		0		0		0		0		0
Striped Bass	0		0		0		0		0		0
Striped Bass Hybrid	0		0		0		0		0		0
Bluegill	0		0		0		0		0		0
Smallmouth Bass	2		0		0		0		0		0
Largemouth Bass	0		0		0		0		0		0
White Crappie	0		0		0		0		0		0
Yellow Perch	0		0		0		0		0		0
Walleye	12		9		2		1		0		0
Sea Lamprey	0		0		0		0		0		0
<b>Total</b>	<b>110</b>	<b>0</b>	<b>120</b>	<b>0</b>	<b>271</b>	<b>0</b>	<b>57</b>	<b>0</b>	<b>1,322</b>	<b>0</b>	<b>1,852</b>

*SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY*

**Table 1. (Continued)**

Date	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23
<b>Start Fishing Time</b>		8:00		8:00		8:00			8:00		8:00
<b>End Fishing Time</b>		16:00		15:40		16:00			15:45		16:10
<b>Elapsed Fishing Time</b>		8.0		7.7		8.0			7.8		8.2
<b>Viewing Hours</b>		8.2		8.0		8.0			7.5		8.5
<b>Lifts Per Day</b>		10		10		10			10		12
<b>Water Temperature (°F)</b>	48.2	51.2	51.3	51.5	52.1	49.9	48.2	47	47.3	48.3	50.3
American Eel		0		0		0			0		0
American Shad		0		0		0			2		0
Hickory Shad		0		0		0			0		0
Blueback Herring		0		0		0			0		0
Alewife		5		42		0			1		0
Gizzard Shad		3,851		1,485		4,518			663		13,853
Rainbow Trout		0		0		0			0		0
Brown Trout		0		0		0			0		0
Muskellunge		0		0		0			0		0
Carp		0		0		0			0		0
Spottail Shiner		0		0		0			0		0
Quillback		0		0		0			0		0
White Sucker		0		0		0			1		0
Shorthead Redhorse		1		5		0			0		1
Yellow Bullhead		0		0		0			0		0
Brown Bullhead		0		0		0			0		0
Channel Catfish		0		0		0			0		0
Flathead Catfish		0		0		0			0		0
White Perch		0		0		0			0		0
Striped Bass		0		0		0			0		0
Striped Bass Hybrid		0		0		0			0		0
Bluegill		0		0		0			0		0
Smallmouth Bass		4		10		1			0		4
Largemouth Bass		0		0		0			0		0
White Crappie		0		0		0			0		1
Yellow Perch		0		0		0			0		0
Walleye		0		2		2			2		0
Sea Lamprey		1		0		0			0		0
<b>Total</b>	<b>0</b>	<b>3,862</b>	<b>0</b>	<b>1,544</b>	<b>0</b>	<b>4,521</b>	<b>0</b>	<b>0</b>	<b>669</b>	<b>0</b>	<b>13,859</b>

*SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY*

**Table 1. (Continued)**

Date	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4
<b>Start Fishing Time</b>	8:00	8:00	8:00	8:00	8:00	8:00	8:00	8:00	9:00	8:00	8:00
<b>End Fishing Time</b>	16:10	16:10	16:10	16:10	16:10	17:00	18:00	18:00	18:00	18:00	18:00
<b>Elapsed Fishing Time</b>	8.2	8.2	8.2	8.2	8.2	9.0	10.0	10.0	9.0	10.0	10.0
<b>Viewing Hours</b>	8.5	8.5	8.5	8.5	8.5	9.5	10.5	10.3	9.3	9.3	9.0
<b>Lifts Per Day</b>	11	11	11	12	17	16	18	21	18	23	20
<b>Water Temperature (°F)</b>	51.8	53.1	54.9	55.8	56.7	57.3	57.4	58	60.6	62.7	64.5
American Eel	0	0	0	0	0	0	0	0	0	0	0
American Shad	0	0	4	5	17	113	60	7	124	432	1,061
Hickory Shad	0	0	0	0	0	0	0	0	0	0	0
Blueback Herring	0	0	0	0	0	0	0	0	0	0	0
Alewife	0	0	1	1	2	2	2	0	1	0	1
Gizzard Shad	14,547	21,219	15,083	27,795	42,451	21,546	30,687	43,970	34,585	44,620	36,680
Rainbow Trout	0	0	1	0	0	1	0	0	0	0	1
Brown Trout	0	0	0	0	0	0	2	1	0	0	1
Muskellunge	0	0	0	0	0	0	0	0	0	0	0
Carp	0	0	0	0	0	0	0	0	0	0	3
Spottail Shiner	0	0	0	0	0	0	0	0	0	0	1
Quillback	0	0	0	0	0	0	1	0	0	0	5
White Sucker	0	0	0	0	0	0	0	0	1	0	2
Shorthead Redhorse	0	6	4	4	2	14	8	0	1	1	8
Yellow Bullhead	0	0	0	0	0	0	0	0	0	0	0
Brown Bullhead	0	0	0	0	0	0	0	0	0	0	0
Channel Catfish	0	3	0	0	0	0	0	0	0	1	0
Flathead Catfish	0	0	0	0	0	0	0	0	0	0	0
White Perch	0	0	0	0	0	0	0	0	0	0	0
Striped Bass	0	0	0	1	0	0	0	0	0	0	0
Striped Bass Hybrid	0	2	0	0	0	0	0	0	0	0	0
Bluegill	0	0	0	0	1	0	0	1	0	0	1
Smallmouth Bass	2	8	10	12	14	17	12	8	18	9	69
Largemouth Bass	0	0	0	0	1	0	0	0	0	0	0
White Crappie	0	0	0	0	0	0	0	0	0	0	0
Yellow Perch	0	0	0	0	0	0	0	0	0	0	0
Walleye	2	0	0	0	0	1	0	0	0	0	3
Sea Lamprey	0	0	0	1	0	0	2	0	0	1	0
<b>Total</b>	<b>14,551</b>	<b>21,238</b>	<b>15,103</b>	<b>27,819</b>	<b>42,488</b>	<b>21,694</b>	<b>30,774</b>	<b>43,987</b>	<b>34,730</b>	<b>45,064</b>	<b>37,836</b>

*SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY*

**Table 1. (Continued)**

Date	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15
<b>Start Fishing Time</b>	7:45	8:00	0:00	8:35	8:00	8:00	8:00	8:00	8:00	8:00	8:00
<b>End Fishing Time</b>	18:45	16:45	0:00	18:00	18:00	18:00	18:00	18:00	18:00	18:00	16:00
<b>Elapsed Fishing Time</b>	11.0	8.8	0.0	9.4	10.0	10.0	10.0	10.0	10.0	10.0	8.0
<b>Viewing Hours</b>	11.3	8.8	2.6	8.3	8.5	8.5	8.7	8.7	8.8	9.0	8.2
<b>Lifts Per Day</b>	25	20	0	28	19	18	21	17	18	20	19
<b>Water Temperature (°F)</b>	65.5	66.4	68.3	70.2	69.4	69.2	70.5	71.1	69.1	68.9	67
American Eel	0	0	0	0	0	0	0	0	0	0	0
American Shad	985	187	5	292	652	398	542	665	607	163	3
Hickory Shad	0	0	0	0	0	0	0	0	0	0	0
Blueback Herring	0	1	0	0	0	0	0	0	0	0	0
Alewife	0	0	0	0	0	0	0	0	0	0	0
Gizzard Shad	54,137	49,031	2,074	83,660	31,380	29,298	40,933	20,206	30,780	42,264	45,180
Rainbow Trout	2	0	0	1	0	0	1	1	0	0	0
Brown Trout	1	0	0	0	0	3	0	1	0	0	0
Muskellunge	1	0	0	0	0	0	0	0	0	0	0
Carp	1	5	0	0	1	3	2	2	1	2	0
Spottail Shiner	0	0	0	0	0	0	0	0	0	0	0
Quillback	1	0	0	0	3	3	1	23	9	6	0
White Sucker	0	0	1	0	0	0	0	0	0	0	0
Shorthead Redhorse	9	3	0	2	1	0	1	0	7	6	0
Yellow Bullhead	0	0	0	1	0	0	0	0	0	0	0
Brown Bullhead	0	0	0	0	2	2	2	9	16	61	26
Channel Catfish	5	3	0	1	52	33	14	18	93	306	183
Flathead Catfish	0	0	0	0	0	0	0	0	0	0	1
White Perch	0	1	0	12	27	1	4	1	15	43	2
Striped Bass	2	0	0	1	3	16	3	11	18	41	10
Striped Bass Hybrid	0	0	0	0	1	0	0	0	0	0	0
Bluegill	0	0	0	0	0	0	2	0	0	0	0
Smallmouth Bass	27	29	0	50	35	3	7	8	8	10	8
Largemouth Bass	0	0	0	0	0	0	1	0	0	0	1
White Crappie	0	0	0	0	0	0	0	0	0	0	0
Yellow Perch	0	0	0	0	1	0	0	0	0	0	0
Walleye	2	3	2	4	3	1	0	0	18	12	6
Sea Lamprey	3	4	1	0	0	0	0	2	0	2	0
<b>Total</b>	<b>55,176</b>	<b>49,267</b>	<b>2,083</b>	<b>84,024</b>	<b>32,161</b>	<b>29,761</b>	<b>41,513</b>	<b>20,947</b>	<b>31,572</b>	<b>42,916</b>	<b>45,420</b>

*SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY*

**Table 1. (Continued)**

Date	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
<b>Start Fishing Time</b>	<b>8:00</b>	<b>8:00</b>	<b>8:00</b>			<b>8:00</b>	<b>8:00</b>	<b>8:00</b>	<b>8:00</b>		<b>8:00</b>
<b>End Fishing Time</b>	<b>15:45</b>	<b>16:00</b>	<b>13:30</b>			<b>16:00</b>	<b>16:00</b>	<b>16:00</b>	<b>12:00</b>		<b>16:00</b>
<b>Elapsed Fishing Time</b>	<b>7.8</b>	<b>8.0</b>	<b>5.5</b>			<b>8.0</b>	<b>8.0</b>	<b>8.0</b>	<b>4.0</b>		<b>8.0</b>
<b>Viewing Hours</b>	<b>8.0</b>	<b>8.2</b>	<b>6.0</b>			<b>8.1</b>	<b>8.5</b>	<b>8.2</b>	<b>4.3</b>		<b>8.5</b>
<b>Lifts Per Day</b>	<b>10</b>	<b>10</b>	<b>7</b>			<b>10</b>	<b>10</b>	<b>16</b>	<b>6</b>		<b>11</b>
<b>Water Temperature (°F)</b>	<b>67</b>	<b>65.9</b>	<b>63.8</b>	<b>62.5</b>	<b>63.2</b>	<b>64.2</b>	<b>64.6</b>	<b>65.7</b>	<b>66.9</b>	<b>67.6</b>	<b>67.4</b>
American Eel	0	0	0			0	0	0	0		0
American Shad	0	1	0			1	4	5	2		0
Hickory Shad	0	0	0			0	0	0	0		0
Blueback Herring	0	0	0			0	0	0	0		0
Alewife	0	0	0			0	0	0	0		0
Gizzard Shad	2,542	492	108			897	21,766	24,248	2,093		16,072
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	0			1	2	2	0		1
Spottail Shiner	0	0	0			0	0	0	0		0
Quillback	1	0	1			0	0	0	0		0
White Sucker	0	0	0			0	0	0	0		0
Shorthead Redhorse	8	2	0			1	0	0	1		1
Yellow Bullhead	0	0	0			0	0	0	0		0
Brown Bullhead	91	13	1			0	0	2	6		13
Channel Catfish	1,154	743	103			96	1,006	243	108		1,426
Flathead Catfish	0	0	0			0	0	0	0		0
White Perch	15	1	2			1	2	0	1		0
Striped Bass	8	5	4			2	36	5	3		2
Striped Bass Hybrid	0	0	0			0	0	0	0		0
Bluegill	0	0	0			0	0	0	0		0
Smallmouth Bass	2	0	0			0	11	6	0		3
Largemouth Bass	0	0	0			0	0	0	0		0
White Crappie	0	0	0			0	0	0	0		0
Yellow Perch	0	0	0			0	0	0	0		0
Walleye	3	0	0			0	4	9	1		0
Sea Lamprey	0	0	0			0	0	0	0		0
<b>Total</b>	<b>3,824</b>	<b>1,258</b>	<b>219</b>	<b>0</b>	<b>0</b>	<b>999</b>	<b>22,831</b>	<b>24,520</b>	<b>2,215</b>	<b>0</b>	<b>17,518</b>

*SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY*

**Table 1. (Continued)**

Date	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3	6/4	6/5	Season Total
<b>Start Fishing Time</b>	8:00	7:50	8:00	8:00	8:00	8:00	8:00	8:00			
<b>End Fishing Time</b>	16:00	16:00	18:00	18:00	18:00	17:55	18:00	18:00			
<b>Elapsed Fishing Time</b>	8.0	8.2	10	10	10	9.9	10	10			416
<b>Viewing Hours</b>	8.3	8.3	10.5	10.2	9.2	9.2	10.3	10.3			416
<b>Lifts Per Day</b>	16	12	20	16	19	18	19	20			714
<b>Water Temperature (°F)</b>	68.4	69.7	71.4	73.1	72.6	73.9	75.5	74.7			
American Eel	0	0	0	0	0	0	0	0			0
American Shad	6	25	108	100	133	120	85	78			6,992
Hickory Shad	0	0	0	0	0	0	0	0			0
Blueback Herring	0	1	0	0	0	0	0	0			2
Alewife	0	0	0	0	0	0	0	0			58
Gizzard Shad	19,557	25,886	31,086	17,314	20,515	19,130	10,729	20,186			1,022,819
Rainbow Trout	0	0	0	0	0	0	1	0			9
Brown Trout	0	0	0	0	0	0	0	1			11
Muskellunge	0	0	0	0	0	0	0	0			1
Carp	0	2	1	1	0	14	5	3			53
Spottail Shiner	0	0	0	0	0	0	0	0			1
Quillback	0	0	0	0	1	4	12	0			71
White Sucker	0	0	0	0	0	0	0	0			5
Shorthead Redhorse	0	0	0	0	0	2	0	0			101
Yellow Bullhead	0	0	0	0	0	0	0	0			1
Brown Bullhead	0	3	4	0	0	1	0	1			253
Channel Catfish	149	50	130	334	589	365	627	1,400			9,236
Flathead Catfish	1	0	0	0	0	0	0	0			2
White Perch	0	0	3	1	2	1	0	0			135
Striped Bass	10	13	18	42	26	23	17	24			344
Striped Bass Hybrid	0	0	0	0	0	0	0	0			3
Bluegill	0	0	0	1	0	0	0	0			6
Smallmouth Bass	1	7	11	16	4	10	12	10			478
Largemouth Bass	0	0	0	0	0	0	2	1			6
White Crappie	0	0	0	0	0	0	2	0			3
Yellow Perch	0	0	0	0	0	0	0	0			1
Walleye	1	5	4	7	8	14	10	27			180
Sea Lamprey	0	0	0	1	0	0	0	0			18
<b>Total</b>	<b>19,725</b>	<b>25,992</b>	<b>31,365</b>	<b>17,817</b>	<b>21,278</b>	<b>19,684</b>	<b>11,502</b>	<b>21,731</b>	<b>0</b>	<b>0</b>	<b>1,040,789</b>

\*Hobo water temperature data logger placed in EFL trough.

*SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY*

Table 2. Summary of American Shad catch, Maryland DNR recaptures, daily average river flow (USGS Gauge Marietta) and water temperature, turbidity (secchi), unit operation, entrance gates utilized, attraction flow, and average project water elevations during operation of the Conowingo Dam EFL in 2018.

Date	American Shad Catch	MD DNR Recaptures	Marietta Water		Maximum Entrance			Attraction Flow (cfs)	Tailrace Elevation (ft)	Forebay Elevation (ft)	Crest Gates Open
			River	Temp.	Secchi	Units in	Gates				
			Flow (cfs)	(°F)	(in)	Operation	Utilized				
4/2	0		61,700	47.1	26	11	C	310	24.1	107.0	
4/3	DNO		93,100	47.9							
4/4	0		89,100	47.1	28	11	C	310	24.1	108.0	1
4/5	DNO		88,000	45.8							
4/6	0		91,300	44.6	20	11	C	310	23.5	107.0	1
4/7	DNO		94,900	45.9							
4/8	8		89,200	45	18	11	C	310	23.2	106.4	
4/9	DNO		83,300	44							
4/10	0		74,800	44.4	20	10	C	310	22.6	107.5	
4/11	DNO		65,700	47.2							
4/12	0		58,400	46.1	24	10	C	310	22.0	107.6	
4/13	DNO		52,400	48.2							
4/14	0		47,900	51.2	36	10	C/A	310	18-22	107.1	
4/15	DNO		44,300	51.3							
4/16	0		41,500	51.5	30	10	C	310	22.0	108	
4/17	DNO		50,500	52.1							
4/18	0		94,000	49.9	12	10	C	310	24.5	108.8	3
4/19	DNO		121,000	48.2							
4/20	DNO		132,000	47							
4/21	2		116,000	47.3	15	11	C	310	23.4	108	
4/22	DNO		95,200	48.3							
4/23	0		79,800	50.3	15	11	C	310	23.0	107.5	
4/24	0		67,300	51.8	18	11	C	310	22.5	107.8	
4/25	0		59,100	53.1	18	10	C	310	22.0	107.6	
4/26	4		56,700	54.9	18	10	C	310	22.5	107	
4/27	5		56,400	55.8	18	11	C	310	21.9	108.1	
4/28	17		56,600	56.7	30	10	C	310	22.1	107.5	
4/29	113		55,500	57.3	20	10	C	310	22.1	107.5	
4/30	60		57,400	57.4	20	10	C	310	23.0	108.1	
5/1	7		50,100	58	24	10	C/A/C	310	20.5	107.5	
5/2	124		45,600	60.6	25	10	C	310	22.6	107.4	
5/3	432		41,900	62.7	20	9	C	310	22.3	107.5	
5/4	1,061	1 Blue	39,900	64.5	19	9	C	310	22.5	107.2	
5/5	985		38,200	65.5	20	6	C	310	21.7	106.4	
5/6	187		36,900	66.4	20	5	C	310	20.7	106.2	
5/7	5		36,700	68.3	24						

SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY

Table 2. (Continued)

Date	American Shad Catch	MD DNR Recaptures	Marietta Water		Maximum Entrance			Attraction Flow (cfs)	Tailrace Elevation (ft)	Forebay Elevation (ft)	Crest Gates Open
			River	Temp.	Secchi	Units in	Gates				
			Flow (cfs)	(°F)	(in)	Oper ation	Util- ized				
5/8	292		38,000	70.2	20	8	A/C	310	18.5	107.2	
5/9	652	2 Blue	39,700	69.4	24	8	C	310	22.4	106.8	
5/10	398		38,900	69.2	36	7	C	310	22.3	106.7	
5/11	542		37,000	70.5	30	8	A/C	310	21.0	107.1	
5/12	665	1 Yellow	35,600	71.1	36	6	A/C	310	20.5	106.7	
5/13	607	2 Blue	39,600	69.1	31	8	C	310	22.0	108.5	
5/14	163		65,400	68.9	20	10	C	310	23.1	106.1	
5/15	3		99,500	67	18	9	C	310	24.0	108.0	3
5/16	0		101,000	67	11	8	C	310	24.5	108.3	3
5/17	1		107,000	65.9	12	9	C	310	24.6	108.2	2
5/18	0		112,000	63.8	8-10	9	C	310	25.0	108.2	4
5/19	DNO		102,000	62.5							
5/20	DNO		106,000	63.2							
5/21	1		100,000	64.2	8-10	9	C	310	24.6	107.9	2
5/22	4		86,700	64.6	17	9	C	310	23.5	108.5	2
5/23	5		85,000	65.7	18	9	C	310	23.4	108.2	2
5/24	2		144,000	66.9	18	9	C	310	24.1	108.1	4
5/25	DNO		126,000	67.6			C	310			
5/26	0		95,400	67.4	8	9	C	310	24.4	108.7	2
5/27	6		74,700	68.4	8-10	9	C	310	23.3	107.4	
5/28	25		61,400	69.7	8-10	9	C	310	22.9	107.8	
5/29	108		54,400	71.4	15-18	9	C	310	23.1	107.5	
5/30	100		50,200	73.1	16	9	C	310	22.9	107.3	
5/31	133		46,600	72.6	18	8	C	310	22.9	106.5	
6/1	120		43,000	73.9	20	8	C	310	22.8	107.5	
6/2	85		41,200	75.5	20	8	C	310	22.3	108.3	
6/3	78		39,400	74.7	20	7	C	310	22.5	108.6	

*SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY*

Table 3. Hourly summary of American Shad passage at the Conowingo Dam East Fish Passage Facility in 2018.

<b>Date:</b>	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13
<b>Observation Time-Start:</b>	8:00		8:00		8:00		8:00		8:00		8:00	
<b>Observation Time-End:</b>	16:00		16:00		16:00		16:00		16:00		16:00	
<b>Military Time (hrs)</b>												
0600 to 0659												
0700 to 0759												
0800 to 0859	0		0		0		0		0		0	
0900 to 0959	0		0		0		0		0		0	
1000 to 1059	0		0		0		0		0		0	
1100 to 1159	0		0		0		0		0		0	
1200 to 1259	0		0		0		0		0		0	
1300 to 1359	0		0		0		0		0		0	
1400 to 1459	0		0		0		0		0		0	
1500 to 1559	0		0		0		0		0		0	
1600 to 1659												
1700 to 1759												
1800 to 1859												
1900 to 1959												
2000 to 2059												
<b>Total</b>	0	0	0	0	0	0	0	0	0	0	0	0

<b>Date:</b>	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25
<b>Observation Time-Start:</b>	8:00		8:00		8:00			8:00		8:00	8:00	8:00
<b>Observation Time-End:</b>	16:10		16:00		16:00			16:00		16:30	16:30	16:30
<b>Military Time (hrs)</b>												
0600 to 0659												
0700 to 0759												
0800 to 0859	0		0		0			0		0	0	0
0900 to 0959	0		0		0			0		0	0	0
1000 to 1059	0		0		0			0		0	0	0
1100 to 1159	0		0		0			0		0	0	0
1200 to 1259	0		0		0			0		0	0	0
1300 to 1359	0		0		0			0		0	0	0
1400 to 1459	0		0		0			2		0	0	0
1500 to 1559	0		0		0			0		0	0	0
1600 to 1659	0									0	0	0
1700 to 1759												
1800 to 1859												
1900 to 1959												
2000 to 2059												
<b>Total</b>	0	0	0	0	0	0	0	2	0	0	0	0

SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY

Table 3. (Continued)

Date:	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7
Observation Time-Start:	8:00	8:00	8:00	8:00	8:00	8:00	9:00	9:15	9:15	8:00	8:00	9:10
Observation Time-End:	16:30	16:30	16:30	17:30	18:30	18:15	18:20	18:30	18:15	19:15	16:45	11:45
Military Time (hrs)												
0600 to 0659												
0700 to 0759												
0800 to 0859	0	0	1	0	16	0	0			40	52	
0900 to 0959	2	1	2	1	6	0	1	76	9	32	54	0
1000 to 1059	0	1	4	2	7	1	1	71	175	20	5	2
1100 to 1159	1	0	1	10	0	0	5	38	230	48	10	3
1200 to 1259	1	0	1	3	10	0	4	25	265	39	8	
1300 to 1359	0	0	0	1	3	3	4	39	87	64	8	
1400 to 1459	0	0	4	9	4	2	17	76	61	37	8	
1500 to 1559	0	1	2	15	2	0	42	58	61	73	15	
1600 to 1659	0	2	2	54	9	0	19	20	96	59	27	
1700 to 1759				18	1	0	31	15	52	233		
1800 to 1859					2	1		14	25	283		
1900 to 1959										57		
2000 to 2059												
<b>Total</b>	4	5	17	113	60	7	124	432	1,061	985	187	5

Date:	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19
Observation Time-Start:	10:00	10:00	9:40	9:30	9:30	9:24	9:30	8:00	8:00	8:00	8:00	
Observation Time-End:	18:15	18:30	18:10	18:10	18:10	18:10	18:30	16:10	16:00	16:10	14:00	
Military Time (hrs)												
0600 to 0659												
0700 to 0759												
0800 to 0859								1	0	0	0	
0900 to 0959			60	45	14	22	20	0	0	0	0	
1000 to 1059	25	26	66	157	14	7	29	0	0	0	0	
1100 to 1159	81	15	62	181	22	80	38	0	0	0	0	
1200 to 1259	68	36	81	94	25	247	22	0	0	0	0	
1300 to 1359	20	181	54	40	9	64	12	0	0	0	0	
1400 to 1459	33	145	31	12	5	92	17	1	0	1		
1500 to 1559	29	106	14	8	161	76	17	1	0	0		
1600 to 1659	8	96	15	2	336	7	4	0		0		
1700 to 1759	20	28	11	2	60	12	4					
1800 to 1859	8	19	4	1	19		0					
1900 to 1959												
2000 to 2059												
<b>Total</b>	292	652	398	542	665	607	163	3	0	1	0	0

*SUMMARY OF OPERATIONS AT THE CONOWINGO DAM EAST FISH PASSAGE FACILITY*

**Table 3. (Continued)**

<b>Date:</b>	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
<b>Observation Time-Start:</b>		8:00	8:00	8:00	8:00		8:00	8:00	8:00	8:00	8:00	9:30
<b>Observation Time-End:</b>		16:05	16:30	16:10	12:20		16:30	16:15	16:15	18:30	18:10	18:40
<b>Military Time (hrs)</b>												
0600 to 0659												
0700 to 0759												
0800 to 0859		0	1	0	1		0	0	0	9	3	
0900 to 0959		0	0	0	0		0	0	0	5	2	4
1000 to 1059		0	0	0	0		0	1	1	12	7	33
1100 to 1159		0	0	2	0		0	0	7	14	13	13
1200 to 1259		0	1	0	1		0	0	0	16	25	28
1300 to 1359		0	1	0			0	1	1	13	30	17
1400 to 1459		0	1	2			0	2	5	3	12	2
1500 to 1559		1	0	1			0	1	6	7	5	7
1600 to 1659		0	0	0			0	1	5	9	2	10
1700 to 1759										15	0	9
1800 to 1859										5	1	10
1900 to 1959												
2000 to 2059												
<b>Total</b>	0	1	4	5	2	0	0	6	25	108	100	133

<b>Date:</b>	6/1	6/2	6/3	<b>Season Total</b>
<b>Observation Time-Start:</b>	9:20	8:00	8:00	
<b>Observation Time-End:</b>	18:30	18:15	18:15	
<b>Military Time (hrs)</b>				
0600 to 0659				<b>0</b>
0700 to 0759				<b>0</b>
0800 to 0859		0	11	<b>124</b>
0900 to 0959	11	3	23	<b>367</b>
1000 to 1059	34	3	7	<b>704</b>
1100 to 1159	30	14	5	<b>918</b>
1200 to 1259	10	12	3	<b>1,049</b>
1300 to 1359	16	12	2	<b>677</b>
1400 to 1459	9	3	2	<b>614</b>
1500 to 1559	5	7	5	<b>723</b>
1600 to 1659	4	9	8	<b>800</b>
1700 to 1759	1	15	7	<b>532</b>
1800 to 1859	0	7	5	<b>415</b>
1900 to 1959				<b>69</b>
2000 to 2059				<b>0</b>
<b>Total</b>	120	85	78	<b>6,992</b>

Table 4. Summary Information for Conowingo EFL Volitional Passage, 1997 through 2018.

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
2014	54	509	988	1,192,750	10,425	1,170,200	136	1,207	1/112
2015	46	433	674	754,057	8,341	742,661	13	1,119	1/89
2016	55	536	860	865,179	14,276	833,681	34	1,006	1/58
2017	46	463	849	844,917	16,265	813,687	65	995	1/50
<b>2018</b>	<b>48</b>	<b>416</b>	<b>714</b>	<b>1,040,789</b>	<b>6,992</b>	<b>1,022,819</b>	<b>60</b>	<b>1,458</b>	<b>1/146</b>

Table 5. Summary of selected operation and fish catch statistics at the Conowingo Dam East Fish Passage Facility, 1991 to 2018.

Year	Number of Days Operated	Number of Lifts	Operating Time (hrs)	Number of Species	American Shad	Blueback herring	Alewife	Hickory Shad
1991	60	1168	647.2	42	13,897	13,149	323	0
1992	49	599	454.1	35	26,040	261	3	0
1993	42	848	463.5	29	8,203	4,574	0	0
1994	55	955	574.8	36	26,715	248	5	1
1995	68	986	706.2	36	46,062	4,004	170	1
1996	49	599	454.1	35	26,040	261	3	0
1997	64	652	640.0	36	90,971	242,815	63	0
1998	50	652	640.0	33	39,904	700	6	0
1999	52	610	467.0	31	69,712	130,625	14	0
2000	45	570	367.8	30	153,546	14,963	2	0
2001	43	559	359.8	30	193,574	284,921	7,458	0
2002	49	560	440.7	31	108,001	2,037	74	6
2003	44	645	416.6	25	125,135	530	21	0
2004	44	590	390.3	30	109,360	101	89	0
2005	52	541	434.3	30	68,926	4	0	0
2006	61	619	429.8	32	56,899	0	0	4
2007	39	479	335.3	31	25,464	460	429	0
2008	51	483	407.0	29	19,914	1	4	0
2009	57	618	495.6	30	29,272	71	160	0
2010	59	685	526.2	38	37,757	4	1	0
2011	15	259	142.4	24	20,571	17	2	20
2012	62	1230	633.7	35	22,143	25	27	0
2013	60	925	575.6	27	12,733	7	0	1
2014	54	988	509	34	10,425	25	111	2
2015	46	674	433	28	8,341	3	10	8
2016	55	860	536	27	14,276	34	0	0
2017	46	849	463	32	16,265	59	6	0
<b>2018</b>	<b>48</b>	<b>714</b>	<b>416</b>	<b>25</b>	<b>6,992</b>	<b>2</b>	<b>58</b>	<b>0</b>

Table 6. Summary of American Shad passage counts and percent passage values at Susquehanna River dams, 1997-2018.

Year	Conowingo East	Holtwood*		Safe Harbor		York Haven**	
		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%
2014	10,425	2,589	24.8%	1,336	51.6%	8	0.6%
2015	8,341	5,286	63.3%	3,896	73.7%	43	1.1%
2016	14,276	6,718	47.0%	4,242	63.1%	178	4.2%
2017	16,265	3,171	19.5%	2,007	63.3%	62	3.1%
<b>2018</b>	<b>6,992</b>	<b>1,483</b>	<b>21.2%</b>	<b>661</b>	<b>44.6%</b>	<b>N/A</b>	<b>N/A</b>

\*Includes all American Shad passed at Holtwood during resident and migratory fish passage operations.

\*\*Visual counts not conducted at York Haven in spring, 2018.

## Appendix 1

Draft

## Ray Bleistine

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**From:** Fish Lift  
**Sent:** Monday, May 07, 2018 7:41 AM  
**To:** Sheila\_Eyler@fws.gov; brett\_towler@fws.gov; ahenning@srbc.net; Don.Pugh@yahoo.com; dklemon@gw.dec.state.ny.us; paul.adair@exeloncorp.com; Adams, Erik T;(GenCo-Pwr); Jesus\_Morales@fws.gov; Mike.Tursi@exeloncorp.com; Larry\_M\_Miller@fws.gov; ashiels@pa.gov; Barb Tollinger; Ray Bleistine; Robert.Matty@exeloncorp.com; Chris.Frese@KleinschmidtUSA.com; Colleen.Hicks@exeloncorp.com; steve\_minkkinen@fws.gov; David\_Sutherland@fws.gov; Dilip Mathur; Jim Thompson; tiklinger@pa.gov; tsullivan@gomezandsullivan.com; Jay Ryan; jennifer.gutekunst@exeloncorp.com; jtrynnews@pa.gov; ksmith@gomezandsullivan.com; Chris Avalos; Doug Royer; Tim Brush; Andrea.Danucalov@exeloncorp.com; bob.sadzinski@maryland.gov; Brandon.Commodore@exeloncorp.com; brett.coakley@maryland.gov; Cheri.Peifer@exeloncorp.com; glemay@gomezandsullivan.com; grpSHWPFishLift@brookfieldrenewable.com; jeremmille@pa.gov; Kevin.N.Craft@constellation.com; patricia.boling@exeloncorp.com; Richard\_McCorkle@fws.gov; scwilliams@pa.gov; shawn.seaman@maryland.gov; timothy.bridgeford@exeloncorp.com; genine.mcclair@maryland.gov; Jay.Campbell@exeloncorp.com; Bryan Didonato; Fredp.smith@exeloncorp.com; harry.rickabaugh@maryland.gov  
**Subject:** Revised EFL Daily report for 5/6/18  
**Attachments:** Daily Report 5-6.xls

Please disregard the daily report sent last evening for the Conowingo East Fish Lift. The attached file has been corrected. Yesterday, at 1645 hours, the EFL hopper malfunctioned resulting in a shutdown of the facility. Exelon was notified immediately and they are assessing the situation. Additional information regarding the necessary repair and expected time will be provided when that information becomes available.

Today we passed 187 American shad;  
Season total is now 2,997.  
Next day of operation will be:

**Normandeau Fish Lift Team**  
1921 River Road  
Drumore, PA 17518  
Project Manager  
Ray Bleistine  
(717)207-8367

## Ray Bleistine

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**From:** Danucalov, Andrea H:(GenCo-Pwr) <Andrea.Danucalov@exeloncorp.com>  
**Sent:** Monday, May 07, 2018 5:10 PM  
**To:** Fish Lift; Sheila\_Eyler@fws.gov; brett\_towler@fws.gov; ahenning@srbc.net; Don.Pugh@yahoo.com; dklemon@gw.dec.state.ny.us; Adair, Paul V:(GenCo-Pwr); Adams, Erik T:(GenCo-Pwr); Jesus\_Morales@fws.gov; Tursi, Michael A:(GenCo-Pwr); Larry\_M\_Miller@fws.gov; ashieles@pa.gov; Barb Tollinger; Ray Bleistine; Matty Jr, Robert M:(GenCo-Pwr); Chris.Frese@KleinschmidtUSA.com; Hicks, Colleen E:(GenCo-Pwr); steve\_minkkinen@fws.gov; David\_Sutherland@fws.gov; Dilip Mathur; Jim Thompson; tiklinger@pa.gov; tsullivan@gomezandsullivan.com; Jay Ryan; Gutekunst, Jennifer:(GenCo-Pwr); jtrynnews@pa.gov; ksmith@gomezandsullivan.com; Chris Avalos; Doug Royer; Tim Brush; bob.sadzinski@maryland.gov; Commodore, Brandon M:(GenCo-Pwr); brett.coakley@maryland.gov; Peifer, Cheri A:(GenCo-Pwr); glemay@gomezandsullivan.com; grpSHWPFishLift@brookfieldrenewable.com; jeremmille@pa.gov; Craft, Kevin N:(GenCo-Pwr); Boling, Patricia Carlson:(GenCo-Pwr); Richard\_McCorkle@fws.gov; scwilliams@pa.gov; shawn.seaman@maryland.gov; Bridgeford, Timothy S:(GenCo-Pwr); genine.mcclair@maryland.gov; Campbell, John B:(GenCo-Pwr); DiDonato, Bryan J:(GenCo-Pwr); Smith, Fred P:(GenCo-Pwr); harry.rickabaugh@maryland.gov  
**Subject:** RE: Conowingo East Fish Lift Daily report for May 7, 2018 - Update

All,

Background: at 16:45 on May 6, 2018, the east side hopper cable snapped on the EFL. The EFL, which began operation for the season on April 2, 2018, had operated on May 6, 2018 with over 20 lifts prior to 16:45 with no issues. Normandeu immediately pushed the stop button. The hopper was stopped just above the water line about 20 feet below the EFL control room. Approximately 2,220 gizzard shad and 2 small mouth bass died as a result of being stuck in the hopper.

Maintenance is currently working to replace the east side hopper cable after safely securing the hopper in place.

The west side hopper cable is being replaced as a preventative measure.

Once both the cables have been replaced, the hopper will be lifted to the trough. From the trough, the dead fish will be transferred to a tank and disposed of off-site properly.

We expect to have the EFL back in service on Wednesday, May 9, 2018. Additional updates will be provided. Every effort is being made to safely return the EFL to service as quickly as possible.

Please let me know if you have any questions.

Andrea

**Andrea Danucalov**  
FERC License Compliance Manager

## Ray Bleistine

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**From:** Danucalov, Andrea H:(GenCo-Pwr) <Andrea.Danucalov@exeloncorp.com>  
**Sent:** Tuesday, May 08, 2018 10:46 AM  
**To:** Fish Lift; Sheila\_Eyler@fws.gov; brett\_towler@fws.gov; ahenning@srbc.net; Don.Pugh@yahoo.com; dklemon@gw.dec.state.ny.us; Adair, Paul V:(GenCo-Pwr); Adams, Erik T:(GenCo-Pwr); Jesus\_Morales@fws.gov; Tursi, Michael A:(GenCo-Pwr); Larry\_M\_Miller@fws.gov; ashiels@pa.gov; Barb Tollinger; Ray Bleistine; Matty Jr, Robert M:(GenCo-Pwr); Chris.Frese@KleinschmidtUSA.com; Hicks, Colleen E:(GenCo-Pwr); steve\_minkkinen@fws.gov; David\_Sutherland@fws.gov; Dilip Mathur; Jim Thompson; tiklinger@pa.gov; tsullivan@gomezandsullivan.com; Jay Ryan; Gutekunst, Jennifer:(GenCo-Pwr); jtrynnews@pa.gov; ksmith@gomezandsullivan.com; Chris Avalos; Doug Royer; Tim Brush; bob.sadzinski@maryland.gov; Commodore, Brandon M:(GenCo-Pwr); brett.coakley@maryland.gov; Peifer, Cheri A:(GenCo-Pwr); glemay@gomezandsullivan.com; grpSHWPFishLift@brookfieldrenewable.com; jeremmille@pa.gov; Craft, Kevin N:(GenCo-Pwr); Boling, Patricia Carlson:(GenCo-Pwr); Richard\_McCorkle@fws.gov; scwilliams@pa.gov; shawn.seaman@maryland.gov; Bridgeford, Timothy S:(GenCo-Pwr); genine.mcclair@maryland.gov; Campbell, John B:(GenCo-Pwr); DiDonato, Bryan J:(GenCo-Pwr); Smith, Fred P:(GenCo-Pwr); harry.rickabaugh@maryland.gov  
**Subject:** RE: Conowingo East Fish Lift Daily report for May 8, 2018 - Update

All,

The EFL returned to service at approximately 8:40 am this morning. Since then, five (5) hopper lifts have occurred with no issues.

Twenty-five (25) American Shad have been identified and passed through the trough.

We will send an end of day report summarizing the fish lifts.

Please let me know if you have any questions.

Andrea

**Andrea Danucalov**  
FERC License Compliance Manager



Exelon Generation  
300 Exelon Way  
Kennett Square, PA 19348  
New Phone Number - Skype: 267.533.1125  
Fax: 610.765.5805  
Cell: 610.301.1664  
[andrea.danucalov@exeloncorp.com](mailto:andrea.danucalov@exeloncorp.com)

**From:** Danucalov, Andrea H:(GenCo-Pwr)  
**Sent:** Monday, May 7, 2018 5:10 PM

## Appendix 2

Draft

## Ray Bleistine

---

**From:** Sheila Eyler <sheila\_eyler@fws.gov>  
**Sent:** Friday, June 01, 2018 11:18 AM  
**To:** Ray Bleistine  
**Cc:** Danucalov, Andrea; Lester, Katie; Doug Royer  
**Subject:** Re: [EXTERNAL] Final Radio-tag event in EFL trough and Shutdown scenario

Ray,

Thank you for the update. Glad you were able to get all the fish tagged. Hoping for good results!

The proposed shutdown scenario is acceptable to PFBC, MDNR and FWS - I am confirming as with with PADEP for Holtwood, but am assuming at this time that there will be no objection. Please move forward with implementation. I believe Jeremy will be on the EPAG call at 1:00 today and we can get verbal confirmation from him at that time if I don't hear from him sooner.

Thanks again and have a good weekend.

Sheila Eyler  
U.S. Fish & Wildlife Service  
Mid-Atlantic Fish and Wildlife Conservation Office  
177 Admiral Cochrane Dr., Annapolis, MD 21401  
410-573-4554 (O)  
717-387-2117 (C)  
[Sheila\\_Eyler@fws.gov](mailto:Sheila_Eyler@fws.gov)

On Fri, Jun 1, 2018 at 11:02 AM Ray Bleistine <[rbleistine@normandeau.com](mailto:rbleistine@normandeau.com)> wrote:

Hello Sheila,

Normandeau conducted a final tagging event in the Conowingo EFL trough this morning. Overall, the shad were in good condition with the majority of them having little to no scale loss. One female shad was discarded as it was spent, but a total of 31 American Shad were tagged as of 9:15 AM this morning. At this point, all 320 radio-tags have been used. In light of this, I am proposing the following shut down scenario as briefly discussed with you yesterday:

Conowingo EFL: shut down after full-day operations end on Sunday, 6/3/18;

Holtwood: continue migratory fish passage operation (8:00 AM - 6:00 PM) through Wednesday 6/6/18 to allow five full days for radio-tagged shad to exit Conowingo EFL and pass Holtwood's facility; starting Thursday 6/7/18, the Holtwood fish lift switches to Resident Fish Passage Operation (9:00 AM to 3:00 PM);

Safe Harbor: Shut down of the facility after operations end on Friday, 6/8/18;

## Ray Bleistine

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**From:** Miller, Jeremy <jeremmille@pa.gov>  
**Sent:** Friday, June 01, 2018 2:56 PM  
**To:** Ray Bleistine; Danucalov, Andrea H:(GenCo-Pwr)  
**Cc:** Sheila Eyler; Williamson, Scott; Mccollum, Allyson  
**Subject:** FW: [EXTERNAL] Final Radio-tag event in EFL trough and Shutdown scenario

Ray,

PADEP concurs with the proposed shutdown scenario for the 2018 migratory fish passage season.

Thanks,  
Jeremy

**Jeremy Miller** | Aquatic Biologist II  
Department of Environmental Protection | Clean Water Program  
Southcentral Regional Office  
909 Elmerton Ave. | Hbg PA 17110  
Phone: 717.705.4777 | Fax: 717.705.4760  
[www.dep.pa.gov](http://www.dep.pa.gov)

----- Forwarded message -----

**From:** Ray Bleistine <[rbleistine@normandeau.com](mailto:rbleistine@normandeau.com)>  
**Date:** Fri, Jun 1, 2018 at 11:02 AM  
**Subject:** [EXTERNAL] Final Radio-tag event in EFL trough and Shutdown scenario  
**To:** Sheila Eyler <[sheila\\_eyler@fws.gov](mailto:sheila_eyler@fws.gov)>  
**Cc:** Danucalov, Andrea H:(GenCo-Pwr) <[Andrea.Danucalov@exeloncorp.com](mailto:Andrea.Danucalov@exeloncorp.com)>, Lester, Katie <[Kathleen.Lester@brookfieldrenewable.com](mailto:Kathleen.Lester@brookfieldrenewable.com)>, Doug Royer <[droyer@normandeau.com](mailto:droyer@normandeau.com)>

Hello Sheila,

Normandeau conducted a final tagging event in the Conowingo EFL trough this morning. Overall, the shad were in good condition with the majority of them having little to no scale loss. One female shad was discarded as it was spent, but a total of 31 American Shad were tagged as of 9:15 AM this morning. At this point, all 320 radio-tags have been used. In light of this, I am proposing the following shut down scenario as briefly discussed with you yesterday:

Conowingo EFL: shut down after full-day operations end on Sunday, 6/3/18;

Holtwood: continue migratory fish passage operation (8:00 AM - 6:00 PM) through Wednesday 6/6/18 to allow five full days for radio-tagged shad to exit Conowingo EFL and pass Holtwood's facility; starting Thursday 6/7/18, the Holtwood fish lift switches to Resident Fish Passage Operation (9:00 AM to 3:00 PM);

Safe Harbor: Shut down of the facility after operations end on Friday, 6/8/18;

## Appendix 3

Draft

**Summary of Tier II radio-telemetry tagging events in the Conowingo EFL trough during spring, 2018.**

<b>Release No.</b>	<b>Date</b>	<b>No. Released</b>	<b>Water Temp °F</b>	<b>Start Tagging</b>	<b>End Tagging</b>	<b>Total Tagging Time (minutes)</b>
1	5/3/2018	32	59.4	845	915	45
2	5/4/2018	32	62.6	845	905	20
3	5/7/2018	1	66.2	845	935	50
4	5/10/2018	50	69.9	845	940	55
5	5/11/2018	45	69.7	837	935	58
6	5/12/2018	15	68.9	825	905	40
7	5/13/2018	49	69.9	823	924	61
8	5/14/2018	47	69.9	835	930	55
9	5/31/2018	27	72.5	855	920	25
10	6/1/2018	31	71.6	825	905	40

## Appendix 4

Draft

## Ray Bleistine

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**From:** Danucalov, Andrea H:(GenCo-Pwr) <Andrea.Danucalov@exeloncorp.com>  
**Sent:** Tuesday, April 17, 2018 1:02 PM  
**To:** Hicks, Colleen E:(GenCo-Pwr); Bennett, Bryan J:(GenCo-Pwr); Campbell, John B:(GenCo-Pwr); Smith, Fred P:(GenCo-Pwr); Commodore, Brandon M:(GenCo-Pwr); Tom Sullivan; Ray Bleistine; Mike Martinek; Cutler, Todd D:(BSC); Ryan, H Alfred:(BSC); Jay T. Ryan (jay.ryan@bakerbotts.com); marcia.hook@bakerbotts.com  
**Subject:** FW: [EXTERNAL] 2018 SRAFRFC BMPs for Invasive Species at Susquehanna River Fish Lifts  
**Attachments:** SRAFRFC 2018 Fish Lift BMPs for Invasives 04\_17\_2018.docx

See below and attached from Sheila Eyler. Document seems to reflect what we provided with the exception of our concern that during removal of invasive species from the EFL could result in mortality of other fish (due to low DO, etc)

Let me know if you have any concerns/questions. I will talk with Sheila about adding our concern about the EFL and Exelon/Normandeau would not be responsible for any mortality resulting from shutting down the EFL to remove invasive species.

Andrea

**Andrea Danucalov**  
FERC License Compliance Manager



Exelon Generation  
300 Exelon Way  
Kennett Square, PA 19348  
New Phone Number - Skype: 267.533.1125  
Fax: 610.765.5805  
Cell: 610.301.1664  
[andrea.danucalov@exeloncorp.com](mailto:andrea.danucalov@exeloncorp.com)

**From:** Eyler, Sheila [mailto:sheila\_eyler@fws.gov]  
**Sent:** Tuesday, April 17, 2018 12:19 PM  
**To:** Danucalov, Andrea H:(GenCo-Pwr) <Andrea.Danucalov@exeloncorp.com>; Campbell, John B:(GenCo-Pwr) <Jay.Campbell@exeloncorp.com>; Lester, Katie <Kathleen.Lester@brookfieldrenewable.com>  
**Subject:** [EXTERNAL] 2018 SRAFRFC BMPs for Invasive Species at Susquehanna River Fish Lifts

Andrea, Jay, and Katie,

Please see the attached document recently approved for implementation by the Susquehanna River Anadromous Fish Restoration Cooperative (SRAFRFC) Policy Committee.

The request is that Exelon and Brookfield implement these voluntary measures for the 2018 fish passage season to minimize the spread of invasive species through the fish lifts.

If you have questions or concerns about this document or would like SRAFRFC to consider edits to the document, please let me know.

Thank you for all of your feedback in working with the resource agencies on this issue in the past months. Your cooperation is greatly appreciated.

Sheila Eyler  
SRAFRC Coordinator  
U.S. Fish & Wildlife Service  
Mid-Atlantic Fish and Wildlife Conservation Office  
177 Admiral Cochrane Dr., Annapolis, MD 21401  
410-573-4554 (O)  
717-387-2117 (C)  
[Sheila\\_Eyler@fws.gov](mailto:Sheila_Eyler@fws.gov)

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# **2018 Susquehanna River Fish Passage Voluntary Best Management Practices to Mitigate Spread of Aquatic Invasive Species**

Date: April 17, 2018

**Goal:** Achieve appreciable results for American shad passage in 2018, including completing telemetry study objectives while utilizing voluntary best management practices to minimize the introduction and spread of aquatic invasive species (AIS) into the Susquehanna River through the fish lifts at Conowingo, Holtwood and Safe Harbor Dams.

## **Conowingo:**

1. Begin migratory fish passage operations on April 2, 2018.
2. Prioritize operations to complete tagging for telemetry studies early in the fish passage season to reduce likelihood of invasive species passage.
3. Notify Resource Agencies (Agencies) if an invasive species is observed at Conowingo Dam (see Agency Notification Protocol below) under any of the following circumstances:
  - a. Collected in the Conowingo West Fish Lift (WFL)
  - b. Collected in the Conowingo East Fish Lift (EFL)
  - c. Passed in the EFL into Conowingo Pond
4. EFL Operations
  - a. View the hopper dumping into the fish exit trough. If an invasive species is viewed in the hopper or chute, close the gate at the viewing window immediately, and institute a draw-down to remove the invasive species from the trough before releasing the remaining fish into Conowingo Pond.
  - b. Remove any invasive species that are observed while conducting tagging operations in the East Fish Lift trough.
5. WFL Operations
  - a. Remove any invasive species that are collected in the West Fish Lift.
6. For all invasive species collected at Conowingo Dam, kill or dispatch the fish and place it in the freezer (used for shad heads during the tank spawning studies) and the Agencies will dispose of the fish.
  - a. If freezer space becomes limited during the fish passage season, please notify Resource Agency staff, (Sheila\_Eyler@fws.gov, jtrynnews@pa.gov, and genine.mcclair@maryland.gov) and we will arrange for pick-up.
  - b. If freezer space is not limited, at the end of the season, send the frozen invasive species with the shad heads to the Van Dyke Hatchery.

7. The Agencies will consult with Normandeau, Exelon, and Brookfield on closure of volitional fish passage in 2018 to occur at, or near, the end of the American shad upstream migration period. Expected proportion of fish passage by date based on environmental conditions (see Appendix) will be considered in making a final closure decision.

**Holtwood:**

1. Begin resident fish passage operations April 2, 2018.
2. Notify Agencies (see Agency Notification Protocol) if an invasive species is passed at Holtwood Dam.

**Safe Harbor:**

1. Begin resident fish passage operations when the American shad passage at Holtwood Dam trigger is met.
2. Notify Agencies (see Agency Notification Protocol) if an invasive species is passed at Safe Harbor Dam.

**Agency Notification Protocol:**

1. If an invasive species (Northern Snakehead or Blue Catfish) is captured and removed or passed in a fish lift, notify the Agencies within 24 hours.
2. Notification should be sent by email to Sheila Eyler (Sheila\_Eyler@fws.gov) with a copy to station management. If email is not accessible during that time period, call 717-387-2117.
3. Notification should include:
  - a. Species name and number observed/collected
  - b. Disposition of the fish (collected or passed)
  - c. Approximate size of fish
  - d. Date and time of passage
  - e. Estimated flow thru the dam at time of passage
4. The SRAFRC Policy Board will convene within 72 hours to decide how to address the invasive species incident.

**Appendix.** Daily estimates for percent of cumulative shad passage occurring by date at Conowingo Dam, based on multiple scenarios of spring air temperature and river flow based on data from 2008-2017.

<b>Date</b>	<b>Typical</b>	<b>high flow; cool</b>	<b>high flow; warm</b>	<b>low flow; cool</b>	<b>low flow; warm</b>	<b>T&amp;T model 1990-2014</b>
1-Apr	0%	0%	0%	0%	0%	1%
2-Apr	0%	0%	0%	0%	3%	1%
3-Apr	0%	0%	0%	0%	3%	1%
4-Apr	0%	0%	0%	0%	6%	1%
5-Apr	0%	0%	0%	0%	7%	1%
6-Apr	0%	0%	0%	0%	8%	1%
7-Apr	0%	0%	0%	0%	9%	1%
8-Apr	0%	0%	0%	0%	10%	2%
9-Apr	0%	0%	0%	0%	11%	2%
10-Apr	0%	0%	0%	0%	12%	2%
11-Apr	0%	0%	0%	0%	12%	2%
12-Apr	0%	0%	0%	0%	12%	3%
13-Apr	1%	0%	0%	0%	14%	3%
14-Apr	1%	0%	0%	0%	17%	3%
15-Apr	1%	0%	0%	0%	20%	4%
16-Apr	1%	0%	0%	0%	21%	4%
17-Apr	1%	0%	2%	0%	24%	5%
18-Apr	2%	0%	5%	0%	30%	6%
19-Apr	4%	0%	9%	0%	33%	7%
20-Apr	8%	0%	10%	0%	35%	8%
21-Apr	12%	0%	12%	0%	37%	9%
22-Apr	15%	0%	14%	0%	37%	10%
23-Apr	17%	0%	14%	0%	37%	11%
24-Apr	21%	0%	14%	0%	45%	12%
25-Apr	22%	0%	14%	1%	46%	14%
26-Apr	23%	1%	14%	15%	46%	16%
27-Apr	23%	4%	14%	25%	54%	18%
28-Apr	25%	15%	16%	31%	55%	20%
29-Apr	26%	21%	19%	37%	55%	22%
30-Apr	29%	21%	23%	38%	56%	24%
1-May	31%	21%	25%	38%	57%	27%
2-May	35%	21%	31%	51%	59%	30%
3-May	42%	21%	32%	56%	60%	33%
4-May	49%	22%	32%	58%	63%	36%
5-May	51%	22%	33%	63%	69%	39%
6-May	53%	23%	34%	73%	72%	43%
7-May	56%	26%	34%	75%	72%	46%

8-May	59%	26%	34%	79%	74%	50%
9-May	60%	32%	34%	81%	75%	53%
10-May	64%	39%	34%	82%	76%	57%
11-May	67%	49%	37%	85%	76%	60%
12-May	69%	57%	42%	87%	76%	63%
13-May	73%	86%	46%	87%	77%	66%
14-May	75%	88%	56%	87%	82%	69%
15-May	76%	89%	63%	87%	82%	72%
16-May	78%	89%	71%	87%	83%	75%
17-May	81%	89%	75%	87%	83%	78%
18-May	82%	89%	77%	87%	83%	80%
19-May	83%	89%	79%	88%	83%	82%
20-May	84%	89%	85%	91%	84%	84%
21-May	85%	89%	89%	92%	86%	86%
22-May	86%	89%	94%	93%	88%	88%
23-May	88%	89%	95%	94%	92%	89%
24-May	89%	89%	96%	95%	94%	90%
25-May	91%	89%	96%	95%	96%	92%
26-May	93%	89%	98%	96%	97%	93%
27-May	94%	89%	99%	97%	99%	94%
28-May	95%	90%	99%	97%	99%	94%
29-May	96%	90%	100%	98%	100%	95%
30-May	97%	91%	100%	98%	100%	96%
31-May	98%	92%	100%	98%	100%	96%
1-Jun	98%	93%	100%	100%	100%	97%
2-Jun	99%	96%	100%	100%	100%	97%
3-Jun	99%	98%	100%	100%	100%	98%
4-Jun	100%	98%	100%	100%	100%	98%
5-Jun	100%	98%	100%	100%	100%	98%
6-Jun	100%	99%	100%	100%	100%	99%
7-Jun	100%	100%	100%	100%	100%	99%
8-Jun	100%	100%	100%	100%	100%	99%
9-Jun	100%	100%	100%	100%	100%	99%
10-Jun	100%	100%	100%	100%	100%	100%



## **2018 Fish Passage Season Operation Modification of Conowingo Fish Lifts to Impede the Expansion of Invasive Fish Species Into Areas Upstream of Conowingo Dam**

The United States Fish and Wildlife Service (USFWS), Maryland Department of Natural Resources (MDNR), Pennsylvania Fish and Boat Commission (PFBC), and Susquehanna River Basin Commission (SRBC) (collectively, Resource Agencies) have expressed concern regarding the potential for invasive species to pass through the fish passage facilities at the Conowingo Hydroelectric Project (Conowingo). Accordingly, the Resource Agencies have requested that Exelon Generation Company, LLC (Exelon) implement measures to decrease the risk that invasive species will pass through the Conowingo East Fish Lift (EFL) and West Fish Lift (WFL). This document outlines the actions that will be taken by Exelon during the 2018 Fish Passage Season.

### **Conowingo EFL:**

The Conowingo EFL is operated by Normandeau on behalf of Exelon. The Conowingo EFL currently has no means to prevent volitional passage of any fish species once it swims past the viewing window. Moreover, Exelon and Normandeau cannot guarantee the capture of the invasive fish if it is observed in the hopper or fish trough. Nonetheless, at the request of the Resource Agencies, the following actions will be taken during the 2018 Fish Passage Season.

### **Actions:**

1. If the lift supervisor observes an invasive species in the hopper or during the hopper dump, there may be time to radio and direct the viewing technician to close the viewing window doors before the fish passes the window. If the fish passes the viewing window it is too late to capture the fish, as it takes about 5 minutes for the trough gate to close completely.
2. If the fish is successfully trapped in the downstream end of the trough, the station will have to be notified, a lockout/tagout procedure enacted prior to closing the trough gate, followed by dewatering the trough to a safe level to allow personnel safe entry into the trough to retrieve the specimen (this process may take up to 4 hours to complete).

### **Potential outcomes:**

- a. Fish is successfully retrieved in short period of time from the EFL trough.
- b. Fish is not observed; retrieval impossible due to large numbers of Gizzard Shad and other species.
3. Any invasive species that is successfully culled will be placed into a receptacle for proper disposal. USFWS/MDNR will be responsible for disposal of the invasive species and will be contacted that day to arrange for proper disposal.
4. Any invasive species retrieved from the EFL trough or observed passing the counting window will be documented and reported on that day's catch report. USFWS/MDNR will be notified as soon

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Tel. (717) 548-2121 [www.normandeau.com](http://www.normandeau.com)



as possible. In addition, Normandeau will contact MDNR to provide location and length data as required by Normandeau's Scientific Collection Permit.

5. As a result of the actions described above, including the temporary shutdown of the EFL to remove an invasive species, mortality events may occur due to, among other things, low water level, low dissolved oxygen levels, and high water temperature. All precautions will be taken to avoid a mortality event. However, Exelon and Normandeau will not be liable for any mortality event that occurs as a result of the actions described above.

#### **Conowingo WFL:**

The Conowingo WFL is operated by the PFBC and Normandeau. The Conowingo WFL does not have volitional fish passage capability, therefore, upstream passage of invasive species from this facility is not a concern. Nonetheless, Exelon has identified the following actions that could be taken with respect to invasive species at the WFL.

#### **Potential Actions:**

1. If an invasive fish species is observed during the WFL fish sorting process and is successfully culled, the fish will be documented and placed in a holding receptacle for proper disposal. MDNR will be contacted as required by Normandeau's Scientific Collection Permit to provide location and length data. USFWS/MDNR will be responsible for disposal of the invasive species and will be contacted that day to arrange for proper disposal.
2. If an invasive fish species is observed in the sorting tank but escapes capture, the fish will be able to reside in the river below Conowingo Dam, but will be prevented from moving upstream. The fish will be documented in the day's daily catch report.

These procedures will be filed with the Federal Energy Regulatory Commission.

# Invasive Species Alert

During operations of the Conowingo East and West Fish Lifts, if at any time an invasive fish species (Northern Snakehead or Blue Catfish) is observed, passed volitionally, or collected, the following personnel must be contacted ASAP:

Ray Bleistine: [Rbleistine@normandeau.com](mailto:Rbleistine@normandeau.com); 717-380-4204

Sheila Eyler: [sheila\\_eyler@fws.gov](mailto:sheila_eyler@fws.gov); 717-387-2117

Jay Campbell: [Jay.Campbell@exeloncorp.com](mailto:Jay.Campbell@exeloncorp.com); 484-844-2832

Andrea Danucalov: [Andrea.Danucalov@exeloncorp.com](mailto:Andrea.Danucalov@exeloncorp.com); 267-533-1125

Thank you for your time and dedication to the American Shad  
Restoration Program.

Sincerely,

A handwritten signature in cursive script that reads "Ray A. Bleistine".

Senior Scientist, Normandeau Associates, Inc.