



January 15, 2021

Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

**RE: Muddy Run Pumped Storage Project, FERC Project No. 2355, License Article 401 and
Conowingo Hydroelectric Project, FERC Project No. 405
2020 Conowingo Eel Collection Facility Report**

Dear Secretary Bose,


Article 401(b) of the Muddy Run Pumped Storage Project (Project) license requires Exelon Generation Company, LLC (Exelon) to file various reports, required by the Pennsylvania Department of Environmental Protection's (PADEP) Water Quality Certification and the U.S. Department of the Interior's (DOI) fishway prescription, with the Federal Energy Regulatory Commission (Commission). In part, Article 401(b) requires Exelon to file an annual American Eel Collection Facility report, documenting the performance of an eel trapping facility at Conowingo Hydroelectric Station no later than January 15th each year.

Please note that the Conowingo Eel Collection Facility operated from May 18, 2020 through October 3, 2020 instead of May 1, 2020 through September 15, 2020 due to COVID-19 state restrictions. The delayed start of the season and subsequent extension into October was approved by the Muddy Run Eel Passage Advisory Group.

The enclosed documentation provides the American Eel Collection Facility at the Conowingo Hydroelectric Station. The report was previously distributed to the PADEP and the Resource Agencies to review and to solicit comments. Comments were received in December 2020 and are included in Appendix G of the attached report.

If you have any questions regarding the attached report, please feel free to contact me at (267) 533-1125 or via email at andrea.danucalov@exeloncorp.com.

Respectfully submitted,


Andrea Danucalov
FERC License Compliance Manager
Exelon Generation
Conowingo Hydroelectric Dam
2569 Shures Landing Road
Darlington, MD 21034

cc: Scott Williamson, Pennsylvania Department of Environmental Protection
Sheila Eyer, US Fish and Wildlife Service
Josh Tryniewski, Pennsylvania Fish and Boat Commission
Aaron Henning, Susquehanna River Basin Commission
Shawn Seaman, Maryland Department of Natural Resources

Muddy Run Pumped Storage Project Conowingo Eel Collection Facility

FERC Project No. 2355



Prepared for:



Submitted On:
January 8, 2021

Prepared By:
Normandeau Associates, Inc.
1921 River Road
Drumore, Pennsylvania 17518

Table of Contents

	Page
EXECUTIVE SUMMARY	V
LIST OF ABBREVIATIONS	VII
1 INTRODUCTION.....	1
2 BACKGROUND	3
3 METHODS.....	4
3.1 DESIGN, CONSTRUCTION, AND INSTALLATION OF FACILITY	4
3.2 DATA COLLECTION	4
3.3 JUVENILE EEL TRANSPORT	4
4 RESULTS	6
4.1 JUVENILE EEL COLLECTION	6
4.2 JUVENILE EEL BIOLOGICAL DATA	6
4.3 EEL SACRIFICE AND INTERNAL ANALYSIS	7
4.4 PEAK PERIODS OF EEL COLLECTIONS.....	7
4.5 JUVENILE EEL CATCH IN RELATION TO ENVIRONMENTAL FACTORS.....	7
4.6 JUVENILE EEL HOLDING AND MORTALITY	9
4.7 JUVENILE EEL TRANSPORT AND MORTALITY.....	9
5 QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES	11
6 CONCLUSIONS AND DISCUSSION.....	13
7 REFERENCES	15
8 TABLES AND FIGURES	16

LIST OF APPENDICES:

Appendix A: COVID-19 Information, 2020

Appendix B: Method of Aging Eel Otolith, Conowingo Eel Collection Facility, 2020

Appendix C: Weekly Biological Data and Environmental Conditions for Conowingo Eel Collection Facility, 2017-2020

Appendix D: Fish Health Inspection Report, Conowingo Eel Collection Facility 2020

Appendix E: Chain of Custody Sheet, Conowingo Eel Collection Facility 2020

Appendix F: Assessment of the Current Spray Bar Apparatus at the Conowingo Eel Collection Facility, 2020

Appendix G: Agency Comments on Draft 2020 Conowingo Eel Collection Report

DISCLOSURE STATEMENT

The data contained in all pages of this document have been submitted in confidence and contain trade secrets and/or privileged or confidential information, and such data shall be used or disclosed only for evaluation purposes, provided that if a contract is awarded to this proposer as a result of or in connection with the submission of this proposal, the client shall have the right to use or disclose the data herein to the extent provided in the contract. This document includes data that shall not be disclosed outside of the purposes of this submittal and shall not be duplicated, used, or disclosed--in whole or in part--for any purpose other than for evaluation purposes.

List of Tables

	Page
Table 4.0-1: Number of Juvenile Eel Caught Daily, Conowingo Eel Collection Facility, 2020	17
Table 4.0-2: Known Eel Numbers in the 200 Milliliter Subsample during Days of Volumetric Estimates, Conowingo Eel Collection Facility, 2020	18
Table 4.2-1: Number of Juvenile Eel Captured with Length and Weight Measurements, Conowingo Eel Collection Facility, 2020	19
Table 4.2-2: Juvenile Eel Length Frequency, Conowingo Eel Collection Facility, 2020....	20
Table 4.2-3: Juvenile Eel Weight Frequency, Conowingo Eel Collection Facility, 2020 ...	21
Table 4.2-4: Observed Injuries of Juvenile American Eels, Conowingo Eel Collection Facility, 2020	22
Table 4.3-1: Sacrificed Eel Data, Conowingo Eel Collection Facility, 2020.....	23
Table 4.3-2: Sacrificed Eels Length Frequency with Detailed Info, Conowingo Eel Collection Facility, 2020	25
Table 4.4-1: Juvenile Eel Collection by Week and Ranks, Conowingo Eel Collection Facility, 2020	26
Table 4.5-1: Daily Average River flows (cfs), USGS 01578310 - Conowingo Dam USGS Gage Station, 2020.....	27
Table 4.5-2: Fraction of Moon Illumination, 2020 EST (<i>1.0 equals full moon</i>)	28
Table 4.5-3: Water Temperature (°C) Taken in Collection Tank, Conowingo Eel Collection Facility, 2020	29
Table 4.5-4: Dissolved Oxygen (mg/L) Reading from the Control Room (Station 643), Conowingo Eel Collection Facility, 2020.....	30
Table 4.6-1: Eel Transport/Stocking Data, 2020.....	31
Table 4.7-1: Detailed Individual Eel Transport Data, 2020.....	32
Table 5.0-1: Specified Operating Range of Conowingo Eel Collection Facility, 2020	37
Table 5.0-2: Calibration of Flows (Gallons per Minute), Conowingo Eel Collection Facility, 2020	38
Table 5.0-3: Quality Control Checks on Counts, Conowingo Eel Collection Facility, 2020	39
Table 6.0-1: Summary of Eel Collections and Biological Data, Conowingo Eel Collection Facility, 2017-2020.....	40

List of Figures

	Page
Figure 2.0-1: Location of the Conowingo Eel Collection Facility at Conowingo Dam, 2020	41
Figure 2.0-2: Location of the Conowingo Eel Collection Facility Just Downstream of the West Fish Lift, Conowingo, MD, 2020.....	42
Figure 2.0-3: USFWS* Weekly Catch of Juvenile American Eel at Conowingo, 2008-2016	43
Figure 3.2-1: Measuring Juvenile Eel to Nearest Millimeter While Sedated, Conowingo Eel Collection Facility, 2020.....	44
Figure 3.2-2: Weighing Juvenile Eel in Grams While Sedated, Conowingo Eel Collection Facility, 2020	45
Figure 3.3-1: Sample Location (Herring Run) of American Eel Collected for Wild Health Screening, Conowingo Eel Collection Facility, 2020.....	46
Figure 3.3-2: Herring Run, a Tributary of Susquehanna River used for the Wild Health Screening, Conowingo Dam, 2020.....	47
Figure 3.3-3: Small Eel Transport Tank, Conowingo Eel Collection Facility, 2020	48
Figure 3.3-4: Large Eel Transport Tank, Conowingo Eel Collection Facility, 2020	49
Figure 4.1-1: Daily Eel Catch, Conowingo Eel Collection Facility, 2020	50
Figure 4.2-1: Eels with Lesion, Conowingo Eel Collection Facility, 2020	51
Figure 4.2-2: Eel with Hemorrhage Tail, Conowingo Eel Collection Facility, 2020.....	52
Figure 4.2-3: Eel with Scrapes/Marks on Side, Conowingo Eel Collection Facility, 2020	53
Figure 4.2-4: Eel with Scrapes/Marks on Side, Conowingo Eel Collection Facility, 2020	54
Figure 4.3-1: Swim Bladder Parasite Dissection, Conowingo Eel Collection Facility, 2020	55
Figure 4.4-1: Percentage of Eels Collected per Week, Conowingo Eel Collection Facility, 2020	56
Figure 4.5-1: Daily Eel Catch and Daily Average River Flow (cfs, top graph) and Weekly Eel Catch and Weekly Average River Flow (cfs, bottom graph), Conowingo Eel Collection Facility, 2020.....	57

Figure 4.5-2: Eel Catch to Lunar Fraction (Daily above, Weekly Average below),
Conowingo Eel Collection Facility, 2020 (*1.0 Equals Full Moon*) 58

Figure 4.5-3: Eel Catch to Water Temperature, Conowingo Eel Collection Facility,
2020 59

Figure 4.5-4: Eel Catch to Dissolved Oxygen, Conowingo Eel Collection Facility,
2020 60

Figure 4.7-1: Normandeau Eel Stocking Sites, 2016-2020 61

Figure 4.7-2: Bloomsburg Boat Ramp (Site 8) Stocking Site, 2020 62

Figure 4.7-3: Lock Haven Boat Ramp (Site 11) Stocking Site, 2020 63

Figure 4.7-4: Wrightsville Boat Ramp (Site 3A) Stocking Site, 2020 64

Figure 4.7-4: Columbia Boat Ramp (Site 3B) Stocking Site, 2020 65

Figure 5.0-1: Transition from Rip-Rap Shoreline to Ramp Entrance, (upper)
Beginning of Season, (lower) End of Season, CECF, 2020 66

Executive Summary

Exelon Generation Company, LLC (Exelon) received a license from the Federal Energy Regulatory Commission (FERC) on December 22, 2015 for the Muddy Run Pumped Storage Project (Muddy Run Project). An American Eel, *Anguilla rostrata*, Passage Plan (Eel Plan) was developed by Exelon and was included as a condition of the Pennsylvania (PADEP) 401 Water Quality Certification (PADEP File No. EA 36-033; dated December 10, 2014) for the Muddy Run Project. This plan is also a condition of the FERC license for the Muddy Run Project. Specifically, the Eel Plan states that Exelon will trap, hold, and transport American Eels from the Conowingo Dam and transport them to designated points in the Susquehanna River watershed.

Exelon designed, installed, and operated the permanent eel collection and holding facility (Conowingo Eel Collection Facility, CECF) at Conowingo Dam in 2017 and continued operating this facility in the same manner in 2020. Eels collected at Conowingo and those transported from the Octoraro Creek eel facility were held and later transported and released at designated stocking areas in the Susquehanna River watershed as approved by PADEP and the Eel Passage Advisory Group (EPAG).

The start of the 2020 season was delayed due to concerns with the COVID-19 pandemic, as Maryland, Pennsylvania, and federal closures followed the mandated restrictions of the novel COVID-19 procedures for essential workers. The Conowingo Eel Collection Facility was operated in 2020 following Exelon and Normandeau's COVID-19 protocols which followed all local, state, federal, and CDC guidelines. These protocols allowed the operation of the eel facility and still provided a safe, healthy, and efficient workplace for all employees.

Specifically, the objectives of the 2020 field investigation were to:

- Operate, maintain, and monitor the eel collection and holding facility (daily) from May 1 through September 15, 2020;
- Collect catch and length data, water quality, stream flow, and moon phase data during the entire sampling period;
- Examine a subsample of juvenile eels for presence of swim bladder parasite and determine age from a portion of subsample;
- Transport eels from the CECF at Conowingo Dam to designated points in the Susquehanna River watershed;
- Conduct weekly quality control (QC) checks and cleaning of the eel collection facility to maintain proper attraction water flow;
- Document any modifications made to the facility during the course of the season to improve functionality.

The facility was placed in service on May 18, 2020. The facility operated a total of 138 days from May 18 to October 3. A total of 254,651 juvenile eels were collected at the CECF. Juvenile eel numbers > 1,000 individuals were recorded on 43.5% (60 days) of the collection days. The greatest number of juvenile eels was collected on May 30, 2020 with 14,137 or 5.6% of the total season

catch. Eels collected between May 30 and June 2, July 21 and July 25, and August 6 through August 10 accounted for 44.6% (113,603 of 254,651) of the total eels in 2020. Volumetric estimates were utilized on 56 days this year.

Length, weight, and condition factor were recorded from biweekly subsamples on 851 juvenile eels. Length of juvenile eels ranged from 71-186 mm and an average length of 112.2 mm. The average weight of juvenile eels was 1.5 grams (g) and ranged from 0.3-5.4 g. Only 28 of the 851 (3.3%) showed any form of external injury (condition factor) such as bruising, scrape, hemorrhage, or fungus.

Over 11% (96 of 851) of the eels sampled were examined internally for presence of the eel swim bladder parasite (*Anguillicoloides crassus*). Parasites were found in 60 (62.5%) of the 96 sacrificed eels. The number of parasites per eel ranged from one to three. Eighty-nine of the 96 sacrificed eels were examined for age and it was determined that the average age was 1.97 years old (range 1 - 4 years old).

The CECF collected a total of 254,651 juvenile eels in 2020 with a total of 68 eel mortalities found in the collection tank. A total of 2,155 (0.84% mortality) juvenile eels were recovered dead from the holding tanks over the entire season. Eels were held no longer than one week prior to transport from the CECF. A combined total of 255,889 eels from CECF and the Octoraro Creek Eel facility were transported to designated locations in the Susquehanna River watershed. A total of 40 juvenile eels were removed by the Susquehanna River Basin Commission (SRBC) on July 23, 2020, for an avoidance study being conducted by Penn State University. Bloomsburg boat ramp (Site 8) was stocked with 109,308 juvenile eels. Lock Haven boat ramp (Site 11) received a stocking of 109,123 juvenile eels. Wrightsville (Site 3A) and Columbia (Site 3B) boat ramp were stocked with the remainder of the juvenile eels, 19,319 and 17,660, respectively. A total of 479 (0.19%) juvenile eels died during the 93 transport trips from the CECF in 2020. Daily transports occurred from July 13 to September 18 due to elevated water temperatures.

Cleaning and calibration of the trapping facility was performed weekly. Scrubbing of the collection tank and the screened drain occurred daily after eels were removed. The holding tank and overflow drain were scrubbed every time the eels were removed for transport. Volumetric estimates were compared against actual counts three times during the season, and due to the small differences in numbers, the method provided accurate estimates and no changes are warranted.

List of Abbreviations

Agencies/Groups

CECF	Conowingo Eel Collection Facility
EPAG	Eel Passage Advisory Group
EXELON	Exelon Generation Company, LLC
FERC	Federal Energy Regulatory Commission
PADEP	Pennsylvania Department of Environmental Protection
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
SRBC	Susquehanna River Basin Commission
SUNY	State University of New York

Units of Measure

C	Celsius
cfs	cubic feet per second
DO	dissolved oxygen
g	gram
gpm	gallons per minute
L	liter
mg/L	milligrams per liter
mL	milliliter
mm	millimeter
QC	quality control
WFL	West Fish Lift

1 Introduction

Exelon Generation Company, LLC (Exelon) received a license from the Federal Energy Regulatory Commission (FERC) on December 22, 2015 for the Muddy Run Pumped Storage Project (Muddy Run Project). An American Eel Passage Plan (Eel Plan) was developed by Exelon and included as a condition of the Pennsylvania 401 Water Quality Certification (PADEP File No. EA 36-033; dated December 10, 2014) for the Muddy Run Project, and is a condition of the FERC license for the Muddy Run Project.

The Eel Plan required Exelon to install and operate a juvenile eel trapping and holding facility (the Conowingo Eel Collection Facility (CECF) at Conowingo Dam. The location identified for the CECF is on the Susquehanna River immediately downstream of the West Fish Lift (WFL) where a previous USFWS temporary eel facility was located from 2005 to 2016. This site was approved by the Pennsylvania Department of Environmental Protection (PADEP) and other members of the Eel Passage Advisory Group (EPAG)¹.

In 2017, Exelon designed, installed, and operated the permanent eel collection and holding facility at Conowingo Dam and continued operation through 2020. Eels collected at Conowingo and those transported from Exelon's Octoraro Creek Eel Facility were held and later transported and released at designated points in the Susquehanna River watershed.

The 2020 season was delayed due to concerns with the COVID-19 pandemic, as Maryland, Pennsylvania, and federal closures followed the mandated restrictions of the novel COVID-19 procedures for essential workers. The Conowingo Eel Collection Facility was operated in 2020 following Exelon and Normandeau's COVID-19 protocols which followed all local, state, federal, and CDC guidelines. These protocols allowed the operation of the eel facility and provided a safe, healthy, and efficient workplace for all employees. [Appendix A](#) contains Maryland and Pennsylvania mandates for essential workers, and communications between Exelon and the FERC documenting delays.

Specifically, the objectives of the 2020 field investigation were to:

- Operate, maintain, and monitor the eel collection and holding facility (daily) from May 1 through September 15, 2020;
- Collect catch and length data, water quality, stream flow, and moon phase data during the entire sampling period;
- Examine a subsample of juvenile eels for presence of swim bladder parasite and determine age from a portion of subsample;
- Transport eels from the CECF at Conowingo Dam to designated points in the Susquehanna River watershed;
- Conduct weekly quality control (QC) checks and cleaning of the eel collection facility to maintain proper attraction water flow;

¹ EPAG members include the Pennsylvania Department of Environmental Protection, United States Fish and Wildlife Service (USFWS), Pennsylvania Fish and Boat Commission, Maryland Department of Natural Resources, Susquehanna River Basin Commission, and Exelon.

- Document any modifications made to the facility during the course of the season to improve functionality.

2 Background

The American Eel (*Anguilla rostrata*) is the only species of freshwater eel in North America. The species is catadromous, meaning the eels are hatched in the ocean, mature in freshwater, and then return to the sea to spawn. Throughout their life cycle, the American Eel occupies a variety of habitats and goes through multiple physical changes, known as metamorphoses. The American Eel begins its life in the Sargasso Sea. The larval eels, known as leptocephalus larvae, are transported to the eastern seaboard of North America via ocean currents, which takes about a year. Their coastal range extends as far north as Greenland and as far south as Brazil. By the time the larvae reach the coast, they have developed fins and have taken on the shape of an adult eel ([Hedgepeth 1983](#)). The glass eel is clear and is usually less than 25 millimeters (mm), and when these eels start to become pigmented, they are considered juvenile eels.

The CECF is located on the west shore of the Susquehanna River just downstream of the WFL ([Figures 2.0-1](#) and [2.0-2](#)). This report describes the work completed by Normandeau Associates, Inc. for Exelon with oversight from EPAG in 2020 to collect and transport juvenile American Eels past Conowingo Dam.

USFWS trapping efforts performed on the west shore on the Susquehanna River, below Conowingo Dam were from 2005-2016 in the same vicinity of the CECF ([Minkinen and Park 2014](#) and personal communication with USFWS, Christopher Reily, October 27, 2016) Their efforts showed that the bulk of the juvenile eel migration occurs from May to September with most eels collected in June and July ([Figure 2.0-3](#)).

The PADEP 401 WQC for Muddy Run Project required Exelon to design and install an eel collection facility at Conowingo and start operation by May 1, 2017.

3 Methods

3.1 Design, Construction, and Installation of Facility

The 2020 trapping facility was identical to the one used since 2017 ([Normandeau Associates and Gomez and Sullivan 2018, 2019, and 2020](#)). Complete designs descriptions can be found in Section 3: Methods in the [Normandeau Associates and Gomez and Sullivan 2018 and 2019](#) report.

3.2 Data Collection

Sample data including date, time of sample, weather, eel counts, flow readings, water temperature, and dissolved oxygen were recorded daily. The data were verified, tabulated, and entered into an electronic format each week as part of a quality control and quality assurance protocol. Environmental conditions such as river flow and lunar fraction were also recorded, verified, and entered into an electronic format.

Eel count data included actual counts or volumetric estimates (when performed). Volumetric estimates were performed as in 2017, 2018, and 2019 ([Normandeau Associates and Gomez and Sullivan 2018, 2019, and 2020](#)).

Length and weight measurements, along with condition factor were recorded biweekly from a maximum of 25 individuals (when available). Eels were measured and weighed after being anesthetized ([Figures 3.2-1 and 3.2-2](#)). Once a week during this biweekly subsample, a portion of these eels were examined for the presence of a swim bladder parasite (*Anguillicoloides crassus*) and for age analysis. Age analysis methodology is described in [Appendix B](#).

Flow readings and water quality data (temperature and dissolved oxygen) were recorded daily from the control panel readouts for the collection tank and any holding tank in service. The main flow was also recorded daily. Additional tailrace dissolved oxygen from Station 643 was obtained daily from the Conowingo Dam Control Room.

Environmental data including river flow, moon phase, and weather condition was also recorded daily.

3.3 Juvenile Eel Transport

A wild health screening was required prior to the transport of eels upstream into the Susquehanna River watershed. Juvenile eels were collected by a backpack electroshocker in March 2020 from Herring Run, a tributary of the Susquehanna River, and sent to the USFWS Fish Health Center (Lamar, PA) for examination ([Figures 3.3-1 and 3.3-2](#)). After the results of the wild health screening were received and reviewed by the EPAG, eels were stocked in the approved locations.

All juvenile eels captured from the CECF, plus eels collected at the Octoraro Creek eel facility, were held for no longer than one week prior to transport. All eels were transported and released at designated locations in the Susquehanna River watershed.

When fewer than 150 eels were collected during a sampling event, transport occurred using aerated 19-liter (L) buckets with lids, containing the maximum amount of water to prevent sloshing, with ≤ 50 eels in each bucket. When counts of juvenile eels were greater than 150 but less than 2,500 individuals, a small enclosed transport tank (250 L) with supplemental oxygen capability was used to transport eels to designated locations ([Figure 3.3-3](#)). When large loads ($> 2,500$) of American Eels were transported, the

custom-made transport truck and tank unit was used to efficiently and safely deliver eels to designated stocking locations ([Figure 3.3-4](#)).

4 Results

The CECF commenced operation on May 18 and shut down operation on October 3, 2020². This facility was delayed in starting operation in 2020 due to the COVID-19 pandemic. The end of the season was extended 18 days to operate the facility for the full 138 days. A total of 254,651 juvenile eels were collected during the 2020 season ([Table 4.0-1](#)). The following report considers Week 1 as May 1 to be able to compare past, present and future years of study results.

4.1 Juvenile Eel Collection

A total of 254,651 juvenile American Eels were captured at the CECF during the 2020 season. Counts or volumetric estimates were recorded daily. Volumetric estimates were taken from the CECF on 56 of the 138 days of operation (approximately 40.6% of the season, [Table 4.0-1](#)). The number of eels in the 200 milliliters (mL) subsample varied daily throughout the season, ranging from 85 to 167 eels ([Table 4.0-2](#)). Detailed information on the 200 mL subsample is shown on [Table 4.0-2](#) including length and average lengths on eels in this subsample if biological data was collected.

The highest one-day total of 14,137 juvenile eels occurred on May 30, when 5.6% of the total number of eels collected were captured ([Table 4.0-1](#) and [Figure 4.1-1](#)). For the 2020 season, 43.5% (60 days) of the monitoring checks recorded juvenile eel numbers > 1,000 individuals ([Table 4.0-1](#)), while 15 (10.9%) of the sample days recorded eel collection > 5,000 individuals, three (2.2%) of the sampling days recorded eel collection > 10,000 individuals.

4.2 Juvenile Eel Biological Data

Biological data (length, weight and condition factor) were recorded from biweekly subsamples. A total of 851 juvenile eels was collected from these biweekly subsamples (0.3% of total eels collected), during 39 of the 138 sample days ([Table 4.2-1](#)).

The average length of juvenile eels was 112.2 mm, with a median size of 112.0 mm ([Table 4.2-1](#)). The length of juvenile eels ranged from 71 – 186 mm. One hundred sixty-nine juvenile eels measured less than 100 mm and one eel measured greater than 175 mm ([Table 4.2-2](#)). The average weight of juvenile eels was 1.5 grams (g), with a median weight of 1.4 g ([Table 4.2-1](#)). The weight of juvenile eels ranged from 0.3 – 5.4 g ([Table 4.2-2](#)). Almost 78% of the 851 juvenile eels weighed between 1 – 3 g ([Table 4.2-3](#)).

Eels from each biweekly subsample were examined for external injuries. Individual condition factors, date, and detailed biological data for these are shown on [Table 4.2-4](#). External injuries were noted on 3.3% (28 of 851 individuals) of the examined eels. All injuries were coded as a scrape (scratches or marks), hemorrhage, lesion, or fungus. Thirteen eels showed evidence of fungus, while eight eels contained a lesion and five eels had scrapes. Photos of each injury type is shown in [Figures 4.2-1](#) through [4.2-4](#).

² On an April 16, 2020 teleconference, Exelon informed EPAG that 2020 seasonal set-up was delayed due to precautions to limit the spread of Covid-19. EPAG was notified that the Conowingo Eel Collection Facility had started seasonal operations on May 18, 2020. On an August 20, 2020 teleconference, Exelon consulted EPAG regarding continuing seasonal operation through October 3, 2020; EPAG approved extended the collection season. On a September 17, 2020 teleconference, Exelon confirmed that it planned to continue operation of the Conowingo Eel Collection Facility through October 3, 2020.

4.3 Eel Sacrifice and Internal Analysis

From each biweekly subsample, a portion of juvenile eels were retained and inspected for the presence of the swim bladder parasite (*Anguillicoloides crassus*) and examined for age determination. Roughly 11% (96 of the 851 individuals) were dissected for the parasite and later examined for age ([Tables 4.3-1 and 4.3-2](#)).

Of the 96 juvenile eels that were inspected for the parasite, 36 (37.5%) eels did not contain the swim bladder parasite ([Table 4.3-1](#) and [Figure 4.3-1](#)). The other 60 (62.5%) eels contained the swim bladder parasite. The infected eels contained one, two, or three parasites per individual; 41, 18, and 1 eels, respectively. [Table 4.3-2](#) provides detailed information by length frequency (five mm interval groups) of the 96 sacrificed eels with information including weight, age, and number that were infected by the parasite. The average length of the sacrificed eels was 113.2 (range 71-161) mm, average weight of 1.6 (range 0.3-4.2) g, and average number of parasites was 0.8 (range 0-3, [Table 4.3-1](#)).

Age of the juvenile eels was determined from 89 eels; seven additional eel otoliths could not be read for aging. The 89 juvenile eels analyzed for age were determined to be 1 to 4 years old (Average age = 1.97, [Table 4.3-1](#)). Detailed information of the 89 sacrificed and aged eels is shown on [Table 4.3-1](#). Of the 89 aged eels, 34 eels (38.2%) were aged 1-year-old, 32 eels (36.0%) were aged 2 years old, 15 eels (16.9%) were aged 3 years old, and 8 eel (9.0%) were aged 4 years old. Age agreement between Normandeau biologists occurred 94.4% (84 of the 89 eels) of the time ([Appendix B](#)). The average length of the aged eels was 113.0 (range 71-161) mm, average weight of 1.6 (range 0.3-4.2) g, and average number of parasites 0.8 (range 0-2). Length frequency of aged eels with weights, parasites, and age data are found on [Table 4.3-2](#).

4.4 Peak Periods of Eel Collections

The greatest percentage of juvenile eels was collected during Week 6 (May 31-June 6) when the facility collected 14.5% (36,993 individuals) of the season total, with nearly the same number of eels collected on Week 13 (14.4% of the season total, 36,742 individuals [Table 4.4-1](#) and [Figure 4.4-1](#)). Week 16 also collected a large number of eels with 12.5% (31,905 individuals) of the season total. Weeks 6, 13, and 16 combined accounted for a large percentage of the juvenile eels caught in 2020 (41.5%, 105,640 individuals, [Table 4.4-1](#) and [Figure 4.4-1](#)). Week 15 (August 2 – August 8) was the only other week when ≥ 10% of the season total was collected in a single week, 11.6% (29,622 individuals).

Weeks 4, 9, and 20 - 23 of sampling collected no greater than 1.0% of the season total, accounting for 2.0% (5,126) individuals combined. Only 0.4% (941) individuals were collected during the last four weeks of the season ([Table 4.4-1](#) and [Figure 4.4-1](#)).

During the season, there were three large peak periods. The largest peak (May 30 – June 2, 4 days) yielded 16.9% (42,971 of the 254,651) juvenile eels ([Table 4.0-1](#)). A slightly smaller peak occurred from August 6 - 10 (5 days), accounting for 15.1% (38,411 of the 254,651) juvenile eels collected at the facility. During the smallest peak, the CECF collected 12.7% (32,221 of the 254,651) juvenile eels collected, and occurred from July 21 through 25 (5 days). Nearly 45% (113,603 individuals) of the juvenile eels collected at this facility occurred during these 14 days or 10.1% of the sampling days.

4.5 Juvenile Eel Catch in Relation to Environmental Factors

See [Appendix C](#) for weekly averages of juvenile eel capture, river flow, lunar fraction, water temperature, and dissolved oxygen (DO).

River Flow

River flow and juvenile eel catch did not appear to be related during the 2020 season. Daily average river flow was taken from The United States Geological Survey (USGS) 01578310 Susquehanna River at Conowingo, MD gage located at Conowingo Dam ([Table 4.5-1](#)). The highest daily average river flow value per the USGS gage station occurred on May 19, 2020 (58,400 cubic feet per second, cfs). This single highest daily value occurred on the first day of operation of the eel facility in 2020 ([Tables 4.0-1 and 4.5-1](#)). The lowest daily average river flow value per the USGS gage station occurred on September 27, 2020 (3,970 cfs) during the last week of the season. The majority of the American Eel captured at the CECF in 2020 occurred when average river flow values were below 40,000 cfs ([Figure 4.5-1](#)). During the last six weeks of the sampling season (Weeks 18-23) the average weekly flow decreased, which corresponded to decreasing weekly eel capture totals at the CECF. The last two weeks of the season, Weeks 22 and 23, recorded the lowest daily river flow, which corresponded to the lowest eel capture rate of the season. The higher catch numbers during Weeks 13 and 16 of the season may be a function of other variables (e.g., migration timing).

Lunar Fraction

Juvenile eel catch did not appear to be strongly correlated to lunar fraction (cycle) during the 2020 season. Full moon is equal to 1.0. The largest peak (May 30 – June 2) of 42,971 eels occurred during the fifth brightest week of the season ([Table 4.0-1](#) and [Appendix C](#)). Week 4, the first week of the 2020 season, occurred during one of the darkest weeks of the season and contributed only 1.0% of the total eels collected during the 2020 Season ([Table 4.4-1](#) and [Appendix C](#)). The other darkest week of the season was Week 17, which recorded nearly 25,000 eels (9.8% of the season total, [Table 4.5-2](#) and [Figure 4.5-2](#), [U.S Naval Observatory website 2018](#)). The slightly smaller peak (August 6 -10) of 38,411 eels occurred just after the second brightest week (Week 15) of the season ([Table 4.0-1](#) and [Appendix C](#)). Week 13 was ranked the second darkest week of the season and occurred during the week when the second most eel were collected ([Table 4.5-2](#) and [Figure 4.5-2](#), [U.S Naval Observatory website 2018](#)). Typically, the lower illuminance during lower lunar fraction periods, (new moon) has been associated with increases in eel catch at eel traps ([Welsh et al. 2015](#), and [Schmidt et al. 2009](#)).

Water Temperature

Water temperature and eel catch did not appear to be related this season. Water temperatures reached 20.0° Celsius (C) ten days after the start of the facility on May 28, 2020. By this time the CECF collected only 4,785 eels (1.89% of season total, [Tables 4.0-1](#) and [4.5-3](#)). The greatest catch of eel at the CECF occurred two days after the water temperature reached 20.0°C. Over 73% (186,452 of the 254,651 eels) were captured after water temperatures reached 25.0° C on June 12, 2020 ([Tables 4.0-1](#) and [4.5-3](#)). Over the course of the study, the water temperature ranged from a high of 31.3°C during July to a low of 17.1°C in May. ([Table 4.5-3](#) and [Figure 4.5-3](#)). Water temperature during the 2020 season was ≥ 27.9° C for 64 continuous days from June 30 until September 1, (46.4% of the season) when 175,405 eels (66.9% of the season total) were captured ([Tables 4.0-1](#) and [4.5-3](#)).

Dissolved Oxygen

Dissolved oxygen and eel collection numbers did not appear to be related this season. The DO was obtained from the Conowingo Dam Control Room upon arrival to the station prior to starting the daily work. This DO valve is taken from Station 643 (0.6 miles downstream of Conowingo Dam). The attraction flow from the CECF has additional aeration and diffused compressed oxygen supplied to each of the

enabled tanks for most of the season, therefore no relationship between eel catch and dissolved oxygen values could be derived. Daily DO values ranging between 6.20 and 9.93 milligrams per Liter (mg/L) are presented in [Table 4.5-4](#) and displayed in [Figure 4.5-4](#).

4.6 Juvenile Eel Holding and Mortality

Of the 254,651 juvenile eels that were captured at this facility, 68 eels died in the collection tank (99.9% survival, [Table 4.6-1](#)). All mortalities from the collection tank were recorded over the course of the season, and were not attributed to a single event such as low DO or loss of water flow to holding tanks.

A total of 2,155 (0.84% mortality) juvenile eels died in holding ([Table 4.6-1](#)). On July 13, a total of 1,320 juvenile eels were recovered dead from holding while transferring them to the transport vehicle. Some of these eels showed signs of fungus. During this occasion, none of the 1,988 eels in the collection tank that day were found dead, and there were 8,072 eels that remained in holding that were alive, which were ultimately transported upriver. Because of the unknown cause of mortality, this holding tank was drained, scrubbed clean, and left dewatered. Daily transports were started after this event and continued until mid-September to decrease mortalities due to higher than ideal holding tank water temperatures. The water temperature of the collection and holding tanks was recorded above 29°C starting on June 30.

On June 12, 406 juvenile eels were discovered dead when being removed from the holding tank. The collection tank water temperature was 25.1°C. Only eels collected at the CECF were held together in the same holding tanks prior to transport for a period of only four days. The 2,169 eels in the collection tank on this day were all alive along with the additional 7,817 eels alive in the holding tank.

4.7 Juvenile Eel Transport and Mortality

See [Table 4.7-1](#) for detailed information of transport and mortality data.

On March 9, 2020, a Normandeau field crew collected 60 juvenile American Eels (< 200 mm) by backpack electroshocker from Herring Run, a tributary of the Susquehanna River near Lapidum boat ramp in Susquehanna State Park, MD. The following day, these 60 live juvenile American Eels were delivered to the USFWS Fish Health Center located at Lamar Fish Hatchery, Lamar, Pennsylvania for examination. Due to the smaller sized eels provided, only 27 of the larger eels could provide an adequate bacterial sample, in which no bacterial or viral pathogens of concern were detected. The Fish Health Inspection Report is presented in [Appendix D](#).

A total of 40 eels were supplied to the SRBC on July 23, 2020 from the CECF for an avoidance study being conducted by Penn State University. The chain of custody sheet for this event is located in [Appendix E](#), which relinquishes Exelon's responsibility for these eels.

All juvenile eels that were captured in the CECF at Conowingo Dam, plus any eels collected at the Octoraro Creek Eel Facility, were held for no longer than one week prior to transport. All eels were transported and released at designated locations in the Susquehanna River watershed ([Figure 4.7-1](#)). A total of 255,889 juvenile eels were transported upstream ([Tables 4.6-1](#) and [4.7-1](#)). Daily transports occurred from July 13 to September 18, 2020.

Eels were transported to Bloomsburg, Lock Haven, Wrightsville, and Columbia boat ramps. Total elapsed time of transport from the holding facility at Conowingo Dam to each stocking location varied between trips. Eel transports from the CECF to Bloomsburg (Site 8) and Lock Haven (Site 11), were completed in

approximately three and a half hours (\pm 30 minutes). Eel transports from the CECF to Wrightsville (Site 3A) and Columbia (Site 3B), were completed in approximately one and a half hours (\pm 30 minutes).

Of the 109,709 eels that were transported to Bloomsburg Boat Ramp (Site 8), 109,308 eels were stocked ([Tables 4.6-1](#) and [4.7-2](#) and [Figure 4.7-2](#)). This location was stocked 30 times from May 2 to August 29. Detailed data from each of the transports is found on [Table 4.7-1](#).

Of the 109,175 eels that were transported to Lock Haven Boat Ramp (Site 11), 109,123 eels were stocked ([Tables 4.6-1](#) and [4.7-2](#) and [Figure 4.7-3](#)). This location was stocked 27 times from May 29 to August 30. Detailed data from each of the transports is found on [Table 4.7-1](#).

Of the 19,339 eels that were transported to Wrightsville Boat Ramp (Site 3A), 19,319 eels were stocked ([Tables 4.6-1](#) and [4.7-2](#) and [Figure 4.7-4](#)). This location was stocked nine times over a five day period from July 17 to September 1. Detailed data from each of the transports is found on [Table 4.7-1](#).

Of the 17,666 eels that were transported to Columbia Boat Ramp (Site 3B), 17,660 eels were stocked ([Tables 4.6-1](#) and [4.7-2](#) and [Figure 4.7-4](#)). This location was stocked 27 times over 25 days from July 16 to October 3. Detailed data from each of the transports is found on [Table 4.7-1](#).

Mortality

Mortality during the 93 transport trips from the CECF at Conowingo Dam totaled 479 eels (0.19%, 479 of 255,889, [Table 4.6-1](#)). Four hundred and one eels died (0.37%, 401 of 109,709 eels) during transports from the CECF to Bloomsburg (Site 8), which was the same day the largest number of eels were removed from the holding tank at CECF. Fifty-two eels (0.05%, 52 of 109,175) died during transports to Lock Haven (Site 11). Twenty eels (0.10%, 20 of 19,339) died during transports to Wrightsville (Site 3A). Six eels (0.03%, 6 of 17,666) died during transports to Columbia (Site 3B).

5 Quality Assurance/Quality Control Activities

The CECF requires oversight to ensure its reliability and effectiveness. The area below the ramp entrance was covered with a shade cloth to about the normal high water tailrace elevation to protect the juvenile eels when ascending the attraction flow over/through the rip-rap shoreline. Small areas had to be filled in or secured to keep small birds from climbing under the cloth periodically during the season. The shade cloth over the rip-rap on the shoreline below the entrance of the ramp was a major help in deterring birds and animals from preying on juvenile eels as they ascended the wetted substrate. The entire ramp was covered with a sheet of aluminum to protect the juvenile eels while climbing.

The transition from the ramp to the rip-rap was inspected periodically to insure a smooth transition for eels climbing the substrate. The transition of the ramp to the rip-rap was photographed at the beginning and at the end of the season from the same general angle, these photos are presented in [Figure 5.0-1](#).

The area over the collection tank, holding tanks, and hoses is partially shaded by a scaffold frame and shade cloth. The tanks were covered with a sheet of Lexan with weather stripping attached to prevent large-scale insect hatches from clogging the screened drains. No indications were observed of animals attempting to enter any of the tanks during the season.

The control panel to the CECF provided an instantaneous readout of DO and water temperature and connected to the flow meters for all of the tanks and fill lines. When a one-minute average was outside the range of specification, an alarm would be sent to the control room, followed ten minutes later by an alarm sent to Normandeau via a text or e-mail message. The alarm systems were useful, and required some minor debugging and troubleshooting throughout the season to prevent excessive notifications and/or false alarms. The alarm to the control room was a general alarm but the alarm to Normandeau was a detailed message stating the cause of the alarm. Conowingo operations handled most of the alarms with guidance from Normandeau. Supplemental aeration from the bubblers and the compressed oxygen diffusers were great assets during times of low DO levels in the water supply line from the forebay. The total attraction flow of the facility varied throughout the season dependent upon which tanks were in-service, but an attraction flow was always being discharged down the ramp and shoreline. Total attraction flows were set for approximately 70 gallons per minutes (gpm). Periodically throughout the season, low flow alarms did occur. Slight adjustments made to the gravity feed line to adjust the pressure within the pipe to obtain a constant water flow into the tanks resolved this issue. The hardiness of this species and its ability to adjust to parameters outside of those developed for this facility was evidenced by the numbers captured here. Future testing and adjustments to this facility will continue to be investigated in future years.

Continuous water temperature and DO readings were taken from each tank in use. A linear piston blower and blower box controlled the air supplied to the collection tank and Holding Tank #1 through a manifold, while the other blower and blower box controlled air to Holding Tanks #2 and #3. An air pump was in service constantly throughout the season for all tanks that were in-service. Compressed bottled oxygen (125 cubic feet) was also supplied to each of the tanks. As with the air blower, an oxygen manifold was used for the collection tank and Holding Tank #1, while another oxygen manifold controlled Holding Tanks #2 and #3. Compressed oxygen was used for every tank in-service for the duration of the season. Both the air blower manifold and the oxygen manifold were attached to a diffuser by a six mm hose. Each tank had one air blower fine pore diffuser and an oxygen micro pore diffuser. These diffusers laid flat on the tank bottom to insure that the full length of the diffuser was expelling bubbles. The micro pore diffusers reduced the amount of oxygen required to supply the tanks

with sufficient oxygen levels. A 125 cubic foot bottle of oxygen connected to a micro pore diffuser lasted nearly five days, when adjusted properly for two tanks.

Cleaning and calibration activities were conducted at least weekly during the season. Operating ranges of flow, DO, and water temperature specifications for the CECF is located on [Table 5.0-1](#). The collection tank and screened drain were scrubbed after eels were removed daily, whereas the holding tanks and overflow drain were scrubbed every time the eels were removed for transport. Holding tanks remained empty after dewatering and removing eels for transport until the following day. Dissolved oxygen probes were cleaned regularly. The overflow tank was cleaned periodically. With the gravity feed line from the forebay, the amount of algae was minimal but cleaning was still performed. Quality control checks were also performed on the volumetric eel count estimates.

Calibration of the ramp flow was executed each week after cleaning, using a 19-L graduated bucket. Multiple locations of the facility were checked for calibration purposes - the spray bar, the collection tank fill and drain, scent line, and the drains of each of the holding tanks that were in service. Some of the water from the spray bar that was not used for attracting eels up the ramp but used to help slide eels into the collection tank was identified as the backside of ramp flow. The backside of ramp flow was calculated by adding the scent line to the collection tank drain and subtracting the collection tank fill. The attraction flow at the top of the ramp (top attraction) was calculated by subtracting the backside of ramp flow from the spray bar amount. Bottom of ramp attraction is a sum of the collection tank drain and the drains of the in-service holding tanks. Total attraction flow is equal to the collection tank fill, the spray bar and the drains of the holding tanks. Details and calibration records are listed in [Table 5.0-2](#).

Actual eel counts were compared to volumetric eel estimates to determine accuracy of the volumetric estimates. A quality control comparison on estimates occurred three times during the 2020 season: May 27, June 14, and August 30. The detailed estimates for juvenile eels per 200 milliliter (mL), displacement, total estimated, and actual counts are in [Table 5.0-3](#). With only a small difference observed between estimates and actual counts (-2.3%), no further changes to this method are warranted.

6 Conclusions and Discussion

The Conowingo Eel Collection Facility captured 254,651 eels compared to the Octoraro Creek Eel Facility that captured 3,597 juvenile eels during the 2020 season. The CECF operated nearly 1.5 times longer than the Octoraro Creek Eel Facility from May 18 to October 3 compared to June 26 to October 3, but the CECF at Conowingo Dam captured approximately 70 times the number of eels collected by the Octoraro Creek Eel Facility. Both the CECF at Conowingo Dam and the Octoraro Creek Eel Facility contained one Enkamat substrate ramp at each site during the 2020 season. During the 2020 season, the size range of the juvenile eels caught at the CECF at Conowingo Dam facility was 71-186 mm with an average length of 112.2 mm, compared to the size range of 64-165 mm (average 114.4 mm), 84-173 mm (average 121.6) mm, and 78-192 mm (average 122.3 mm) observed in 2019, 2018 and 2017, respectively ([Table 6.0-1](#) and [Normandeau Associates and Gomez and Sullivan 2018, 2019 and 2020](#)).

All environmental factors including lunar fraction and river flow did not appear to have a measurable effect on the number of eels collected in 2020. The highest daily average river flow value per the USGS gage station occurred on May 19, 2020 (58,400 cfs) and the lowest daily average river flow occurred on September 27, 2020 (3,970 cfs). The discharge at Conowingo Dam can change hourly, sometimes quicker, depending on energy demand, and may not be a good metric to use to compare eel collection numbers in a given season. In 2020, the dissolved oxygen readings were obtained from the Conowingo Control Room when the crew arrived at the site for work, but did not show correlation in eel collection. The lower lunar fraction is one environmental factor typically showing the greatest relationship to the number of eels collected, but in 2020, the largest peak of eels collected at Conowingo Dam was during the fifth brightest week (Week 5) of the season. A period of low lunar fraction (second darkest week) and the second largest peak in eel capture occurred during Week 13, although the second darkest week of the season (Week 15) collected a slightly smaller peak. Periods of low light (near new moon) typically have a significantly higher collection of juvenile eels than those periods of higher illumination. Weekly comparison between number of eels captured and environmental factors for 2017, 2018, 2019, and 2020 are in [Appendix C](#).

Mortality from collection, holding, and transport was below the 5% maximum value mandated for the facility. Mortality at the CECF was low this year because of the implementation of the suggestions that were made in the 2018 report, which were:

- Transport eels between June 15 and September 1 at least twice a week;
- When excessive air temperature is forecasted to be above 32 °C for three straight days and water temperature is approximately 29 °C, daily transports will be instituted;
- Ensure proper water flow and DO levels are maintained.

A slight modification to this suggestion (listed below) may prevent large mortality events like the one on July 13, 2020, which accounted for 61.5% (1,620 of 2,634) of the season's eel mortalities from holding and transporting.

- When water temperature reaches 28° C, daily transports will be instituted regardless of the forecasted air temperature.

The Conowingo Eel Collection Facility designs were approved by the Resource Agencies prior to the 2017 season. The 2019 USFWS inspection report was received by Exelon on November 27, 2019, which identified salient issues to the eel pass attraction flow at the apex of the ramp ([Appendix F](#)). Methodology was discussed at a high level during the annual EPAG meeting in December 2019, and EPAG continued to discuss additional methodology concerning the issue during monthly EPAG calls. Prior the June 2020 EPAG call the resource agencies received a study plan from Exelon to assess the spray bar at the CECF. The plan was reviewed and verbal approval to proceed was given by Sheila Eyler (USFWS). The study plan and report are in [Appendix F](#).

7 References

- Hedgepeth, M. V. 1983. Age, Growth and Reproduction of American eels, *Anguilla rostrata*, from the Chesapeake Bay Area. Master of Arts Thesis, College of William and Mary/Virginia Institute of Marine Science, Gloucester Point, Virginia.
- Minkinen, S., and I. Park. 2014. American eel sampling at Conowingo Dam, 2013. USFWS Technical Report, February 2014.
- Normandeau Associates, Inc. and Gomez and Sullivan. 2020. Muddy Run Pumped Storage Project. Conowingo Eel Collection Facility, FERC Project No. 2355. Prepared for Exelon.
- Normandeau Associates, Inc. and Gomez and Sullivan. 2019. Muddy Run Pumped Storage Project. Conowingo Eel Collection Facility, FERC Project No. 2355. Prepared for Exelon.
- Normandeau Associates, Inc. and Gomez and Sullivan. 2018. Muddy Run Pumped Storage Project. Conowingo Eel Collection Facility, FERC Project No. 2355. Prepared for Exelon.
- Schmidt, R.E., C.M. O'Reilly, D. Miller. 2009. Observations of American eels using an upland passage facility and effects of passage on the population structure. *North American Journal of Fisheries Management*, 29: 715-720.
- U.S. Naval Observatory website. 2019. Fraction of the Moon Illuminated. http://aa.usno.navy.mil/cgi-bin/aa_moonill2.pl?form=1&year=2018&task=00&tz=-05
- Welsh S.A., J.L. Aldinger, M.A. Braham, J.L. Zimmerman. 2015. Synergistic and singular effects of river discharge and lunar illumination on dam passage of upstream migrant yellow-phase American eels. *ICES Journal of Marine Science*. Doi:10.1093/icesjms/fws052.

8 Tables and Figures

Table 4.0-1: Number of Juvenile Eel Caught Daily, Conowingo Eel Collection Facility, 2020

Date	Number of Eels	Date	Number of Eels	Date	Number of Eels
5/19/2020	0	7/5/2020	309	8/20/2020	3198
5/20/2020	255	7/6/2020	664	8/21/2020	2227
5/21/2020	1080	7/7/2020	931	8/22/2020	1276
5/22/2020	506	7/8/2020	1957	8/23/2020	1245
5/23/2020	449	7/9/2020	2576	8/24/2020	1344
5/24/2020	683	7/10/2020	4233	8/25/2020	610
5/25/2020	388	7/11/2020	4457	8/26/2020	562
5/26/2020	414	7/12/2020	2933	8/27/2020	949
5/27/2020	1010 *	7/13/2020	1988	8/28/2020	1089
5/28/2020	1080	7/14/2020	783	8/29/2020	1194
5/29/2020	3089	7/15/2020	513	8/30/2020	1185 *
5/30/2020	14,137	7/16/2020	352	8/31/2020	436
5/31/2020	11,426	7/17/2020	299	9/1/2020	343
6/1/2020	10,809	7/18/2020	641	9/2/2020	155
6/2/2020	6,599	7/19/2020	1293	9/3/2020	161
6/3/2020	3367	7/20/2020	3188	9/4/2020	130
6/4/2020	1735	7/21/2020	5761	9/5/2020	160
6/5/2020	1988	7/22/2020	8449	9/6/2020	78
6/6/2020	1069	7/23/2020	5600	9/7/2020	32
6/7/2020	739	7/24/2020	6480	9/8/2020	32
6/8/2020	954	7/25/2020	5931	9/9/2020	35
6/9/2020	2065	7/26/2020	3153	9/10/2020	10
6/10/2020	1189	7/27/2020	4339	9/11/2020	19
6/11/2020	2808	7/28/2020	2440	9/12/2020	17
6/12/2020	2169	7/29/2020	2676	9/13/2020	130
6/13/2020	918	7/30/2020	2223	9/14/2020	289
6/14/2020	835 *	7/31/2020	1628	9/15/2020	138
6/15/2020	830	8/1/2020	1229	9/16/2020	37
6/16/2020	832	8/2/2020	895	9/17/2020	9
6/17/2020	456	8/3/2020	726	9/18/2020	1
6/18/2020	346	8/4/2020	658	9/19/2020	4
6/19/2020	234	8/5/2020	2384	9/20/2020	1
6/20/2020	240	8/6/2020	8626	9/21/2020	1
6/21/2020	207	8/7/2020	7626	9/22/2020	2
6/22/2020	218	8/8/2020	8506	9/23/2020	2
6/23/2020	186	8/9/2020	7983	9/24/2020	2
6/24/2020	248	8/10/2020	5670	9/25/2020	1
6/25/2020	401	8/11/2020	4065	9/26/2020	0
6/26/2020	326	8/12/2020	3837	9/27/2020	2
6/27/2020	309	8/13/2020	3735	9/28/2020	3
6/28/2020	371	8/14/2020	3008	9/29/2020	4
6/29/2020	488	8/15/2020	3607	9/30/2020	1
6/30/2020	1508	8/16/2020	3432	10/1/2020	1
7/1/2020	718	8/17/2020	4435	10/2/2020	15
7/2/2020	322	8/18/2020	4367	10/3/2020	75
7/3/2020	338	8/19/2020	6012	TOTAL	254,651
7/4/2020	263				

Volumetric estimates are in Italics (56)
 Bolded numbers are peak days

The peak periods are shown in boxes
 * QC checks (3)

Table 4.0-2: Known Eel Numbers in the 200 Milliliter Subsample during Days of Volumetric Estimates, Conowingo Eel Collection Facility, 2020

Date	Number of Eels in 200 mL	Average (mm)	Range of lengths (mm)
5/27/2020	121		
5/29/2020	140		
5/30/2020	145		
5/31/2020	114		
6/1/2020	129	112.1	91-145
6/2/2020	131		
6/3/2020	99		
6/4/2020	85	124.8	92-147
6/5/2020	95		
6/11/2020	121	107.6	82-127
6/12/2020	139		
6/14/2020	121		
6/30/2020	145		
7/1/2020	142		
7/8/2020	120		
7/9/2020	134	103.5	85-126
7/10/2020	129		
7/11/2020	151		
7/12/2020	153		
7/13/2020	128		
7/14/2020	125	108.1	88-131
7/20/2020	160	106.6	88-130
7/21/2020	143		
7/22/2020	164		
7/23/2020	153	104.2	92-114
7/24/2020	162		
7/25/2020	164		
7/26/2020	146		
7/27/2020	146	111.8	89-133
7/28/2020	122		
7/29/2020	119		
7/30/2020	117	115	98-136
7/31/2020	146		
8/1/2020	131		
8/5/2020	149		
8/6/2020	167	100.2	89-112
8/7/2020	164		
8/8/2020	159		
8/9/2020	155		
8/10/2020	151	108.9	91-126
8/11/2020	149		
8/12/2020	142		
8/13/2020	148	114.9	94-134
8/14/2020	128		
8/15/2020	145		
8/16/2020	132		
8/17/2020	151	116.5	86-150
8/18/2020	163		
8/19/2020	167		
8/20/2020	139	114.5	88-139
8/21/2020	131		
8/22/2020	116		
8/23/2020	108		
8/24/2020	133	118.8	93-152
8/29/2020	139		
8/30/2020	127		
Average (mm)	137.6	111.2	
Min (mm)	85	100.2	82
Max (mm)	167	124.8	152

Table 4.2-1: Number of Juvenile Eel Captured with Length and Weight Measurements, Conowingo Eel Collection Facility, 2020

	Total
Number eels collected	254,651
Number measured	851
Data Collection Days	39
Range of lengths (mm)	71-186
Average length (mm)	112.2
Median length (mm)	112.0
Range of weights (g)	0.3-5.4
Average weight (g)	1.5
Median weight (g)	1.4

Table 4.2-2: Juvenile Eel Length Frequency, Conowingo Eel Collection Facility, 2020

TL (mm)	Number
70-74	1
75-79	3
80-84	3
85-89	29
90-94	46
95-99	87
100-104	104
105-109	101
110-114	125
115-119	107
120-124	86
125-129	60
130-134	42
135-139	22
140-144	17
145-149	5
150-154	7
155-159	2
160-164	2
165-169	1
185-189	1
Total	851

Table 4.2-3: Juvenile Eel Weight Frequency, Conowingo Eel Collection Facility, 2020

Weight (g)	Number
0.0-0.4	11
0.5-0.9	152
1.0-1.4	319
1.5-1.9	194
2.0-2.4	106
2.5-2.9	40
3.0-3.4	20
3.5-3.9	6
4.0-4.4	1
4.5-5.0	1
5.0-5.4	1
Total	851

Table 4.2-4: Observed Injuries of Juvenile American Eels, Conowingo Eel Collection Facility, 2020

Date	Length	Weight	Condition Factor
5/21/2020	115	1.4	Marks on both sides *
5/25/2020	125	2.6	Lesion near gills
6/1/2020	91	0.7	Lesion on side
6/4/2020	92	0.9	Lesion on belly
	127	2.2	Lesion on side of head
	119	2.1	Marks on both sides
6/9/2020	131	2.4	Tail Redness *
	99	0.5	Fungus, marks on belly
6/11/2020	87	0.7	Lesion behind lower jaw
6/18/2020	142	3.1	Fungus
6/23/2020	115	1.7	Scrape on side
	120	1.8	Fungus
6/25/2020	135	2.3	Abrasion/Lesion on tail
7/2/2020	96	0.8	Red around gills
7/14/2020	131	2.6	Fungus
	95	1.0	Fungus
	130	2.6	Fungus
	102	1.0	Fungus
7/23/2020	94	0.9	Fungus
	101	1.2	Fungus
7/27/2020	104	1.1	Fungus on belly
	117	1.7	Fungus on side
7/30/2020	115	1.3	Fungus
	107	1.2	Fungus
8/17/2020	113	1.6	Lesion on tail
8/27/2020	125	1.4	Scrape on side
	125	1.5	Scratches on side
9/14/2020	98	0.7	Lesion on left side

* Taken as a sacrifice

28 of 851 eels (3.3%) that were processed had injury

2 of the 28 were sacrificed (7.1%)

Neither sacrificed eel contained a parasite

Table 4.3-1: Sacrificed Eel Data, Conowingo Eel Collection Facility, 2020

Date	Length (mm)	Weight (g)	Parasite	Age	Date	Length (mm)	Weight (g)	Parasite	Age
5/21/2020	100	1.3	1	2	8/3/2020	86	0.5	0	1
	114	1.7	2	2		93	1.1	0	1
	85	1.3	0	1		143	2.9	0	3
	130	2.5	1	3		121	1.8	2	2
	115	1.4	0	2		132	2.8	1	3
5/25/2020	139	3.0	2	3	8/10/2020	94	0.8	1	1
	91	0.6	1	1		91	0.8	1	1
	154	3.9	0	4		113	1.5	1	NR
	111	1.0	0	NR		109	1.4	0	2
	122	1.9	1	2		126	2.2	0	2
6/1/2020	122	1.9	1	3	8/17/2020	86	0.6	2	1
	110	1.1	1	2		138	2.7	1	3
	97	0.9	2	1		144	2.4	0	NR
	145	3.3	1	3		113	1.6	1	2
	131	2.8	2	2		150	3.1	0	4
6/9/2020	131	2.4	0	2	8/24/2020	152	2.4	0	4
	107	1.4	2	1		140	3.1	1	3
	143	3.2	0	4		126	2.3	0	2
	94	1.0	1	1		114	1.5	0	2
	118	1.8	1	2		100	1.3	1	1
	106	1.4	1	1	8/31/2020	157	3.2	1	4
	116	1.2	2	2		116	1.4	2	2
105	1.0	1	2	99		0.7	0	1	
6/16/2020	161	4.2	1	4	135	1.1	0	3	
	102	1.5	0	1	136	1.7	2	3	
	90	0.5	2	1	9/7/2020	79	0.4	1	1
	85	0.4	2	1		71	0.3	0	1
	6/23/2020	96	1.0	0		1	97	0.9	2
151		2.5	1	4		88	0.5	0	1
89		0.7	0	1		91	0.5	1	1
131		2.9	0	3	9/14/2020	99	0.6	1	1
90		1.1	1	1		100	0.7	1	1

(continued)

Table 4.3-1. (Continued)

Date	Length (mm)	Weight (g)	Parasite	Age
6/29/2020	101	1.4	1	2
	132	2.5	2	3
	96	0.5	1	1
	127	2.5	1	NR
	102	1.0	0	2
7/6/2020	124	1.8	0	2
	110	.3	1	2
	131	1.8	3	NR
	104	1.3	0	1
	119	1.6	2	2
7/14/2020	96	0.8	1	2
	88	0.5	0	1
	122	1.5	0	1
	120	2.0	1	3
	102	1.0	2	2
7/20/2020	95	1.0	0	1
	89	0.7	0	1
	97	1.1	1	1
	98	1.0	1	NR
	130	2.8	0	2
7/27/2020	124	1.8	0	2
	100	1.3	1	2
	131	2.8	2	3
	133	2.6	1	3
	89	0.7	0	1

Date	Length (mm)	Weight (g)	Parasite	Age
9/14/2020	153	2.4	1	4
	92	0.6	2	1
	103	0.9	2	2
9/21/2020	121	1.2	0	2
9/28/2019	103	1.2	0	2
	116	1.5	1	2
	99	1.1	0	2
Average	113.2	1.6	0.83	1.97
Range	71-161	0.3-4.2	0-3	1-4
Total Sacrificed		96		
Total Aged		89		
0 Parasites		36 (37.5%)		
1 Parasite		41 (42.7%)		
2 Parasites		18 (18.8%)		
3 Parasites		1 (1.0%)		
Eels without parasites		36 (37.5%)		
Eels with parasites		60 (62.5%)		
NR – age could not be determined				

Table 4.3-2: Sacrificed Eels Length Frequency with Detailed Info, Conowingo Eel Collection Facility, 2020

TL (mm)	Weight (g)	Number	Contained Parasite	Age
70-74	0.3	1	0	1
75-79	0.4	1	1	1
85-89	0.4-1.3	9	2	1, 1, 1, 1, 1, 1, 1, 1, 1
90-94	0.5-1.1	9	8	1, 1, 1, 1, 1, 1, 1, 1, 1
95-99	0.5-1.1	11	7	1, 1, 1, 1, 1, 1, 1, 1, 2, NR, NR
100-104	0.7-1.5	10	7	1, 1, 1, 1, 2, 2, 2, 2, 2
105-109	1.0-1.4	4	3	1, 1, 2, 2
110-114	1.0-1.7	8	5	2, 2, 2, 2, 2, 2, NR, NR
115-119	1.2-1.8	5	5	2, 2, 2, 2, 2
120-124	1.2-2.0	8	4	2, 2, 2, 2, 2, 2, 3, 3
125-129	2.2-2.5	5	1	2, 2, 2, 3, NR
130-134	1.8-2.9	10	8	2, 2, 2, 3, 3, 3, 3, 3, 3, NR
135-139	1.1-3.0	3	3	3, 3, 3
140-144	2.4-3.2	4	1	3, 3, 4, NR
145-149	3.3	1	1	3
150-154	2.4-3.9	5	2	4, 4, 4, 4, 4
155-159	3.2	1	1	4
160-164	4.2	1	1	4
Total		96	60	

NR – age could not be determined

Table 4.4-1: Juvenile Eel Collection by Week and Ranks, Conowingo Eel Collection Facility, 2020

	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10	Wk 11	Wk 12
Total				2290	20801	36993	10842	3773	1895	4008	15127	7509
Rank				15	6	1	9	13	16	12	8	10
Percent Catch (%)				0.90	8.17	14.53	4.26	1.48	0.74	1.57	5.94	2.95

	Wk 13	Wk 14	Wk 15	Wk 16	Wk 17	Wk 18	Wk 19	Wk 20	Wk 21	Wk 22	Wk 23
Total	36742	17693	29622	31905	24947	6993	2570	223	608	9	101
Rank	2	7	4	3	5	11	14	18	17	20	19
Percent Catch (%)	14.43	6.95	11.63	12.53	9.8	2.75	1.01	0.09	0.24	0.00	0.04

**Top 3 ranked weeks are shown in boxes.
No Collection occurred until May 18, 2020**

Wk 1: May 1 - May 2

Wk 2: May 3 - May 9

Wk 3: May 10 - May 16

Wk 4: May 17 - May 23

Wk 5: May 24 - May 30

Wk 6: May 31 - June 6

Wk 7: June 7 - June 13

Wk 8: June 14 - June 20

Wk 9: June 21 – June 27

Wk 10: June 28 – July 4

Wk 11: July 5 – July 11

Wk 12: July 10 – July 18

Wk 13: July 19 - July 25

Wk 14: July 26 – August 1

Wk 15: August 2 - August 8

Wk 16: August 9 - August 15

Wk 17: August 16 - August 22

Wk 18: August 23 - August 29

Wk 19: August 30 - September 5

Wk 20: September 6 - September 12

Wk 21: September 13 – September 19

Wk 22: September 20 – September 26

Wk 23: September 27 – October 3

Table 4.5-1: Daily Average River flows (cfs), USGS 01578310 - Conowingo Dam USGS Gage Station, 2020

Day	May	June	July	August	September	October
1		34,900	10,500	9,230	5,780	4,020
2		27,900	11,600	13,500	5,820	4,720
3		25,800	14,600	7,090	5,850	4,050
4		24,500	14,100	18,000	16,100	
5		35,100	9,450	17,800	13,600	
6		38,000	8,100	8,650	8,900	
7		33,000	10,100	9,960	9,590	
8		29,200	6,730	33,300	5,860	
9		20,400	16,000	18,900	5,810	
10		27,300	10,400	13,000	5,810	
11		21,000	15,400	15,200	5,740	
12		22,400	9,420	18,700	5,780	
13		29,000	12,000	7,750	5,730	
14		23,500	1,090	7,700	5,760	
15		26,600	12,300	9,560	4,320	
16		19,200	9,650	14,900	4,040	
17		19,900	9,510	5,740	4,050	
18		15,100	16,900	10,600	4,060	
19	58,400	16,800	14,900	9,270	4,060	
20	44,600	14,200	7,860	7,210	7,510	
21	39,200	15,700	6,800	5,800	7,660	
22	37,000	17,400	7,290	8,060	4,040	
23	40,400	20,200	10,900	9,480	4,050	
24	30,000	15,900	8,290	9,030	4,040	
25	35,600	10,800	15,000	5,820	4,030	
26	31,500	15,900	10,700	5,770	3,980	
27	29,300	14,600	5,980	6,110	3,970	
28	44,100	17,300	7,190	5,690	4,010	
29	18,600	7,780	8,400	7,840	4,010	
30	24,500	11,300	6,150	8,880	4,190	
31	33,900		7,160	5,780		

Bolded value represents the highest average river flow
 Daily average river flows are represented in cubic feet per second (cfs)

Table 4.5-2: Fraction of Moon Illumination, 2020 EST (1.0 equals full moon)

Day	May	June	July	August	September	October
1		0.71	0.79	0.92	0.98	0.99
2		0.81	0.88	0.97	1.00	1.00
3		0.89	0.94	0.99	0.99	0.99
4		0.95	0.98	1.00	0.97	
5		0.99	1.00	0.98	0.93	
6		1.00	0.99	0.94	0.87	
7		0.98	0.96	0.89	0.80	
8		0.94	0.91	0.82	0.72	
9		0.88	0.85	0.75	0.63	
10		0.80	0.77	0.66	0.54	
11		0.72	0.69	0.57	0.44	
12		0.62	0.59	0.47	0.34	
13		0.53	0.50	0.38	0.25	
14		0.43	0.40	0.28	0.16	
15		0.34	0.31	0.20	0.09	
16		0.25	0.23	0.12	0.03	
17		0.17	0.15	0.06	0.01	
18		0.11	0.08	0.02	0.01	
19	0.13	0.05	0.04	0.00	0.04	
20	0.07	0.02	0.01	0.01	0.10	
21	0.03	0.00	0.00	0.05	0.18	
22	0.01	0.01	0.02	0.12	0.28	
23	0.00	0.03	0.07	0.20	0.38	
24	0.02	0.08	0.14	0.31	0.49	
25	0.05	0.16	0.22	0.42	0.60	
26	0.11	0.25	0.33	0.53	0.70	
27	0.18	0.35	0.44	0.64	0.79	
28	0.27	0.46	0.56	0.74	0.86	
29	0.37	0.58	0.67	0.83	0.92	
30	0.48	0.69	0.77	0.90	0.97	
31	0.60		0.85	0.95		

Table 4.5-3: Water Temperature (°C) Taken in Collection Tank, Conowingo Eel Collection Facility, 2020

Day	May	June	July	August	September	October
1		23.2	28.0	31.2	28.1	23.0
2		22.9	28.2	31.0	27.7	22.9
3		22.9	28.9	30.5	27.6	22.7
4		23.0	29.0	29.8	27.6	
5		23.2	29.1	29.6	27.7	
6		23.7	29.0	29.2	27.8	
7		23.1	28.9	29.2	27.5	
8		23.4	29.4	29.3	27.6	
9		23.6	29.3	29.1	27.4	
10		23.8	29.3	28.6	27.4	
11		24.8	29.9	28.3	27.5	
12		25.1	29.5	28.6	26.7	
13		25.9	29.4	28.9	27.3	
14		25.6	29.4	28.9	27.1	
15		25.2	29.7	29.1	26.3	
16		25.3	29.4	28.8	25.8	
17		25.1	29.1	28.5	25.7	
18		25.1	29.1	28.1	25.6	
19	19.2	25.1	29.4	27.9	24.8	
20	17.4	24.8	29.5	28.1	24.4	
21	17.1	24.8	29.7	28.4	23.9	
22	17.3	25.3	30.3	28.3	23.7	
23	17.3	25.2	30.1	28.5	23.5	
24	17.6	25.9	30.2	28.4	23.3	
25	17.6	26.9	30.3	28.4	23.3	
26	18.9	26.8	30.2	28.8	23.0	
27	19.6	27.1	30.3	29.2	23.1	
28	20.7	27.1	30.7	29.2	23.1	
29	21.6	27.4	31.1	29.2	23.1	
30	21.5	27.9	31.3	28.9	23.1	
31	23.7		31.3	28.6		

Table 4.5-4: Dissolved Oxygen (mg/L) Reading from the Control Room (Station 643), Conowingo Eel Collection Facility, 2020

Day	May	June	July	August	September	October
1		7.79	7.06	6.30	7.24	7.79
2		8.71	6.86	7.25	7.13	7.50
3		7.46	7.06	6.70	7.26	9.40
4		7.21	7.46	6.72	7.12	
5		7.15	7.23	7.07	7.26	
6		7.50	6.38	7.44	7.17	
7		8.07	6.23	7.51	7.19	
8		8.01	7.36	8.48	7.18	
9		8.34	7.27	7.87	7.54	
10		7.86	6.20	7.13	7.02	
11		7.50	6.51	7.24	7.16	
12		7.88	6.51	6.97	7.22	
13		7.94	6.96	6.87	7.29	
14		7.75	6.72	7.61	7.40	
15		8.50	6.72	7.42	7.86	
16		8.08	8.46	7.38	7.79	
17		8.16	7.91	7.42	7.70	
18		8.06	7.77	7.30	7.79	
19	9.93	7.16	7.48	7.10	8.08	
20	9.61	7.03	6.68	7.04	7.98	
21	9.52	6.92	6.56	7.58	8.66	
22	9.50	7.06	6.67	7.46	8.75	
23	9.21	7.02	6.63	7.50	8.47	
24	8.81	7.17	7.35	7.23	8.41	
25	8.59	7.29	7.36	7.28	8.61	
26	8.81	7.33	7.37	7.19	7.44	
27	8.42	7.28	6.40	6.79	7.58	
28	8.51	7.08	6.70	7.07	7.68	
29	8.37	7.01	7.50	6.94	7.19	
30	7.39	7.09	7.50	7.05	7.67	
31	7.53		7.18	7.34		

Table 4.6-1: Eel Transport/Stocking Data, 2020

Location of stocking	Number of eels	Died (Mortality)			Removed for Analysis	Removed for SRBC	Number Stocked
		Collection Tank	Holding Tank	Transported			
Octoraro Creek Collection Tank	3,597	0 (0.00%)					
Transported to Conowingo Eel Collection Facility	3,597			0 (0.00%)			3,597
Conowingo Collection Tank	254,651	68 (0.03%)	2,155 (0.84%)		96	40	252,292
Total Transported from Conowingo Eel Collection Facility	255,889			479 (0.19%)			255,410
Stocked at Bloomsburg (Site 8)*	109,709			401 (0.37%)			109,308
Stocked at Lock Haven (Site 11)**	109,175			52 (0.05%)			109,123
Stocked at Wrightsville (Site 3A)***	19,339			20 (0.10%)			19,319
Stocked at Columbia (Site 3B)****	17,666			6 (0.03%)			17,660
TOTAL Transported #	255,889			479 (0.19%)			255,410

Bolded value is assumed as worst case, could be eels from Octoraro or Conowingo

* Transported to Bloomsburg (Site 8), (May 22, June 2, 5, 15, 19, 22, 26, and 30, July 3, 9, 13, 28, 29, and 31, August 1, 3, 5, 7, 9, 11, 12, 14, 16, 18, 20, 22, 23, 24, 28 and 29)

** Transported to Lock Haven (Site 11), (May 29 and 31, June 8 and 12, July 7, 10, 14, 15, 18, 19, 20, 21, and 30, August 2, 4, 6, 8, 10, 13, 15, 17, 19, 21, 25, 26, 27, and 30)

*** Transported to Wrightsville (Site 3B), (July 17, 22, 25, and 27, September 1)

**** Transported to Columbia (Site 3A), (July 16, 23, 24, and 26, August 4 and 31, September 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 25, October 3)

Table 4.7-1: Detailed Individual Eel Transport Data, 2020

Transport to Bloomsburg (Site 8)

Date	Number of eels stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
5/22	1,836	950	16.9	9.9	1038	18.5	7.9	1339	18.3	13.2	17.5	10.2
6/2	14,720	817	22.5	7.8	925	23.5	7.9	1306	23.0	16.3	19.3	8.8
6/2	6,599	817	22.9	8.0	925	23.5	8.9	1306	22.8	16.0	19.3	8.8
6/5	7,000	951	23.0	8.1	951	24.1	5.4	1304	24.2	10.5	22.0	8.2
6/15	2,533	835	24.8	7.3	920	25.1	5.4	1245	25.8	15.7	24.0	8.8
6/19	1,805	830	24.8	5.7	940	26.6	5.7	1306	26.6	11.8	25.1	7.9
6/22	655	845	25.2	8.0	930	26.8	9.0	1221	26.6	15.1	27.8	78
6/26	1,134	800	26.6	8.2	849	27.4	7.6	1221	27.4	15.9	27.1	8.5
6/30	2,656	800	27.7	6.7	903	28.5	5.6	1250	28.4	11.7	26.4	7.9
7/3	1,377	855	28.7	7.6	930	29.5	5.9	1255	29.0	7.6	28.6	10.4
7/9	4,556	834	29.0	7.5	1009	30.3	15.6	1351	30.6	12.5	29.8	12.3
7/13	7,722	930	29.1	11.5	1100	30.1	6.7	1432	30.0	12.0	27.7	11.6
7/28	2,439	951	30.7	6.6	1045	31.2	8.9	1427	30.7	7.5	30.0	11.1
7/29	2,672	815	31.1	6.4	906	31.8	5.8	1255	31.5	10.0	29.5	10.6
7/31	1,626	855	31.3	12.0	943	25.6	6.0	1252	26.5	18.0	28.8	8.3
8/1	1,230	840	31.2	6.1	915	31.8	5.7	1237	31.5	13.8	27.8	6.8
8/3	721	835	30.5	8.1	930	31.2	7.1	1302	30.8	11.8	27.9	7.8
8/5	2,584	912	29.6	7.7	1020	30.6	11.4	1408	30.4	15.7	27.3	8.4
8/7	7,626	815	29.2	8.8	917	29.9	10.9	1319	29.2	15.4	26.5	8.2
8/9	7,997	915	29.1	8.6	1010	29.8	6.3	1410	30.0	15.5	28.1	7.8
8/11	4,232	915	28.3	8.9	951	29.3	17.6	1307	29.5	14.7	29.2	9.9
8/12	4,442	1105	28.6	9.5	1215	23.1	12.7	1526	24.0	16.5	30.2	8.9
8/14	3,249	900	28.9	12.5	940	29.8	11.1	1258	29.6	9.5	29.0	9.8
8/16	3,721	739	28.8	8.8	835	29.4	7.6	1215	28.5	11.1	26.8	8.1
8/18	4,535	848	28.1	7.3	945	28.8	12.8	1300	28.4	15.8	27.7	10.8
8/20	3,301	848	28.1	10.4	954	28.7	10.8	1320	28.6	8.4	27.0	11.3
8/22	1,332	839	28.3	10.8	900	28.6	5.4	1208	29.0	7.2	27.9	10.7
8/23	1,267	900	28.5	7.2	940	29.2	6.0	1250	29.2	16.0	27.7	9.1
8/24	1,436	927	28.4	6.9	1028	28.2	6.6	1345	28.6	12.3	30.3	12.1
8/28	1,103	900	29.2	9.3	920	29.6	7.5	1245	29.6	11.3	26.2	10.2
8/29	1,202	845	29.2		924	29.3	6.5	1326	28.7	12.8	25.4	9.3
Total	109,308											

Table 4.7-1 (Continued)

Transport to Lock Haven (Site 11)

Date	Number of eels stocked	Holding Facility		
		Time	Temp (°C)	DO (mg/L)
5/29	4,015	831	21.4	8.3
5/31	15,775	800	23.5	7.5
5/31	8,943	800	24.1	8.2
6/8	2,656	845	23.2	8.7
6/12	7,812	846	24.9	7.3
7/7	2,089	830	28.5	11.4
7/10	4,239	845	29.3	6.1
7/14	776	850	29.4	6.5
7/15	521	919	29.7	6.7
7/18	646	815	29.1	7.7
7/19	1,296	800	29.4	7.6
7/20	3,188	900	29.5	6.2
7/21	5,766	804	29.7	6.1
7/30	2,221	851	31.3	7.4
8/2	893	755	31.0	10.5
8/4	663	917	29.8	8.5
8/6	8,626	924	29.2	5.4
8/8	8,506	917	29.3	6.2
8/10	5,699	932	28.6	10.6
8/13	4,395	958	28.9	8.0
8/15	3,871	840	29.1	6.0
8/17	4,589	847	28.5	7.2
8/19	6,110	1020	27.9	10.7
8/21	2,354	929	28.4	9.2
8/25	674	856	28.4	6.9
8/26	597	1002	28.8	6.2
8/27	1,007	900	29.2	8.0
8/30	1,196	748	28.9	10.0

Total 109,123

Loaded for Transport		
Time	Temp (°C)	DO (mg/L)
910	22.3	16.7
950	24.3	17.2
950	24.2	12.8
1045	24.4	7.5
1030	25.2	6.5
929	28.8	3.9
920	29.1	2.2
950	29.6	18.8
940	30.5	6.2
904	29.8	7.2
900	30.1	7.8
957	30.3	6.5
850	30.5	10.1
925	32.1	6.0
845	31.3	7.9
1000	28.7	12.3
1030	22.4	10.3
1015	30.2	8.7
1009	29.5	15.3
1100	27.2	7.7
921	29.8	9.6
945	28.0	9.3
1030	28.6	9.4
1015	27.1	11.3
915	25.2	6.6
1023	29.4	9.4
945	29.9	8.6
820	29.9	5.3

Prior to Unloading		
Time	Temp (°C)	DO (mg/L)
1354	23.6	15.2
1340	24.0	17.7
1340	23.9	12.2
1405	24.6	9.7
1503	26.6	10.1
1306	28.7	7.8
1330	28.9	8.9
1425	29.1	11.2
1331	30.3	12.2
1233	29.4	11.7
1220	29.3	11.3
1339	30.6	16.2
1421	30.8	12.0
1305	31.4	9.8
1251	30.4	11.8
1340	26.6	15.3
1424	22.8	14.6
1400	29.9	14.6
1425	30.0	16.5
1448	28.0	15.7
1253	29.3	13.4
1335	28.2	10.4
1450	28.0	10.2
1400	27.7	13.1
1259	25.5	16.5
1414	29.4	14.8
1330	30.0	10.7
1224	28.8	12.4

Stocking site	
Temp (°C)	DO (mg/L)
22.6	8.3
20.3	8.9
20.3	8.9
21.4	8.5
24.3	7.9
29.6	7.1
30.7	6.4
27.1	5.9
27.7	7.7
27.7	6.9
29.2	6.7
30.0	7.0
30.8	7.6
28.7	7.1
27.6	6.9
26.7	6.9
26.2	8.0
27.2	7.8
28.5	8.2
30.0	7.9
28.0	7.9
27.3	8.1
27.0	8.1
25.3	7.7
25.0	7.5
26.7	8.0
26.4	7.4
25.6	8.1

Table 4.7-1 (Continued)

Transport to Wrightsville (Site 3A)

Date	Number of eels stocked	Holding Facility		
		Time	Temp (°C)	DO (mg/L)
7/17	303	850	29.1	7.3
7/22	3,119	940	30.3	5.9
7/22	3,362	1230	30.3	5.9
7/22	1,975	1510	30.3	5.9
7/25	2,813	830	30.3	6.5
7/25	3,116	1130	30.4	6.5
7/27	2,831	900	30.3	9.0
7/27	1,453	1250	30.3	9.0
9/1	347	800	28.1	7.0

Total 19,319

Loaded for Transport		
Time	Temp (°C)	DO (mg/L)
946	29.5	9.4
1000	31.2	6.4
1240	30.8	6.6
1530	30.4	10.0
900	30.5	7.5
1150	32.0	6.6
930	30.5	9.0
1310	31.9	6.1
915	28.5	14.6

Prior to Unloading		
Time	Temp (°C)	DO (mg/L)
1112	29.5	14.3
1115	30.8	9.1
1355	30.7	11.1
1645	30.9	12.1
1012	29.9	7.4
1320	31.7	6.7
1109	30.8	13.0
1440	32.0	11.1
1021	28.2	12.0

Stocking site	
Temp (°C)	DO (mg/L)
27.7	8.0
31.2	7.2
31.4	7.6
31.0	7.5
29.5	7.3
31.2	8.6
30.6	7.6
32.1	8.9
23.8	8.1

Table 4.7-1 (Continued)
Transport to Columbia (Site 3B)

Date	Number of eels stocked	Holding Facility		
		Time	Temp (°C)	DO (mg/L)
7/16	359	1005	29.4	6.6
7/23	2,620	915	30.1	5.2
7/23	2,983	1255	30.2	6.1
7/24	3,092	840	30.2	6.5
7/24	3,401	1140	30.3	5.3
7/26	3,158	800	30.2	9.4
8/4	63	1615	25.7	7.1
8/31	432	839	28.6	7.6
9/2	155	930	27.8	7.2
9/3	163	914	27.6	7.4
9/4	132	830	27.6	8.1
9/5	160	830	27.7	8.2
9/6	79	749	27.8	7.5
9/7	27	933	27.5	8.8
9/8	31	830	27.6	8.7
9/9	36	950	27.4	7.8
9/10	10	845	27.4	7.5
9/11	19	930	27.5	8.1
9/12	20	736	26.7	7.2
9/13	128	837	27.3	8.4
9/14	284	829	27.1	8.6
9/15	141	900	26.3	8.6
9/16	37	935	25.8	7.5
9/17	10	848	25.7	7.5
9/18	2	914	25.6	8.2
9/25	14	856	22.7	8.7
10/3	104	800	22.7	8.6

Loaded for Transport		
Time	Temp (°C)	DO (mg/L)
1035	28.3	8.7
915	30.0	7.1
1256	30.8	5.7
929	29.0	5.1
1150	31.5	7.5
900	30.8	9.4
1620	25.9	6.9
943	29.2	12.7
1005	27.7	5.9
941	28.2	6.5
815	27.4	7.2
845	27.0	5.9
820	28.3	5.8
939	28.0	5.0
836	27.7	7.5
1033	25.2	9.1
901	27.9	7.2
930	27.7	10.9
746	27.3	8.2
900	27.2	7.2
940	28.2	6.1
930	21.3	7.2
1008	24.5	7.4
910	23.4	7.2
955	21.0	7.8
931	23.4	8.5
945	17.0	9.1

Prior to Unloading		
Time	Temp (°C)	DO (mg/L)
1204	28.8	16.0
1042	29.9	6.0
1425	30.8	15.7
1040	29.9	6.1
1345	31.4	7.8
1015	30.6	11.5
1710	6.4	25.7
1120	28.7	12.1
1215	28.2	7.8
1124	28.4	5.1
1045	28.2	14.8
1100	28.4	5.0
1015	26.8	8.8
1108	28.2	11.2
1040	24.0	6.8
1202	25.4	6.1
1020	26.8	7.1
1100	25.7	7.4
953	22.2	6.9
1035	24.4	5.0
1115	27.5	7.4
1045	20.1	5.4
1147	23.6	7.6
1008	22.3	7.0
1112	20.8	7.8
1050	22.1	7.7
1115	16.6	9.5

Stocking site	
Temp (°C)	DO (mg/L)
27.3	7.6
29.5	6.2
30.3	7.1
29.2	7.1
30.2	7.6
29.4	7.0
29.8	8.2
27.8	7.8
25.4	8.6
25.4	7.6
25.5	8.4
25.0	7.8
24.6	7.5
25.4	7.9
24.9	8.1
25.9	8.1
26.3	7.8
26.4	8.1
24.0	7.1
24.4	7.0
23.9	7.8
22.2	8.2
21.2	8.6
22.0	7.8
21.0	8.2
19.6	9.6
19.0	10.2

Total 17,660

• **Table 4.7-2: Exelon’s Eel Stocking Locations by Year, 2015 – 2020**

Location	2015	2016	2017	2018	2019	2020	TOTAL
Conowingo Creek boat ramp (USFWS request)	847	-	-	-	-	-	847
North Branch Muddy Creek	-	22,004	-	-	-	-	22,004
Conewago Creek	-	378	16,502	-	-	-	16,880
Beaver Creek	-	-	9,738	-	-	-	9,738
Etter’s boat ramp	-	-	103,662	-	-	-	103,662
West Fairview Access	-	-	-	22,586	40,950	-	63,536
Fort Hunter Access	-	-	-	22,348	41,116	-	63,464
City Island boat ramp	-	-	-	24,869	41,132	-	66,001
Bloomsburg boat ramp	-	-	-	-	-	109,308	109,308
Lock Haven boat ramp	-	-	-	-	-	109,123	109,123
Wrightsville boat ramp	-	-	-	-	-	19,319	19,319
Columbia boat ramp	-	-	-	-	-	17,660	17,660
TOTAL	847	22,382	129,902	69,803	123,198	255,410	601,542

Table 5.0-1: Specified Operating Range of Conowingo Eel Collection Facility, 2020

	Main flow	Collection Tank	Holding tank
Flow (GPM)	5 - 150	5 - 25	5 – 40
Dissolved Oxygen (mg/L)		5 - 20	5 – 20
Temperature (°C)		10 - 32	10 – 32

Table 5.0-2: Calibration of Flows (Gallons per Minute), Conowingo Eel Collection Facility, 2020

	DATE									
	5/18	5/27	6/3	6/10	6/17	6/24	7/1	7/8	7/16	7/22
Collection Tank Fill	16.5	15.9	15.6	13.2	16.2	15.0	14.4	12.0	16.8	9.6
Collection Tank Drain	16.5	16.5	15.9	13.5	16.5	15.0	13.2	10.5	16.2	10.5
Holding Tank #1 Drain	16.2	15.3		15.6		15.6	15.3			
Holding Tank #2 Drain			17.4		15.0			10.8		
Holding Tank #3 Drain	23.5	32.3	30.0	30.0	35.0	27.5	33.0	38.3	49.5	62.0
Spray Bar	8.6	8.3	8.4	8.3	8.3	7.8	8.0	7.8	7.8	8.1
Scent line	2.0	1.9	1.8	1.8	1.9	1.9	1.9	1.9	1.8	1.5
Backside of Ramp	2.0	2.5	2.1	2.1	2.2	1.9	0.7	0.4	1.2	2.4
Top Attraction	6.6	5.8	6.4	6.2	6.1	6.0	7.3	7.5	6.6	5.8
Bottom of Ramp Attraction	56.2	64.1	63.3	59.1	66.5	58.1	61.5	59.6	65.7	72.5
Total Attraction	64.8	71.7	71.4	67.1	74.5	65.9	70.7	68.9	74.1	79.7

	DATE									
	7/28	8/5	8/12	8/19	8/26	9/2	9/9	9/16	9/23	9/30
Collection Tank Fill	11.7	9.0	9.3	11.4	9.6	11.7	14.7	14.4	11.1	8.1
Collection Tank Drain	12.9	10.2	10.2	11.7	10.5	12.9	15.0	13.2	11.7	9.0
Holding Tank #1 Drain									15.0	15.3
Holding Tank #2 Drain										
Holding Tank #3 Drain	55.0	45.0	56.0	59.0	49.0	40.8	49.5	48.0	23.0	42.0
Spray Bar	8.4	8.8	8.6	8.3	8.3	8.3	8.3	8.3	8.3	8.3
Scent line	2.1	1.7	1.8	2.5	1.5	1.9	1.6	2.0	1.8	1.2
Backside of Ramp	3.3	2.9	2.8	2.8	2.4	3.1	1.9	0.8	2.4	2.1
Top Attraction	5.1	5.9	5.9	5.5	5.9	5.2	6.4	7.5	5.9	6.2
Bottom of Ramp Attraction	67.9	55.2	66.2	70.7	59.5	53.7	64.5	61.2	49.7	66.3
Total Attraction	75.1	62.8	73.9	78.7	66.9	60.8	72.5	70.7	57.4	73.7

Table 5.0-3: Quality Control Checks on Counts, Conowingo Eel Collection Facility, 2020

Date	Number of eels in:		Displacement of Water	Volumetric Estimate	Actual Counts	Difference
	200 mL	1 L				
5/27/2020	121	605	1.45	1131	1010	-121
6/14/2020	121	605	1.2	847	835	-12
8/30/2020	127	635	1.5	1122	1185	63
Total				3100	3030	-70
						-2.3%

All estimated eel counts contain extra eels that were anesthetized and counted.

Table 6.0-1: Summary of Eel Collections and Biological Data, Conowingo Eel Collection Facility, 2017-2020

		2017	2018	2019	2020	Average	Total
Eels Collected		122,300	67,949	126,181	254,651	142,770	571,081
Peak	Number	7,280	5,572	10,166	14,137		
	Day	July 30	July 30	July 5	May 30		
Days of Operation		138	138	138	138	138	
Average eels per day		886.2	492.4	914.4	1,845.3	1,034.6	
Days over 1,000 eels		31	22	26	60	34.8	139
Volumetric Estimate Days		40	25	31	56	38	152
Accuracy of Volumetric days (±)		-1.0%	+1.6%	-1.1%	-2.3%		-2.8%
Sample Size		926	857	909	851	885.8	3,543
Length (mm)	Average	122.3	121.6	114.4	112.2	117.6	
	Range	78 - 192	84 - 173	64 - 165	71 - 186		64 - 192
	Median	122.0	120.0	115.0	112.0		
Weight (g)	Average	2.1	2.0	1.8	1.5	1.9	
	Range	0.5 - 6.0	0.5 - 4.8	0.2 - 4.7	0.3 - 5.5		0.2 - 6.0
	Median	2.0	2.0	1.7	1.4		
Sacrificed	Number	193	93	91	96		473
	Contained Parasites	53.9%	48.4%	52.7%	62.5%		54.4%
	Age	2.2	2.3	1.65	1.97		
	Age range	1 - 4	1 - 4	1 - 4	1 - 4		
River Flows (cfs, daily average flows at Conowingo)	Average	37,053	62,036	40,214	14,256	38,390	
	Min	6,000	11,100	4,560	3,970		
	Max	178,000	329,000	157,000	58,400		

Figure 2.0-1: Location of the Conowingo Eel Collection Facility at Conowingo Dam, 2020

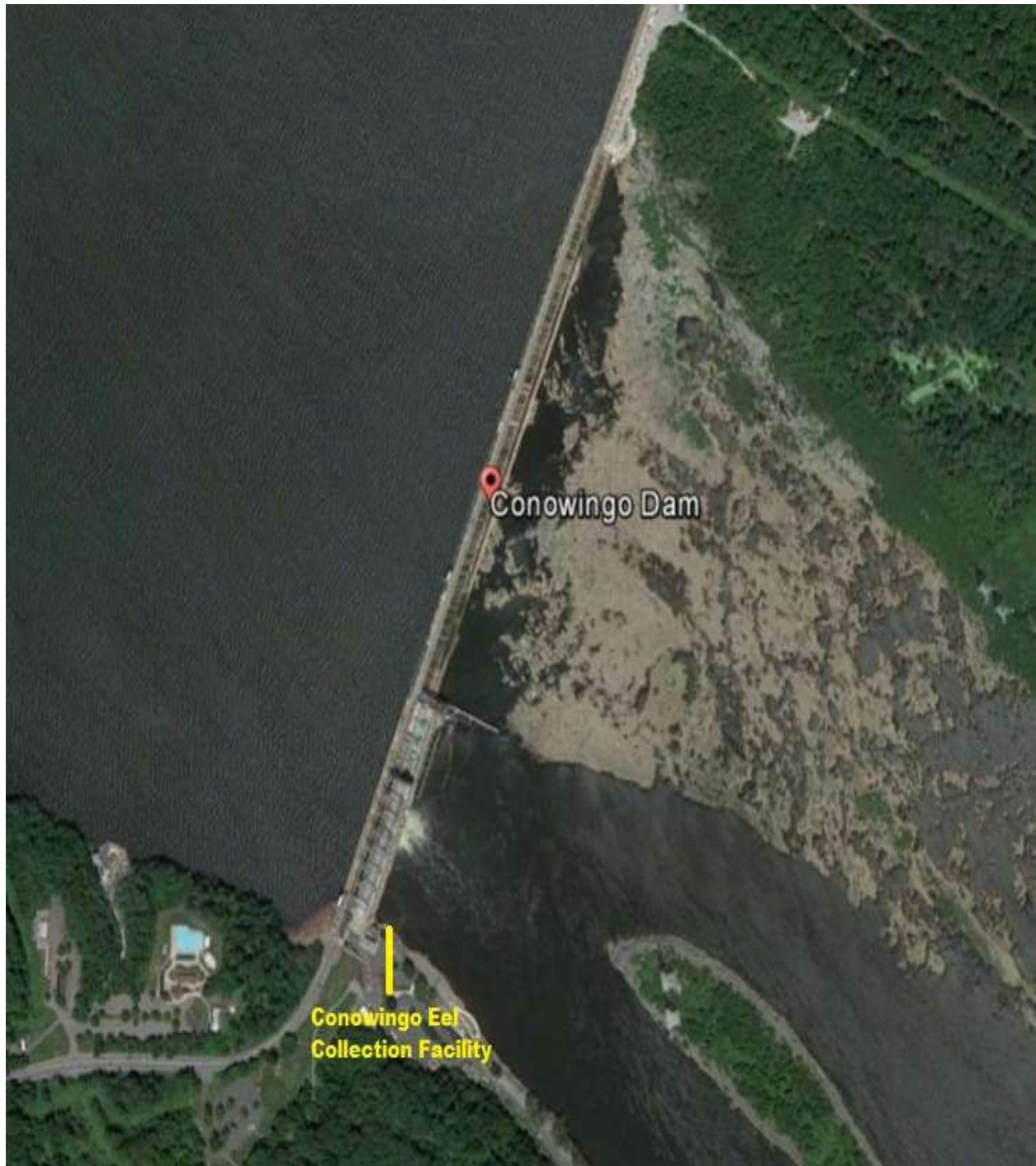


Figure 2.0-2: Location of the Conowingo Eel Collection Facility Just Downstream of the West Fish Lift, Conowingo, MD, 2020

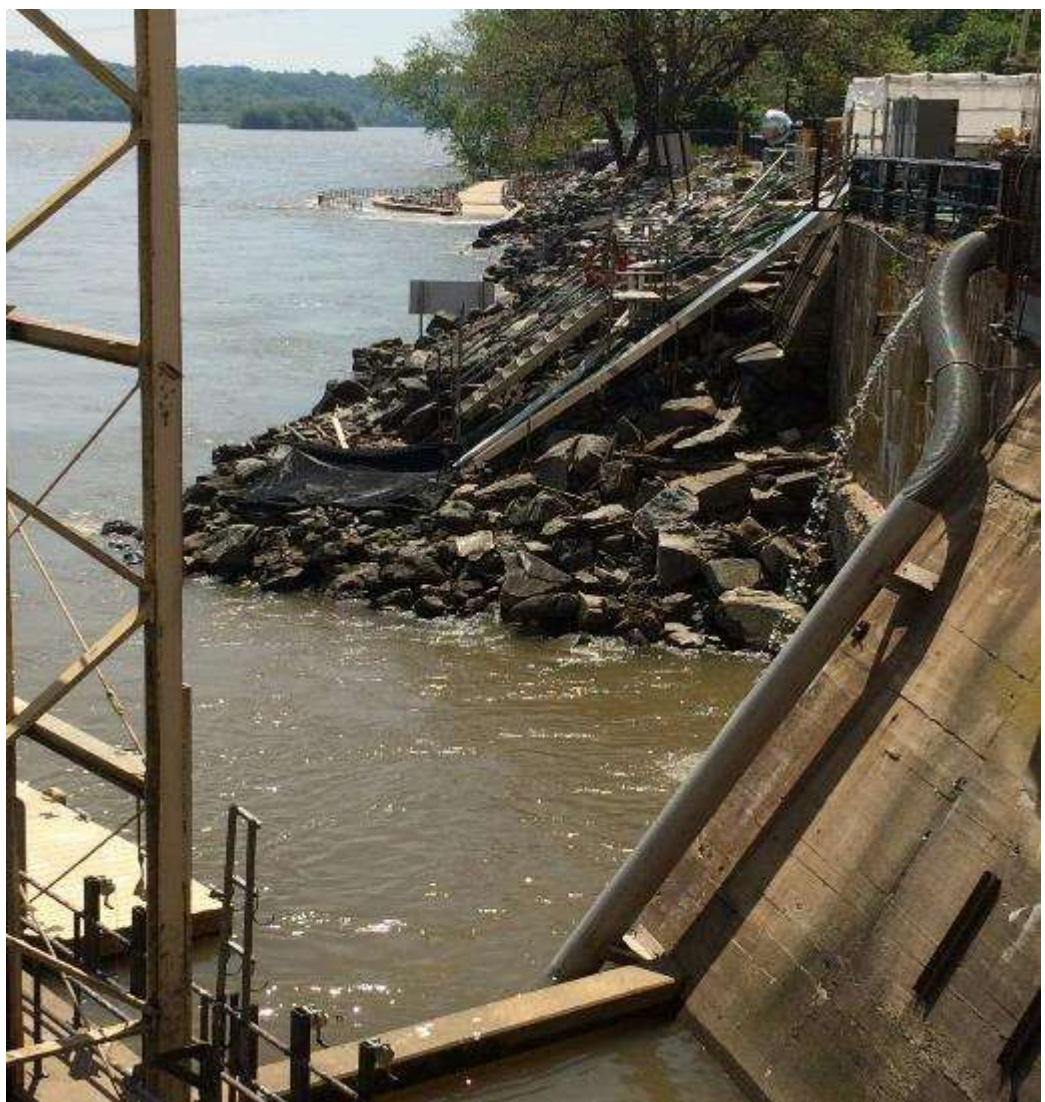
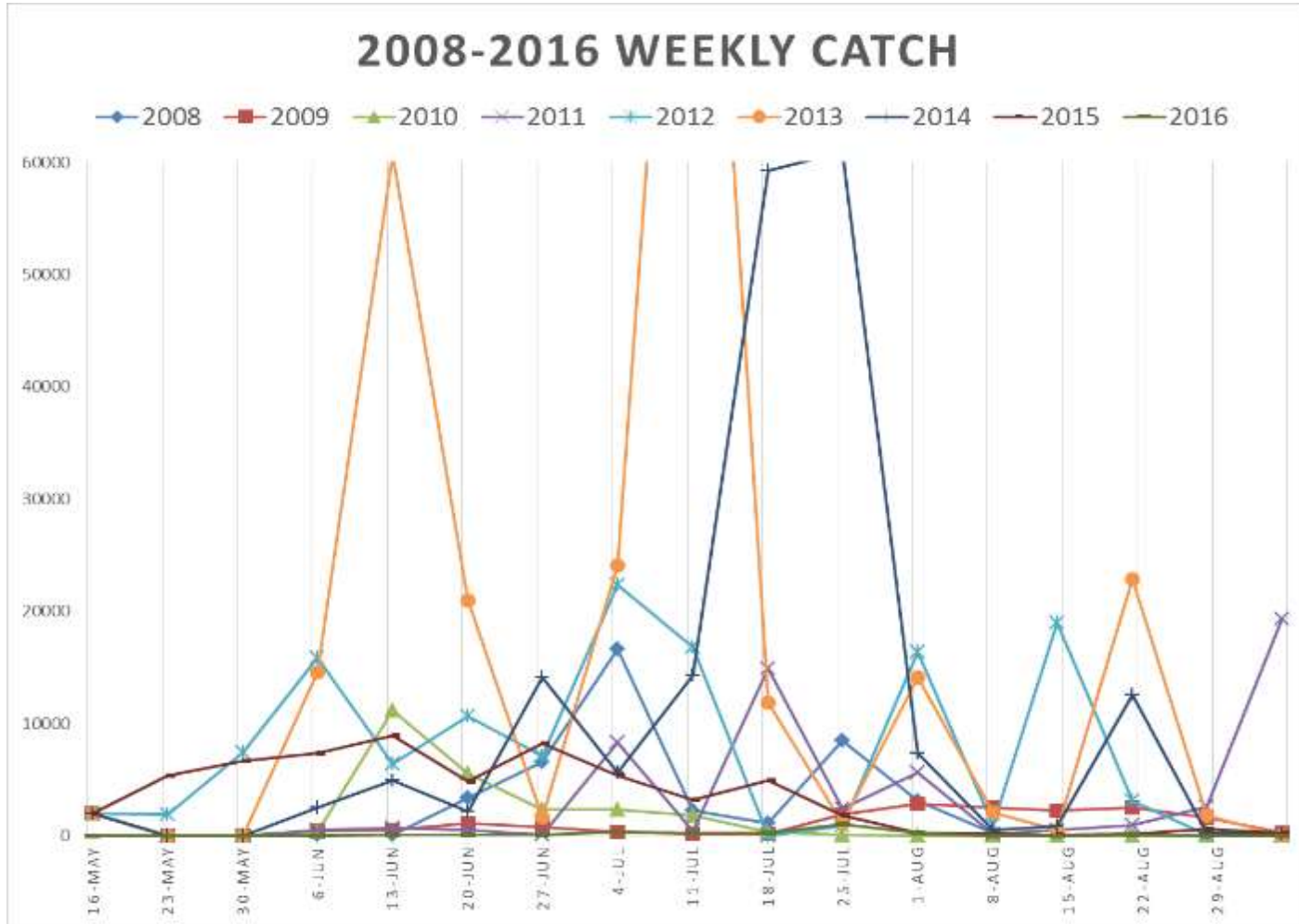


Figure 2.0-3: USFWS* Weekly Catch of Juvenile American Eel at Conowingo, 2008-2016



*Minkinen and Park 2014 and personal communication with USFWS, Christopher Reily, October 27, 2016

Figure 3.2-1: Measuring Juvenile Eel to Nearest Millimeter While Sedated, Conowingo Eel Collection Facility, 2020



Figure 3.2-2: Weighing Juvenile Eel in Grams While Sedated, Conowingo Eel Collection Facility, 2020



Figure 3.3-2: Herring Run, a Tributary of Susquehanna River used for the Wild Health Screening, Conowingo Dam, 2020



Figure 3.3-3: Small Eel Transport Tank, Conowingo Eel Collection Facility, 2020



Figure 3.3-4: Large Eel Transport Tank, Conowingo Eel Collection Facility, 2020



Figure 4.1-1: Daily Eel Catch, Conowingo Eel Collection Facility, 2020

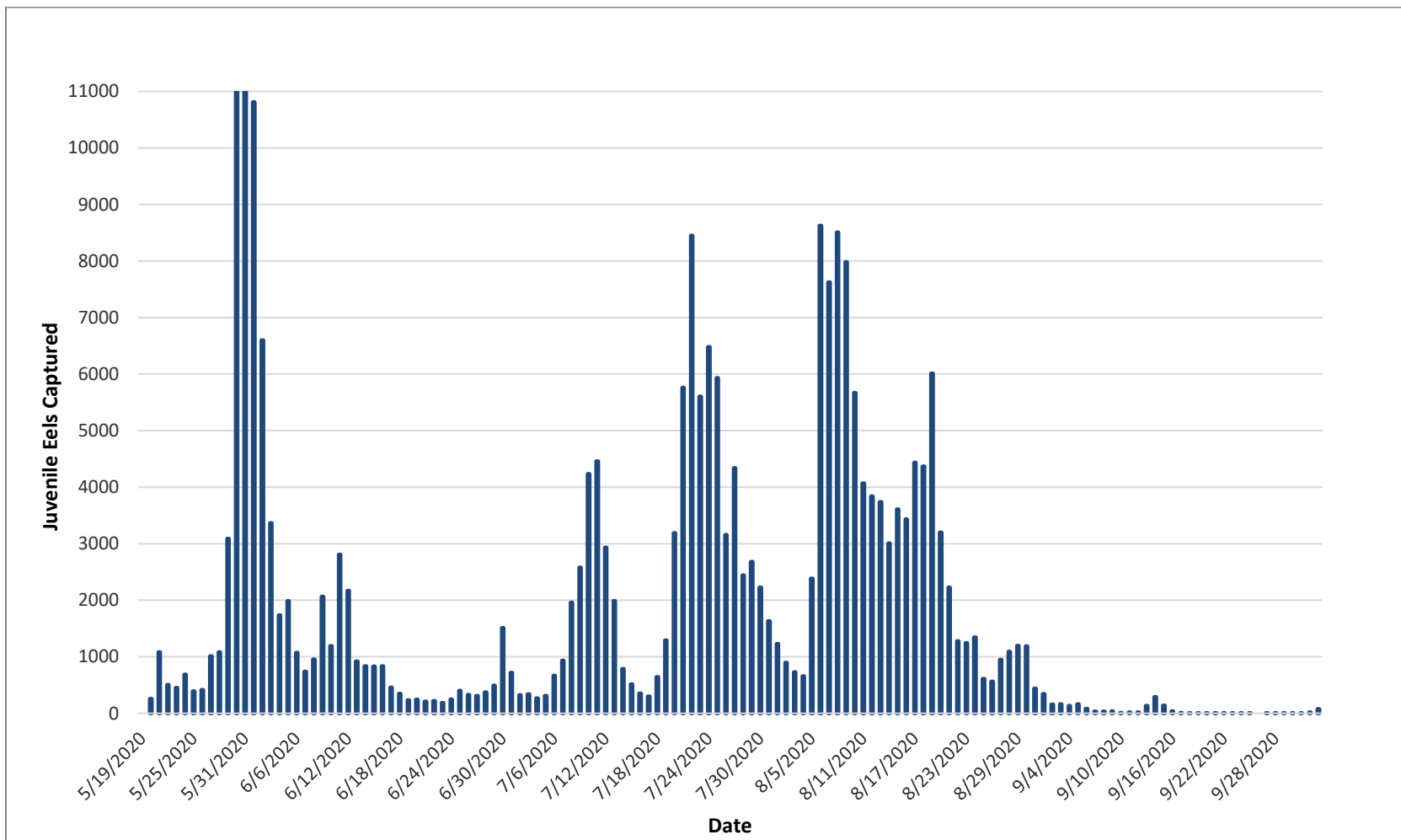


Figure 4.2-1: Eels with Lesion, Conowingo Eel Collection Facility, 2020



Figure 4.2-2: Eel with Hemorrhage Tail, Conowingo Eel Collection Facility, 2020



Figure 4.2-3: Eel with Scrapes/Marks on Side, Conowingo Eel Collection Facility, 2020



Figure 4.2-4: Eel with Scrapes/Marks on Side, Conowingo Eel Collection Facility, 2020



Figure 4.3-1: Swim Bladder Parasite Dissection, Conowingo Eel Collection Facility, 2020



Figure 4.4-1: Percentage of Eels Collected per Week, Conowingo Eel Collection Facility, 2020

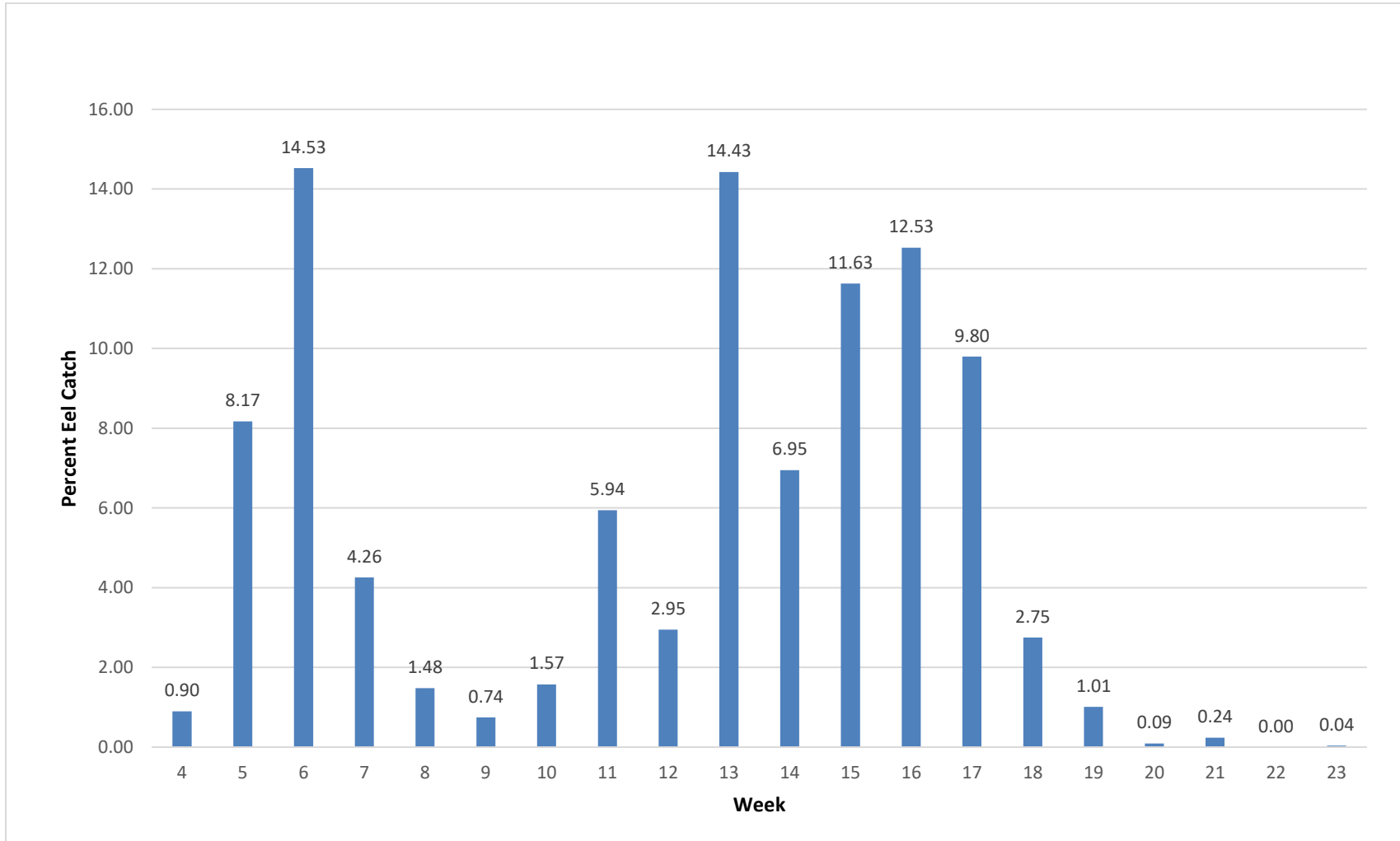
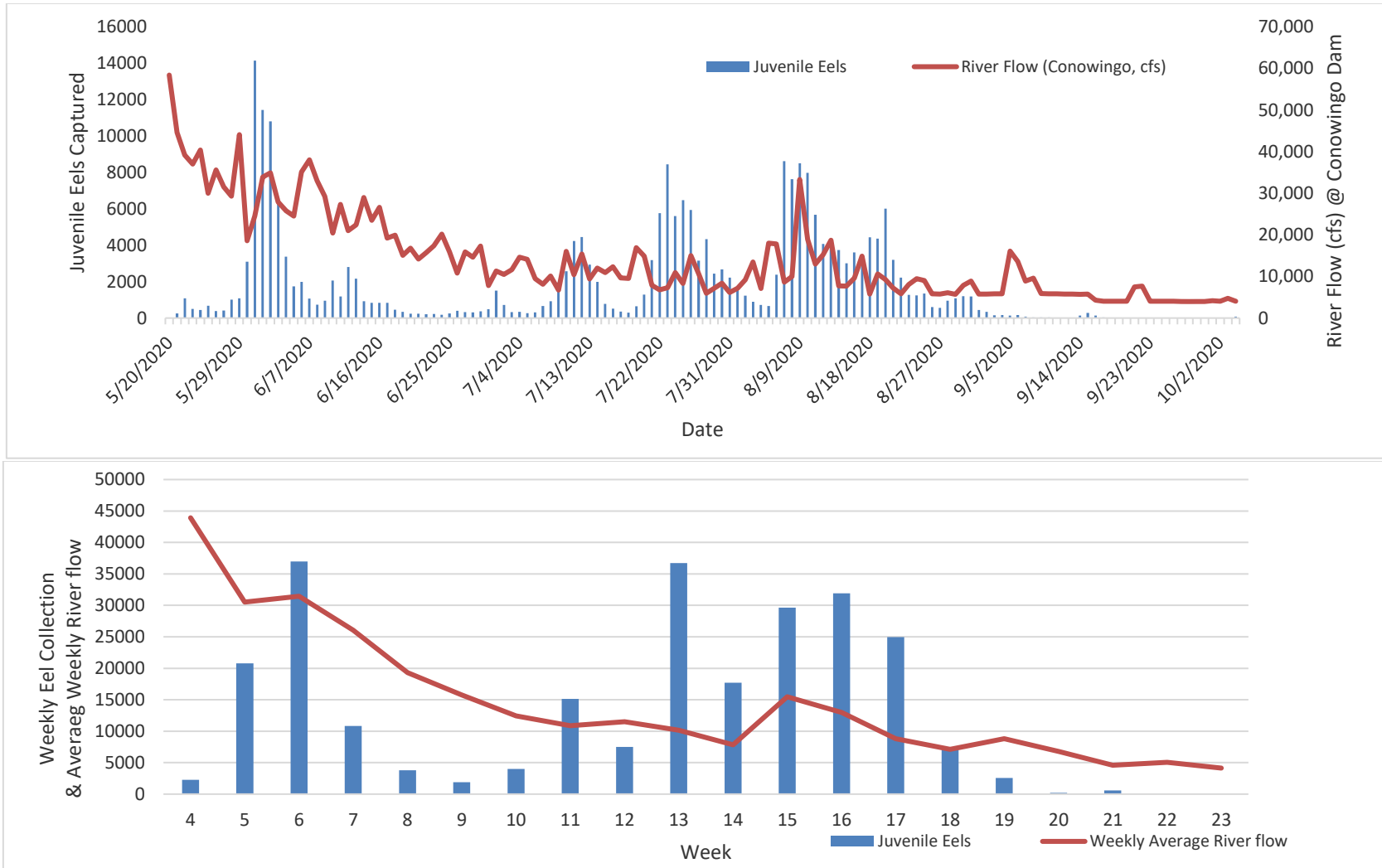


Figure 4.5-1: Daily Eel Catch and Daily Average River Flow (cfs, top graph) and Weekly Eel Catch and Weekly Average River Flow (cfs, bottom graph), Conowingo Eel Collection Facility, 2020



**Figure 4.5-2: Eel Catch to Lunar Fraction (Daily above, Weekly Average below), Conowingo Eel Collection Facility, 2020
(1.0 Equals Full Moon)**

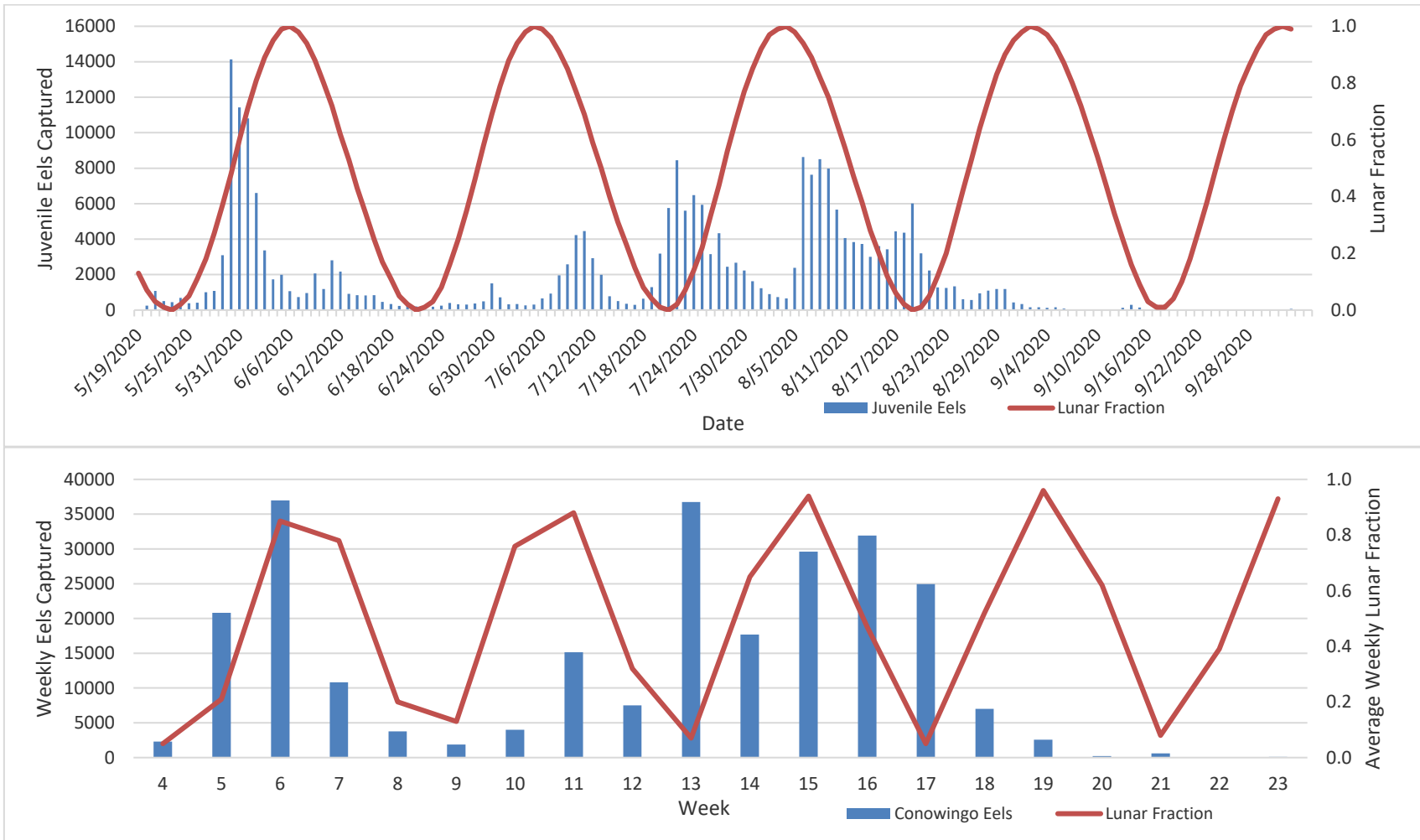


Figure 4.5-3: Eel Catch to Water Temperature, Conowingo Eel Collection Facility, 2020

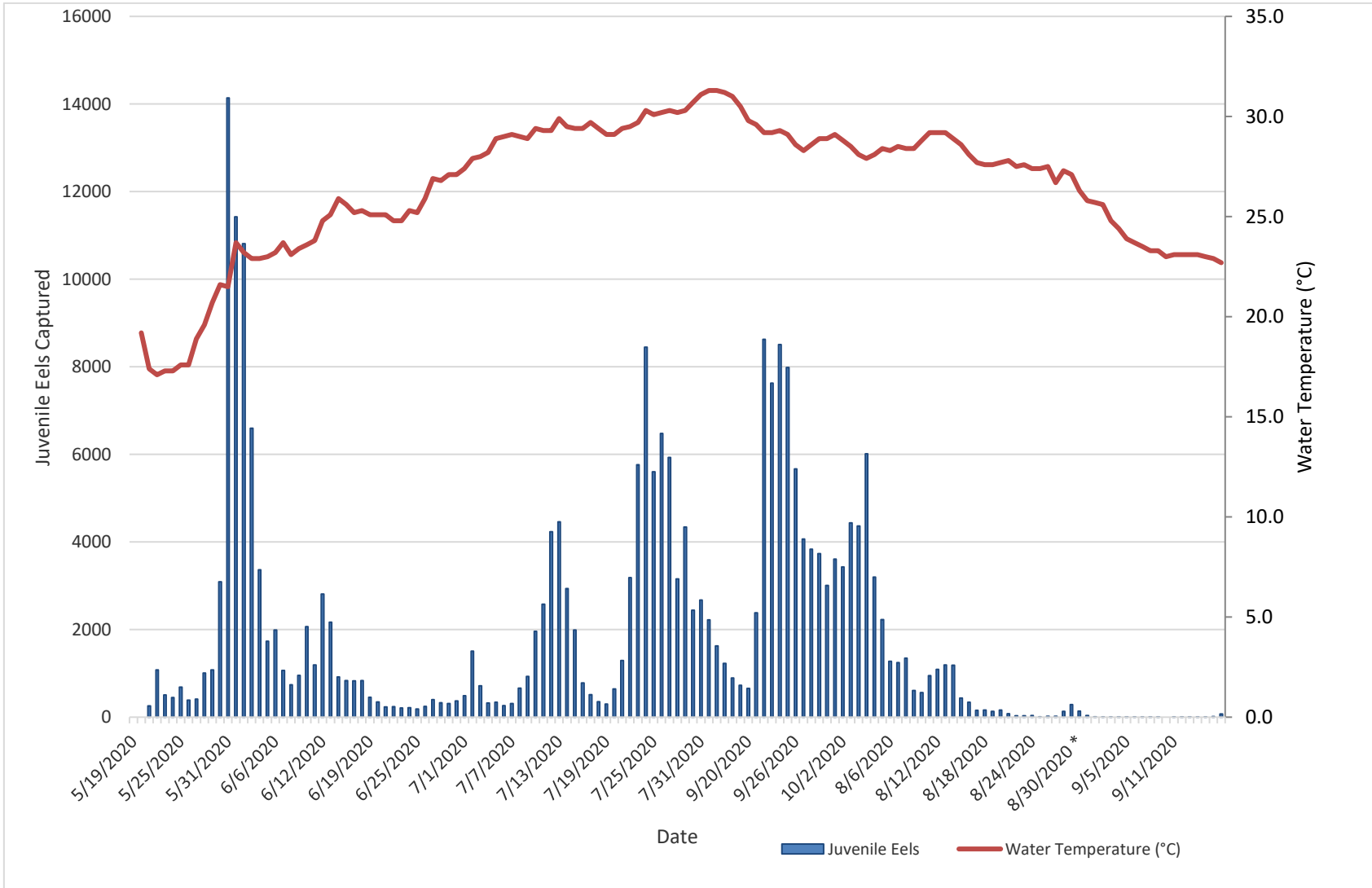


Figure 4.5-4: Eel Catch to Dissolved Oxygen, Conowingo Eel Collection Facility, 2020

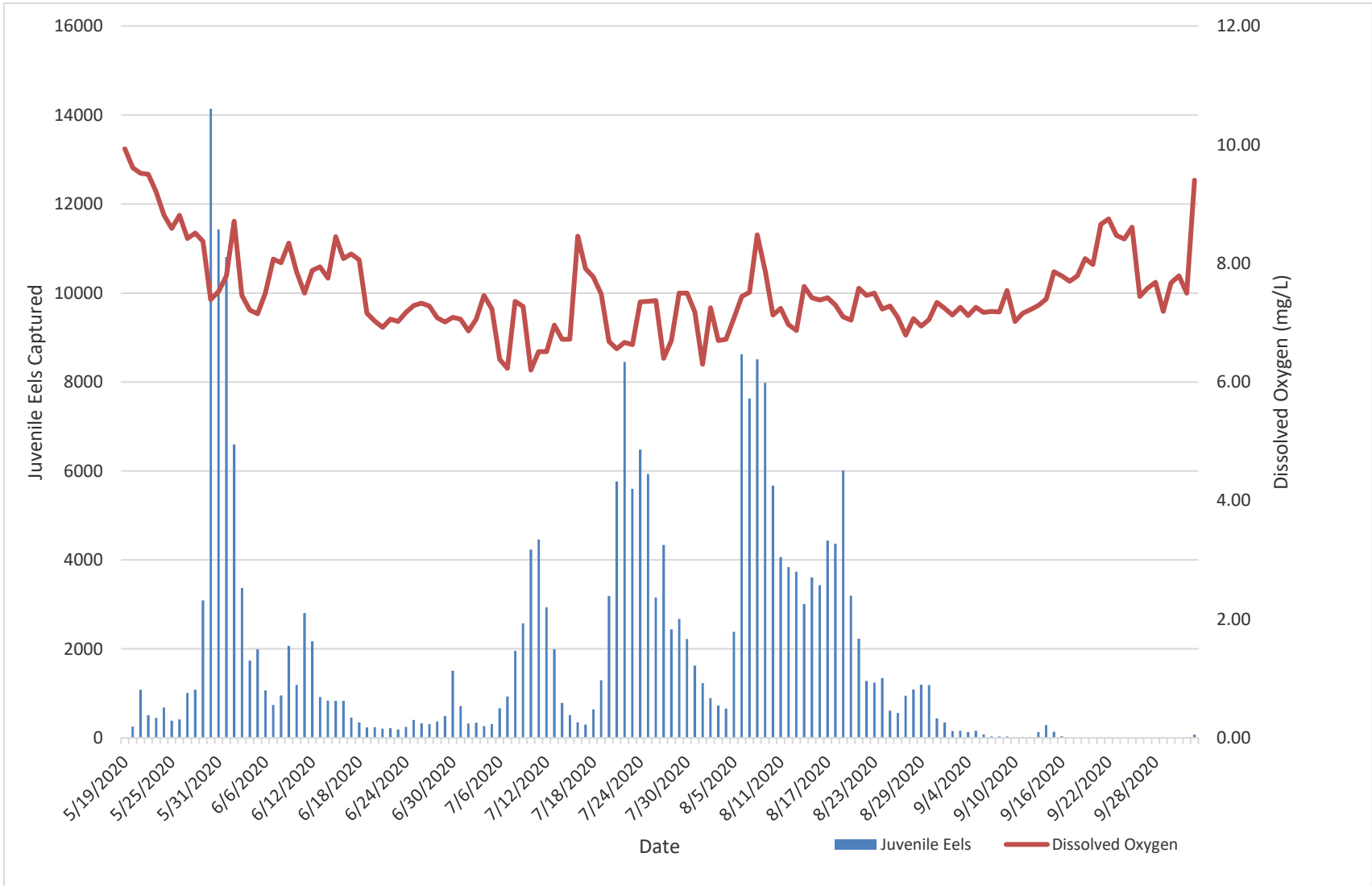


Figure 4.7-1: Normandeu Eel Stocking Sites, 2016-2020

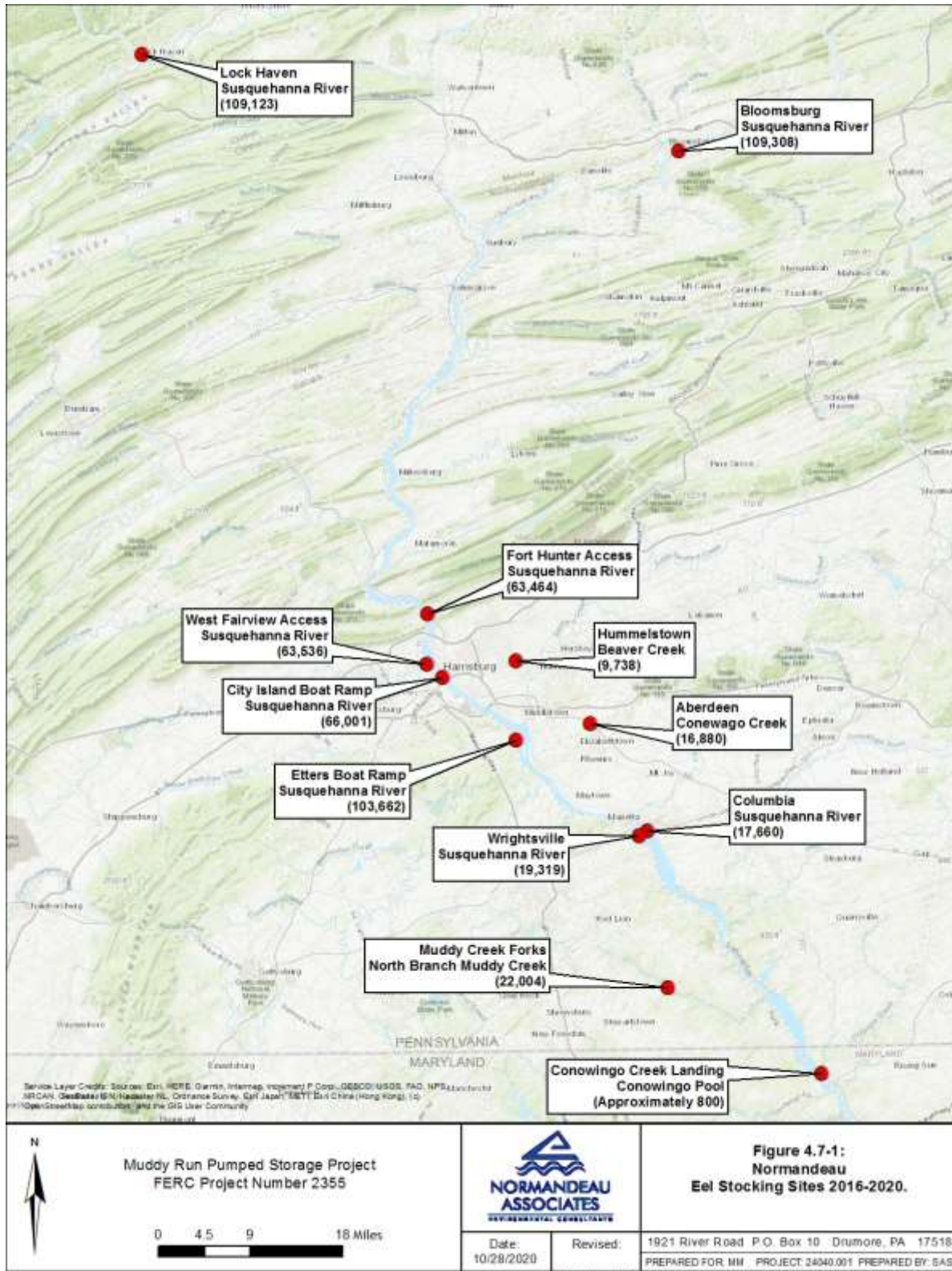


Figure 4.7-2: Bloomsburg Boat Ramp (Site 8) Stocking Site, 2020



Figure 4.7-3: Lock Haven Boat Ramp (Site 11) Stocking Site, 2020



Figure 4.7-4: Wrightsville Boat Ramp (Site 3A) Stocking Site, 2020



Figure 4.7-4: Columbia Boat Ramp (Site 3B) Stocking Site, 2020



Figure 5.0-1: Transition from Rip-Rap Shoreline to Ramp Entrance, (upper) Beginning of Season, (lower) End of Season, CECF, 2020



**Appendix A:
COVID-19 Information, 2020**



**AMENDMENT TO THE ORDER OF
THE GOVERNOR OF THE COMMONWEALTH OF PENNSYLVANIA REGARDING
THE CLOSURE OF ALL BUSINESSES THAT ARE NOT LIFE SUSTAINING**

I hereby amend my Order directing "The Closure of All Businesses that Are Not Life Sustaining" dated March 19, 2020, as subsequently amended. Section 1 of that Order is amended by deleting Section 1 in its entirety and replacing it with the following:

Section 1: Prohibition on Operation of Certain Businesses That Are Not Life Sustaining

All prior orders and guidance regarding business closures, to the extent they conflict with this Order, are hereby superseded.

No person or entity shall operate a place of business in the Commonwealth that is not a life-sustaining business regardless of whether the business is open to members of the public unless the business has been designated to conduct operations as described below. This prohibition does not apply to virtual or telework operations (e.g., work from home), so long as social distancing and other mitigation measures are followed in such operations. Life-sustaining businesses may remain open, but they must follow, at a minimum, the social distancing practices and other mitigation measures described by the Centers for Disease Control and Prevention to protect workers and patrons and, as applicable, the requirements of the "Order of the Secretary of the Pennsylvania Department of Health Directing Building Safety Measures" issued April 6, 2020, and the "Order of the Secretary of the Pennsylvania Department of Health Directing Public Health Safety Measures for Businesses Permitted to Maintain In-person Operations" issued April 15, 2020.

The following businesses are authorized to conduct operations in the manner described, as long as they follow, at a minimum, the aforementioned guidance and Orders:

- A. Online motor vehicle sales are authorized to commence statewide immediately;*
- B. The Pennsylvania Liquor Control Board is authorized to commence curbside pickup sales statewide immediately;*
- C. Limited construction activity is authorized to commence in-person operations statewide beginning on May 8, 2020.*

A list of businesses that may open or remain open is attached to and incorporated into this Order.

Enforcement actions previously commenced against businesses that are out of compliance on March 23, 2020, at 8:00 a.m. and enforcement of this Order is ongoing.

This Amendment is effectively immediately. The March 19, 2020, Order, as amended, remains unchanged in every other respect.



GIVEN under my hand and the Seal of the Governor, at the city of Harrisburg, on this twentieth day of April two thousand twenty, the year of the commonwealth the two hundred and forty-fourth.

Tom Wolf
TOM WOLF
Governor



The State of Maryland
Executive Department

ORDER
OF THE
GOVERNOR OF THE STATE OF MARYLAND
NUMBER 20-05-06-01

AMENDING AND RESTATING THE ORDER OF MARCH 30, 2020, PROHIBITING
LARGE GATHERINGS AND EVENTS AND CLOSING SENIOR CENTERS, AND
ALL NON-ESSENTIAL BUSINESSES AND OTHER ESTABLISHMENTS, AND
ADDITIONALLY REQUIRING ALL PERSONS TO STAY AT HOME

- WHEREAS, A state of emergency and catastrophic health emergency was proclaimed on March 5, 2020, and renewed on March 17, 2020, April 10, 2020, and May 6, 2020, to control and prevent the spread of COVID-19 within the state, and the state of emergency and catastrophic health emergency still exists;
- WHEREAS, COVID-19, a respiratory disease that spreads easily from person to person and may result in serious illness or death, is a public health catastrophe and has been confirmed throughout Maryland;
- WHEREAS, To reduce the spread of COVID-19, the U.S. Centers for Disease Control and Prevention and the Maryland Department of Health recommend canceling large gatherings and social distancing in smaller gatherings;
- WHEREAS, The currently known and available scientific evidence and best practices support limitations on large gatherings and social distancing to prevent exposures and transmissions, and reduce the threat to especially vulnerable populations, including older individuals and those with chronic health conditions;
- WHEREAS, To reduce the threat to human health caused by transmission of the novel coronavirus in Maryland, and to protect and save lives, it is necessary and reasonable that individuals in the state refrain from congregating;
- WHEREAS, To protect the public health, welfare, and safety, prevent the transmission of the novel coronavirus, control the spread of COVID-19,

and save lives, it is necessary to control and direct the movement of individuals in Maryland, including those on the public streets;

WHEREAS, It is further necessary to control and direct in Maryland the occupancy and use of buildings and premises, as well as places of amusement and assembly; and

WHEREAS, the Coronavirus Response Team will continue to advise on related public health and emergency management decisions;

NOW, THEREFORE, I, LAWRENCE J. HOGAN, JR., GOVERNOR OF THE STATE OF MARYLAND, BY VIRTUE OF THE AUTHORITY VESTED IN ME BY THE CONSTITUTION AND LAWS OF MARYLAND, INCLUDING BUT NOT LIMITED TO TITLE 14 OF THE PUBLIC SAFETY ARTICLE, AND IN AN EFFORT TO CONTROL AND PREVENT THE SPREAD OF COVID-19 WITHIN THE STATE, DO HEREBY ORDER:

I. Administrative and Implementing Provisions.

- a. The Order of the Governor of the State of Maryland, dated March 12, 2020, entitled “Prohibiting Large Gatherings and Events and Closing Senior Centers,” as amended and restated on March 16, 2020, and further amended and restated on March 19, 2020 by Order Number 20-03-19-01, and further amended and restated on March 23, 2020 by Order Number 20-03-29-01, and further amended and restated on March 30, 2020 by Order Number 20-03-30-01 is further amended and restated in its entirety as set forth herein.
- b. The Secretary of Health is hereby authorized to issue directives under this Order (“Secretary’s Directives”), as the Secretary deems necessary, to monitor, treat, prevent, reduce the spread of, and suppress COVID-19 in relation to any activity permitted under this Order or any business, organization, establishment, or facility that is permitted by this Order to be open to the general public, which directives may include, without limitation, binding requirements and/or non-binding recommendations.
- c. Political subdivisions are not prohibited from opening outdoor public spaces to the general public (such as parks, sports fields and courts, beaches, dog parks, and playgrounds), subject to the following:
 - i. The decision to do so shall be made after consultation with the health officer for the county in which the outdoor public space is located (or, in the case of outdoor public spaces located in Baltimore City, the Commissioner of Health for Baltimore City) (the “Local Health Officer”).
 - ii. The Local Health Officer may issue such directives or orders as may be necessary to monitor, prevent, reduce the spread of, and suppress COVID-19 with respect to the use of the outdoor public space (“Health Officer

Directives”).

- iii. The political subdivision must require persons using the outdoor public space to comply with applicable Secretary’s Directives, applicable Health Officer Directives, and applicable social distancing guidance published by the U.S. Centers for Disease Control and Prevention (“CDC”) and the Maryland Department of Health (“MDH”).

II. Stay-at-Home Order.

- a. All persons living in the State of Maryland are hereby ordered, effective as of 8:00 p.m. on March 30, 2020, to stay in their homes or places of residences (“Homes”) except:
 - i. to conduct or participate in Essential Activities (defined below) or Permitted Outdoor Activities (defined below);
 - ii. staff and owners of businesses and organizations that are not required to close pursuant to paragraph IV or paragraph V below may travel:
 - 1. between their Homes and those businesses and organizations; and
 - 2. to and from customers for the purpose of delivering goods or performing services; and
 - iii. staff and owners of Non-Essential Businesses (defined below) may travel:
 - 1. between their Homes and those Non-Essential Businesses for the purpose of engaging in Minimal Operations; and
 - 2. to and from customers for the purpose of delivering goods.
- b. As used herein, “Essential Activities” means:
 - i. Obtaining necessary supplies or services for one’s self, family, household members, pets, or livestock, including, without limitation: groceries, supplies for household consumption or use, supplies and equipment needed to work from home, laundry, and products needed to maintain safety, sanitation, and essential maintenance of the home or residence;
 - ii. Engaging in activities essential for the health and safety of one’s self, family, household members, pets, or livestock, including such things as seeking medical or behavior health or emergency services, and obtaining medication or medical supplies;
 - iii. Caring for a family member, friend, pet, or livestock in another household or location, including, without limitation, transporting a family member, friend, pet, or livestock animal for essential health and safety activities,

and to obtain necessary supplies and services;

- iv. Traveling to and from an educational institution for purposes of receiving meals or instructional materials for distance learning;
 - v. Travel required by a law enforcement officer or court order; or
 - vi. Traveling to and from a federal, State, or local government building for a necessary purpose.
- c. As used herein, "Permitted Outdoor Activities" means the following, done in compliance with paragraph III below, applicable Secretary's Directives, Health Officer Directives, and social distancing guidance published by CDC and MDH:
- i. Outdoor exercise activities, such as walking, hiking, running, biking, or individual and small group sports such as golfing, tennis, and similar activities;
 - ii. Outdoor fitness instruction;
 - iii. Recreational fishing, hunting, shooting, and archery;
 - iv. Recreational boating;
 - v. Horseback riding; and
 - vi. Visiting cemeteries.

III. Gatherings Larger Than 10 Persons Prohibited.

- a. Social, community, spiritual, religious, recreational, leisure, and sporting gatherings and events of more than 10 people ("large gatherings and events") are hereby prohibited at all locations and venues, including but not limited to parades, festivals, conventions, and fundraisers.
- b. Planned large gatherings and events must be canceled or postponed until after termination of the state of emergency and the proclamation of the catastrophic health emergency has been rescinded.

IV. Closure of Non-Essential Businesses, Generally.

- a. This Order controls the occupancy and use of all businesses, organizations, establishments, and facilities that are not part of the critical infrastructure sectors identified by the U.S. Department of Homeland Security's Cybersecurity and Infrastructure Security Agency (currently described at <https://www.cisa.gov/identifying-critical-infrastructure-during-covid-19>) (collectively, "Non-Essential Businesses").

- b. Subject to paragraph IV.c, all Non-Essential Businesses shall remain closed to the general public.
 - c. Staff and owners may continue to be on-site at Non-Essential Businesses for only the following purposes (“Minimal Operations”):
 - i. Facilitating remote working (a/k/a/ telework) by other staff;
 - ii. Maintaining essential property;
 - iii. Preventing loss of, or damage to property, including without limitation, preventing spoilage of perishable inventory;
 - iv. Performing essential administrative functions, including without limitation, picking up mail and processing payroll;
 - v. Caring for live animals; and
 - vi. In the case of Non-Essential Businesses that are retail establishments, continuing to sell retail products on a delivery basis.
 - d. All businesses, organizations, establishments, and facilities that are required to close pursuant to paragraph V, pursuant to any other Order of the Governor of the State of Maryland or any other Order of a political subdivision, shall be and remain closed in accordance with paragraph V or such other Order, as the case may be.
- V. Closure of Certain Specific Businesses, Organizations, and Facilities.
- a. Senior Centers. All senior citizen activities centers (as defined in Section 10-501(i) of the Human Services Article of the Maryland Code) shall remain closed until after termination of the state of emergency and the proclamation of the catastrophic health emergency has been rescinded.
 - b. Restaurants and Bars.
 - i. This Order controls the occupancy and use of restaurants, bars, and other similar establishments that sell food or beverages for consumption on-premises in Maryland (“Restaurants and Bars”). This Order does not apply to food or beverage services in health care facilities, which are expressly excluded from the definition of “Restaurants and Bars.”
 - ii. All Restaurants and Bars shall remain closed to the general public, except that, to the extent permitted by applicable law, and in accordance with any social-distancing recommendations of MDH, food and beverages may be:
 - 1. sold if such food or beverages are promptly taken from the premises, i.e., on a carry-out or drive-through basis; or

2. delivered to customers off the premises.

c. *Fitness Centers.*

- i. This Order controls the occupancy and use of fitness centers, health clubs, health spas, gyms, aquatic centers, and self-defense schools in Maryland ("Fitness Centers").
- ii. All Fitness Centers shall remain closed to the general public, except that the portion of any Fitness Center that is licensed or otherwise permitted by applicable law, regulation, or order to provide child care services may remain open to the general public for the purpose of continuing to provide such child care services.

d. *Theaters.*

- i. This Order controls the occupancy and use of theatres in Maryland at which live performances occur or motion pictures are shown ("Theaters").
- ii. All Theaters shall remain closed to the general public.

e. *Malls.*

- i. This Order controls the occupancy and use of shopping centers in Maryland that have one or more enclosed pedestrian concourses ("Enclosed Malls").
- ii. The following portions of Enclosed Malls shall remain closed to the general public:
 1. pedestrian concourses and other interior common areas open to the general public, including without limitation, food courts; and
 2. retail establishments only accessible to the general public from enclosed pedestrian concourses or other interior areas.
- iii. This paragraph V.e does not require closure of retail establishments attached to Enclosed Malls that are directly accessible from the outside.
- iv. Notwithstanding paragraph V.e.ii, local governments may approve access by the general public to the following parts of Enclosed Malls:
 1. retail establishments (a) that primarily sell groceries or pharmacy products, or (b) at which licensed professionals provide health care services; and
 2. pedestrian concourses and other interior common areas, but solely to the extent necessary for the general public to access the retail

establishments described in paragraph V.e.iv.1.

f. Other Recreational Establishments.

- i. This Order controls the occupancy and use of the following establishments in Maryland ("Recreational Establishments"):
 1. bingo halls;
 2. bowling alleys;
 3. pool halls;
 4. amusement parks;
 5. roller and ice skating rinks;
 6. miniature golf establishments;
 7. social and fraternal clubs, including without limitation, American Legion posts, VFW posts, and Elks Clubs; and
 8. any other establishment not listed above that is subject to the admission and amusement tax under Title 4 of the Tax-General Article of the Maryland Code.
- ii. All Recreational Establishments shall remain closed to the general public (including members, in the case of private clubs).
- iii. Effective as of 7:00 a.m. on May 7, 2020, notwithstanding anything to the contrary elsewhere in this Order, the following establishments in Maryland may open to the general public, subject to paragraph III above and all applicable Secretary's Directives and physical distancing guidance published by CDC and MDH:
 1. golf courses and driving ranges;
 2. outdoor archery and shooting ranges;
 3. marinas and watercraft rental businesses; and
 4. campgrounds.

g. Other Miscellaneous Establishments.

- i. This Order controls the occupancy and use of the following establishments in Maryland:
 1. tattoo parlors;
 2. tanning salons;
 3. barber shops; and
 4. beauty salons and all other establishments that provide esthetic services, provide hair services, or provide nail services (as described in Title 5, Subtitle 2 of the Business Occupations Article of the Maryland Code).
- ii. The establishments listed in paragraph V.g.i above shall remain closed to

the general public.

VI. Specific Exclusions. For avoidance of doubt:

- a. This Order does not require the closure of, or prohibit the movement of any staff or volunteer traveling to, from, or in connection with their duties at any:
 - i. federal, State, or local government unit, building, or facility;
 - ii. newspaper, television, radio, or other media service; or
 - iii. non-profit organization or facility providing essential services to low-income persons, including, without limitation, homeless shelters, food banks, and soup kitchens.
- b. Paragraph II of this Order does not apply to:
 - i. Persons whose homes or residences have become unsafe, such as victims of domestic violence; and
 - ii. Persons who are experiencing homelessness, but governmental and other entities are strongly encouraged to make shelter available for such persons to the maximum extent practicable, in a manner consistent with the social distancing guidelines of the CDC and MDH.

VII. Government Buildings and Facilities with Large Occupancy or Attendance.

- a. State and local government buildings and facilities with an expected occupancy or attendance of more than 10 people shall:
 - i. Promptly and conspicuously post in the building or facility a copy of the MDH recommendations for social distancing; and
 - ii. Provide all occupants and attendees with the capability to wash their hands.
- b. A copy of this Order shall be made available to all occupants or attendees at any State or local government building and facility with an expected occupancy or attendance of more than 10 people.

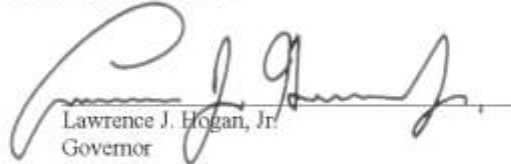
VIII. General Provisions.

- a. Each law enforcement officer of the State or a political subdivision shall execute and enforce this Order.
- b. A person who knowingly and willfully violates this Order is guilty of a misdemeanor and on conviction is subject to imprisonment not exceeding one year or a fine not exceeding \$5,000 or both.
- c. This Order remains effective until after termination of the state of emergency and

the proclamation of the catastrophic health emergency has been rescinded, or until rescinded, superseded, amended, or revised by additional orders.

- d. The effect of any statute, rule, or regulation of an agency of the State or a political subdivision inconsistent with this order is hereby suspended to the extent of the inconsistency.
- e. The underlined paragraph headings in this Order are for convenience of reference only and shall not affect the interpretation of this Order.
- f. If any provision of this Order or its application to any person, entity, or circumstance is held invalid by any court of competent jurisdiction, all other provisions or applications of the Order shall remain in effect to the extent possible without the invalid provision or application. To achieve this purpose, the provisions of this Order are severable.

ISSUED UNDER MY HAND THIS 6TH DAY OF MAY, 2020, AND
EFFECTIVE IMMEDIATELY.



Lawrence J. Hogan, Jr.
Governor



Order of the Secretary of the Pennsylvania Department of Health Directing Public Health Safety Measures for Businesses Permitted to Maintain In-person Operations

The 2019 novel coronavirus (COVID-19) is a contagious disease that is rapidly spreading from person to person in the Commonwealth of Pennsylvania. COVID-19 can be transmitted from people who are infected with the virus even if they are asymptomatic or their symptoms are mild, such as a cough. Additionally, exposure is possible by touching a surface or object that has the virus on it and then touching one's mouth, nose, or eyes.

COVID-19 is a threat to the public's health, for which the Secretary of Health may order general control measures, including, but not limited to, closure, isolation, and quarantine. This authority is granted to the Secretary of Health pursuant to Pennsylvania law. See Section 5 of the Disease Prevention and Control Law, 35 P.S. §§ 521.1, 521.5; sections 2102 and 2106 of the Administrative Code of 1929, 71 P.S. §§ 532, 536; and the Department of Health's (Department's) regulations at 28 Pa. Code §§ 27.60-27.68 (relating to disease control measures; isolation; quarantine; movement of persons subject to isolation or quarantine; and release from isolation and quarantine). Particularly, the Secretary has the authority to take any disease control measure appropriate to protect the public from the spread of infectious disease. See 35 P.S. § 521.5; 71 P.S. §§ 532(a), 1402(a); 28 Pa. Code § 28.60.

Recognizing that certain life-sustaining businesses in the Commonwealth must remain open despite the need for strong mitigation to slow the spread of the virus, I am ordering certain actions to be taken by employers and their employees to protect their health and lives, the health and lives of their families, and the health and lives of the residents of the Commonwealth who depend upon their services. Special consideration is required to protect not only customers, but the workers needed to run and operate these establishments.

As cleaning, disinfecting, and other maintenance and security services performed by building service employees are critical to protecting the public health by reducing COVID-19 infection in the Commonwealth, I previously directed building safety measures in an Order that went into effect at 12:01 a.m. on April 6, 2020. Similarly, based upon the manner of COVID-19's continued and extensive spread in the Commonwealth and in the world, and its danger to Pennsylvanians, I have determined that an additional appropriate disease control measure is the further direction of safety measures for all employees and visitors at life-sustaining businesses that have remained open during the COVID-19 disaster emergency.

Accordingly, on this date, April 15, 2020, to protect the public from the spread of COVID-19, I hereby order:

- A. A business that is authorized to maintain in-person operations, other than health care providers, pursuant to the Orders that the Governor and I issued on March 19, 2020, as subsequently amended, shall implement, as applicable, the following social distancing, mitigation, and cleaning protocols:
- (1) in addition to maintaining pre-existing cleaning protocols established in the business, as specified in paragraph (2) below, clean and disinfect high-touch areas routinely in accordance with guidelines issued by the Centers for Disease Control and Prevention (CDC), in spaces that are accessible to customers, tenants, or other individuals;
 - (2) maintain pre-existing cleaning protocols established by the business for all other areas of the building;
 - (3) establish protocols for execution upon discovery that the business has been exposed to a person who is a probable or confirmed case of COVID-19, including:
 - a. close off areas visited by the person who is a probable or confirmed case of COVID-19. Open outside doors and windows and use ventilation fans to increase air circulation in the area. Wait a minimum of 24 hours, or as long as practical, before beginning cleaning and disinfection. Cleaning staff should clean and disinfect all areas such as offices, bathrooms, common areas including but not limited to employee break rooms, conference or training rooms and dining facilities, shared electronic equipment like tablets, touch screens, keyboards, remote controls, and ATM machines used by the ill person, focusing especially on frequently touched areas;
 - b. identify employees that were in close contact (within about 6 feet for about 10 minutes) with a person with a probable or confirmed case of COVID-19 from the period 48 hours before symptom onset to the time at which the patient isolated;
 - i. If the employee remains asymptomatic, the person should adhere to the practices set out by the CDC in its April 8, 2020 Interim Guidance for Implementing Safety Practice for Critical Infrastructure Workers Who May Have Had Exposure to a Person with Suspected or Confirmed COVID-19;
 - ii. If the employee becomes sick during the work day, the person should be sent home immediately. Surfaces in the employee's workspace should be cleaned and disinfected. Information on other employees who had contact with the ill employee during the time the employee had symptoms

and 48 hours prior to symptoms should be compiled. Others at the workplace with close contact within 6 feet of the employee during this time would be considered exposed;

- iii. Promptly notify employees who were close contacts of any known exposure to COVID-19 at the business premises, consistent with applicable confidentiality laws;
 - iv. ensure that the business has a sufficient number of employees to perform the above protocols effectively and timely;
- c. implement temperature screening before an employee enters the business, prior to the start of each shift or, for employees who do not work shifts, before the employee starts work, and send employees home that have an elevated temperature or fever of 100.4 degrees Fahrenheit or higher. Ensure employees practice social distancing while waiting to have temperatures screened;
 - d. employees who have symptoms (*i.e.*, fever, cough, or shortness of breath) should notify their supervisor and stay home;
 - e. sick employees should follow CDC-recommended steps. Employees should not return to work until the CDC criteria to discontinue home isolation are met, in consultation with healthcare providers and state and local health departments. Employers are encouraged to implement liberal paid time off for employees who do not return to work as set forth above.
- (4) stagger work start and stop times for employees when practicable to prevent gatherings of large groups entering or leaving the premises at the same time;
 - (5) provide sufficient amount of space for employees to have breaks and meals while maintaining a social distance of 6 feet, while arranging seating to have employees facing forward and not across from each other in eating and break settings;
 - (6) stagger employee break times to reduce the number of employees on break at any given time so that appropriate social distancing of at least 6 feet may be followed;
 - (7) limit persons in employee common areas (such as locker or break rooms, dining facilities, training or conference rooms) at any one time to the number of employees that can maintain a social distance of 6 feet;

- (8) conduct meetings and trainings virtually (*i.e.*, by phone or through the internet). If a meeting must be held in person, limit the meeting to the fewest number of employees possible, not to exceed 10 employees at one time, and maintain a social distance of 6 feet;
 - (9) provide employees access to regular handwashing with soap, hand sanitizer, and disinfectant wipes and ensure that common areas (including but not limited to break rooms, locker rooms, dining facilities, rest rooms, conference or training rooms) are cleaned on a regular basis, including between any shifts;
 - (10) provide masks for employees to wear during their time at the business, and make it a mandatory requirement to wear masks while on the work site, except to the extent an employee is using break time to eat or drink, in accordance with the guidance from the Department of Health and the CDC. Employers may approve masks obtained or made by employees in accordance with Department of Health guidance;
 - (11) ensure that the facility has a sufficient number of employees to perform all measures listed effectively and in a manner that ensures the safety of the public and employees;
 - (12) ensure that the facility has a sufficient number of personnel to control access, maintain order, and enforce social distancing of at least 6 feet;
 - (13) prohibit non-essential visitors from entering the premises of the business; and
 - (14) ensure that all employees are made aware of these required procedures by communicating them, either orally or in writing, in their native or preferred language, as well as in English or by a methodology that allows them to understand.
- B. In addition to the above, the following measures apply to businesses, other than health care providers, that serve the public within a building or a defined area:
- (1) where feasible, businesses should conduct business with the public by appointment only and to the extent that this is not feasible, businesses must limit occupancy to no greater than 50% of the number stated on the applicable certificate of occupancy at any given time, as necessary to reduce crowding in the business, and must maintain a social distance of 6 feet at check-out and counter lines, and must place signage throughout each site to mandate social distancing for both customers and employees;

- (2) based on the building size and number of employees, alter hours of business so that the business has sufficient time to clean or to restock or both;
- (3) install shields or other barriers at registers and check-out areas to physically separate cashiers and customers or take other measures to ensure social distancing of customers from check-out personnel, or close lines to maintain a social distance between of 6 feet between lines;
- (4) encourage use of online ordering by providing delivery or pick-up options;
- (5) designate a specific time for high-risk and elderly persons to use the business at least once every week if there is a continuing in-person customer-facing component;
- (6) require all customers to wear masks while on premises, and deny entry to individuals not wearing masks, unless the business is providing medication, medical supplies, or food, in which case the business must provide alternative methods of pick-up or delivery of such goods; however, individuals who cannot wear a mask due to a medical condition (including children under the age of 2 years per CDC guidance) may enter the premises and are not required to provide documentation of such medical condition;
- (7) in businesses with multiple check-out lines, only use every other register, or fewer. After every hour, rotate customers and employees to the previously closed registers. Clean the previously open registers and the surrounding area, including credit card machines, following each rotation;
- (8) schedule handwashing breaks for employees at least every hour; and
- (9) where carts and handbaskets are available for customers' use, assign an employee to wipe down carts and handbaskets before they become available to each customer entering the premises.

This Order shall take effect immediately and be enforceable as of 8:00 p.m. on April 19, 2020.



Rachel Levine, MD
Secretary of Health



June 2, 2020

VIA ELECTRONIC FILING

Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Andrea Danucalov
FERC License Compliance
Manager
(267) 533-1125
(610) 765-5805 (Fax)
andrea.danucalov@exeloncorp.com

Re: Conowingo Hydroelectric Project (P-405) and Muddy Run Pumped Storage Project (P-2355) Recreation Site Closures and Modifications Due to COVID-19

Dear Secretary Bose:

On March 18, 2020, Exelon Generation Company, LLC ("Exelon") provided notice to the Federal Energy Regulatory Commission ("FERC") regarding the closure of certain recreation sites associated with FERC Project Nos. P-405 and P-2355 due to the States of Emergency announced in Maryland ("MD") and Pennsylvania ("PA") and Centers For Disease Control ("CDC") guidelines due to COVID-19. The following recreation sites were reopened after amended orders were issued by PA Governor Wolf on May 1, 2020 and MD Governor Hogan on May 6, 2020.

- Fisherman's Park – reopened on May 15, 2020
- Dorsey Park – reopened on May 21, 2020
- Wissler's Run – reopened on May 22, 2020
- Muddy Run Recreation Park – reopened on May 22, 2020
- Glen Cove Marina – reopened on May 22, 2020
- Peach Bottom Marina – reopened on May 22, 2020
 - Note, Peach Bottom Marina was closed in September 2019 to complete maintenance dredging.

State executive orders remain in place in both MD and PA limiting certain activities, including the size of gatherings and travel for essential reasons. In compliance with State executive orders, CDC guidelines and to prevent the spread of COVID-19, amenities may be limited at some recreation sites, such as use of playgrounds, pavilions, boat rentals, bathrooms (portable bathrooms available), amphitheater, observatory and splash pad. COVID-19 protocols for cleaning, worker safety and public safety have been posted at the reopened recreation sites and on social media. All events have been cancelled until further notice.

Three (3) recreation sites remain closed (Conowingo Swimming Pool, Conowingo Visitor's Center, and Muddy Run Visitor's Center), which is consistent with the revised orders issued in PA and MD.

None of the above actions impact any license articles or specific requirements. Exelon will update FERC staff periodically regarding the status of the above-listed closures.

Sincerely,


Andrea Damucalov
FERC License Compliance Manager

cc: Robert Fletcher, FERC, Land Resources

**Appendix B:
Method of Aging Eel Otolith, Conowingo Eel
Collection Facility, 2020**

Method of Aging

A representative sample of juvenile eels were frozen for future age determination. Aging of the preserved individuals was conducted using otolith microstructure analysis and followed established techniques for the species presented in the Proceedings of the Workshop on Aging and Sexing American Eel (ASMFC 2001). To remove the sagittal otoliths from an individual eel, a transverse cut was made through the cranium. When positioned correctly, the cut exposed the posterior part of the brain and the two cavities of the inner ear were visible on either side of the rachidian bulb. The otolith bones were then carefully removed from the inner ear cavities with a pair of tweezers, cleaned, and placed in a clean, dry, labeled glass vial. Each otolith sample was allowed to dry for a minimum of 12 hours prior to proceeding to the next step.

At the conclusion of the drying time, each otolith was embedded in a clear epoxy (e.g., 2-part West System epoxy resin) poured into a small mold and allowed adequate time to fully cure. Utilizing a double-bladed, slow speed saw, a 0.2-mm thick transverse section was cut through the nucleus perpendicular to the sulcus. The otolith section was then bonded to a glass slide using CrystalBond. Each mounted otolith sample was polished using a series of fine grade lapping films (12, 9 and 3 micron) and the sample was periodically inspected to insure no damage to the otolith section. Following polishing, the mounted sections were etched in a 5% solution of EDTA for 3-5 minutes, rinsed and then stained in a bath of toluidine blue for approximately 5 minutes to enhance visibility of each annulus.

After removal of the slide and otolith section from the staining bath, the sample was rinsed with distilled water and ready for age determination. Sectioned otoliths were inspected under a dissecting microscope using both reflected and transmitted light and an external fiberoptic light source. Each otolith sample was examined by two readers and the number of distinct annuli was determined. Following independent age determinations for each sample by both readers, the list of age estimates were compared. If the two readers agreed on the analysis, the age estimate was accepted. If readers of the slides weren't in agreement on an age, that slide was re-analyzed. If no consensus was met, the otolith was rejected. The age reported herein is the freshwater age (i.e., the numbers of annuli outside the transition mark - the end of larval growth in salt water).

NR- Could not be read

ASMFC (Atlantic States Marine Fisheries Commission). 2001. Proceedings of the Workshop on Aging and Sexing American Eel. ASMFC Special Report No. 72. Washington, D.C. 25 p.

MUDDY RUN PUMPED STORAGE PROJECT - FERC PROJECT NUMBER 2355

Date	Collection #	Batch #	Eel #	Total Length (mm)	Age 1 - CAF*	Age 2-ERS*	Age consensus
5/21/2020	MDM20003	1	3	100	2.0	2	2
	MDM20003	1	7	114	2.0	2	2
	MDM20003	1	11	85	1.0	1	1
	MDM20003	1	16	130	3.0	3	3
	MDM20003	1	24	114	2.0	2	2
5/25/2019	MDM20007	2	1	139	3	3	3
	MDM20007	2	2	91	1	1	1
	MDM20007	2	3	154	3	4	4
	MDM20007	2	4	111	NR	NR	NR
	MDM20007	2	5	122	2	2	2
6/1/2020	MDM20014	4	1	122	3	3	3
	MDM20014	4	2	110	2	2	2
	MDM20014	4	5	97	1	1	1
	MDM20014	4	7	145	3	3	3
	MDM20014	4	9	131	2	2	2
6/9/2020	MDM20022	6	1	131	2	3	2
	MDM20022	6	2	107	1	2	1
	MDM20022	6	3	143	4	4	4
	MDM20022	6	4	94	1	1	1
	MDM20022	6	6	118	2	2	2
	MDM20022	6	24	106	1	1	1
	MDM20022	6	25	116	2	2	2
6/16/2020	MDM20029	8	3	105	1	2	2
	MDM20029	8	5	161	4	4	4
	MDM20029	8	18	102	1	2	1
	MDM20029	8	20	90	1	1	1
	MDM20029	8	21	85	1	1	1
6/23/2020	MDM20036	10	3	96	1	1	1
	MDM20036	10	6	151	4	4	4
	MDM20036	10	9	89	1	1	1
	MDM20036	10	18	131	3	3	3
	MDM20036	10	20	90	1	1	1
6/29/2020	MDM20042	12	1	101	2	2	2
	MDM20042	12	2	132	3	3	3
	MDM20042	12	3	96	1	1	1
	MDM20042	12	4	127	NR	NR	NR
	MDM20042	12	7	102	2	2	2
7/6/2020	MDM20049	14	2	124	2	2	2
	MDM20049	14	4	110	2	2	2
	MDM20049	14	7	133	NR	NR	NR

MUDDY RUN PUMPED STORAGE PROJECT - FERC PROJECT NUMBER 2355

Date	Collection #	Batch #	Eel #	Total Length (mm)	Age 1 - CAF*	Age 2-ERS*	Age consensus
	MDM20049	14	15	104	1	1	1
	MDM20049	14	25	119	2	2	2
7/14/2020	MDM20057	16	1	120	2	2	2
	MDM20057	16	7	96	1	1	1
	MDM20057	16	8	88	1	1	1
	MDM20057	16	17	120	3	3	3
	MDM20057	16	25	102	2	2	2
7/20/2020	MDM20063	18	4	95	1	1	1
	MDM20063	18	7	89	1	1	1
	MDM20063	18	8	97	1	1	1
	MDM20063	18	12	98	NR	NR	NR
	MDM20063	18	18	130	2	2	2
7/27/2019	MDM20070	20	4	124	2	2	2
	MDM20070	20	8	100	2	2	2
	MDM20070	20	9	131	3	3	3
	MDM20070	20	15	133	3	3	3
	MDM20070	20	22	89	1	1	1
8/3/2020	MDM20077	22	1	86	1	1	1
	MDM20077	22	5	93	1	1	1
	MDM20077	22	11	143	3	3	3
	MDM20077	22	19	121	2	2	2
	MDM20077	22	22	132	3	3	3
8/10/2020	MDM20084	24	1	94	1	1	1
	MDM20084	24	5	91	1	1	1
	MDM20084	24	12	113	NR	NR	NR
	MDM20084	24	19	109	2	2	2
	MDM20084	24	20	126	2	2	2
8/17/2020	MDM20091	26	1	86	1	1	1
	MDM20091	26	2	138	3	3	3
	MDM20091	26	5	144	NR	NR	NR
	MDM20091	26	14	113	2	2	2
	MDM20091	26	21	150	4	4	4
8/24/2020	MDM20098	28	1	152	4	4	4
	MDM20098	28	2	140	3	3	3
	MDM20098	28	4	126	2	2	2
	MDM20098	28	6	114	2	2	2
	MDM20098	28	8	100	1	1	1
8/31/2020	MDM20105	30	1	157	4	4	4
	MDM20105	30	9	116	2	2	2
	MDM20105	30	10	99	1	1	1

MUDDY RUN PUMPED STORAGE PROJECT - FERC PROJECT NUMBER 2355

Date	Collection #	Batch #	Eel #	Total Length (mm)	Age 1 - CAF*	Age 2-ERS*	Age consensus
	MDM20105	30	11	125	3	3	3
	MDM20105	30	13	136	3	3	3
9/7/2020	MDM20112	32	1	79	1	1	1
	MDM20112	32	6	71	1	1	1
	MDM20112	32	10	97	NR	NR	NR
	MDM20112	32	11	88	1	1	1
	MDM20112	32	16	91	1	1	1
9/14/2020	MDM20119	34	3	99	1	1	1
	MDM20119	34	6	100	1	1	1
	MDM20119	34	9	153	4	4	4
	MDM20119	34	14	92	1	1	1
	MDM20119	34	16	127	2	2	2
9/21/2020	MDM20126	36	1	121	2	2	2
9/28/2020	MDM20133	38	1	103	2	2	2
	MDM20133	38	2	116	2	2	2
	MDM20133	38	3	99	2	2	2

**Appendix C:
Weekly Biological Data and Environmental Conditions
for Conowingo Eel Collection Facility, 2017-2020**

2017 Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Octoraro Eels	17	9	9	39	21	7	2	61	1565	19	13	7067	419	48	16	68	1793	12	149	12
Conowingo Eels	4387	151	1224	5384	2196	1761	5199	23318	8090	799	1503	1432	15435	32524	13130	2654	2931	88	51	43
Creek flow (cfs) (wk avg)	69100	127229	53543	29800	47886	47729	33100	32257	27443	22700	21414	38157	60143	30057	26471	20886	16614	11819	13779	11922
Lunar Fraction (wk avg)	0.56	0.96	0.66	0.09	0.37	0.92	0.78	0.16	0.24	0.84	0.88	0.26	0.14	0.72	0.94	0.38	0.07	0.58	0.96	0.56
Water temp (°C) (wk avg)	17.7	12.9	15.0	19.2	19.2	20.2	22.1	25.9	26.4	27.4	28.0	28.6	27.6	25.0	26.1	25.8	27.0	26.7	25.0	23.4
Dissolved Oxygen (mg/L) (wk avg)	9.1	10.3	10.2	8.7	8.5	7.9	7.2	7.9	7.3	6.4	7.3	11.7	9.5	7.8	7.3	7.3	9.4	8.3	8.6	9.2

2018 Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Octoraro Eels	5	31	2072	101	115	407	55	3	4	0	1	11	464	29	393	343	73	5	69	22
Conowingo Eels	7	6443	6879	197	398	1316	462	657	1077	6020	3175	1029	7986	20965	5262	3948	1870	165	73	20
Creek flow (cfs) (wk avg)	49220	39000	83957	99900	54800	36086	39886	25500	25314	24471	19314	13871	208320	84300	75471	127271	65486	36386	27286	139943
Lunar Fraction (wk avg)	0.89	0.40	0.06	0.60	0.96	0.55	0.06	0.47	0.95	0.69	0.10	0.34	0.91	0.80	0.18	0.22	0.82	0.89	0.29	0.12
Water temp (°C) (wk avg)	15.2	19.5	19.2	18.5	21.5	23.2	23.1	24.6	26.0	27.7	29.5	29.4	24.8	23.5	25.4	25.2	23.5	25.3	26.9	21.5
Dissolved Oxygen (mg/L) (wk avg)	11.9	9.8	9.4	9.5	8.3	8.0	8.8	9.9	8.2	9.0	8.8	7.9	10.9	11.0	10.0	11.0	10.6	11.1	8.0	9.8

2019 Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Octoraro Eels	1	9	5	3	9	20	144	12	36	73	2244	8266	2874	391	42	5	19	12	4	1	0
Conowingo Eels	6	4616	2237	1774	9359	2097	1706	2187	2056	39685	3076	3141	5210	3213	1158	38115	3160	3135	192	40	18
Creek flow (cfs) (wk avg)	59425	76614	121329	70857	58300	59143	34271	61371	69800	29100	30243	21214	24643	16857	16643	14343	16214	12221	10260	12191	4560
Lunar Fraction (wk avg)	0.07	0.16	0.80	0.85	0.29	0.09	0.69	0.93	0.43	0.06	0.57	0.96	0.58	0.07	0.44	0.95	0.71	0.12	0.31	0.89	0.99
Water temp (°C) (wk avg)	15.3	17.5	15.4	18.6	22.6	21.9	23.0	23.3	22.8	26.7	28.6	28.9	30.3	29.5	30.4	29.2	29.2	28.0	27.5	26.6	26.3
Dissolved Oxygen (mg/L) (wk avg)	10.8	9.5	10.2	9.3	8.6	8.2	9.2	8.8	8.3	7.9	7.6	10.3	8.9	8.5	8.9	7.3	8.5	8.3	9.1	7.5	8.1

2020 Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Octoraro Eels									0	15	64	44	40	20	71	1992	1005	306	22	5	5	2	6
Conowingo Eels				2290	20801	36993	10842	3773	1895	4008	15127	7509	36742	17693	29622	31905	24947	6993	2570	223	608	9	101
Creek flow (cfs) (wk avg)				43920	30514	31443	26043	19329	15786	12454	10883	11526	10149	7830	15471	12973	8797	7106	8830	6784	4574	5044	4139
Lunar Fraction (wk avg)				0.05	0.21	0.85	0.78	0.20	0.13	0.76	0.88	0.32	0.07	0.65	0.94	0.47	0.05	0.52	0.96	0.62	0.08	0.39	0.93
Water temp (°C) (wk avg)				17.66	19.64	23.23	24.24	25.17	26.00	28.07	29.27	29.37	29.93	30.87	29.80	28.79	28.30	28.81	28.03	27.41	26.09	23.59	23.00
Dissolved Oxygen (mg/L) (wk avg)				9.55	8.41	7.62	7.94	7.81	7.15	7.09	6.74	7.29	6.96	6.99	7.31	7.30	7.33	7.13	7.20	7.21	7.70	8.33	7.83

No collection occurred until May 18, 2020 (Week 4)

**Appendix D:
Fish Health Inspection Report, Conowingo Eel
Collection Facility 2020**



DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service
FISH HEALTH INSPECTION REPORT¹

This report is NOT evidence of future disease status. To determine status, contact the inspecting biologist below.

Additional Inspection Information
Laboratory Case Number:

20-109 received March 10, 2020. Collection of 60 American eels occurred on 3/9/20 by Michael Martinek.

Bacterial cultures - primary inoculum from kidney onto BHIA, negative for AS, YR, EI. some fish were small this year, only the 27 largest specimens could provide an adequate bacterial sample.

Virology exam of kidney/spleen homogenates on CHSE-214, EPC, BF-2, and FHM cells on microtiter, negative for IH, IP, OM, VH, and any other replicating agent.

General gross observation for the swimbladder nematode was conducted with the 34 eels that could be assessed accurately. Incidence was 23 for 67% (23/34).

PATHOGEN ABBREVIATIONS	SPECIES ABBREVIATIONS			
AS <i>Aeromonas salmonicida</i> EI <i>Edwardsiella ictaluri</i> RS <i>Renibacterium salmoninarum</i> YR <i>Yersinia ruckeri</i> MC <i>Myxobolus cerebralis</i> IH Infectious Hematopoietic Necrosis Virus IP Infectious Pancreatic Necrosis Virus IS Infectious Salmon Anemia Virus LM Largemouth Bass Virus OM <i>Oncorhynchus masou</i> Virus SV Spring Viremia of Carp Virus VH Viral Hemorrhagic Septicemia Virus	Amur Pike AMP Apache Trout APT Arctic Grayling ARG Atlantic Salmon ATS Beautiful Shiner BBS Big Bend Gambusia BBG Bigmouth Buffalo BIB Black Bullhead BLB Black Crappie BLC Blue Catfish BCF Blue X Channel BCFCF Bluegill BLG Blue Pike BLP Bluntnose Shiner PBS Bonytail Chub BTC Bowfin BON Brook Trout BKT Brown Bullhead BRB Brown Trout BNT Carp CAP Channel Catfish CCF Chihuahua Chub CCH Chum Salmon CHS Coho Salmon COS	Colorado Pikeminnow CPM Comanche Springs pupfish CSP Cutthroat Trout CUT Darters DAR Desert Pupfish DEP Desert Sucker DES Devis Hole Pupfish DHP Dolly Varden DOV Dolly Varden X BKT DOVBKT Fall Chinook Salmon FCS Fathead Minnow FHM Flathead Catfish FCF Freshwater Drums FRD Gars GAR Gila Topminnow GTM Gila Trout GIT Golden Shiner GOS Golden Trout GOT Goldfish GOF Grass Carp GRC Green Sunfish GSF Guadalupe Bass GUB Herrings HEG Killifishes KIH	Kokanee KUE Landlocked ATS LAS Leon Springs pupfish LSP Lake Trout LAT Lampreys LAY Largemouth Bass LMB Livebearers LIR Miscellaneous Warm Water MSC Mooneyes MOE Mudminnows MUW Muskellunge MUE Northern Pike NOP Orid Trout OHT Other Catfishes OCF Other Minnows OTM Other Pikes OTP Other Salmonids OSA Other Suckers OTS Other Sunfishes OSF Ruddfish PAH Pahranagel Roundtail Chub PRC Peccos Gambusia PEG Pink Salmon PKS Rainbow Trout RBT	Rainbow Trout X Steelhead RBTSTT Razorback Sucker RBS Redear Sunfish RSF Rio Grande Silvery Minnow RGSM Sanora Sucker SOS Sauger SAR Smallmouth Buffalo SAB Silver Carp SVC Smallmouth Bass SMB Sockeye Salmon SDS Spotted Bass SPB Spring Chinook Salmon SCS Steelhead Trout STT Sticklebacks STK Striped Bass STB Sturgeons STN Virgin Chub VRC Walleye WAE Walleye X Sauger WAESAR Warmouth WAM White Catfish WCF Winter Chinook Salmon WCS Woundfin WDF

**Appendix E:
Chain of Custody Sheet, Conowingo Eel Collection
Facility 2020**



CHAIN OF CUSTODY SHEET: JUVENILE EELS PROVIDED TO RESOURCE AGENCY
PERSONNEL FROM THE CONOWINGO EEL COLLECTION FACILITY

Date: 7/23/2020

Time: 0822

No. of eels provided from CECF Collection Tank: 40

No. of eels provided from Holding Tank # 1: _____

No. of eels provided from Holding Tank # 2: _____

No. of eels provided from Holding Tank # 3: _____

Total number of eels provided for Transport: 40

SIGNATURES:

Normandeau/Exelon Representative: Scott Capenhausen

Agency Representative: _____

Agency (circle one): USFWS PADEP PFBC SRBC MDNR

**Appendix F:
Assessment of the Current Spray Bar Apparatus at the
Conowingo Eel Collection Facility, 2020**



Assessment of the Current Spray bar Apparatus at the Conowingo Eel Collection Facility

Presented To:
Exelon Generation Company, LLC
2569 Shures Landing Road
Darlington, MD 21034-1503

Submitted On:
June 15, 2020

Submitted By:
Normandeau Associates, Inc.
1921 River Road
Drumore, PA 17518

www.normandeau.com

ASSESSMENT OF SPRAY BAR AT CONOWINGO EEL COLLECTION FACILITY

Table of Contents

	Page
1.0 INTRODUCTION.....	1
2.0 METHODS.....	1
3.0 RESULTS/REPORT.....	2
APPENDIX A: USFWS 2019 INSPECTION REPORT FOR CONOWINGO FISH PASSAGE FACILITIES.	3

ASSESSMENT OF SPRAY BAR AT CONOWINGO EEL COLLECTION FACILITY

1.0 Introduction

Exelon Generation Company, LLC (Exelon) and the Department of Interior (DOI) conducted the seasonal inspection of the Conowingo Fish Passage Facilities for the Federal Energy Regulatory Commission Project No. 405 Conowingo Hydroelectric Project on Thursday, May 23, 2019 at 9:00 am. Sheila Eyler and Jesus Morales, United States Fish and Wildlife Service, (USFWS) led the DOI review team. Exelon received a 2019 Inspection Report of the Conowingo Fish Passage Facilities on November 27, 2019 that recommended an assessment of the current spray bar that provides attraction water to the eel ramp. The gravity-fed attraction flow enters the eel pass vertically from the spray bar at the apex of the ramp. The USFWS requested monitoring of this area to determine if eels ascending the ramp are deterred or hindered from entering the collection tank.

The design of the Conowingo Eel Collection Facility, (CECF) was presented to the Eel Passage Advisory Group (EPAG) as part of the Muddy Run Pumped Storage Project (FERC Project No. 2355) in February 2017, and approved prior the start of the 2017 eel season (May 1, 2017). The design included: the large gravity feed line, aeration, holding tanks, collection tank, eel pass (ramp) including the spray bar, and the overflow tank.

2.0 Methods

The assessment will determine if eels are negatively affected by the current spray bar arrangement. Behavior such as delayed up ramp movement or fallback will be documented as negative impacts. The assessment will be conducted at the CECF, but the results will also be used to inform decisions relating to the same concerns at the Octoraro Creek Eel Facility as well.

Video monitoring

The purpose of this assessment is to test the spray bar to determine if eels are being deterred from entering the collection tank. The spray bar will be cleaned prior to commencement of the video monitoring. The day prior to testing, during the normal eel check, Exelon will ensure all features of the eel ramp, spray bar, and other sections of the CECF are set to specifications through our calibration method used throughout the season. The total flow from the spray bar will be set between eight and nine gallons per minutes (gpm), with approximately two gpm set to fall back into the collection tank from the backside of the ramp, providing six to seven gpm of attraction flow water to the ramp to attract eels.

Normandeau assumes the assessment will be performed during the 2020 season when the facility is collecting a consistent number of American Eels. The assessment should be done during the first three hours after dark using a Go Pro Hero 4 video camera and a red head lamp. Normandeau intends to conduct two separate night time surveys (2 three hour surveys). The Go Pro and the headlamp will be affixed to a predetermined location to assess the spray bar discharge and the apex of the ramp. The video recording on the Go Pro will start prior to the hinged lid at the top of the eel facility. The Go Pro will record for a known time depending on the video settings with respect to memory card space and battery life. Additional memory card and additional Go Pro batteries will be available for quick change during the duration of the assessment. American Eels typically move at

ASSESSMENT OF SPRAY BAR AT CONOWINGO EEL COLLECTION FACILITY

night and are not affected by a red light. The video then will be reviewed to determine if eels are being negatively impacted by the current spray bar configuration.

3.0 Results/Report

A draft report summarizing the assessment of the spray bar at the Conowingo Eel Collection Facility will be produced and distributed to Exelon for review. The report will include video clips, images, and results of the assessment. The three criteria (fallback, pass within one minute, and pass after one minute) will be presented and recommendations will be included. If the assessment of the spray bar shows negative results, a follow up study to assess a flexible spray type nozzle design will be conducted upon approval by Exelon and the Resource Agencies.

ASSESSMENT OF SPRAY BAR AT CONOWINGO EEL COLLECTION FACILITY

Appendix A: USFWS 2019 Inspection Report for Conowingo Fish Passage Facilities.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mid-Atlantic Fish and Wildlife Conservation Office
177 Admiral Cochrane Drive
Annapolis, MD 21401



November 27, 2019

Andrea Damacalov
FERC License Compliance Manager
Exelon Generation
2569 Shires Landing Road
Darlington, MD 21034

RE: 2019 Inspection of Conowingo Fish Passage Facilities

Ms. Damacalov,

Attached is the report of the U.S. Fish and Wildlife Service's (Service) inspection of the fish passage facility at Conowingo Dam. During our upcoming meeting in December, the Service would like to discuss feasibility of implementing the suggested modifications to East Fish Lift Crowder Screen operation and moving the attraction flow spray bar in the Eel Collection Facility.

Please contact me if you have any questions or need further clarification of these items.

Sincerely,

Sheila Eyer
Project Leader
Mid-Atlantic Fish & Wildlife Conservation Office
U. S. Fish and Wildlife Service

ASSESSMENT OF SPRAY BAR AT CONOWINGO EEL COLLECTION FACILITY



United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 Westgate Center Drive
Hudley, MA 01035-9589



November 25, 2019

MEMORANDUM

To: Susquehanna River Coordinator, Mid-Atlantic Fish & Wildlife Conservation Office
From: Jesus Morales, Hydraulic Engineer, Fish Passage Engineering
Subject: Inspection of Fishways at Conowingo Hydroelectric Project (FERC #405) on May 23, 2019

A seasonal inspection of the fish passage facilities at the Conowingo Hydroelectric Project (Project) was performed at 9:00 am on Thursday, 05/23/2019. The Project is owned and operated by the Exelon Corporation (Licensee). The USFWS (Service) review team was led by Sheila Eyster, and included Jesus Morales, Jessica Pica, John Wiley and Jessica Goretzke. Consultants from Normandeau Associates, and personnel from the Pennsylvania Fish & Boat Commission, the Susquehanna River Basin Commission and the Maryland Department of Natural Resources were also present during the visit. On the day of the site inspection the Susquehanna River flow was approximately 68,000 cfs, as measured by the Marietta USGS water gage.

Persistent fish passage issues have been previously identified by the Service over a series of annual fish passage inspection reports. During this year's site inspection the Service was able to identify a few additional issues that had not been previously reported. These newly identified salient passage issues appear to center on the following:

East Fish Lift (EFL) Crowding Operation:

- Screen position during fishing mode - A fish exclusion screen on the downstream boundary of the hopper, designed to keep fish inside the hopper while this one is hoisted up, it's being intentionally operated in a way to keep fish from entering the area over the hopper, even during periods of "fishing mode" (Figure 1). Normally, during the fishing mode operation of a fish lift, the fish crowding mechanisms should be attempting to accumulate as many fish as possible within its holding pool/hopper area. Excluding fish from entering the area over the hopper essentially reduces the holding pool estimated capacity and could potentially become a bottleneck for the overall biological capacity of the EFL. The Service requests further discussion about the strategic choice to operate this screen in this manner.



ASSESSMENT OF SPRAY BAR AT CONOWINGO EEL COLLECTION FACILITY



Figure 1 - Exclusion screen in down position during fishing mode

Eel Pass Attraction Flow:

- **Attraction flow enters the eel pass vertically** - Service personnel noticed that the existing eel pass, located on the western river bank in the tailrace, currently introduces its attraction flow through a gravity-fed water line that discharges flow vertically above the apex of the eel ramp, near its exit (Figure 2). Traditional eel passes are typically designed to provide attraction flow through a pump-fed system, and introduce the attraction flow horizontally at the exit of the eel ramp, somewhere upstream of the apex (Figure 3). The goal of this recommended configuration is to hone into the migrating eels' motivation to move in an upstream direction, specifically at the moment when they'd be required to overcome the apex of the eel ramp. The Service believes that a closer look at eel behavior near and around the apex of the Conowingo's eel pass is warranted. Any eel reluctance or failure to move over the apex should be noted, and a different attraction flow system could be considered.



Figure 2 - Eel pass attraction flow entering the eel ramp vertically

ASSESSMENT OF SPRAY BAR AT CONOWINGO EEL COLLECTION FACILITY

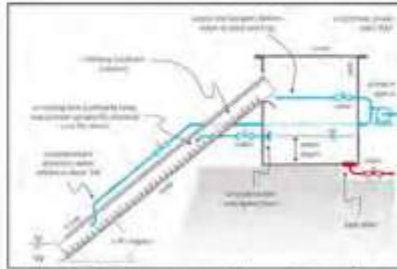


Figure 3 – Conventional arrangement of an eel pass and trap assembly

An agreement to address many other Conowingo's fish passage issues was achieved and submitted to FERC on June 7, 2016. As part of the Phase-1 fish passage requirements agreed to in the settlement agreement, the Service is actively collaborating with Exelon and their consultants on finding solutions to previously identified salient issues.

Thank you for the opportunity to participate in this review. For questions please contact Jesus at 413-253-8206.

Assessment of the Current Spray Bar Apparatus at the Conowingo Eel Collection Facility

Introduction

The design of the Conowingo Eel Collection facility (CECF) was presented to the Eel Passage Advisory Group (EPAG) as part of the Muddy Run Pumped Storage Project (FERC Project No. 2355) in February 2017, and approved prior the start of the 2017 eel season (May 1, 2017). The design included: a large gravity feed waterline, aeration system, holding tanks, collection tank, overflow tank, and the eel pass (ramp) including the spray bar.

Exelon Generation Company, LLC (Exelon) and the Department of Interior (DOI) conducted the seasonal inspection of the Conowingo Fish Passage Facilities for the Federal Energy Regulatory Commission Project No. 405 Conowingo Hydrologic Project on Thursday, May 23, 2019 at 0900 hours. Sheila Eyler and Jesus Morales, United States Fish and Wildlife Service (USFWS) led the DOI review team. Exelon received a 2019 Inspection Report of the Conowingo Fish Passage Facilities on November 27, 2019 that recommended an assessment of the current spray bar that provides attraction flow to the eel ramp. The gravity-fed attraction flow enters the eel pass vertically from the spray bar at the apex of the ramp. The USFWS requested monitoring of this area to determine if eels ascending the ramp are deterred or hindered from entering the collection tank.

Methods

The assessment of the spray bar was to determine if American Eel (*Anguilla rostrata*) are negatively affected by the current spray bar arrangement. As explained in the study plan, behavior such as delay (greater than one minute) or fallback were documented as negative impacts, whereas positive behavior (passing apex less than one minute) was documented as well. Assessments were conducted at the CECF, but the results provide information that can be used to address the same concerns at the Octoraro Creek Eel Facility.

Attraction flows within ramp

The spray bar was cleaned prior to testing and set to normal attraction flows. The calibration of the spray bar and collection tank components was recorded to determine the proper position of the spray bar prior to conducting the assessment. The total flow from the spray bar was set between seven and eight gallons per minute (gpm), with approximately two gpm set to fall back into the collection tank from the backside of the ramp, providing five to six gpm of attraction flow water to the ramp to attract eels.

Video Monitoring

The assessment of the spray bar was captured by video monitoring of the area near the apex for determining the behavior of the American Eels. Two nights of video monitoring occurred when the Conowingo eel ramp was collecting a consistent number of American Eels. A Go Pro Hero 4 video camera was clamped to the cover of the ramp and positioned near the spray bar (Figure 1). The camera was set to 720 Super View resolution, 60 frame per second and 6400 ISO. About six feet of Minger RGB LED Strip Lights set to the dimmest amount of red, which does not affect the eel and their movements, was used to illuminate the area of concern. The lights were attached to the cover of the ramp and to the spray bar without affecting the flow/holes of the spray bar. The camera and lights were set up after the calibration of the components was completed and prior to testing and remained off until it was time to start the test. This allowed the eels to readjust after having the hinged cover open and possibly having

eels negatively impacted to the brighter than normal conditions. During the first night, a single camera was used to assess the ramp whereas the second night two cameras were used (Figure 2).

The assessment was completed during the first three hours after dark. The Go Pro recorded video for a period of time not to exceed the battery life or memory card space. After recording was complete, the battery was charged and the memory card was downloaded and backed up for security purposes.

Detailed information such as date, start and stop times, weather, change in generation, water temperature, and air temperature were also recorded.

Eel Behavior

The videos were reviewed to determine the behavior of eels approaching the apex. Eel behavior (entry into collection tank) was divided into three criteria groups: immediate, delay, and fallback. Immediate is passage into the collection tank within one minute, delay is passage after one minute, and fallback is non-passage after passing into the zone near the apex. The zone is about one inch from the end of the Enkamat substrate at the apex of the ramp where the spray bar flow enters the ramp (Figure 3). An eel is categorized as fallback when an eel enters the zone, but fully leaves the zone.

All eels observed in the zone prior to the start of the video or after the video was finished were not counted or assessed.

Results from 7-20-20

Timing and Environmental Conditions

The first Go Pro assessment occurred on Monday, July 20, 2020, with the spray bar and associated components calibrated at 1940 hours and set to 5.2 gpm attraction and 2.8 gpm of flow entering the collection tank from the backside of the ramp for a total of 8.0 gpm (Table 1). The water temperature was 29.1 °C with an air temperature of 32.2 °C under partly cloudy skies (Table 2). Sunset was at 2028 hours, and the video recording started at 2055 hours and concluded at 2323 hours with small breaks in video for downloading and changing batteries. Total time of the four video recordings was 2 hours 19 minutes over a period of 2 hours 28 minutes using a single camera.

Assessment

The daily check prior to the first night of assessment on July 20 recorded a total of 3,188 eels in the collection tank at the CECF, with 5,761 eels being recorded the morning after video recording. The total number of eels used in the assessment from July 20, 2020 was 475 individuals (Table 3). Of these eels, the majority (63.4% or 301 eels) passed within minute of entering the zone. Fallback occurred to 113 eels (23.8%) and 61 eels (12.8%) eventually passed after delaying for greater than one minute. The average time of an eel that passed within one minute after entering the zone was 18 seconds with a range of 3 - 59 seconds (Table 4). The eels that delayed took an average of 3:39 minutes with a range of 1:04 – 18:11 minutes to pass. The average time an eel was in the zone prior to falling back was 2:00 minutes with a range of 3 seconds to 23:09 minutes.

The first 50 minute video recording (2055-2145 hours) on July 20 accounted for 55.4% (263 of 475) all eels that night. (Table 3). Of these 263 eels, 172 eels (65.4%) passed within one minute with an average time of 18 seconds (Table 4). A total of 52 eels (19.8%) fell back after entering the zone and stayed for an average of 0:44 seconds and a range of 3 seconds to 5:10 minutes. The remaining 39 eels (14.8%) delayed longer than one minute averaged 3:28 minutes with a range of 1:04 – 18:11 minutes. The last 20 minute video (2303 – 2323 hours) of the assessment focused on the corner of the ramp, which reduced the amount of camera view. This video accounted for 19 eels, (4.0%) of those observed during the July 20, 2020 assessment. Of these 19 eels, 15 eels (78.9%) passed immediately with an

average time of 16 seconds and a range of 4 – 38 seconds. Three eels fell back with an average of 2:38 minutes and a range of 25 seconds to 6:29 minutes. Only a single eel passed after one minute (2:28 minutes) during this portion of video.

Results from 8-25-20

Timing and Environmental Conditions

The second Go Pro assessment occurred on Tuesday, August 25, 2020, with the spray bar and associated components calibrated at 1930 hours and set to 6.1 gpm attraction and 2.2 gpm of flow entering the collection tank from the backside of the ramp for a total of 8.3 gpm (Table 1). The water temperature was 28.1 °C with an air temperature of 26.1 °C under overcast skies (Table 2). Sunset occurred at 1946 hours and the video recording started at 2015 hours and concluded at 2313 hours with small breaks in video for downloading and changing batteries. The total time of the eight video recordings was 3 hours 25 minutes over a period of 2 hours 58 minutes with two cameras recording. Each camera was recording the upstream or downstream half of the ramp apex and zone. Definitive assessment could only be obtained from five of the eight videos for 2 hour 27 seconds (72.0%) due to water on the lens of the cameras (Table 3).

Assessment

The daily check prior to the assessment on August 25, recorded a total of 610 eels removed from the collection tank at the CECF, with 562 eels being removed the morning after video recording. The total number of eels used for assessment on August 25, 2020 was 70 individuals (Table 3). Of these eels, the majority (50.0% or 35 eels) fell back after entering the zone. Immediate passage occurred to 28 eels (42.9%) and 5 eels (7.1%) eventually passed after delaying for greater than one minute. The average time of eels that passed within one minute after entering the zone was 24 seconds with a range of 4 - 50 seconds (Table 5). The eels that delayed took an average of 2:10 minutes with a range of 1:13 – 4:44 minutes to pass. The average time an eel was in the zone prior to falling back was 1:20 minutes with a range of 4 seconds to 4:58 minutes.

The downstream camera video from 2054 – 2118 hours accounted for 40.0% (28 of 70) of all eels assessed on August 25, 2020 (Table 3). Of these 28 eels, 14 eels (50.0%) passed within one minute with an average time of 25 seconds and a range of 4 – 48 seconds (Table 5). The 11 eels (15.3%) that fell back after entering the zone stayed for an average of 1:06 minutes and a range of 16 seconds to 3:44 minutes. The remaining three eels (10.7%) delayed longer than one minute with an average of 3:28 minutes and a range of 1:04 – 18:11 minutes.

The last 35 minute video (2238 – 2313 hours) of the August 25, 2020 assessment from the upstream half of the ramp accounted for 20 of the 70 (28.6%) eels (Table 5). Of these 20 eels, 8 eels (40.0%) passed immediately with an average time of 28 seconds and a range of 7 – 50 seconds. Eleven eels fell back with an average of 1:45 minutes and a range of 7 seconds to 6:19 minutes. Only a single eel passed after one minute (1:46 minutes) during this video.

Overall Assessment Results

The total number of eel observed during the two assessments was 545 eels (Table 3). Immediate passage accounted for the majority (60.5% or 331 of 545 eels) of eels observed during the assessments. Fallback accounted for 148 of the 545 eels (27.2%), while 66 or 12.1% eels that delayed passage of the total eels assessed.

Conclusion and Discussion

The purpose of this assessment was to determine if the gravity-fed attraction flow that enters the eel pass vertically from the spray bar at the apex of the ramp deters or hinders the eels from entering the collection tank. The July 20 and the August 25 assessments were completed with different circumstances. The July videos accounted for 87.2% (475 of 545 eels) of the total eels assessed (Table 3). The eel collection during the July assessment was 5-10 times greater than the August assessment according to the number of eels removed from the CECF Collection Tank the day of and the day after the assessment. Due to the large number of eels observed during the July assessment, individual eel QA/QC documentation was not obtained. The majority of the assessments were obtained with the hinged lid closed but some visual observations were recorded.

Visual observations were supported by the July video assessment. Some eels climbed up and over with little or no hesitation in less than one minute. Eels near the vertical sides of the ramp (corner) appeared to continue traveling without hesitation. Some eels came up to the apex (where the Enkamat ends) and rested for a period of time (greater than one minute) and most of these eels would eventually drop into the collection tank. A sizeable proportion of eels would reach the apex, then travel (laterally) along the change in substrate edge before dropping into the collection tank or returning back into the Enkamat slightly. Few eels were observed to just pass into the zone and then fallback, but some eels made a second attempt and passed into the collection tank. No eels were observed swimming or trying to rise out of the substrate and into the flow of water coming from the spray bar. Eels that were in the zone prior to and after a video were not counted in this assessment because the fate of these eel were unknown.

The assessment in July was a baseline assessment with no adjustment or added flows compared to the August assessment, except for the last 20 minutes of video in July that focused on the corner of the ramp. The corner video captured an area that was observed during the assessment to have high use of eels compared to the center of the ramp.

Additional flow from a fan sprayer was introduced during partial videos of the August assessment (Figure 4). A small garden hose pump was placed inside an oyster spat bag and lowered into the collection tank. The pump was placed in the bag to keep eels from being impinged in or on the screen of the pump. The amount of water flow from the fan sprayer was 2.5 gpm. The fan sprayer was held in place to determine the best location on the collection tank side of the apex to create a smooth flow over the apex and down the ramp. The positioning of the fan sprayer proved to be difficult, but some video was captured with a limited number of eels observed. No useful information was obtained during the attempts to assess the fan sprayer.

The amount of time recorded for eels that passed was similar between the two assessments with an average time of 18 and 24 seconds for the July and August assessments, respectively (Table 3). The range for delayed and fallback eels was greater for the July assessment than the August assessment, but this could be due to the large number of eels assessed during the July assessment. Individual passage groups by 5 second intervals are shown in Tables 6 and 7.

Suggestions

The Conowingo Eel Collection Facility ramp collected 254,651 American Eels during the 138 day season from May 18 to October 3, 2020 utilizing the spray bar configuration that has been in place since 2017.

The average number of eels per collection day was 1,845.3. Suggested modifications to the eel facility must be carefully considered prior to any deployment to minimize impacts that may negatively affect the capture of eel in future seasons.

The corner or edge of the ramp showed greater success for eel entering the collection tank. This was documented with the 2303-2323 hour video on July 20, 2020. This video showed that of the 19 eels (4.0% of the assessment), 15 (78.9%) of the eels passed within one minute of starting into the zone, with three eels falling back and one eel passed after being delayed over one minute. This area shows a better rate of immediate passage than the center of the ramp, but could be due to eels using the edge of the ramp as guidance, or the amount of flow in this area is not from the spray bar positioned directly overhead.

Eels seem to stop at the apex and rest for some period of time before passing or falling back. Not knowing the time it takes eels to climb the 29.5 foot long eel ramp at Conowingo may have a part into why these eels rest upon arrival at the apex. The eels could be confused at the apex because the Enkamat substrate ends, leaving a short section of exposed bare metal to traverse before dropping into the collection tank. This change in substrate could deter eels from committing over the apex, but adding additional substrate on the other side of the apex may allow some eels to return back to the apex. Some eels were observed almost fully extended over the apex on the bare metal ramp with a small bit of their tail clinging to the Enkamat substrate and were able to pull themselves back up over the apex and back into the substrate. Small guidance ribs installed on the backside of the ramp could help direct eels to committing over the apex and into the collection tank.

Some eels were observed moving/searching laterally in the Enkamat substrate. These lateral movements were observed prior to entering the zone, so it may not be the direct result of flow patterns, but rather a method of mobility that eels use to transverse various substrates when climbing obstacles in their path.

During periods of high eel movement, immediate passage appeared to be greater than during periods of low eel movement. This was observed during the July assessment compared to the August assessment. This could be the result of additional eel scent present on the ramp attracting more eels to climb the Enkamat substrate and committing to the collection tank with less hesitation during these high movement periods.

The flow from the spray bar is from a one inch outlet on the gravity fed pipe and controlled by a ball valve. This is important to note because if a pump is installed for the spray bar in another tank (such as the overflow tank), fungus or other biological pathogens (if present) could be recirculated into the ramp and the collection tank.

A spray bar with $1/8$ " holes will not clog as fast as a spray nozzle (recommended in the USFWS guidelines). The eel facility's current spray bar can be calibrated in less than one minute (two readings) and is quickly cleaned with minimal interruption to ramp operation. A spray nozzle system will require more time to clean as it needs to be dismantled (particularly the section of the nozzle that restricts the flow with the center pin).

Figure 1: Position of the Go Pro Video Camera and the Minger RGB LED Strip Lights at the Top of the Ramp, Conowingo Eel Collection Facility, July 2020.



Figure 2: Position of the Go Pro Video Cameras and the Minger RGB LED Strip Lights at the Top of the Ramp, Conowingo Eel Collection Facility, August 2020.

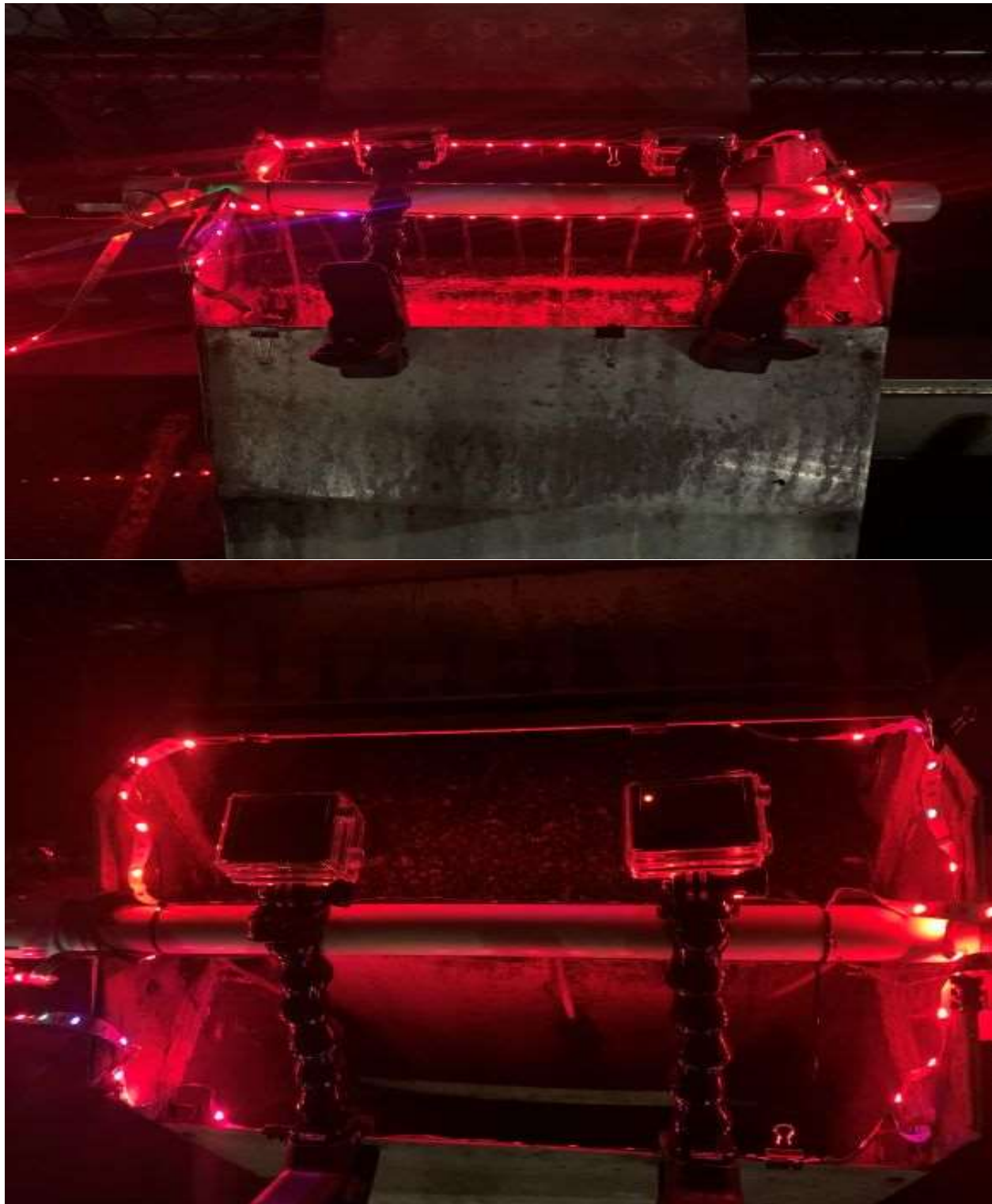


Figure 3: Image of the Apex of the Ramp, Spray Bar, Backside of Ramp, and Enkamat Substrate Including the “Zone” of the Assessment, Conowingo Eel Collection Facility, 2020.



Figure 4: Pump, Oyster Spat Bag, Garden Hose, and Fan Sprayer, Conowingo Eel; Collection Facility, 2020.



Table 1: Calibration of Spray Bar, Collection Tank Flows and Calculated Backside of Ramp, Conowingo Eel Collection Facility, July and August 2020.

7/20/2020	Sample seconds	Amount (gallons)	Multiplication Factor	Gallons per minute
Collection Tank fill	10	2.15	6	12.9
Spray Bar	20	2.65	3	7.95
Collection Tank Drain	10	2.25	6	13.5
Scent Line	60	2.2	1	2.2
Backside of Ramp				2.8
Top Attraction				5.15

8/25/2020	Sample seconds	Amount (gallons)	Multiplication Factor	Gallons per minute
Collection Tank fill	10	2.5	6	15
Spray Bar	20	2.75	3	8.25
Collection Tank Drain	10	2.45	6	14.7
Scent Line	60	2.5	1	2.5
Backside of Ramp				2.2
Top Attraction				6.05

Table 2: Environmental Conditions During the July and August Video Assessments, Conowingo Eel Collection Facility, 2020.

Date	Time	Minutes of video	View	Weather	Generation	Air temperature	Water Temperature
7/20/2020	2055-2145	50	Overall	Pt. Cloudy	2 small	32.2 °C	29.1 °C
7/20/2020	2145-2221	36	Overall	Pt. Cloudy	2 small	31.1 °C	29.1 °C
7/20/2020	2236-2255	19	Overall	Pt. Cloudy	2 small	30.0 °C	29.0 °C
7/20/2020	2303-2323	20	Overall	Pt. Cloudy	2 small	29.4 °C	29.0 °C

Date	Time	Minutes of video	View	Weather	Generation	Air temperature	Water Temperature
8/25/2020	2015-2035	20	Downstream	Overcast	1 small	24.4 °C	28.1 °C
8/25/2020	2017-2035	18	Upstream	Overcast	1 small	24.4 °C	28.1 °C
8/25/2020	2054-2118	24	Downstream	Overcast	1 small	24.4 °C	28.1 °C
8/25/2020	2059-2119	20	Upstream	Overcast	1 small	24.4 °C	28.1 °C
8/25/2020	2155-2222	27	Downstream	Overcast	1 small	24.4 °C	28.1 °C
8/25/2020	2156-2222	26	Upstream	Overcast	1 small	24.4 °C	28.1 °C
8/25/2020	2238-2313	35	Downstream	Overcast	1 small	24.4 °C	28.0 °C
8/25/2020	2238-2313	35	Upstream	Overcast	1 small	24.4 °C	28.1 °C

Table 3: Individual Video Assessments with Eel Behavior Criteria Determined, Conowingo Eel Collection Facility, July and August 2020.

Date	Recording Time	View	Eels observed	Passed with 1 minutes	Delayed passage over 1 minute	Fallback
7/20/2020	2055-2145	overall	263	172	39	52
7/20/2020	2145-2221	overall	124	75	11	38
7/20/2020	2236-2255	overall	69	39	10	20
7/20/2020	2303-2323	corner	19	15	1	3
		Total	475	301	61	113
		Percent		63.4%	12.8%	23.8%

8/25/2020	2015-2035	DS	<i>Video not good for positive determination</i>			
8/25/2020	2017-2035	US	<i>Video not good for positive determination</i>			
8/25/2020	2054-2118	DS	28	14	3	11
8/25/2020	2059-2119	US	<i>Video not good for positive determination</i>			
8/25/2020	2155-2222	DS	3	0	1	2
8/25/2020	2156-2222	US	8	3	0	5
8/25/2020	2238-2313	DS	11	5	0	6
8/25/2020	2238-2313	US	20	8	1	11
		Total	70	30	5	35
		Percent		42.9%	7.1%	50.0%
	OVERALL	Total	545	331	66	148
		Percent		60.7%	12.1%	27.2%

Table 4: Individual Video Assessments with Average, Min, Max, and Median Times per Eel Behavior, Conowingo Eel Collection Facility, July 2020.

Date	Recording Time	View	Criteria	No. Eels	Time (Min:Sec)			
					Average	Min	Max	Median
7/20/2020	2055-2145	overall	Immediate	172	0:18	0:03	0:59	0:07
			Delay	39	3:28	1:04	18:11	2:15
			Fallback	52	0:44	0:03	5:10	0:28
7/20/2020	2145-2221	overall	Immediate	75	0:18	0:04	0:58	0:12
			Delay	11	4:05	1:28	11:58	3:09
			Fallback	38	3:29	0:05	23:09	1:29
7/20/2020	2236-2255	overall	Immediate	39	0:18	0:03	0:56	0:12
			Delay	10	4:03	1:28	8:51	3:12
			Fallback	20	2:21	0:07	12:22	1:13
7/20/2020	2303-2323	corner	Immediate	15	0:16	0:04	0:38	0:09
			Delay	1	2:28	2:28	2:28	2:28
			Fallback	3	2:38	0:25	6:29	0:59
Overall	2055-2323		Immediate	301	0:18	0:03	0:59	0:12
			Delay	61	3:39	1:04	18:11	2:25
			Fallback	113	2:00	0:03	23:09	0:40

Table 5: Individual Video Assessments with Average, Min, Max, and Median Times per Eel Behavior, Conowingo Eel Collection Facility, August 2020.

Date	Recording Time	View	Criteria	No. Eels	Time (min:sec)			
					Average	Min	Max	Median
8/25/2020	2015-2035	DS	N/A					
8/25/2020	2017-2035	US	N/A					
8/25/2020	2054-2118	DS	Immediate	14	0:25	0:04	0:48	0:25
			Delay	3	1:27	1:13	1:36	1:32
			Fallback	11	1:06	0:16	3:44	0:55
8/25/2020	2059-2119	US	N/A					
8/25/2020	2155-2222	DS	Immediate	-	-	-	-	-
			Delay	1	4:44	4:44	4:44	4:44
			Fallback	2	1:17	0:16	2:18	1:17
8/25/2020	2156-2222	US	Immediate	3	0:07	0:14	0:22	0:17
			Delay	-	-	-	-	-
			Fallback	5	0:41	0:07	1:39	0:29
8/25/2020	2238-2313	DS	Immediate	5	0:21	0:07	0:48	0:20
			Delay	-	-	-	-	-
			Fallback	6	2:18	0:04	4:58	1:36
8/25/2020	2238-2313	US	Immediate	8	0:28	0:07	0:50	0:30
			Delay	1	1:46	1:46	1:46	1:46
			Fallback	11	1:45	0:07	6:19	1:29
Overall	2015-2313		Immediate	30	0:24	0:04	0:50	0:21
			Delay	5	2:10	1:13	4:44	1:36
			Fallback	24	1:20	0:04	4:58	0:56

Table 6: Passage Groups (in 5 second) Intervals per Eel Behavior, Conowingo Eel Collection Facility, July 2020.

Immediate Passage		Delayed Passage		Fallback	
Passage Group	No. Eels	Passage Group	No. Eels	Passage Group	No. Eels
0:01-0:04	25	1:00-1:04	1	0:01-0:04	3
0:05-0:09	84	1:05-1:09	1	0:05-0:09	7
0:10-0:14	61	1:20-1:24	1	0:10-0:14	9
0:15-0:19	32	1:25-1:29	2	0:15-0:19	10
0:20-0:24	21	1:30-1:34	2	0:20-0:24	7
0:25-0:29	13	1:35-1:39	1	0:25-0:29	6
0:30-0:34	20	1:40-1:44	1	0:30-0:34	4
0:35-0:39	11	1:45-1:49	4	0:35-0:39	10
0:40-0:44	13	1:50-1:54	2	0:40-0:44	3
0:45-0:49	8	1:55-1:59	4	0:45-0:49	5
0:50-0:54	6	2:00-2:04	4	0:50-0:54	1
0:54-0:59	7	2:05-2:09	2	0:54-0:59	2
Total eels	301	2:10-2:14	1	1:00-1:04	4
		2:15-2:19	2	1:05-1:09	1
		2:25-2:29	3	1:10-1:14	3
		2:30-2:34	1	1:15-1:19	1
		2:35-2:39	1	1:20-1:24	4
		2:40-2:44	1	1:25-1:29	1
		2:45-2:49	1	1:35-1:39	2
		2:50-2:54	1	1:40-1:44	1
		2:55-2:59	1	1:45-1:49	2
		3:05-3:09	2	1:50-1:54	1
		3:15-3:19	3	2:00-2:04	1
		3:25-3:29	1	2:5-2:09	1
		3:45-3:49	1	2:20-2:24	1
		3:50-3:54	1	2:25-2:29	1
		4:35-4:39	1	2:55-2:59	1
		4:45-4:49	1	3:00-3:04	2
		4:55-4:59	1	3:05-3:09	2
		5:00-5:04	1	3:30-3:34	1
		5:55-5:59	1	3:55-3:59	1
		6:05-6:09	1	4:05-4:09	1
		6:10-6:14	1	4:15-4:19	1
		6:15-6:19	1	4:45-4:49	1
		7:05-7:09	1	5:10-5:14	1
		7:20-7:25	1	6:25-6:29	1
		8:50-8:55	1	7:15-7:19	1
		10:40-10:44	1	7:20-7:24	1
		11:55-11:59	1	7:50-7:54	1
		12:15-12:19	1	10:35-10:39	2
		18:10-18:14	1	10:45-10:49	1
		Total eels	61	11:15-11:19	1
				12:20-12:24	1
				12:45-12:49	1
				23:05-23:09	1
				Total eels	113

Table 7: Passage Groups (in 5 second) Intervals per Eel Behavior, Conowingo Eel Collection Facility, August 2020.

Immediate Passage		Delayed Passage		Fallback	
Passage Group	No. Eels	Passage Group	No. Eels	Passage Group	No. Eels
0:01-0:04	1	1:10-1:14	1	0:01-0:04	1
0:05-0:09	6	1:30-1:34	1	0:05-0:09	1
0:10-0:14	4	1:35-1:39	1	0:15-0:19	4
0:15-0:19	2	1:45-1:49	1	0:25-0:29	1
0:20-0:24	4	4:40-4:44	1	0:30-0:34	1
0:25-0:29	3	Total eels	5	0:45-0:49	3
0:30-0:34	1			0:55-0:59	2
0:35-0:39	2			1:05-1:09	1
0:45-0:49	6			1:10-1:14	2
0:50-0:54	1			1:20-1:24	1
Total eels	30			1:35-1:39	2
				1:55-1:59	1
				2:15-2:19	1
				3:40-3:44	1
				4:20-4:24	1
				4:55-4:59	1
				Total eels	24

**Appendix G:
Agency Comments on Draft 2020 Conowingo Eel
Collection Report**

Mike Martinek



Subject: FW: External: FW: [EXTERNAL] Re: MDNR review of 2020 Conowingo & Octoraro Creek Fish Passage Reports

From: Shawn Seaman -DNR- <shawn.seaman@maryland.gov>
Sent: Monday, December 14, 2020 11:58 AM
To: Tryniewski, Joshua <jtryniewski@pa.gov>
Cc: Danucalov, Andrea H:(Exelon Power) <Andrea.Danucalov@exeloncorp.com>; Sheila Eyster <Sheila_Eyster@fws.gov>; Aaron Henning <ahenning@srbc.net>; Miller, Jeremy <jeremmille@pa.gov>; Eberts, Ron <reberts@pa.gov>; Emily Zollweg-Horan <emily.zollweg-horan@dec.ny.gov>; Rob Bourdon <robert.bourdon@maryland.gov>; McCorkle, Richard <richard_mccorkle@fws.gov>; Morales, Jesus J <jesus_morales@fws.gov>
Subject: [EXTERNAL] Re: PFBC review of 2020 Conowingo & Octoraro Creek Fish Passage Reports

Andrea,

Maryland DNR has also reviewed these three (3) draft reports and has no comments. Thanks for the opportunity to review.

Due to the COVID-19 pandemic, I am working remotely.

	<p>Shawn A Seaman Power Plant Research Program Department of Natural Resources Tawes State Office Building 580 Taylor Ave., B-3 Annapolis, MD 21401 410-260-8662 (office) 443-699-6306 (cell) shawn.seaman@maryland.gov</p>
 dnr.maryland.gov	<p>Power Plant Research Program Website</p>

[Click here](#) to complete a three question customer experience survey.

Mike Martinek

Subject: FW: External: FW: FWS Review of Exelon's 2020 Fish Passage Reports

From: Eyler, Sheila <sheila_eyler@fws.gov>
Sent: Monday, December 14, 2020 8:56 AM
To: Danucalov, Andrea H.(Exelon Power) <Andrea.Danucalov@exeloncorp.com>
Cc: Tryninewski, Joshua <jtryninews@pa.gov>; Aaron Henning <ahenning@srbc.net>; Miller, Jeremy <jeremmille@pa.gov>; Ron Eberts <reberts@pa.gov>; Shawn Seaman -DNR- <shawn.seaman@maryland.gov>; Emily Zollweg-Horan <emily.zollweg-horan@dec.ny.gov>; Rob Bourdon <robert.bourdon@maryland.gov>; McCorkle, Richard <richard_mccorkle@fws.gov>; Morales, Jesus J <jesus_morales@fws.gov>
Subject: [EXTERNAL] FWS Review of Exelon's 2020 Fish Passage Reports

EXTERNAL MAIL. Do not click links or open attachments from unknown senders or unexpected Email.

Andrea,

The U.S. Fish and Wildlife Service has reviewed the following fish passage reports for 2020:

1. Muddy Run Pumped Storage Project Conowingo Eel Collection Facility
2. Muddy Run Pumped Storage Project American Eel Collection Facility in Octoraro Creek, 2020
3. Summary of Operations at the Conowingo Dam East Fish Passage Facility Spring 2020
4. Muddy Run Pumped Storage Project Draft 2020 Fish Passage Operating Report

We have no specific comments on these reports.

We appreciate Exelon's efforts to conduct the red-light survey in the Conowingo Eel Collection Facility in 2020. We look forward to working with the company to potentially improve efficiency of the eel collection facility in 2021 based on the results of that evaluation.

Thank you for the opportunity to review the reports. Let me know if you have any questions.

Sheila Eyler
U.S. Fish and Wildlife Service
Mid-Atlantic Fish & Wildlife Conservation Office
177 Admiral Cochrane Dr.
Annapolis, MD 21401
717-387-2117

Mike Martinek

Subject: FW: External: FW: DEP comments Octoraro and Conowingo Eel Ramp and Conowingo EFL

From: Miller, Jeremy <jeremmille@pa.gov>
Sent: Friday, December 11, 2020 9:10 PM
To: Danucalov, Andrea H:(Exelon Power) <Andrea.Danucalov@exeloncorp.com>; Erin Redding <eredding@gomezandsullivan.com>; Ray Bleistine <rbleistine@normandeau.com>
Cc: Williamson, Scott <scwilliams@pa.gov>; Eberts, Ron <reberts@pa.gov>
Subject: [EXTERNAL] DEP comments Octoraro and Conowingo Eel Ramp and Conowingo EFL

EXTERNAL MAIL. Do not click links or open attachments from unknown senders or unexpected Email.

Andrea,

Thank you for the opportunity to review and comment on the 2020 Octoraro Creek Eel Facility, Conowingo Eel Facility, and Conowingo Dam East Fish Passage Facility reports. DEP has reviewed the reports dated 11/13/2020 and 11/18/2020 and offer the following:

1. Muddy Run Pumped Storage Project American Eel Collection Facility in Octoraro Creek, 2020 FERC Project No 2355- No comments
2. Muddy Run Pumped Storage Project Conowingo Eel Collection Facility FERC Project No 2355- No comments
3. Summary of Operations at the Conowingo Dam East Fish Passage Facility Spring 2020- No comments

Thanks,
Jeremy

This Email message and any attachment may contain information that is proprietary, legally privileged, confidential and/or subject to copyright belonging to Exelon Corporation or its affiliates ("Exelon"). This Email is intended solely for the use of the person(s) to which it is addressed. If you are not an intended recipient, or the employee or agent responsible for delivery of this Email to the intended recipient(s), you are hereby notified that any dissemination, distribution or copying of this Email is strictly prohibited. If you have received this message in error, please immediately notify the sender and permanently delete this Email and any copies. Exelon policies expressly prohibit employees from making defamatory or offensive statements and infringing any copyright or any other legal right by Email communication. Exelon will not accept any liability in respect of such communications. -EXCIP

Mike Martinek

Subject: FW: External: FW: [EXTERNAL] Re: PFBC review of 2020 Conowingo & Octoraro Creek Fish Passage Reports

Andrea,

The PFBC has completed its review of 1) *Summary of Operations at the Conowingo Dam East Fish Passage Facility Spring 2020*, 2) *Muddy Run Pumped Storage Project Conowingo Eel Collection Facility*, and 3) *Muddy Run Pumped Storage Project American Eel Collection Facility in Octoraro Creek, 2020* and has no comments to provide. Thank you for the opportunity to review these reports and for Exelon's continued efforts and participation in shad and eel restoration to the Susquehanna River.

Regards,

-Josh

Joshua D. Tryniewski

Anadromous Fish Restoration Unit

Pennsylvania Fish & Boat Commission

1735 Shiloh Rd.

State College, PA 16801

Office: 814-353-2239

Cell: 814-424-0985

Fax: 814-355-8264

Email: jtryniewski@pa.gov

This Email message and any attachment may contain information that is proprietary, legally privileged, confidential and/or subject to copyright belonging to Exelon Corporation or its affiliates ("Exelon"). This Email is intended solely for the use of the person(s) to which it is addressed. If you are not an intended recipient, or the employee or agent responsible for delivery of this Email to the intended recipient(s), you are hereby notified that any dissemination, distribution or copying of this Email is strictly prohibited. If you have received this message in error, please immediately notify the sender and permanently delete this Email and any copies. Exelon policies expressly prohibit employees from making defamatory or offensive statements and infringing any copyright or any other legal right by Email communication. Exelon will not accept any liability in respect of such communications. -EXCIP