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ENVIRONMENTAL CONSULTANTS

Muddy Run Pumped Storage Project and Conowingo Hydroelectric Project Conowingo West Eel Collection Facility, 2023

FERC Project Numbers 2355 and 405

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Constellation

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Executive Summary

Constellation Energy Generation, LLC (Constellation) owns and operates the Muddy Run Pumped Storage Project (MRPSP; FERC Project Number 2355) and Conowingo Hydroelectric Project (Conowingo; FERC Project Number 405) along the Susquehanna River in Pennsylvania (both MRPSP and Conowingo) and Maryland (Conowingo only). Both projects are licensed by the Federal Energy Regulatory Commission (FERC).

The MRPSP License incorporates the Pennsylvania Department of Environmental Protection (PA DEP) 401 Water Quality Certification (WQC), which includes an American Eel Passage Plan (Eel Plan) that requires Constellation to trap, transport, and stock American Eel *Anguilla rostrata* in the Susquehanna River. The Eel Plan covers operation of the Octoraro Creek Eel Collection Facility (OCEF) and the Conowingo West Eel Collection Facility (CWECF)[1].

The CWECF is located on the Susquehanna River immediately downstream of the West Fish Lift (WFL) at Conowingo where a previous United States Fish and Wildlife Service (USFWS) eel collection facility was located from 2005 through 2016. This site was approved by PA DEP and other members of the Eel Passage Advisory Group (EPAG). Constellation designed, installed, and began operation of the CWECF in 2017 and has operated this facility each year through 2023. American Eels collected at CWECF and those transported from OCEF are held and then transported and released at designated stocking locations in the Susquehanna River watershed as approved by PA DEP, EPAG, and Maryland Department of the Environment (MDE).

This report discusses the results of the operation of the CWECF during the period May 1 to November 27, 2023[2]. Specifically, the objectives of the 2023 collection season were to[3]:

- Operate, maintain, and monitor the eel collection and holding facility daily from May 1 until mean daily water temperature was 10° C or less for three consecutive days;
- Transport American Eel collected at the CWECF and OCEF to designated stocking points in the Susquehanna River watershed;
- Document any modifications made to the CWECF during the course of the season to improve functionality.

The CWECF was placed in service on May 1, 2023, and operated for a total of 211 consecutive days from May 1 to November 27. A total of 217,035 juvenile eels were collected at the CWECF. Juvenile

[1] Note the Conowingo Hydroelectric Project (P-405) license issued on March 19, 2021 was vacated by a DC Circuit Court Decision on December 22, 2022. The operation of the Conowingo Eel Facility is therefore governed under the Muddy Run License (P-2355) issued December 22, 2015. During the August 17, 2023, EPAG call, the Resource Agencies requested that Constellation run the Conowingo Eel Facility longer than the May 1 to September 15 season specified in the Muddy Run License.

[2] The report dated December 18, 2023, and filed with FERC on January 16, 2024, contained data from May 1 to September 15, 2023. This report has been revised to include data from September 16 to November 27, 2023. The revised report was sent to the Resource Agencies for review and comment and is shown in Appendix E. The revised report will not be filed with FERC but will be sent to the Resource Agencies.

[3] These are the objectives of the FOMP which is no longer required under the vacated Conowingo Hydroelectric Project (P-405) license issued on March 21, 2023. This revision report includes data collected from September 16 until November 27, 2023.

eel numbers greater than 10,000 individuals were recorded on five of the 211 collection days (2.4%), and juvenile eel numbers greater than 1,000 individuals were recorded on 44 of the 211 collection days (20.9%). The greatest number of juvenile eels collected in a single day occurred on July 7, 2023, when the CWECF collected 17,326 eels or 8.0% of the total season catch. The peak period of daily eels collected occurred from July 7-10 (4 days) and yielded 26.8% (58,157 of the 217,035 individuals) of the total eels collected in 2023. The three peak periods of eel collections, totaling 12 days, accounted for 54.1% (117,425 of the 217,035 individuals) of the collection season. Volumetric estimation methodology was utilized on 28 of the 211 collection days (13.3%) this year, which can be used as a metric to understand the proportion of days when daily eel collections were high.

Biweekly subsamples for biological data were recorded from May 1 until September 15 as a condition of the PA DEP 401 WQC for the MRPSP Eel Plan. Lengths, weights, and condition factors (a metric to assess injury) were recorded from biweekly subsamples on 919 juvenile eels. Lengths of juvenile eels ranged from 79-176 millimeter (mm) with an average length of 117.1 mm. The average weight of juvenile eels was 1.7 grams (g) and ranged from 0.3-5.7 g. Only eight of the 919 eels (0.9%) showed any form of external injury (condition factor) such hemorrhage, abrasion, scrape, or bruise.

Nearly 11% (100 of 919) of the eels sampled were examined internally for presence of the eel swim bladder parasite *Anguillicoloides crassus*. Parasites were found in 60 (60%) of the 100 examined eels. The number of parasites per eel ranged from one to three. Ninety-seven of these eels were examined for age, and it was determined that the average age was 2.07 years old with a range of 1-4 years old.

The CWECF collected a total of 217,035 juvenile eels in 2023 with a total collection mortality rate of 0.02% (50 individuals) in the collection tank. Constellation examined 100 eels for biological analysis. A total of 112 (0.19%) juvenile eels were recovered dead from the holding tanks over the entire season. The Susquehanna River Basin Commission (SRBC) removed a total of 300 juvenile eels on September 5, 2023, for an “Eels in the Classroom” program.

Eels were held no longer than one week prior to transport from the CWECF. A combined total of 278,568 eels from CWECF and the OCEF were transported to designated locations in the Susquehanna River watershed. Loch Haven boat ramp (Site 11) was stocked with 62,134 juvenile eels. City Island Boat Ramp (Site 12) received a stocking of 72,189 juvenile eels. Fort Hunter Access (Site 6) received a stocking of 71,564 juvenile eels. West Fairview Access (Site 5) was stocked with 71,796 juvenile eels. Conowingo Creek boat ramp (Site 1) was stocked with 862 juvenile eels. A total of 23 (<0.01%) juvenile eels died during the 116 transport trips from the CWECF in 2023. Daily transports occurred from June 29 to September 21 due to elevated water temperatures. Biweekly transports occurred from May 30 through June 29 and from September 22 until November 2. Weekly transport occurred for two weeks until November 16, when it was decided, due to the low number of eels collected, to transport daily to Conowingo Creek boat ramp, if any eels were collected instead of holding them. The last day of transport was November 24, 2023, when the last four eels were collected. No eels were collected during the last three days of operation at the CWECF from November 25-27.

Cleaning and calibration of the CWECF was performed weekly. Scrubbing of the collection tank and the screened drain occurred daily after eels were removed. The holding tanks and overflow drains were scrubbed every time the eels were removed for transport. Volumetric estimates of eels were

compared against actual counts twice during the season, and it was determined that the volumetric estimation method provided accurate counts.

List of Abbreviations

Agencies/Groups

Conowingo	Conowingo Hydroelectric Project
CWECF	Conowingo West Eel Collection Facility
Eel Plan	American Eel Passage Plan
EPAG	Eel Passage Advisory Group
EPRP	American Eel Passage and Restoration Plan
CONSTELLATION	Constellation Generation Company, LLC
FERC	Federal Energy Regulatory Commission
FOMP	Fishway Operation and Maintenance Plan
MDE	Maryland Department of the Environment
MRPSP	Muddy Run Pumped Storage Project
PA DEP	Pennsylvania Department of Environmental Protection
SRBC	Susquehanna River Basin Commission
SUNY	The State University of New York
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
WQC	Water Quality Certification

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
WFL	West Fish Lift

1 Introduction

Constellation Energy Generation, LLC (Constellation) owns and operates the Muddy Run Pumped Storage Project (MRPSP; FERC Project Number 2355) and the Conowingo Hydroelectric Project (Conowingo; FERC Project Number 405) along the Susquehanna River in Pennsylvania (both MRPSP and Conowingo) and Maryland (Conowingo only). Both projects are licensed by the Federal Energy Regulatory Commission (FERC).

The MRPSP License includes the Pennsylvania Department of Environmental Protection (PA DEP) 401 Water Quality Certification (WQC), which includes an American Eel Passage Plan (Eel Plan) that requires Constellation to trap, transport, and stock American Eel *Anguilla rostrata* in the Susquehanna River. The Eel Plan covers operation of the Octoraro Creek Eel Collection Facility (OCEF) and the Conowingo West Eel Collection Facility (CWECF[4]). The PA DEP 401 WQC and Eel Plan requires Constellation to begin operating the CWECF by May 1, 2017, and to continue to operate each year from May 1 through September 15.

The CWECF is located on the Susquehanna River immediately downstream of the West Fish Lift (WFL) where a previous United States Fish and Wildlife Service (USFWS) eel collection facility was located from 2005 through 2016. This site was approved by PA DEP and other members of the Eel Passage Advisory Group (EPAG)[5]. Constellation designed, installed, and began operation of the CWECF in 2017 and has operated this facility each year through 2023. American Eel collected at CWECF and those collected at and transported from OCEF are held and then transported and released at designated stocking locations in the Susquehanna River watershed as approved by PADEP, EPAG, and Maryland Department of the Environment (MDE).

This report discusses the results of the operation of the CWECF during the period May 1 to November 27, 2023[6]. Specifically, the objectives of the 2023 collection season were to[7]:

- Operate, maintain, and monitor the eel collection and holding facility daily from May 1 until mean daily water temperature was 10° C or less for three consecutive days;

[4] Note the Conowingo Hydroelectric Project (P-405) license issued on March 19, 2021 was vacated by a DC Circuit Court Decision on December 22, 2022. The operation of the Conowingo Eel Facility is therefore governed under the Muddy Run License (P-2355) issued December 22, 2015. During the August 17, 2023, EPAG call, the Resource Agencies requested that Constellation run the Conowingo Eel Facility longer than the May 1 to September 15 season specified in the Muddy Run License.

[5] EPAG members include PA DEP, USFWS, Pennsylvania Fish and Boat Commission (PFBC), Maryland Department of Natural Resources (MDNR), Susquehanna River Basin Commission (SRBC), and Constellation. MDE has been invited to participate in the EPAG since March 19, 2021.

[6] The report dated December 18, 2023, and filed with FERC on January 16, 2024, contained data from May 1 to September 15, 2023. This report has been revised to include data from September 16 to November 27, 2023. The revised report was sent to the Resource Agencies for review and comment and is shown in Appendix E. The revised report will not be filed with FERC but will be sent to the Resource Agencies.

[7] These are the objectives of the FOMP which is no longer required under the vacated Conowingo Hydroelectric Project (P-405) license issued on March 21, 2023. This revision report includes data collected from September 16 until November 27, 2023.

- Transport American Eel collected at the CWECF and OCEF to designated stocking points in the Susquehanna River watershed;
- Document any modifications made to the CWECF during the course of the season to improve functionality.

2 Background

The American Eel is a catadromous species of eel in North America. Catadromous describes a migratory life cycle in which the eels are hatched in the ocean, migrate to and mature in freshwater, and then return to the sea to spawn. This panmictic fish has a coastal range that extends as far north as Greenland and as far south as Brazil. 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 leptocephali, which are transparent and leaf-shaped and are transported to the eastern seaboard of North America via ocean currents, which takes approximately one year. 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.

USFWS trapping efforts performed on the west shore on the Susquehanna River from 2005 through 2016 below Conowingo Dam's WFL were in the same vicinity as the CWECF (Normandeau Associates and Gomez and Sullivan 2018, 2019, 2020, 2021, 2022, and 2023). Their efforts showed that the bulk of the juvenile eel migration occurs from May to September with most eels collected in June and July (Minkkinen and Park 2014 and personal communication with USFWS, Christopher Reily, October 27, 2016).

The goal of the CWECF is to achieve maximum collections of American Eel while maintaining a minimum combined annual survival rate of 95% for juvenile eels during the trapping, collection, holding, and transport processes. Constellation began to operate the CWECF in 2017, and through the 2023 season 1,551,009 American Eel have been collected, the majority of which were transported upstream to stocking locations, which has contributed to the restoration of the species throughout the watershed. Although there are three other large, FERC-regulated hydroelectric facilities located on the Susquehanna River upstream of Conowingo and MRPSP, which are collectively operated by two other private utility firms, Constellation is the sole financial contributor to this program.

3 Methods

3.1 Design, Construction, and Installation of the Facility

The 2023 CWECF was identical to the one used since 2017 (Normandeau Associates, Inc. 2018, 2019, 2020, 2021, 2022, and 2023). Complete designs descriptions can be found in Section 3 of the Normandeau Associates, Inc. 2018 and 2019 reports and in the EPRP.

3.2 Staffing

Trained and qualified individuals operated the CWECF throughout the eel passage season. A supervising biologist oversaw all operations with the assistance of biologists and biological technicians. Daily CWECF monitoring was completed by a crew of at least two trained personnel. All personnel had reviewed and understood the FOMP.

3.3 Maintenance

Pre-season Maintenance

On April 26, 2023, all CWECF components, including the eel ramp, collection, overflow, and holding tanks, as well as the associated water lines, were installed and tested. All components were in working order before the CWECF was placed into service on May 1, 2023.

Post-season Maintenance

After the season ended on November 27, 2023, the CWECF components were dismantled, cleaned, and stored. The collection, overflow, and holding tanks, as well as the water lines were stored appropriately for the winter period.

3.4 Operation

Throughout the 2023 season, the CWECF operating crew notified pertinent Constellation personnel of their arrival each day, conducted a pre-job safety briefing, informed the Constellation personnel that CWECF work will commence. Additionally, Constellation personnel reported any issues that had been documented since completion of the last CWECF check. When daily eel sampling was complete, the CWECF operating crew notified pertinent Constellation personnel of any major changes to the facility and reported that the work was completed for the day.

3.5 Data Collection

Sample data, including date, time of sample, weather, eel counts, flow readings, water temperature, and dissolved oxygen (DO) 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, lunar fraction, and weather conditions were also recorded, verified, and entered into an electronic format. Rainfall amounts are not taken or recorded at the CWECF.

The number of eels collected daily were enumerated by either actual counts or volumetric estimates. Volumetric estimates were performed using the same methods used in 2017-2022 and described in the EPRP (Normandeau Associates, Inc. 2018, 2019, 2020, 2021 2022, and 2023).

Eels being used for either biological data collection (up to 25 individuals) or for a 200 milliliter (mL) volumetric estimate sample were placed into an anesthetic solution. The anesthetic solution was created by adding two drops of clove oil into one liter (L) of ambient water in a 19 L bucket. The eels were placed in this solution until the eels reached a stage of deep sedation, and the exposure time varied due to water temperature and the time it took to process the anesthetized eels. After either the biological data were collected from the eels or the actual count of eels was tallied from the 200 mL subsample for the volumetric estimate, the eels were immediately placed into buckets of ambient river water to recover from sedation. The eels remained in the ambient water until they fully recovered and were actively swimming in the bucket.

Length and weight measurements, along with condition factors, were recorded biweekly from a maximum of 25 individuals (when available) from May 1 through September 15 to satisfy the PA DEP 401 WQC conditions for the MRPSP. Eels were measured and weighed after being anesthetized. Once per week, a portion of these eels were examined for the presence of the swim bladder parasite *Anguillicoloides crassus* and for age analysis. Age analysis methodology is described in Appendix A.

Tank flow readings and water quality data (temperature and DO) were recorded daily from the control panel readouts for the collection tank and any holding tank(s) in service. The main flow to the entire CWECF was also recorded daily. The ambient DO of the river was obtained from the Conowingo Control Room upon arrival to the station prior to starting the daily work from Station 643 (0.6 miles downstream of Conowingo Dam) until November 2, 2023, when Station 643 was taken out of service and DO was recorded from the tailrace using a YSI water quality meter at Shures Landing boat launch.

The hydroelectric generation was recorded daily as the number of turbines in operation upon arrival to the station on the daily field sheet. A turbine prioritization schedule is followed when the Conowingo East and West Fish Lifts operate in the spring (typically March 1 – June 15). The substrate below the ramp entrance is always wet and provides attraction for eels 24 hours per day when the CWECF is in operation.

3.6 Juvenile Eel Transport

A wild health screening was required by the PA DEP 401 WQC for the MRPSP prior to the transport of eels upstream into the Susquehanna River watershed, which ensures that eels are free of undesirable pathogens. Juvenile eels were collected by a backpack electrofishing unit in March 2023 from Stone Run, which is a tributary of Octoraro Creek, and sent to the USFWS Lamar Fish Health Center (Lamar, PA) for examination (Figures 3.6-1 and 3.6-2). After the results of the wild health screening were received and reviewed by the EPAG and MDE, eels were approved to be stocked in the designated locations.

All juvenile eels captured from the CWECF, along with eels collected at the OCEF, were held for no longer than one week prior to transportation. All eels were transported and released at designated locations in the Susquehanna River watershed (Table 3.6-1).

When fewer than 150 eels were collected during a sampling event, transportation occurred using aerated 19-L buckets with lids which contained a maximum amount of that would maintain escapement prevention, with ≤50 eels in each bucket. When daily collection of juvenile eels were ≥150 but less than 2,500 individuals, a small enclosed transport tank (250 L) with a supplemental oxygen supply was used to transport eels to designated locations (Normandeau Associates, Inc. 2021, 2022, and 2023). When >2,500 eels needed to be transported, a custom-made transport truck equipped with a 2,500-liter tank

and supplemental oxygen supply was used to deliver eels efficiently and safely to designated stocking locations (Normandeau Associates, Inc. 2021, 2022, and 2023).

4 Results

The CWECF commenced operation on May 1, 2023, and operated continuously until November 27, 2023, which is when the water temperature was 10° C or less for three consecutive days, as described in the EPRP, FOMP, and required by the now vacated Conowingo FERC License. This facility operated for 211 days and collected a total of 217,035 juvenile eels during the 2023 season (Table 4.0-1). Biweekly subsamples of biological data were collected from May 1 until September 15 as required by the PA DEP 401 WQC for the MRPSP Eel Plan.

4.1 Juvenile Eel Collection and Mortality

A total of 217,035 juvenile eels were captured at the CWECF during the 2023 season. Counts (either estimated or actual) were recorded daily. Volumetric estimates were taken from the CWECF on 28 of the 211 days of operation (13.3% of the season), which can be used as a metric to understand how frequently the daily abundance of eels at the CWECF was high (Table 4.1-1). The number of eels in the 200 mL subsample varied daily throughout the season, ranging from 85 to 177 eels (Table 4.1-1). This substantial range indicated that the average size of eels collected at the CWECF at any given time changed (i.e., smaller eels displace less water) periodically, which could be caused by environmental or other factors. The average volumetric estimate in the 200 mL subsample was 130.9 eels with a median of 130.5 eels.

The highest single-day collection of 17,326 juvenile eels occurred on July 7, when 8.0% of the total number of eels collected in 2023 were captured (Table 4.0-1 and Figure 4.1-1). For the 2023 season, daily collections of eels were greater than 1,000 eels on 44 days, or 20.9% of the time (Table 4.0-1).

Of the 217,035 juvenile eels that were captured at the CWECF, 50 eels died in the collection tank (0.02% mortality). All mortalities from the collection tank were recorded over the course of the season and were not attributed to an identifiable cause, such as low DO or loss of water flow to collection tank.

4.2 Juvenile Eel Biological Data

Biological data (length, weight, and condition factor) were recorded from biweekly subsamples from May 1 to September 15. A total of 919 juvenile eels (0.4% of the seasonal catch) were evaluated from these biweekly subsamples during 38 of the 138 sample days during this period (Table 4.2-1).

The average length of juvenile eels was 117.1 mm and the median was 116.0 mm (Table 4.2-1). The length of juvenile eels ranged from 79-176 mm. One hundred five (105) juvenile eels (11.4%) measured less than 100 mm and one eel measured greater than 175 mm (Table 4.2-2). The average weight of juvenile eels was 1.7 grams (g) and the median weight was 1.6 g (Table 4.2-1). The weight of juvenile eels ranged from 0.3-5.7 g (Table 4.2-2). Greater than 93% of the 919 juvenile eels weighed between 0.5-3.0 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 0.9% (8 of 919 individuals) of the examined eels. All injuries were coded as a hemorrhage, scrape, or abrasion. Five eels were observed with hemorrhages (bruise included), while two eels showed abrasions, and one eel had scrapes. Photos of these injuries are shown in Figures 4.2-1 through 4.2-3.

4.3 Eel Sacrifice and Internal Analysis

From each biweekly subsample from May 1 to September 15, a portion of juvenile eels were retained and inspected for the presence of the swim bladder parasite and examined for age determination. Nearly 11% (100 of the 919 individuals) were dissected for the parasite analysis and later examined for age (Tables 4.3-1 and 4.3-2).

Of the 100 juvenile eels that were inspected for the parasite, 40 (40%) eels were uninfected (Table 4.3-1 and Normandeau Associates, Inc. 2018, 2019, 2020, 2021, 2022 and 2023). The other 60 (60%) eels were infected by the swim bladder parasite. The infected eels contained one, two or three parasites per individual (41, 15, and 4 eels, respectively). Table 4.3-2 provides detailed information by length frequency (five mm interval groups) of the 100 examined eels with information including weight, age, and number that were infected by the parasite. The average length of a sacrificed eels was 117.3 (range 90-154) mm, average weight of 1.7 (range 0.7-4.0) g, and average number of parasites was 0.8 (range 0-3; Table 4.3-1).

Age of the juvenile eels was determined from 97 eels; three additional eel otoliths could not be read for aging. The 97 juvenile eels analyzed for age were determined to be ages 1-4 (average age = 2.07, Table 4.3-1). Detailed information of the 100 to be aged eels is shown on Table 4.3-1 and Appendix A. Of the 100 to be aged eels, 24 eels (24.0%) were age 1, 42 eels (42.0%) were age 2, 29 eels (29.0%) were age 3, 1 eel (1.0%) were age 4, and 3 eels (3.0%) were not able to be read. Age agreement between Normandeau biologists (a quality control measure) occurred 93.8% (91 of the 97 eels) of the time (Appendix A). The average length of the to be aged eels was 117.6 mm (range: 90-154 mm), the average weight was 1.8 g (range: 0.7-4.0 g), and the average number of parasites was 0.8 (range: 0-3). Length frequency of aged eels with weights, parasites, and age data are found on Table 4.3-2.

4.4 Seasonal Variability of Eel Collection

The greatest weekly collection of juvenile eels occurred during Week 11 (July 9-15) when the CWECF collected 32.1% (69,566 individuals) of the season total (Table 4.4-1 and Figure 4.4-1).). The second highest percentage of juvenile eels was collected during Week 10 (July 2-8) when the CWECF collected 17.4% (37,844 individuals) of the season total. Week 3 (May 14-20) was the only other week during the 2023 season when > 10% of the season total (11.4%) were collected. Weeks 10 and 11 combined accounted for a large portion of the juvenile eels caught in 2023 (49.7%, 107,903 individuals; Table 4.4-1 and Figure 4.4-1).

Eel collections during Weeks 1, 7, 8, 14-16, 21, 22, and 25-31 of sampling collected no greater than 1.0% of the season total, accounting for 2.9% (6,270 individuals) combined (Table 4.4-1 and Figure 4.4-1). Only fourteen individuals were collected during the last twenty days of the season, while only 76 individuals were captured during November, the last month of the season (November 1 – November 27).

During the season, there was a large peak period, a medium peak period, and two smaller peak periods. A peak period was defined as a period of two or more consecutive days each with a collection of 4,500 or more individuals. The largest peak (July 6-10, 5 days) yielded 29.3% (63,617 of the 217,035) juvenile eels; Table 4.0-1). The medium peak period occurred directly after the largest peak period from July 11-15 (5 days, 19.4% or 42,015 individuals). Two other smaller peaks period occurred May 14-16 (3 days, 7.9% or 17,253 individuals), and July 19-20 (2 days, 4.4% or 9,650 individuals) of the 217,035 eels

collected at the facility. When the four peaks are combined, nearly 61.1% (132,535 individuals) of the juvenile eels collected at this facility occurred during these 15 days or 7.1% of the sampling days.

4.5 Juvenile Eel Catch in Relation to Environmental Factors

Appendix B includes weekly averages of juvenile eel capture, river flow, lunar fraction, water temperature, and tailrace DO, which are further described in the subsections below.

River Flow

River flow and juvenile eel collection did not appear to be correlated during the 2023 season. Generally, there was very little variance in the river flow except for the first few days of the season and a bump in mid-August during the 2023 season, but no trend between eel collection and river flow was not expected. Daily average river flow was taken from the United States Geological Survey (USGS) Gage 01576000 – Susquehanna River at Marietta, PA (Table 4.5-1). The highest daily average river flow (166,000 cubic feet per second [cfs]) occurred on May 3, 2023 (Tables 4.0-1 and 4.5-1). The daily average river flow was above the generation capacity of Conowingo (86,000 cfs) during the first five days of the 2023 season. The lowest daily average river flow (6,820 cfs) occurred on June 10, 2023, during which time collections of eels at the CWECF were minimal. The average river flow did not exceed 30,000 cfs during 81.5% of the 2023 season (172 of the 211 days), but flows were less than 10,000 cfs during only 47.9% of the season (101 of the 211 operational days; (Figure 4.5-1). The variation of eel collection abundance during the season could not be explained by river flow.

Lunar Fraction

Lunar phase was assessed by examining the fraction of the visible lunar disk illuminated by the sun each night (lunar fraction) during the 2023 operational period. Full moon is equal to a lunar fraction of 1.0, and new moon is equal to a lunar fraction of 0.0. Because anguillid eels are photophobic, it is possible that their migratory behavior can change throughout any given month based on the lunar phase. However, juvenile eel catch did not appear to be strongly correlated with lunar fraction during the 2023 season. The largest peak (July 6-10) of 63,618 eels occurred heading into a new moon period during Week 11 (Table 4.0-1 and Appendix B). The other peaks of the season occurred just before or during a full or new moon phase in May and July (Table 4.5-2 and Figure 4.5-2, Date and Time Website 2023). 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), but peak periods of eel collection at the CWECF occurred over a wide range of lunar fraction.

Water Temperature

Water temperature and eel catch did not appear to be correlated this season. Water temperatures reached 20.0° Celsius (C) consistently on May 22, 2023. By this time, the CWECF collected 28,436 eels (13.1% of the season total; Tables 4.0-1 and 4.5-3). Nearly 65.7% (142,494 of the 217,035 eels) were captured when recorded water temperature was over 25.0° C (Tables 4.0-1 and 4.5-3). Over the course of the season, the water temperature ranged from a high of 28.9° C in mid-July to a low of 7.8° C in November (Table 4.5-3 and Figure 4.5-3).

Dissolved Oxygen

Tailrace DO and eel collection numbers did not appear to be correlated this season. The DO was obtained from the Conowingo Dam Control Room upon arrival to the station prior to starting the daily

work, which is taken from Station 643. The attraction flow from the CWECF has additional aeration and diffused compressed oxygen supplied to each of the enabled tanks for most of the season, therefore no relationship between eel collection and DO values could be derived. Daily DO values ranged between 6.57 and 12.6 milligrams per Liter (mg/L) and are presented in Table 4.5-4 and displayed in Figure 4.5-4.

4.6 Juvenile Eel Holding and Mortality

Of the 217,035 juvenile eels that were captured at the CWECF, 60,268 eels were held in holding tank(s) prior to being transported upriver, which equates to nearly 27.8% of the eels captured over the season (Table 4.6-1). Eels were placed into holding tanks on 83 days from May 1 until June 29, 2023, and September 22 until November 11, 2023. During all other days of operation, eels were not held because they were transported the same day as being removed from the collection tank (Table 4.6-1). Either one or two of the three holding tanks at the CWECF were used during the 2023 eel season.

Eels were typically held in one holding tank during the 2023 season unless the number of eels held was greater than 12,500 eels. When eel holding numbers were greater than 12,500, eels were placed into Holding Tanks 1 and 2. The capacity of a holding tank is approximately 17,000 eels, but only 12,500 eels can be placed into each side of the large transport tank. When eels are placed into a holding tank, that tank is considered to be in service and the water quality and flow meter alarms are enabled. Holding Tank 3 was used to supplement and maintain the total attraction flow of the CWECF at approximately 70 gallons per minute (gpm). Although water was continuously running through Holding Tank 3, it was not considered to be in-service since no eels were ever held in that tank, so the alarms were disabled for the duration of the season. All water used at the CWECF is passed through a tank and is drained into the overflow tank, all of which is used as the total attraction flow at the entrance of the ramp. The spray bar and scent line are discharged onto the ramp and used to attract eels up the ramp substrate.

All holding tanks are identical size and shape with the exact screen overflow box drain, two-inch fill line, oxygen micro pore diffuser, fine pore diffuser for aeration, and supply water. One oxygen supply manifold supplied from one oxygen bottle is split between the collection tank and Holding Tank 1, while another oxygen supply manifold and a separate oxygen bottle is split between Holding Tanks 2 and 3. Slight differences (flow and DO) were noted between the holding tanks, when two tanks were in-service due to separate individual water feed pipes to each tank and separate oxygen supply systems.

Juvenile eels that were captured in the CWECF, plus any eels collected at the OCEF, that were not immediately transported were held for no longer than one week prior to transportation. A total of 112 juvenile eels (0.19% of the held eel total) died in holding (Table 4.6-2). On May 30, a total of 57 juvenile eels were discovered to have died during holding while transferring them to the transport vehicle. Some of these eels showed signs of fungus. During this occasion, none of the 632 eels in the collection tank that day were found dead, and there were 6,964 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 for a period of time. Daily transports were initiated on June 29 when water temperature was above 25.0 °C to decrease the potential for mortalities due to suboptimal holding tank water temperatures.

4.7 Juvenile Eel Transport and Mortality

Table 4.7-1 includes detailed information of transport and mortality data.

On March 6, 2023, 60 juvenile eels less than 200 mm in length were collected via backpack electrofishing from Stone Run, which is a tributary of the Octoraro Creek near Richardsmere in Cecil County, MD. All 60 of the juvenile eels were used to provide an adequate sample for health screening, which showed that no bacterial or viral pathogens of concern were detected. The results of The Fish Health Inspection Report provided authorization to transport and stock eels upstream of Conowingo Dam and is presented in Appendix C.

A total of 300 eels were supplied to the SRBC on September 6, 2023 from the CWECF for the "Eels in the Classroom" program. The chain of custody sheet for this event can be found in Appendix D, which relinquishes Constellation's responsibility for these eels.

All transported eels were released at designated locations in the Susquehanna River watershed (Table 3.6-1 and Figure 4.7-1). A total of 278,568 juvenile eels were transported upstream, including eels collected at OCEF (Tables 4.6-2 and 4.7-1). Daily transports occurred from June 29 to September 22, 2023. Biweekly transports occurred prior to and after daily transports from May 31 to June 27 and September 22 until November 2, and weekly transports occurred prior to May 9 and between November 2 and November 16. After November 16, daily transports to Conowingo Creek boat launch due to the extremely low number of eels being collected at CWECF. The last transport occurred on November 24, 2023, when the last four eels was collected at the CWECF. No eels were collected during the last three days of operation at the CWECF from November 25 through 27.

Eels were transported to Lock Haven boat ramp, West Fairview Access, Fort Hunter Access, City Island boat ramp, and Conowingo Creek (Table 3.6-1). . Total elapsed time of transport from the holding facility at Conowingo Dam to each stocking location varied between trips. Eel transports from the CWECF to Lock Haven boat launch (Site 11), were completed in approximately five hours (± 30 minutes). Eel transports from the CWECF to Fort Hunter Access (Site 6), were completed in approximately two hours and fifteen minutes (± 30 minutes). Eel transports from the CWECF to City Island boat launch (Site 12) and West Fairview Access (Site 5), were completed in approximately two hours (± 30 minutes). Eel transports from the CWECF to Conowingo Creek boat launch (Site 1), were completed in approximately thirty minutes (± 10 minutes).

Of the 62,153 eels that were transported to Lock Haven boat ramp (Site 11), 62,134 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-2). This location was stocked 11 times from May 9 to October 12. Detailed data from each of the transports are found on Table 4.7-1.

Of the 71,564 eels that were transported to Fort Hunter Access (Site 6), 71,564 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-3). This location was stocked 24 times from June 13 to September 18. Detailed data from each of the transports are found on Table 4.7-1.

Of the 72,192 eels that were transported to City Island boat ramp (Site 12), 72,189 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-4). This location was stocked 25 times from May 4 to October 2. Detailed data from each of the transports are found on Table 4.7-1.

Of the 71,797 eels that were transported to West Fairview Access (Site 5), 72,796 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-5). This location was stocked 28 times from June 2 to October 16. Detailed data from each of the transports are found on Table 4.7-1.

Of the 862 eels that were transported to Conowingo Creek boat ramp (Site 1), 862 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-6). This location was stocked 28 times from August 6 to November 24. Detailed data from each of the transports are found on Table 4.7-1.

Mortality

Mortality during the 116 transport trips from the CWECF at Conowingo Dam totaled 23 eels (<0.01% Table 4.6-2). Nineteen eels died (0.03%) during transports from the CWECF to Lock Haven boat ramp (Site 11). Three eels (<0.01%) died during transports to City Island boat ramp (Site 12). One eel (<0.01%) died during transports to West Fairview Access (Site 5). No eels died during transports from the CWECF to Fort Hunter Access (Site 6) and Conowingo Creek boat launch (Site 1).

5 Quality Assurance/Quality Control Activities

The CWECF required oversight to ensure its reliability and effectiveness. The area below the ramp entrance was covered with a shade cloth to approximately the normal high-water tailrace elevation to protect the juvenile eels ascending the attraction flow over or through the rip-rap shoreline. The area below the normal high-water line (full generation tailrace level) was not covered with a shade cloth, as covering this area may impede eels that were free swimming in the tailrace from finding the attraction flow of the CWECF, and possibly trap other organisms such as fish. 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 riprap 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 riprap to the ramp entrance was inspected periodically to ensure a smooth transition for eels climbing the substrate. The transition of the riprap to the ramp was photographed at the beginning and the end of the season, the 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 of the CWECF provided an instantaneous readout of DO and water temperature and is connected to the flow meters for all 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 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 necessary during times of low DO levels in the water supply line from the forebay. Periodically throughout the season, low DO alarms did occur. Slight adjustments were made to the oxygen management system to increase oxygen concentration to resolve this issue, or an empty oxygen bottle was exchanged. No mechanical or physical repairs to the CWECF were needed during the 2023 passage season.

The total attraction flow of the CWECF 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 gpm. Periodically throughout the season, low flow alarms did occur. Slight adjustments made to the individual tank supply pipes to adjust the output to obtain a constant water flow into the tanks resolved this issue. Since the alarms were addressed within a few minutes, no mortality events were related with these alarms. 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. Testing and adjustments to the CWECF 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 most 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 fine pore diffuser from the blower and a micro pore diffuser from the oxygen bottle. These diffusers laid flat on the tank bottom to ensure 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 CWECF are 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. DO 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 CWECF 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.

Calibration of the water temperature and DO probes were performed prior to the start of the season. Additional calibration of these probes occurred when the weekly calibration check was performed and a large difference was noted between a recently calibrated handheld YSI DO meter and the probes.

Actual eel counts were compared to volumetric eel estimates to determine accuracy of the volumetric estimates. A quality control comparison on estimates occurred two times during the 2023 season: July 16 and August 30. The detailed estimates for the number of juvenile eels per 200 mL, displacement, total estimated, and actual counts are in Table 5.0-3. With only a small difference observed between estimates and actual counts (0.8%), no further changes to this method were warranted.

6 Conclusions and Discussion

The CWECF captured 217,035 eels compared to the OCEF that captured 62,113 juvenile eels during the 2023 season. The CWECF operated for 211 days (May 1 through November 27) compared to the OCEF which only operated 138 days (May 1 through September 15) with a difference of 73 days. The CWECF captured over three times (62,113 versus 204,108 eels) the number of eels collected by the OCEF during the same sampling period. The CWECF contains one substrate (Enkamat) over the 18-inch-wide ramp compared to the OCEF, which contained Enkamat substrate in one 12-inch-wide ramp and Milieu substrate in another 12-inch-wide ramp during the 2023 season. Another difference between the two facilities is the entrance of each ramp in relationship to the tailwater. In 2023 the ramp entrance to the CWECF and OCEF is above the tailwater, but the CWECF ramp entrance is much higher from the tailwater compared to the OCEF entrance. At both the CWEFC and the OCEF, the eel ramp entrance is downstream of a dam, but the geographic location of the two facilities is vastly different. The CWECF is located in the main stem Susquehanna River (an eighth order stream), and the OCEF is located in the Octoraro Creek (a fourth order stream) roughly 22 miles upstream of the confluence with the Susquehanna River and enters the Susquehanna River nearly a mile below the Conowingo Dam.

The size range of the eels collected at the CWECF in 2023 was consistent with the previous years that Constellation has operated the facility. During the 2023 season, the size range of the juvenile eels caught at the CWECF was 79-176 mm with an average length of 117.1 mm, compared to the size range of 65-176 mm (114.3 mm), 66-184 (average 115.7), 71-186 mm (average: 112.2 mm), 64-165 mm (average: 114.4 mm), 84-173 mm (average: 121.6) mm, and 78-192 mm (average: 122.3 mm) observed in 2022, 2021, 2020, 2019, 2018 and 2017, respectively (Table 6.0-1 and Normandeau Associates, Inc. 2018, 2019, 2020, 2021, 2022, and 2023).

Environmental factors, including lunar fraction and river flow, did not appear to have a measurable effect on the number of eels collected in 2023. The highest daily average river flow value per the USGS gage station occurred on May 3, 2023 (166,000 cfs) and the lowest daily average river flow occurred on June 10, 2023 (6,820 cfs). The discharge at Conowingo Dam can change hourly, sometimes quicker, depending on energy demand, and may not be a reliable metric to use to compare eel collection numbers in a given season. Since 2020, the DO readings were obtained from the Conowingo Control Room when the crew arrived at the site for work until November 2 and did not show an obvious correlation with eel collection. The lower lunar fraction is one environmental factor typically related to the number of eels collected, but this relationship was not apparent in 2023. Most of the peak collection period occurred just after the full moon in June. Other smaller peak periods in eel collection occurred near moon phases in May and July. 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, 2020, 2021, 2022, and 2023 are in Appendix B.

Mortality from collection, holding, and transport was below the 5% maximum value mandated for the CWECF. Mortality at the CWECF was low this year because of the implementation of the recommendations 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; and

Ensure proper water flow and DO levels are maintained.

A slight modification was made in 2020 after a large mortality event:

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

During the period September 16 through November 27, 2023, no biological data including length, weight, condition factors was recorded. Additionally, no sacrifices were taken to determine swim bladder parasites or age. The facility operated with no changes in operation or equipment between September 16 and November 27, 2023. The Resource Agencies (USFWS, SRBC, PADEP, and MDNR/MDE) all responded with no comments to this document between December 18, 2023 and January 29, 2024 (Appendix E).

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8 Tables and Figures

Table 3.6-1: Stocking Locations for Juvenile Eel in the Susquehanna River Watershed

Site Number	Location	Water Body	County
1	Conowingo Pond (Conowingo Creek)	Susquehanna River	Cecil/Lancaster
2	Between Holtwood and Safe Harbor	Susquehanna River	Lancaster/York
3	Between Safe Harbor and York Haven	Susquehanna River	Lancaster
4	Upstream of York Haven Dam	Susquehanna River	Dauphin
5	West Fairview Access (Route 11/15)	Susquehanna River	Cumberland
6	Fort Hunter Access	Susquehanna River	Dauphin
7	Shikellamy State Park	Susquehanna River	Northumberland
8	Route 48 Bloomsburg	North Branch Susquehanna River	Columbia
9	Route 29 Bridge (Wilkes Barre) Nesbitt Park (Kingston)	North Branch Susquehanna River	Luzerne
10	Upstream of Hepburn Street Dam (Williamsport)	West Branch Susquehanna River	Lycoming
11	Upstream of Grant Street Dam	West Branch Susquehanna River	Clinton
12	City Island (Harrisburg)	Susquehanna River	Dauphin

Table 4.0-1: Number of Juvenile Eels Caught Daily, Conowingo West Eel Collection Facility, 2023

Date	Number of Eels	Date	Number of Eels	Date	Number of Eels	Date	Number of Eels	Date	Number of Eels
5/1/2023	0	6/13/2023	143	7/26/2023	906	9/7/2023	105	10/20/2023	2
5/2/2023	0	6/14/2023	150	7/27/2023	566	9/8/2023	281	10/21/2023	10
5/3/2023	11	6/15/2023	125	7/28/2023	653	9/9/2023	1203	10/22/2023	3
5/4/2023	11	6/16/2023	97	7/29/2023	630	9/10/2023	402	10/23/2023	3
5/5/2023	6	6/17/2023	43	7/30/2023	91	9/11/2023	385	10/24/2023	2
5/6/2023	5	6/18/2023	65	7/31/2023	233	9/12/2023	262	10/25/2023	0
5/7/2023	54	6/19/2023	251	8/1/2023	229	9/13/2023	306	10/26/2023	3
5/8/2023	111	6/20/2023	124	8/2/2023	123	9/14/2023	73	10/27/2023	4
5/9/2023	49	6/21/2023	73	8/3/2023	123	9/15/2023	2183	10/28/2023	10
5/10/2023	205	6/22/2023	152	8/4/2023	189	9/16/2023	*2047*	10/29/2023	24
5/11/2023	519	6/23/2023	207	8/5/2023	122	9/17/2023	1109	10/30/2023	20
5/12/2023	1371	6/24/2023	56	8/6/2023	72	9/18/2023	477	10/31/2023	7
5/13/2023	132	6/25/2023	200	8/7/2023	37	9/19/2023	303	11/1/2023	16
5/14/2023	*5870*	6/26/2023	159	8/8/2023	89	9/20/2023	118	11/2/2023	2
5/15/2023	*5682*	6/27/2023	162	8/9/2023	19	9/21/2023	61	11/3/2023	3
5/16/2023	*5701*	6/28/2023	20	8/10/2023	17	9/22/2023	16	11/4/2023	4
5/17/2023	*2181*	6/29/2023	1125	8/11/2023	21	9/23/2023	8	11/5/2023	4
5/18/2023	*1966*	6/30/2023	*1915*	8/12/2023	140	9/24/2023	2	11/6/2023	22
5/19/2023	*2009*	7/1/2023	918	8/13/2023	79	9/25/2023	10	11/7/2023	11
5/20/2023	1338	7/2/2023	454	8/14/2023	16	9/26/2023	29	11/8/2023	2
5/21/2023	1215	7/3/2023	430	8/15/2023	10	9/27/2023	24	11/9/2023	2
5/22/2023	1039	7/4/2023	229	8/16/2023	31	9/28/2023	93	11/10/2023	0
5/23/2023	1458	7/5/2023	664	8/17/2023	0	9/29/2023	197	11/11/2023	1
5/24/2023	807	7/6/2023	*5461*	8/18/2023	2	9/30/2023	51	11/12/2023	0
5/25/2023	492	7/7/2023	***17326***	8/19/2023	4	10/1/2023	132	11/13/2023	0
5/26/2023	694	7/8/2023	***13280***	8/20/2023	299	10/2/2023	397	11/14/2023	0
5/27/2023	605	7/9/2023	***13635***	8/21/2023	169	10/3/2023	614	11/15/2023	0
5/28/2023	707	7/10/2023	***13916***	8/22/2023	53	10/4/2023	425	11/16/2023	1
5/29/2023	628	7/11/2023	*7054*	8/23/2023	665	10/5/2023	888	11/17/2023	2
5/30/2023	632	7/12/2023	*7854*	8/24/2023	1180	10/6/2023	*1155*	11/18/2023	1
5/31/2023	313	7/13/2023	*8970*	8/25/2023	781	10/7/2023	458	11/19/2023	0
6/1/2023	275	7/14/2023	***11858***	8/26/2023	900	10/8/2023	519	11/20/2023	0
6/2/2023	294	7/15/2023	*6279*	8/27/2023	2571	10/9/2023	1346	11/21/2023	0
6/3/2023	270	7/16/2023	**2036*	8/28/2023	1827	10/10/2023	1111	11/22/2023	0
6/4/2023	506	7/17/2023	*3525*	8/29/2023	*1741*	10/11/2023	146	11/23/2023	1
6/5/2023	698	7/18/2023	*2581*	8/30/2023	**2129*	10/12/2023	742	11/24/2023	4
6/6/2023	773	7/19/2023	*4517*	8/31/2023	1451	10/13/2023	253	11/25/2023	0
6/7/2023	382	7/20/2023	*5133*	9/1/2023	*1083*	10/14/2023	1	11/26/2023	0
6/8/2023	519	7/21/2023	*1774*	9/2/2023	822	10/15/2023	21	11/27/2023	0
6/9/2023	396	7/22/2023	952	9/3/2023	254	10/16/2023	13		
6/10/2023	219	7/23/2023	961	9/4/2023	273	10/17/2023	70		
6/11/2023	170	7/24/2023	1101	9/5/2023	321	10/18/2023	10		
6/12/2023	151	7/25/2023	988	9/6/2023	470	10/19/2023	7	TOTAL	217,035

The peak periods are shown in boxes
Bolded numbers are peak days

Volumetric Counts in *italics*
* Quality control checks

Table 4.1-1: Counted Eel Numbers in the 200 Milliliter Subsamples during Days of Volumetric Estimates, Conowingo West Eel Collection Facility, 2023

Date	Number of Eels in 200 mL
5/14/2023	129
5/15/2023	119
5/16/2023	142
5/17/2023	89
5/18/2023	97
5/19/2023	103
6/30/2023	131
7/6/2023	85
7/7/2023	154
7/8/2023	160
7/9/2023	177
7/10/2023	147
7/11/2023	164
7/12/2023	154
7/13/2023	130
7/14/2023	155
7/15/2023	138
7/16/2023	140
7/17/2023	133
7/18/2023	129
7/19/2023	153
7/20/2023	138
7/21/2023	130
8/29/2023	118
8/30/2023	129
9/1/2023	93
9/16/2023	117
10/6/2023	110
Average	130.9
Median	130.5
Range	92-182

Table 4.2-1: Number of Juvenile Eels Captured with Length and Weight Measurements, Conowingo West Eel Collection Facility, 2023

	Total
Number eels collected	217,035
Number measured	919
Data Collection Days	38
Range of lengths (mm)	79-176
Average length (mm)	117.1
Median length (mm)	116.0
Range of weights (g)	0.3-5.7
Average weight (g)	1.7
Median weight (g)	1.6

Table 4.2-2: Juvenile Eel Length Frequency, Conowingo West Eel Collection Facility, 2023

Total Length (mm)	Number
75-79	1
80-84	3
85-89	8
90-94	25
95-99	68
100-104	80
105-109	121
110-114	123
115-119	123
120-124	100
125-129	91
130-134	63
135-139	42
140-144	23
145-149	20
150-154	14
155-159	5
160-164	4
170-174	4
175-179	1
Total	**919**

Table 4.2-3: Juvenile Eel Weight Frequency, Conowingo West Eel Collection Facility, 2023

Weight (g)	Number
0.0-0.4	4
0.5-0.9	86
1.0-1.4	304
1.5-1.9	239
2.0-2.4	166
2.5-2.9	61
3.0-3.4	31
3.5-3.9	15
4.0-4.4	8
4.5-4.9	3
5.0-5.4	1
5.5-5.9	1
Total	**919**

Table 4.2-4: Observed Injuries of Juvenile American Eel, Conowingo West Eel Collection Facility, 2023

Date	Length	Weight	Condition Factor
5/11/2023	116	1.9	Small bruise right side
	126	2.0	Hemorrhage pectoral fins insertion
5/25/2023	118	1.1	Scrape on right side
6/1/2023	133	2.9	Hemorrhage on caudal fin
8/3/2023	106	1.0	Minor dorsal hemorrhage
	107	0.9	Minor caudal fin hemorrhage
8/14/2023	119	2.1	Abrasion on right side
9/4/2023	128	1.9	Abrasion to operculum

Table 4.3-1: Sacrificed Eel Data, Conowingo West Eel Collection Facility, 2023

Date	Length (mm)	Weight (g)	Parasite	Age
5/7/2023	108	1.5	2	2
	137	2.8	0	3
	146	2.6	0	3
	115	1.7	2	2
	114	1.4	1	2
5/15/2023	111	1.8	0	1
	132	2.3	3	2
	97	1.0	1	2
	147	3.0	0	3
	129	2.6	1	3
5/22/2023	137	2.8	1	3
	117	1.4	0	2
	152	3.5	1	3
	108	0.9	2	2
	99	1.2	1	2
5/29/2023	92	0.7	1	1
	154	4.0	1	3
	101	1.2	1	2
	123	1.8	1	2
	116	1.6	0	2
6/5/2023	103	1.2	1	1
	117	1.5	0	2
	140	4.0	2	4
	99	1.2	0	1
	130	2.2	0	3
6/12/2023	90	0.8	0	1
	110	1.1	2	2
	137	3.0	1	3
	106	1.4	2	1
	127	1.9	0	2
6/19/2023	132	2.4	2	3
	94	0.8	0	1
	124	2.4	1	3
	91	0.7	1	1
	131	2.6	0	3
8/7/2023	135	2.0	2	3
	106	1.0	0	2
	103	1.3	3	1
	123	1.3	1	3
	128	2.2	1	2
8/14/2023	99	1.5	0	1
	126	2.3	3	2
	98	1.1	0	NR
	111	1.7	1	1
	101	0.8	0	1
8/21/2023	97	0.8	2	2
	128	2.2	1	2
	105	1.1	0	2
	140	3.1	0	3
	115	1.6	1	2
8/28/2023	98	1.1	0	2
	97	1.0	2	1
	133	2.4	0	3
	136	2.1	2	3
	112	1.8	1	2
9/4/2023	117	1.6	1	2
	110	1.4	1	2
	147	2.6	1	3
	125	2.3	1	2
	132	2.4	2	2
9/14/2023	119	1.4	0	3
	107	0.9	0	NR
	126	2.1	0	3
	112	1.3	0	3
	121	1.5	0	2

(continued)

Table 4.3-1. (Continued)

Date	Length (mm)	Weight (g)	Parasite	Age
6/26/2023	134	2.8	0	3
	120	2.4	2	2
	99	0.8	1	1
	150	3.4	1	3
	104	1.4	0	1
7/3/2023	135	3.2	1	3
	112	1.4	0	NR
	134	3.0	0	3
	98	0.9	0	1
	101	1.2	1	1
7/10/2023	120	1.8	0	2
	107	1.3	2	1
	102	1.2	0	1
	115	1.7	1	2
	94	1.1	1	1
7/17/2023	118	1.9	1	1
	122	1.8	1	2
	100	0.9	1	2
	122	1.2	3	2
	99	0.9	1	1
7/24/2023	132	2.0	0	3
	136	2.5	0	3
	106	1.6	1	2
	107	1.3	1	2
	126	1.6	2	3
7/31/2023	108	1.2	0	2
	112	1.0	1	2
	103	1.1	1	1
	98	0.8	0	1
	115	1.1	1	2

Date	Length (mm)	Weight (g)	Parasite	Age
Average	117.3	1.7	0.83	2.07
Range	90 - 154	0.7 – 4.0	0 - 3	1-4

Total Sacrificed	100
0 Parasites	40 (40%)
1 Parasite	41 (41%)
2 Parasites	15 (15%)
3 Parasites	4 (4%)
Eels without parasites	40 (40%)
Eels with parasites	60 (60%)
Total Aged	97
Year 1	24 (24.0%)
Year 2	43 (43.0%)
Year 3	29 (29.0%)
Year 4	1 (1.0%)
Not Able to be Read (NR)	3 (3.0%)

Table 4.3-2: Sacrificed Eels Length Frequency with Detailed Info, Conowingo West Eel Collection Facility, 2023

TL (mm)	Weight (g)	Number	Contained Parasite	Age
90-94	0.7-1.1	5	0,0,1,1,1	1,1,1,1,1
95-99	0.8-1.5	12	0,0,0,0,0,0,1,1,1,1,2,2	NR,1,1,1,1,1,1,1,1,2,2,2,2
100-104	0.8-1.4	9	0,0,0,1,1,1,1,1,3	1,1,1,1,1,1,1,1,2,2
105-109	0.9-1.6	10	0,0,0,0,1,1,2,2,2,2	1,1,2,2,2,2,2,2,2,2
110-114	0.9-1.8	10	0,0,0,0,1,1,1,1,1,2	NR,1,1,2,2,2,2,2,2,2
115-119	1.1-1.9	11	0,0,0,0,1,1,1,1,1,1,2	NR,1,2,2,2,2,2,2,2,2,2
120-124	1.2-2.4	9	0,0,1,1,1,1,1,2,3	2,2,2,2,2,2,2,3,3,3
125-129	1.6-2.6	8	0,0,1,1,1,1,2,3	2,2,2,2,2,2,3,3,3
130-134	2.0-3.0	10	0,0,0,0,0,0,0,2,2,3	2,2,3,3,3,3,3,3,3,3
135-139	2.1-3.2	7	0,0,1,1,1,2,2	3,3,3,3,3,3,3
140-144	2.5-4.0	3	0,0,2	3,3,4
145-149	2.6-3.0	3	0,0,1	3,3,3
150-154	3.4-4.0	3	1,1,1	3,3,3
Total		**100**	**100**	**100**

NR – age could not be determined

Table 4.4-1: Juvenile Eel Collection by Week with Associated Ranks, Conowingo West Eel Collection Facility, 2023

	Week*									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Total	33	2441	24747	6310	3119	3493	879	928	4499	37844
Rank	27	16	3	6	14	13	20	19	9	2
Percent Catch	0.02	1.12	11.40	2.91	1.44	1.61	0.41	0.43	2.07	17.44

	Week*									
	11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Total	69566	20518	5805	1110	395	142	4047	11624	2907	5658
Rank	1	4	7	18	22	23	12	5	15	8
Percent Catch	32.05	9.45	2.67	0.51	0.18	0.07	1.86	5.36	1.34	2.61

	Week*										
	21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
Total	2092	406	4069	4118	133	25	76	42	4	5	0
Rank	17	21	11	10	24	28	25	26	30	29	31
Percent Catch	0.96	0.19	1.87	1.90	0.06	0.01	0.04	0.02	0.00	0.00	0.00

Top 3 ranked weeks are shown in boxes

*Week No.	Dates	*Week No.	Dates	*Week No.	Dates
1	May 1–May 6	11	Jul 9–Jul 15	21	Sep 17-Sep 23
2	May 7–May 13	12	Jul 16–Jul 22	22	Sep 24-Sep 30
3	May 14–May 20	13	Jul 23–Jul 29	23	Oct 1-Oct 7
4	May 21–May 27	14	Jul 30–Aug 5	24	Oct 8-Oct 14
5	May 28–Jun 3	15	Aug 6–Aug 12	25	Oct 15-Oct 21
6	Jun 4–Jun 10	16	Aug 13–Aug 19	26	Oct 22-Oct 28
7	Jun 11–Jun 17	17	Aug 20–Aug 26	27	Oct 29-Nov 4
8	Jun 18–Jun 24	18	Aug 27–Sep 2	28	Nov 5-Nov 11
9	Jun 25–Jul 1	19	Sep 3–Sep 9	29	Nov 12-Nov 18
10	Jul 2–Jul 8	20	Sep 10–Sep 16	30	Nov 19-Nov 25
				31	Nov 26-Nov 27

Table 4.5-1: Daily Average River flows (cfs), USGS 01576000 – Marietta, PA Gage Station, 2023

Day	May	June	July	August	September	October	November
1	98,300	10,300	17,300	19,100	39,600	21,500	21,300
2	165,000	9,830	16,400	17,700	30,900	19,000	27,900
3	**166,000**	9,440	15,900	17,400	25,200	17,100	30,000
4	138,000	9,270	22,800	16,000	21,900	15,400	28,400
5	106,000	9,100	23,700	14,600	19,100	14,000	25,800
6	85,900	8,830	22,300	12,300	17,000	13,700	23,500
7	74,600	8,280	25,700	10,900	15,100	13,400	21,400
8	65,100	7,700	25,400	13,900	14,700	14,300	19,700
9	57,400	7,420	23,100	22,900	13,500	22,300	18,600
10	52,000	6,820	32,200	24,900	15,800	25,500	17,300
11	47,200	6,920	30,700	27,600	22,400	25,500	16,500
12	41,400	7,610	27,700	25,800	36,400	22,200	15,800
13	36,300	8,570	22,700	23,500	31,700	19,000	14,800
14	32,500	9,680	21,900	21,700	36,100	17,700	14,500
15	29,500	12,300	19,500	21,900	37,500	18,200	13,700
16	26,900	14,100	18,100	37,800	31,500	21,800	13,000
17	24,700	13,300	20,000	47,700	27,900	24,300	13,000
18	22,700	12,600	24,000	43,600	25,900	23,800	12,600
19	20,900	11,900	23,800	65,800	23,300	22,900	12,500
20	19,700	12,200	22,400	76,900	22,100	20,800	12,400
21	18,700	12,100	21,300	60,200	19,800	19,500	13,400
22	17,400	11,200	23,200	45,700	17,600	18,100	20,600
23	16,400	11,000	25,500	35,100	16,700	18,200	30,200
24	15,600	10,300	23,400	27,900	17,500	19,000	40,700
25	15,000	10,600	20,500	23,800	20,600	18,900	40,900
26	14,200	12,100	21,500	21,300	25,300	18,100	37,500
27	13,500	10,800	21,300	25,100	36,200	16,800	33,000
28	12,800	14,400	19,200	29,800	30,500	16,000	
29	12,100	17,700	20,200	25,400	26,500	15,400	
30	11,300	18,200	21,300	21,900	23,700	14,700	
31	10,800		20,100	24,200		14,400	

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, 2023 EST (*1.0 equals full moon*)

Day	May	June	July	August	September	October	November
1	0.864	0.949	0.974	0.993	0.978	0.952	0.859
2	0.926	0.968	0.986	0.995	0.927	0.890	0.777
3	0.972	0.987	0.997	0.964	0.853	0.809	0.686
4	0.985	0.999	0.989	0.903	0.761	0.715	0.589
5	0.997	0.982	0.950	0.819	0.658	0.615	0.491
6	0.997	0.936	0.882	0.719	0.552	0.513	0.394
7	0.971	0.862	0.791	0.610	0.447	0.413	0.301
8	0.919	0.768	0.685	0.500	0.346	0.318	0.216
9	0.842	0.658	0.572	0.392	0.254	0.231	0.141
10	0.745	0.542	0.458	0.293	0.174	0.154	0.078
11	0.634	0.425	0.349	0.204	0.106	0.091	0.032
12	0.16	0.314	0.250	0.129	0.054	0.042	0.006
13	0.398	0.215	0.164	0.070	0.019	0.011	0.002
14	0.286	0.132	0.095	0.029	0.002	0.000	0.022
15	0.187	0.068	0.044	0.006	0.004	0.010	0.067
16	0.106	0.025	0.013	0.002	0.026	0.041	0.135
17	0.046	0.004	0.002	0.018	0.068	0.094	0.224
18	0.011	0.004	0.011	0.051	0.129	0.168	0.329
19	0.000	0.026	0.038	0.103	0.206	0.260	0.444
20	0.014	0.066	0.084	0.170	0.299	0.365	0.562
21	0.048	0.123	0.145	0.252	0.405	0.480	0.677
22	0.102	0.194	0.220	0.347	0.518	0.598	0.782
23	0.171	0.277	0.306	0.451	0.633	0.712	0.871
24	0.252	0.368	0.402	0.561	0.744	0.815	0.938
25	0.341	0.465	0.505	0.672	0.844	0.900	0.982
26	0.436	0.566	0.611	0.777	0.923	0.961	0.999
27	0.534	0.667	0.715	0.870	0.976	0.978	0.995
28	0.632	0.763	0.813	0.942	0.988	0.994	
29	0.726	0.851	0.896	0.964	0.999	0.998	
30	0.814	0.923	0.959	0.986	0.990	0.975	
31	0.890		0.976	0.999		0.927	

Table 4.5-3: Water Temperature (˚C) Recorded in the Collection Tank, Conowingo West Eel Collection Facility, 2023

Day	May	June	July	August	September	October	November
1	-	22.4	24.6	27.7	24.7	18.8	14.2
2	13.7	22.8	25.0	27.0	24.6	18.8	13.8
3	11.9	24.0	25.2	27.3	24.4	19.1	13.6
4	11.1	23.5	25.8	27.2	24.1	19.5	13.4
5	11.3	24.6	26.8	27.1	24.9	19.7	13.5
6	12.0	24.7	26.9	27.3	25.5	19.8	13.2
7	13.3	24.3	27.0	27.1	25.7	18.9	12.3
8	14.4	24.1	27.9	27.0	25.6	20.4	12.4
9	14.9	25.0	28.0	27.1	26.6	19.6	11.9
10	15.1	23.3	28.0	27.2	26.0	19.8	12.1
11	15.8	23.7	28.3	26.7	26.7	19.4	11.8
12	15.9	23.9	28.0	26.3	27.4	19.7	11.7
13	15.2	24.1	28.3	26.5	26.4	19.6	11.5
14	18.1	24.1	28.2	26.5	26.6	18.7	11.6
15	18.6	24.5	28.2	26.8	25.1	18.1	11.2
16	19.5	24.6	28.4	27.1	24.5	17.0	11.5
17	19.4	24.2	28.3	27.2	24.0	16.4	11.5
18	20.0	24.5	28.6	26.0	23.6	15.8	11.9
19	19.7	24.3	28.8	26.3	23.2	15.7	11.7
20	19.8	23.9	28.9	25.0	22.6	15.3	11.4
21	18.0	23.8	28.5	24.2	22.2	15.3	11.4
22	20.5	23.5	28.7	24.0	22.1	14.8	11.5
23	20.6	23.5	28.6	23.9	21.5	14.4	11.0
24	20.5	23.7	28.2	23.6	21.0	13.8	10.4
25	20.9	23.7	28.0	23.6	20.7	14.0	9.7
26	21.7	23.9	28.3	23.4	20.1	14.0	7.9
27	21.6	23.7	28.2	24.2	19.7	14.0	7.8
28	21.1	25.1	28.2	24.3	19.6	13.9	
29	21.5	25.2	28.5	24.3	18.9	14.2	
30	21.5	24.7	28.5	24.7	18.5	15.4	
31	21.9		27.8	24.8		14.9	

Table 4.5-4: Dissolved Oxygen (mg/L) Readings from the Control Room (Station 643*), Conowingo West Eel Collection Facility, 2023

Day	May	June	July	August	September	October	November
1	9.58	9.36	7.71	7.59	8.51	9.77	10.16
2	10.08	9.01	7.66	7.72	8.43	9.70	10.26
3	10.70	8.59	7.71	7.81	8.23	9.54	10.42
4	11.07	9.24	7.75	7.69	8.14	9.73	10.34
5	11.04	8.17	7.82	7.61	7.57	9.41	10.21
6	10.72	8.15	7.49	7.55	9.62	9.32	10.28
7	10.28	8.13	7.35	7.32	7.90	7.75	10.64
8	10.05	7.22	7.22	7.41	8.00	7.82	10.30
9	9.55	7.64	7.22	7.45	7.68	7.97	10.25
10	9.17	7.49	7.38	7.06	7.20	9.05	10.20
11	9.46	7.42	7.45	8.27	7.73	8.30	10.77
12	9.57	7.02	7.85	8.39	7.87	8.15	10.50
13	9.61	7.73	7.64	8.45	8.08	9.95	10.20
14	9.81	6.95	7.78	8.01	7.77	10.19	10.62
15	9.93	7.12	7.97	7.43	8.25	10.04	10.50
16	9.90	7.38	7.75	7.89	8.73	10.39	10.92
17	9.18	7.63	7.28	8.97	8.48	10.53	10.60
18	8.40	7.71	7.33	8.34	8.70	10.91	10.30
19	8.30	8.45	7.18	8.14	8.72	10.88	10.48
20	8.01	8.22	7.45	8.81	8.78	10.80	10.50
21	7.87	7.92	6.57	8.53	8.91	10.75	10.40
22	9.88	8.07	6.85	8.74	8.78	10.82	10.61
23	7.67	7.79	7.96	8.49	8.62	11.21	10.80
24	9.20	7.31	7.22	8.70	8.11	10.23	12.60
25	9.26	7.38	7.40	8.34	8.76	10.14	11.49
26	9.75	7.20	8.13	8.40	9.10	9.87	11.86
27	9.18	7.33	7.88	8.26	9.14	9.59	11.65
28	8.99	8.41	8.18	7.78	8.90	9.52	
29	9.08	8.12	8.25	8.02	9.88	9.34	
30	8.79	7.51	8.14	8.06	9.89	10.23	
31	8.83		7.65	8.12	8.73	10.15	

*After November 2, 2023, dissolved oxygen readings were taken at Shures Landing boat ramp.

Table 4.6-1: Number of Juvenile American Eel placed in Holding, Conowingo West Eel Collection Facility, 2023

Day	May	June	July	August	September	October	November
1	-	275	-	-	-	132	16
2	360	114	-	-	-	-	-
3	40	525	-	-	-	614	3
4	-	620	-	-	-	425	4
5	36	765	-	-	-	-	4
6	55	-	*9,549	-	-	1155	22
7	459	461	-	-	-	458	11
8	161	545	-	-	-	519	2
9	-	-	-	-	-	-	-
10	514	241	-	-	-	1107	-
11	864	199	-	-	-	145	1
12	1,921	188	-	-	-	-	-
13	156	-	-	-	-	253	-
14	5,889	296	-	-	-	1	-
15	5,689	207	-	-	-	21	-
16	-	-	-	-	-	-	-
17	2,426	125	-	-	-	70	-
18	2,192	260	-	-	-	8	-
19	2,268	381	-	-	-	-	-
20	2,340	-	-	-	-	2	-
21	1,778	396	-	-	-	10	-
22	3,626	291	-	-	16	3	
23	-	-	-	-	8	-	
24	1,070	169	-	-	2	2	
25	1,721	391	-	-	-	-	
26	1,784	484	-	-	29	-	
27	731	-	-	-	24	4	
28	1,004	245	-	-	-	10	
29	711	-	-	-	197	24	
30	-	-	-	-	51	-	TOTAL
31	386		-	-		7	60,268

Number of eels held were combined from CWECF and OCEF

* Collection tank was checked multiple times the evening before to keep from overcrowding, eels placed in holding tank for a few hours until transport the next morning.

Table 4.6-2: Eel Transport and Stocking Data, 2023

Parameter	Number of eels	Mortality (No. dead eels by location)			Removed for Analysis	Removed for SRBC	Number Stocked
		Collection Tank	Holding Tank	Transport Tank			
OCEF Eels Collected	62,113	18 (0.03%)					
OCEF eels Transported to CWECF				0 (0.00%)			62,095
CWECF Eels Collected	217,035	50 (0.02%)	**112 *(0.19%)***		100	300	216,473
Total Transported from CWECF	278,568			23 (<0.01%)			278,545
Location of stocking							
Lock haven boat ramp (Site 11)	62,153			19 (0.01%)			62,134
Fort Hunter Access (Site 6)	71,564			0 (0.00%)			71,564
West Fairview Access (Site 5)	71,797			1 (<0.01%)			71,796
City Island boat ramp (Site 12)	72,192			3 (<0.01%)			72,189
Conowingo Creek boat ramp (Site 1)	862			0 (0.00%)			862

Bolded value is assumed as worst case; the facility (OCEF or CWECF) where dead eels were collected could not be determined.

Table 4.7-1: Detailed Individual Eel Transport and associated water quality Data, 2023

Date (2023)	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)
Transport to Loch Haven – Upstream of Grant Street Dam (Site 11)												
May 9	1,884	934	14.9	11.0	1003	17.1	6.8	1426	17.3	13.6	16.1	10.3
May 16	20,734	919	17.5	9.7	1145	20.5	8.3	1558	20.3	7.9	20.3	10.2
May 23	17,716	1103	18.7	8.6	1301	19.2	12.1	1727	20.0	10.6	19.8	7.9
May 30	7,603	857	19.6	7.4	1020	22.3	9.4	1411	22.5	13.2	25.4	7.8
Jun 6	2,862	940	22.7	8.7	1040	25.0	10.2	1425	25.0	10.5	22.0	8.6
Jun 9	1,404	854	22.1	7.3	945	24.4	10.4	1355	10.7	24.1	18.5	9.1
Jun 23	1,097	902	21.6	10.1	945	21.2	15.5	1420	21.0	15.7	22.1	7.9
Jun 27	1,441	831	21.7	12.8	925	22.3	10.3	1325	22.5	12.1	26.5	7.7
Oct 5	1,926	805	19.7	10.9	924	19.6	5.25	1338	20.7	17.4	22.3	8.2
Oct 9	3,474	749	19.6	9.5	832	19.2	6.45	1230	18.8	14.2	15.2	12.5
Oct 12	1,993	759	19.7	9.5	845	19.5	8.1	1230	19.4	18.6	14.5	11.5
Total	**62,134**											

Table 4.7-1: (Cont.)

Date (2023)	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)
Transport to Conowingo Creek (Site 1)												
Aug 6	76	855	27.3	8.2	946	28.5	7.3	1002	28.3	5.2	28.8	6.3
Aug 7	41	847	27.1	7.4	910	27.1	5.8	930	27.1	6.5	26.7	5.8
Aug 9	33	1058	27.1	9.1	1150	25.4	7.8	1221	25.5	7.6	23.0	8.2
Aug 10	22	815	27.2	8.8	900	23.6	8.3	918	23.4	8.2	24.7	5.6
Aug 11	26	825	26.7	6.8	845	25.3	7.8	900	24.3	8.1	21.7	7.8
Aug 13	85	830	26.5	7.9	850	26.5	7.5	938	25.4	7.5	27.8	7.4
Aug 14	14	841	26.5	7.8	940	25.1	8.0	955	25.2	7.8	27.5	7.2
Aug 15	14	834	25.8	7.9	836	25.8	7.9	900	25.8	7.8	25.1	6.9
Aug 16	34	1038	27.1	10.1	1130	25.9	7.3	1146	26.4	7.4	29.2	7.4
Aug 17	2	840	27.2	8.2	850	23.5	8.1	913	23.1	8.3	27.1	6.4
Aug 18	5	846	24.2	6.1	900	24.5	6.5	925	24.7	5.9	27.4	6.2
Aug 19	18	850	26.3	11.7	908	21.8	7.05	930	22.4	6.8	27.3	6.2
Aug 22	57	838	24.0	8.2	852	23.6	7.2	910	23.9	6.7	24.1	6.3
Sep 5	21	845	24.9	7.0	900	24.6	6.2	950	26.6	5.5	25.6	6.5
Sep 14	68	840	26.6	6.9	919	26.2	6.4	938	27.4	7.4	25.6	5.8
Sep 21	61	814	22.1	8.4	855	22.1	8.0	925	21.0	8.5	21.4	7.5
Sep 25	36	755	18.9	7.8	815	18.7	9.5	845	18.5	9.8	21.3	8.3
Oct 19	85	840	13.7	10.8	845	15.8	10.8	919	15.6	9.8	14.7	9.0
Oct 23	18	920	14.4	12.2	941	14.9	12.6	1008	13.3	12.7	12.7	13.1
Oct 26	5	900	14.0	12.0	1115	15.2	9.6	1135	15.4	8.9	14.8	8.8
Oct 30	58	831	15.4	10.6	859	16.4	9.4	923	16.4	8.4	16.4	8.2
Nov 2	25	757	13.8	11.9	814	13.7	10.8	840	10.2	12.0	10.4	10.3
Nov 9	48	802	11.9	12.6	830	12.8	10.3	900	13.0	9.3	12.0	9.5
Nov 16	2	820	11.5	12.4	837	12.0	11.4	1010	12.3	11.2	10.6	11.9
Nov 17	2	735	11.5	12.0	750	12.0	10.9	817	11.4	11.0	10.9	10.3
Nov 18	1	729	11.9	11.9	741	12.7	10.6	804	12.5	10.4	12.4	9.7
Nov 23	1	745	11.0	12.4	800	11.7	11.2	821	11.6	11.2	9.9	10.8
Nov 24	4	1011	12.4	12.8	1030	12.2	11.3	1055	12.1	10.2	9.3	10.8
Total	**862**											

Table 4.7-1: (Cont.)

Date (2023)	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)
Transport to City Island boat ramp (Site 12)												
May 4	435	1029	11.1	12.7	1135	14.5	8.4	1316	14.1	7.2	11.2	10.3
Jun 16	625	905	24.6	6.6	1000	23.6	7.1	1245	22.8	9.9	21.4	6.5
Jun 30	1,999	848	24.7	8.7	921	23.8	9.8	1127	24.1	14.8	24.7	7.6
Jul 5	4,711	1032	26.8	8.0	1121	22.5	15.4	1255	23.1	14.2	26.6	7.5
Jul 8	13,459	830	27.9	6.5	915	28.6	10.2	1109	28.6	12.4	28.3	6.9
Jul 10	22,430	1024	28.0	5.5	1101	28.5	9.1	1300	28.6	9.8	25.5	7.8
Jul 14	12,748	852	28.2	5.2	947	29.1	10.8	1147	29.5	16.1	27.9	6.8
Jul 20	5,167	900	28.9	7.6	1015	29.8	9.2	1235	29.8	10.8	28.2	7.8
Jul 27	568	852	28.2	8.5	934	29.2	5.7	1137	28.8	11.1	26.7	7.0
Jul 30	171	900	28.5	7.5	930	28.2	10.2	1135	27.7	16.4	26.7	7.7
Aug 1	236	914	27.7	7.9	940	28.1	6.3	1140	27.9	9.8	25.4	7.5
Aug 2	128	915	27.0	10.4	1015	28.5	10.6	1210	28.5	12.1	25.1	8.3
Aug 8	100	1013	27.0	9.4	1100	27.9	4.9	1250	27.7	20.0	25.2	8.6
Aug 12	153	831	26.2	5.8	831	26.2	25.8	1016	26.0	11.4	24.7	7.6
Aug 23	666	937	23.9	7.5	1015	24.8	6.4	1215	24.8	8.8	23.0	7.6
Aug 26	901	825	23.4	7.2	858	24.9	5.8	1048	25.1	10.2	24.5	7.5
Aug 29	1,740	842	24.3	7.4	925	25.7	6.2	1133	25.2	8.8	22.7	5.8
Aug 31	1,451	841	24.8	8.1	938	25.2	5.5	1141	24.6	10.4	24.8	8.4
Sep 3	254	827	24.6	7.5	915	24.3	7.8	1100	24.4	16.8	23.6	8.1
Sep 6	473	913	25.5	6.7	947	27.0	7.6	1152	26.9	11.7	27.1	7.7
Sep 9	1,205	840	26.6	8.3	930	27.2	7.2	1113	26.1	7.3	26.1	7.3
Sep 11	381	843	26.7	8.26	920	26.6	8.0	1114	26.5	13.5	25.4	7.9
Sep 17	1,109	832	24.0	12.6	915	24.2	7.5	1118	23.7	17.3	20.0	8.8
Sep 19	303	800	23.2	7.5	805	23.2	7.5	940	22.9	9.2	19.0	8.3
Oct 2	776	810	17.0	9.2	900	19.7	7.0	1119	19.9	13.0	20.3	8.9
Total	**72,189**											

Table 4.7-1: (Cont.)

Date (2023)	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)
Transport to Fort Hunter Access (Site 6)												
Jun 13	804	904	22.3	9.9	940	23.1	8.3	1200	22.9	9.1	21.8	7.7
Jun 20	994	901	23.9	6.1	945	23.6	6.1	1212	23.6	13.9	24.1	6.0
Jul 1	950	941	24.6	7.2	944	25.6	7.6	1215	25.5	10.7	24.4	6.6
Jul 3	461	905	25.2	9.3	945	26.1	6.1	1135	23.0	12.0	24.2	6.4
Jul 6	6,750	945	26.9	6.2	1100	26.9	6.2	1240	28.0	13.5	28.3	7.1
Jul 9	14,019	904	28.0	6.6	1040	28.6	10.5	1230	28.7	12.9	27.5	6.8
Jul 11	24,120	818	28.3	8.3	905	29.2	13.6	1310	29.1	12.5	25.0	8.1
Jul 15	6,488	901	28.2	5.4	938	29.6	7.5	1130	29.2	12.6	26.9	10.4
Jul 18	2,597	805	28.6	9.9	900	29.6	10.9	1205	29.3	19.9	26.5	7.3
Jul 21	1,783	803	28.5	6.8	945	29.1	10.8	1120	28.9	10.6	24.5	7.4
Jul 22	983	800	28.7	11.0	930	29.2	11.5	1100	29.0	15.0	24.5	7.3
Jul 24	1,103	900	28.2	8.3	1000	28.2	7.8	1200	27.9	6.4	25.7	7.2
Jul 26	910	958	28.3	5.6	1040	27.4	6.9	1252	27.6	12.0	24.9	7.4
Jul 29	660	901	28.5	6.6	930	28.8	13.5	1053	29.5	11.2	26.8	7.0
Aug 4	189	904	27.2	9.4	930	25.6	6.2	1130	26.4	13.3	24.0	7.5
Aug 21	169	837	24.2	8.8	915	25.3	7.0	1045	26.4	6.9	21.7	8.6
Aug 24	1,180	830	23.6	7.5	915	24.4	7.0	1055	24.2	10.1	21.6	8.5
Aug 28	1,822	900	24.3	7.6	930	25.3	4.8	1115	25.4	10.3	23.5	8.4
Aug 30	2,129	1010	24.7	7.4	1115	26.2	6.2	1307	26.8	15.1	24.1	7.6
Sep 7	106	840	25.7	7.9	907	26.8	7.0	1100	26.7	15.4	26.4	6.0
Sep 8	281	858	25.6	7.9	918	26.7	7.3	1100	26.6	10.4	24.8	6.3
Sep 10	406	818	26.0	9.2	901	26.2	6.8	1048	26.7	8.1	25.2	7.4
Sep 15	2,183	837	25.1	8.8	915	28.7	5.9	1103	28.5	6.9	20.9	7.3
Sep 18	477	1139	24.4	7.6	1140	24.4	7.6	1330	24.2	10.9	19.4	9.0
Total	**71,564**											

Table 4.7-1: (Cont.)

Date (2023)	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)
Transport to West Fairview Access (Site 5)												
Jun 2	953	947	21.2	11.5	1040	21.0	10.3	1250	22.2	11.6	22.6	12.2
Jun 29	1,512	908	23.4	11.5	1010	23.4	5.3	1200	24.0	10.1	23.7	9.2
Jul 2	466	845	24.2	7.7	920	26.4	6.4	1109	26.2	8.6	24.4	7.3
Jul 4	3,306	857	25.8	7.6	913	24.6	6.3	1110	23.8	16.2	25.7	5.9
Jul 7	18,152	915	28.0	8.5	1047	28.0	10.4	1315	28.3	13.1	29.9	8.2
Jul 12	12,405	1036	28.0	7.1	1136	27.5	12.0	1330	28.3	10.7	27.9	9.8
Jul 13	12,714	915	28.3	6.1	1000	29.0	12.2	1200	29.2	15.6	27.6	7.8
Jul 16	2,071	858	28.4	6.2	1006	29.3	15.9	1147	29.1	16.8	26.9	6.2
Jul 17	3,549	853	28.3	5.9	959	29.8	6.7	1209	29.7	11.2	27.9	7.6
Jul 19	4,535	800	28.8	8.5	1100	29.5	11.5	1243	29.3	15.2	27.3	8.3
Jul 23	992	849	28.6	7.7	930	29.5	7.1	1106	29.2	11.8	25.8	7.2
Jul 25	991	840	28.0	6.0	925	26.6	6.5	1105	247	10.3	23.8	6.8
Jul 28	656	830	26.2	7.0	933	28.8	8.0	1150	28.8	7.6	28.8	7.6
Jul 31	249	900	27.8	10.3	930	28.2	6.9	1130	28.3	19.6	26.2	7.4
Aug 3	124	928	25.7	8.5	930	27.3	6.3	1130	27.1	14.8	23.6	7.7
Aug 5	125	830	27.1	10.7	858	27.3	6.0	1103	27.2	10.8	24.2	7.6
Aug 20	299	852	25.0	8.8	920	24.7	6.9	1118	24.8	9.7	23.0	6.7
Aug 25	785	837	23.6	7.2	903	24.6	6.4	1047	24.7	9.0	23.3	7.4
Aug 27	2,571	840	24.2	6.6	943	25.7	5.9	1125	22.8	15.0	26.2	7.6
Sep 1	1,083	845	24.7	7.0	910	24.4	8.9	1051	25.4	11.6	22.5	7.9
Sep 2	822	827	24.6	7.5	900	25.2	8.6	1103	24.9	13.6	22.9	8.2
Sep 4	270	270	24.1	7.2	900	25.2	8.1	1045	25.4	10.7	26.1	8.2
Sep 12	263	900	27.4	6.6	930	27.0	5.9	1128	27.0	12.1	24.1	6.7
Sep 13	306	946	26.4	7.0	1007	27.3	7.7	1217	27.0	12.1	25.0	8.1
Sep 16	2,047	816	24.5	10.1	848	24.9	5.6	1105	24.8	7.3	19.3	8.2
Sep 20	117	733	22.6	10.0	815	22.7	11.7	1007	22.5	10.7	18.2	9.2
Sep 28	146	800	19.6	9.8	830	20.1	10.7	1040	19.9	12.0	16.1	9.0
Oct 16	287	758	17.0	10.9	821	17.1	11.3	1035	16.7	15.2	13.1	9.0
Total	**71,796**											

Table 4.7-2: Constellation's Eel Stocking Totals by Location and Year, 2015 - 2023

Location	2015	2016	2017	2018	2019	2020	2021	2022	2023	TOTAL
Conowingo Creek boat ramp	847	-	-	-	-	-	-	-	862	**1,709**
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	-	233,593	28,743	71,796	**397,668**
Fort Hunter Access	-	-	-	22,348	41,116	-	-	28,715	71,564	**163,743**
City Island boat ramp	-	-	-	24,869	41,132	-	231,694	28,784	72,189	**398,668**
Bloomsburg boat 0ramp	-	-	-	-	-	109,308	-	-	-	**109,308**
Lock Haven boat ramp	-	-	-	-	-	109,123	-	-	62,134	**171,257**
Wrightsville boat ramp	-	-	-	-	-	19,319	-	-	-	**19,319**
Columbia boat ramp	-	-	-	-	-	17,660	-	-	-	**17,660**
Shikellamy State Park	-	-	-	-	-	-	183,609	55,871	-	**239,480**
TOTAL	**847**	**22,382**	**129,902**	**69,803**	**123,198**	**255,410**	**648,896**	**142,113**	**278,545**	**1,671,096**

Table 5.0-1: Specified Operating Ranges of Conowingo West Eel Collection Facility, 2023

	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 West Eel Collection Facility, 2023

	DATE									
	5/3	5/10	5/17	5/23	5/31	6/7	6/14	6/21	6/28	7/5
Collection Tank Fill	12.5	17.5	16.0	15.5	15.0	13.0	11.4	12.5	16.0	12.5
Collection Tank Drain	13.5	18.5	16.0	16.5	17.5	13.5	13.2	13.0	16.5	14.5
Holding Tank #1 Drain	9.0	16.5		17.0						
Holding Tank #2 Drain			15.0		20.0	16.0	13.0	14.0	19.0	
Holding Tank #3 Drain	17.5	37.5	30.0	30.0	27.5	40.5	26.0	33.0	34.0	37.5
Spray Bar	7.0	6.75	6.6	6.6	6.6	6.6	6.4	6.75	6.75	6.75
Scent line	0.6	0.5	0.3	0.8	0.5	0.45	0.45	0.25	0.3	1.2
Backside of Ramp	1.6	1.5	0.3	1.8	3.0	0.95	2.25	0.75	0.8	3.2
Top Attraction	5.4	5.25	6.3	4.8	3.3	5.65	4.15	6.0	5.95	3.55
Bottom of Ramp Attraction	40.0	72.5	61.0	63.5	65.0	70.0	52.2	60.0	69.5	52.0
Total Attraction*	**46.0**	**78.25**	**67.6**	**69.1**	**69.1**	**76.1**	**56.8**	**66.25**	**75.75**	**56.75**

	DATE									
	7/12	7/19	7/26	8/2	8/9	8/16	8/23	8/30	9/6	9/13
Collection Tank Fill	10.0	5.4	15.6	19.0	12.9	10.2	10.0	17.5	9.5	8.7
Collection Tank Drain	11.0	5.25	14.8	19.0	13.2	10.8	9.6	17.0	10.0	8.55
Holding Tank #1 Drain										
Holding Tank #2 Drain										
Holding Tank #3 Drain	48.75	45.0	33.0	38.5	49.5	51.0	64.5	52.5	54.0	51.75
Spray Bar	6.75	6.6	6.4	6.6	6.3	6.15	7.2	6.4	6.3	6.3
Scent line	1.2	1.1	1.4	1.45	1.35	1.1	1.2	1.25	1.2	1.2
Backside of Ramp	2.2	0.95	0.6	1.45	1.65	1.7	0.8	0.75	1.7	1.05
Top Attraction	4.55	5.65	5.8	5.15	4.65	4.45	6.4	5.65	4.6	5.25
Bottom of Ramp Attraction	59.75	50.25	47.8	57.5	62.7	61.8	74.1	69.5	64.0	60.3
Total Attraction*	**65.3**	**57.0**	**55.0**	**64.1**	**68.7**	**67.35**	**81.3**	**76.4**	**69.8**	**66.75**

*Tank flows were reduced to get accurate flow measurement and to calibrate. All Flow returned to normal operating condition after calibration was complete at approximately 70 gpm total flow.

Table 5.0-2: (Continued)

	DATE									
	9/20	9/27	10/4	10/11	10/18	10/25	11/1	11/7	11/14	11/22
Collection Tank Fill	14.5	12.0	14.0	15.0	14.0	15.0	16.2	12.0	16.6	16.2
Collection Tank Drain	13.5	12.5	13.4	14.5	15.5	15.0	15.6	12.0	16.2	16.2
Holding Tank #1 Drain										
Holding Tank #2 Drain	18.0	10.5	14.0	9.0	8.0	18.0	9.9	13.2	15.0	
Holding Tank #3 Drain	30.25	30.0	30.0	36.0	30.0	30.0	31.5	41.25	37.5	57.0
Spray Bar	6.45	6.45	7.0	6.6	6.0	6.15	6.45	6.0	6.0	5.1
Scent line	1.4	0.8	1.25	1.23	1.0	1.3	1.3	0.9	1.2	1.25
Backside of Ramp	0.4	1.3	0.65	0.73	2.5	1.3	0.7	0.9	0.9	1.25
Top Attraction	6.05	5.15	6.35	5.87	3.5	4.85	5.75	5.1	5.1	3.85
Bottom of Ramp Attraction	61.75	53.0	57.4	59.5	53.5	63.0	57.0	66.45	68.7	73.2
Total Attraction*	**69.0**	**58.95**	**65.0**	**66.6**	**58.0**	**69.5**	**64.05**	**72.45**	**75.0**	**78.3**

* Tank flows were reduced to get accurate flow measurement and to calibrate. All Flow returned to normal operating condition after calibration was complete at approximately 70 gpm total flow.

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Table 5.0-3: Quality Control Checks on Volumetric Estimates, Conowingo West Eel Collection Facility, 2023

Date	Number of eels in:		Displacement of Water	Volumetric Estimate	Actual Counts	Difference
	200 mL	1 L				
7/16/2023	140	700	2.8	1,961	2,036	75
8/30/2023	129	645	3.1	2,169	2,129	-40
Total				**4,130**	**4,165**	**35**
						0.8%

All estimated eel counts include eels that were anesthetized and counted in a 200-mL volumetric subsample.

Table 6.0-1: Summary of Eel Collections and Biological Data, Conowingo West Eel Collection Facility, 2017-2023

Year		2017	2018	2019	2020	2021	2022	2023	Average	Total
Eels Collected		122,300	67,949	126,181	254,651	623,095	139,798	217,035	221,572.7	1,551,009
Peak	Number	7,280	5,572	10,166	14,137	16,004	4,158	17,326	10,663	
	Date	July 30	July 30	July 5	May 30	July 7	July 8	July 7		
Days of Operation		138	138	138	138	193	204	211	165.7	1160
Average eels per day		886.2	492.4	914.4	1,845.3	3,228.5	685.3	1033.5	1,352.5	
Daily collections > 1,000 eels		31	22	26	60	111	46	44	48.6	340
Volumetric Estimation Days		40	25	31	56	112	34	28	46.6	326
Accuracy of Volumetric Estimates (±)		-1.0%	+1.6%	-1.1%	-2.3%	+1.4%	-0.4%	+0.8%	-1.0%	
Biological Data										
Sample Size		926	857	909	851	975	966	919	914	5484
Length (mm)	Average	122.3	121.6	114.4	112.2	115.7	114.3	117.1	116.8	
	Range	78-192	84-173	64-165	71-186	66-184	65-176	79-176		64-192
	Median	122.0	120.0	115.0	112.0	115.0	114.0	116.0		
Weight (g)	Average	2.1	2.0	1.8	1.5	1.6	1.7	1.7	1.8	
	Range	0.5-6.0	0.5-4.8	0.2-4.7	0.3-5.5	0.2-5.0	0.3-4.3	0.3-5.7		0.2-6.0
	Median	2.0	2.0	1.7	1.4	1.5	1.6	1.6		
Sacrificed	Number	193	93	91	96	100	101	100		774
	Contained Parasites	53.9%	48.4%	52.7%	62.5%	61.0%	56.5%	60.0%	56.4%	
	Average Age	2.2	2.3	1.65	1.97	2.3	2.4	2.1		
	Age Range	1 - 4	1 - 4	1 - 4	1 - 4	1 - 5	1 - 4	1 - 4		
River Flows (cfs, daily avg. flows at Conowingo)	Average	37,053	62,036	40,214	14,256	43,466	20,251	25,121	33,631	
	Min	6,000	11,100	4,560	3,970	8,560	3,750	6,820		
	Max	178,000	329,000	157,000	58,400	219,000	173,000	166,000		

Figure 3.6-1: Sample Location (Stone Run) of American Eel Collected for Wild Health Screening, Conowingo West Eel Collection Facility, 2023

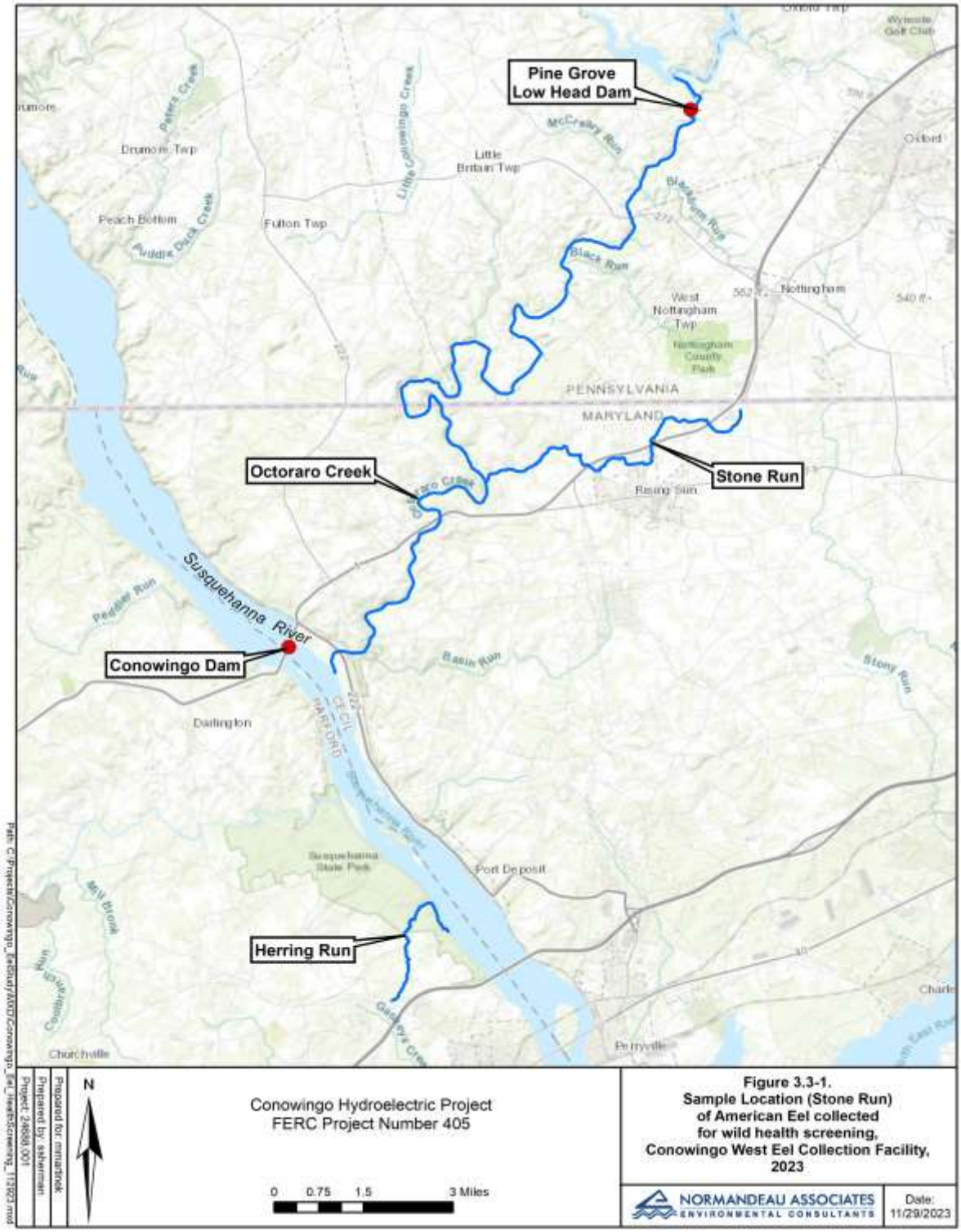

Figure 3.6-2: Stone Run, a Tributary of Octoraro Creek used for the Wild Health Screening, Conowingo Dam, 2023

Figure 4.1-1: Daily Eel Catch, Conowingo West Eel Collection Facility, 2023

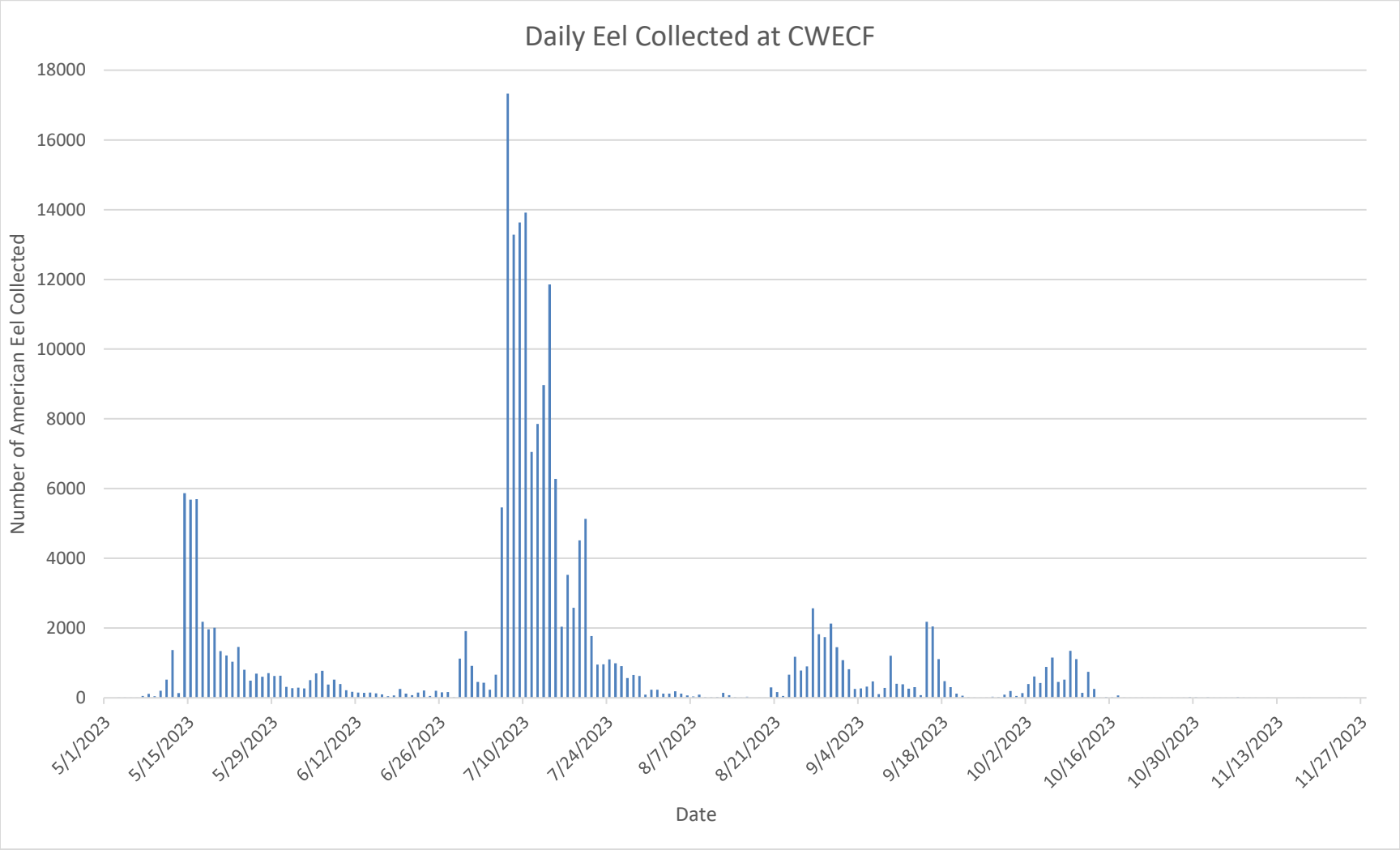

Figure 4.2-1: Eel with Scrapes on Right Side, Conowingo West Eel Collection Facility, 2023

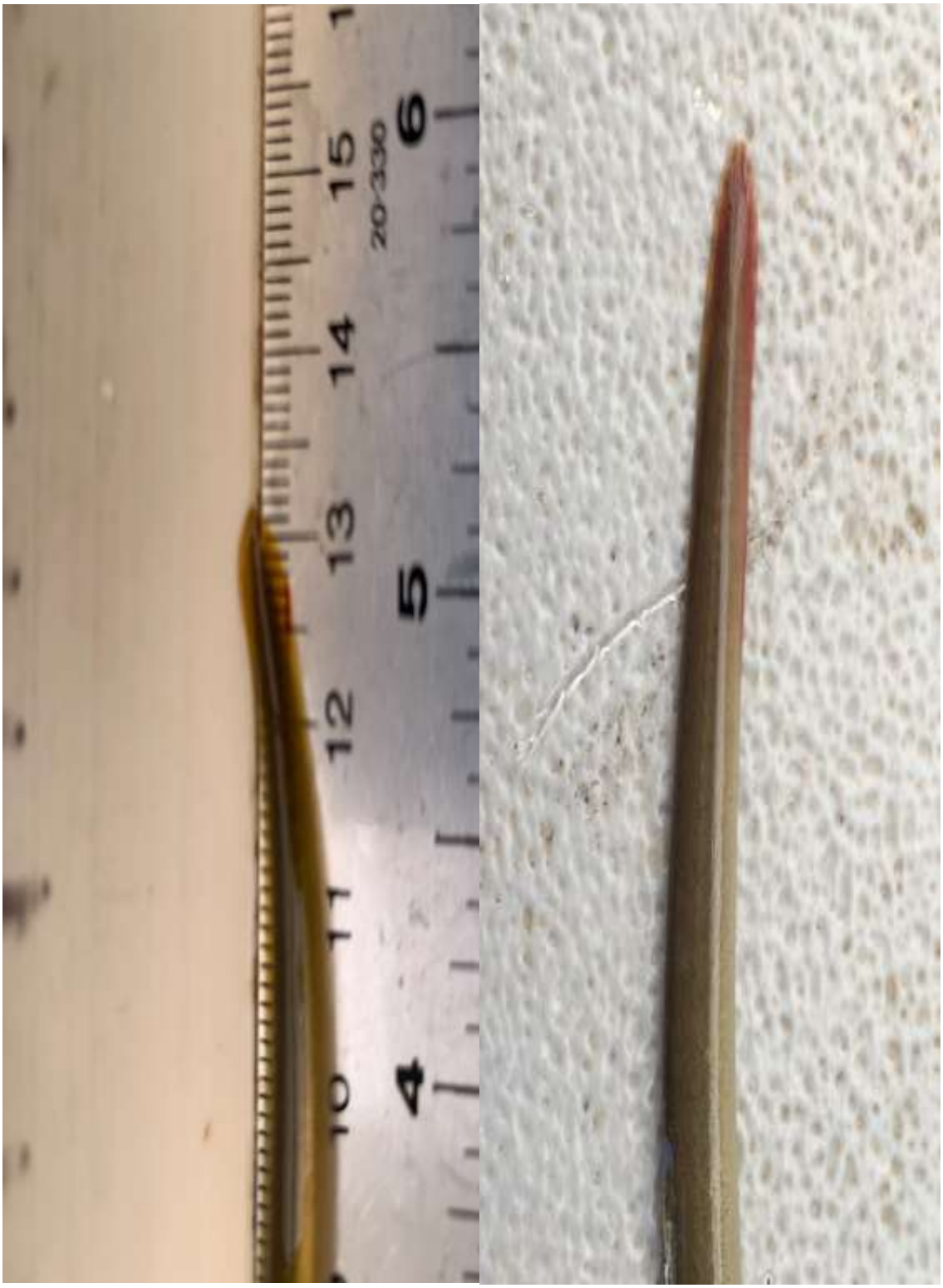

Figure 4.2-2: Eels with Hemorrhage Caudal Tail, Conowingo West Eel Collection Facility, 2023

Figure 4.2-3: Eel with Abrasion on Operculum, Conowingo West Eel Collection Facility, 2023

Figure 4.4-1: Proportion of Eels Collected per Week, Conowingo West Eel Collection Facility, 2023

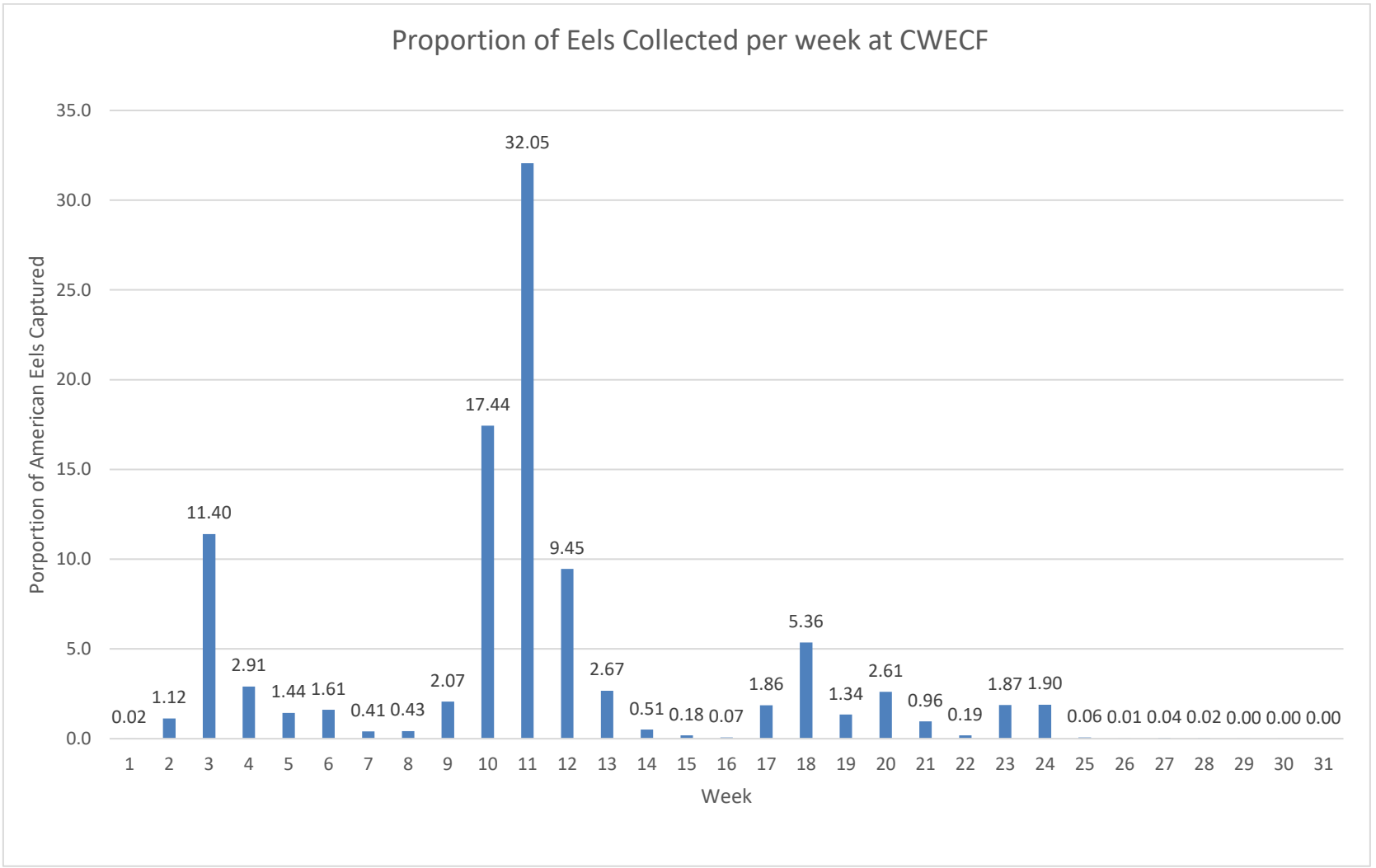

Figure 4.5-1: Daily Eel Catch and Daily Average River Flow (cfs, top graph) and Weekly Eel Catch and Weekly Average River Flow (cfs, bottom graph), Conowingo West Eel Collection Facility, 2023

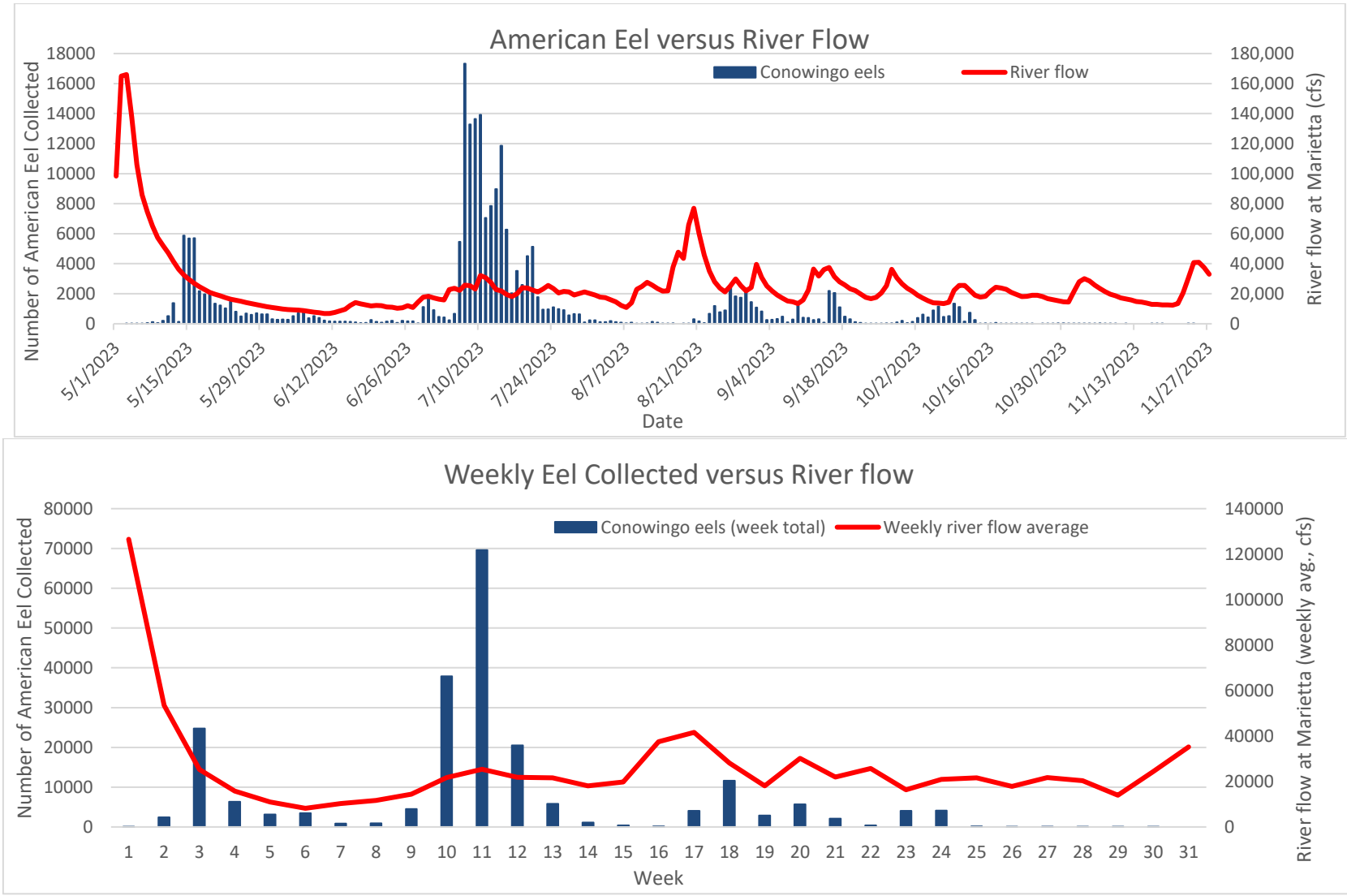

Figure 4.5-2: Eel Catch and Lunar Fraction (Daily above, Weekly Avg. below), Conowingo West Eel Collection Facility, 2023 (*1.0 Equals Full Moon)*

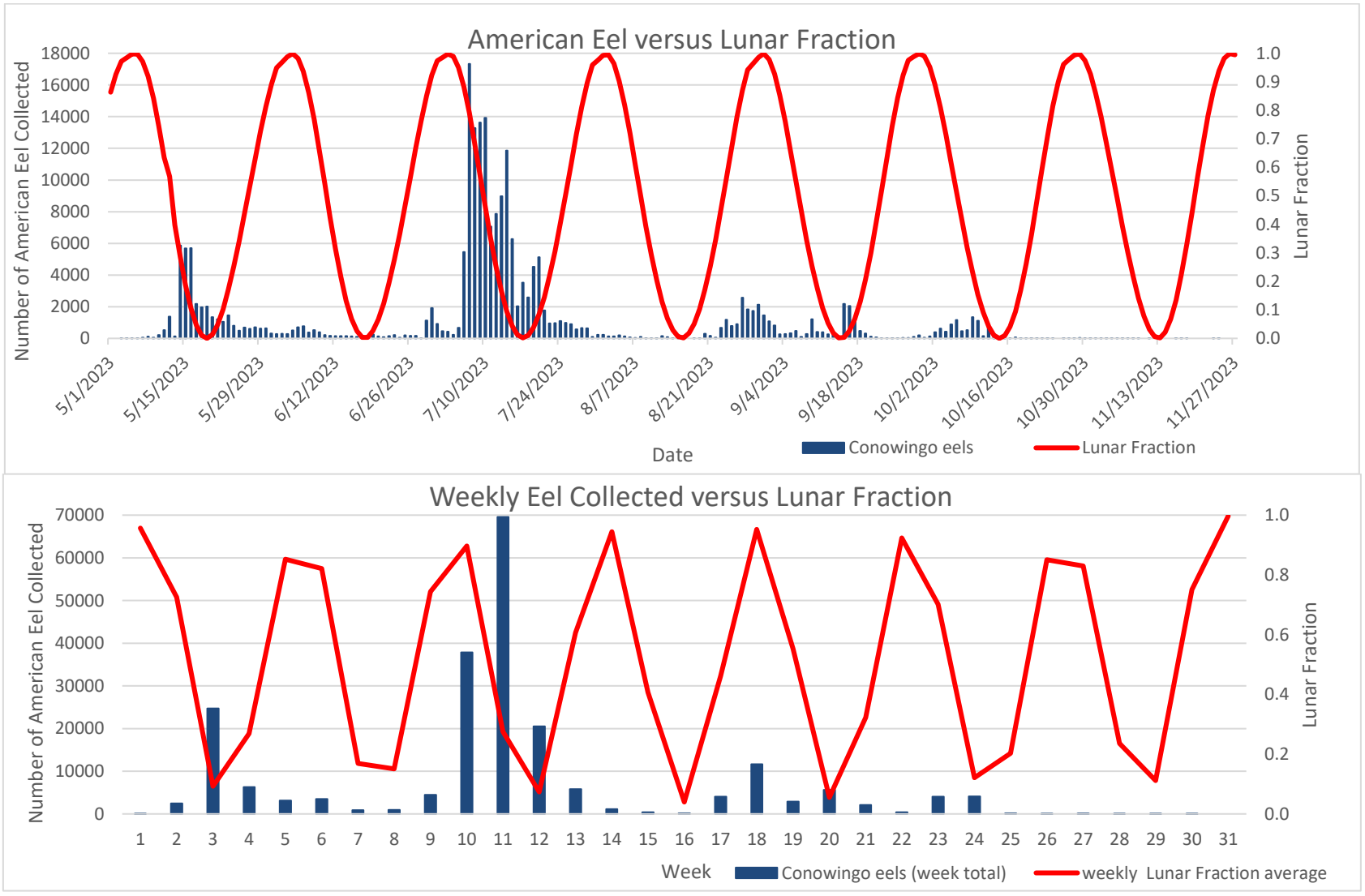

Figure 4.5-3: Eel Catch and Water Temperature, Conowingo Eel Collection Facility, 2023

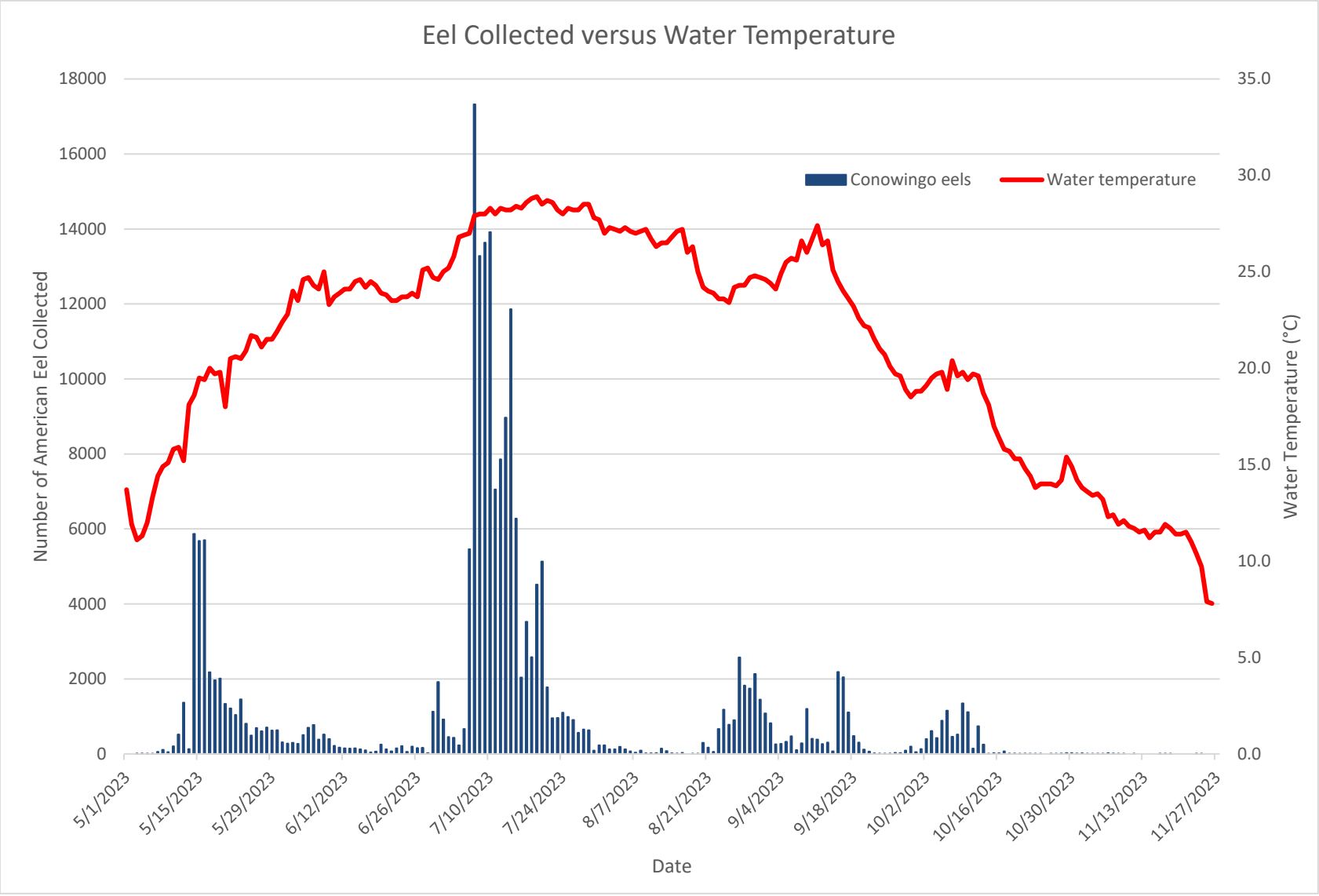

Figure 4.5-4: Eel Catch and Dissolved Oxygen, Conowingo West Eel Collection Facility, 2023

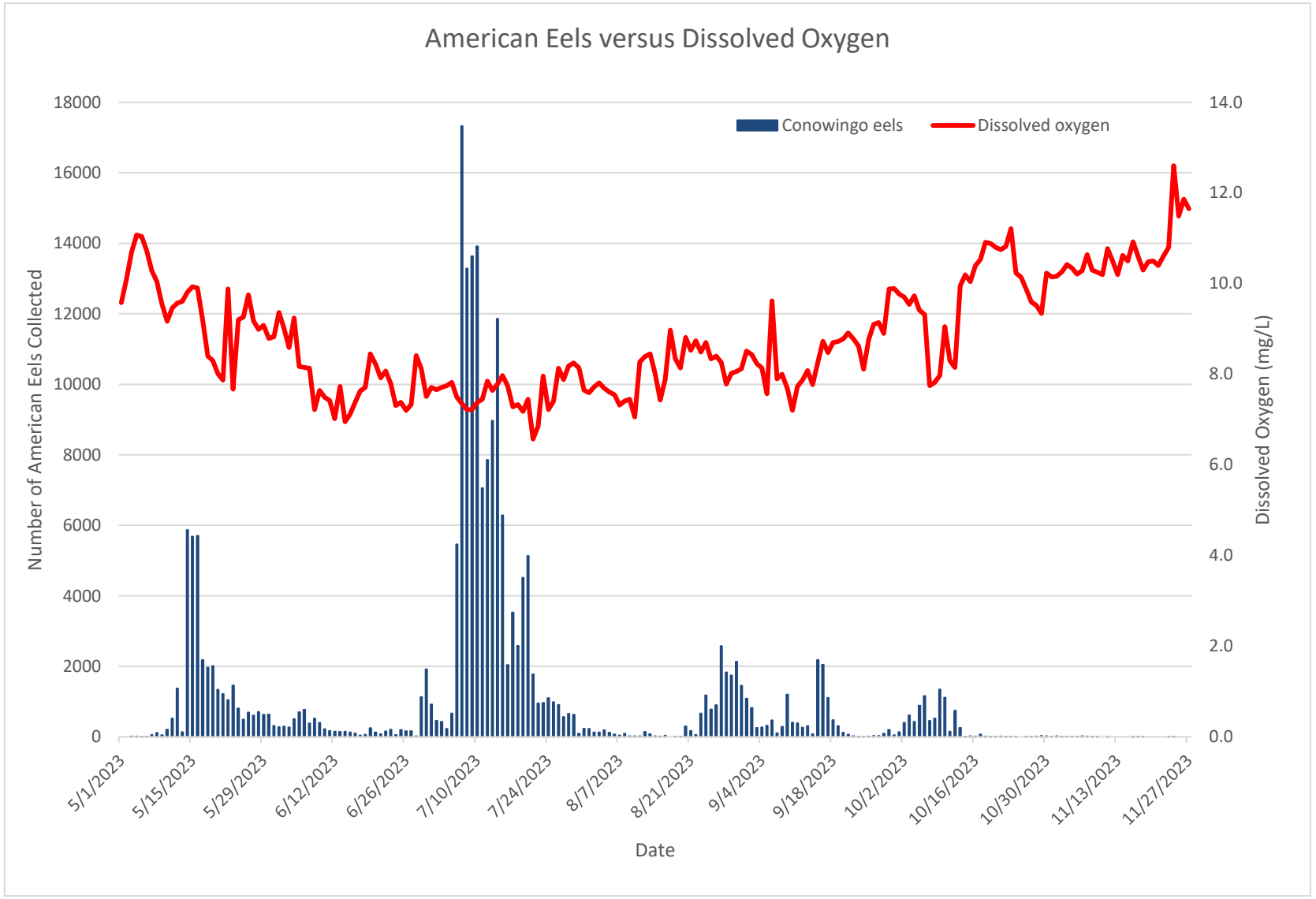

Figure 4.7-1: Eel Stocking Sites, 2015-2023

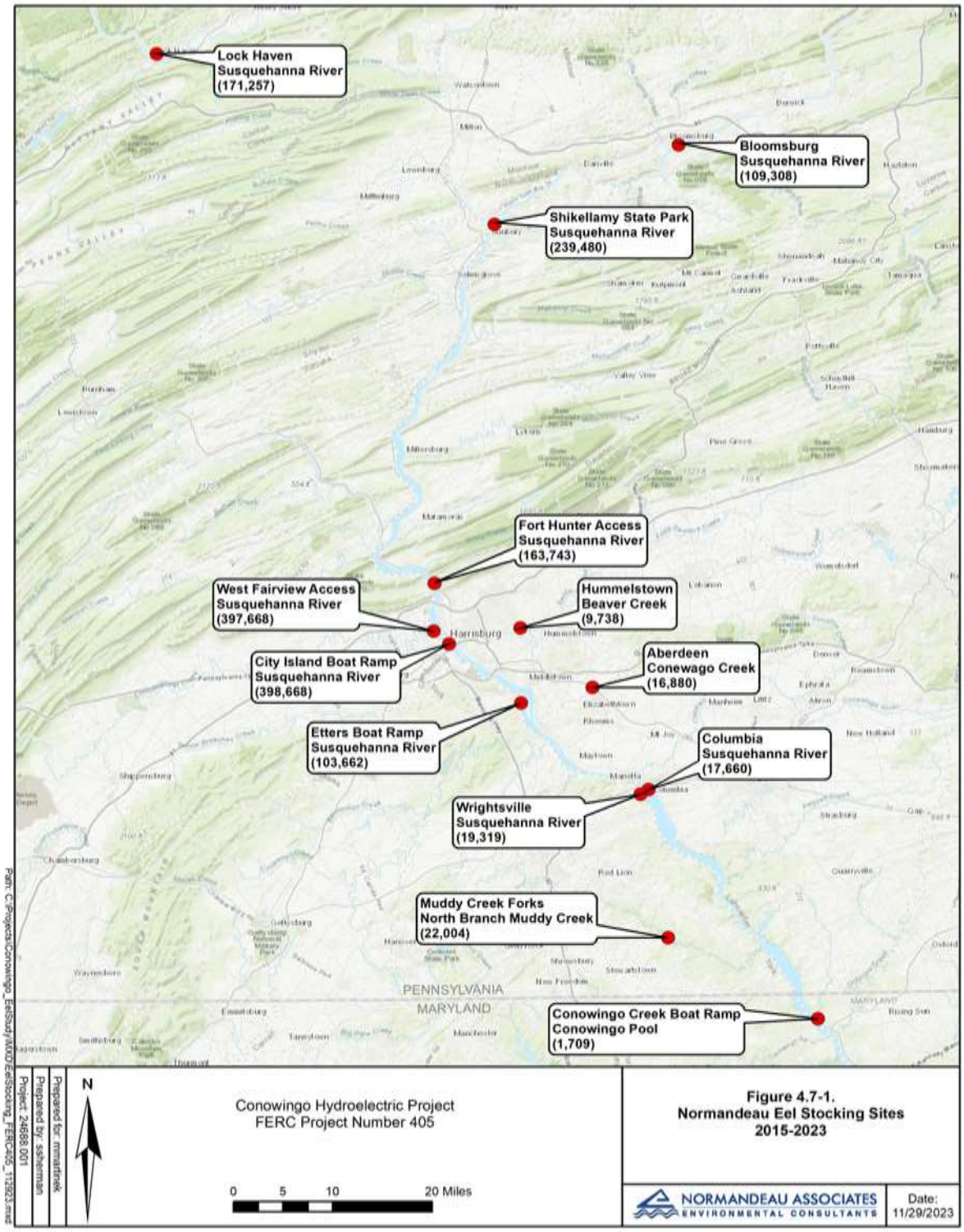

Figure 4.7-2: Lock Haven boat ramp (Site 11) Stocking Site, 2023

Figure 4.7-3: Fort Hunter Access (Site 6) Stocking Site, 2023

Figure 4.7-4: West Fairview Access (Site 5) Stocking Site, 2023

Figure 4.7-5: City Island Boat Ramp (Site 12) Stocking Site, 2023

Figure 4.7-6: Conowingo Creek boat ramp (Site 1) Stocking Site, 2023

Figure 5.0-1: Transition from Riprap Shoreline to Ramp Entrance, Conowingo West Eel Collection Facility, 2023

Appendix A:
Method of Aging Eel Otolith, Conowingo West Eel Collection Facility, 2023

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. Using 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 occurred. 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 was 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, independent readers and the number of distinct annuli was determined. Following independent age determinations for each sample by both readers, the lists 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 was 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.

Date	Collection #	Eel #	Length (mm)	Weight (g)	Age 1-ERS	Age 2-CAF	Consensus
5/7/2023	MDM23306	1	108	1.5	2	2	2
	MDM23306	2	137	2.8	3	3	3
	MDM23306	3	146	2.6	3	3	3
	MDM23306	7	115	1.7	2	2	2
	MDM23306	12	114	1.4	2	2	2
5/15/2023	MDM23314	1	111	1.8	1	1	1
	MDM23314	2	132	2.3	2	2	2
	MDM23314	3	97	1.0	2	2	2
	MDM23314	6	147	3.0	3	3	3
	MDM23314	8	129	2.6	3	3	3
5/22/2023	MDM23321	1	137	2.8	3	3	3
	MDM23321	2	117	1.4	2	2	2
	MDM23321	5	152	3.5	4	3	3
	MDM23321	6	108	0.9	2	2	2
	MDM23321	7	99	1.2	2	2	2
5/29/2023	MDM23328	1	92	0.7	1	1	1
	MDM23328	2	154	4.0	3	3	3
	MDM23328	3	101	1.2	2	2	2
	MDM23328	4	123	1.8	2	2	2
	MDM23328	5	116	1.6	2	2	2
6/5/2023	MDM23335	1	103	1.2	1	1	1
	MDM23335	2	117	1.5	2	2	2
	MDM23335	3	140	4.0	4	4	4
	MDM23335	4	99	1.2	1	1	1
	MDM23335	6	130	2.2	3	3	3
6/12/2023	MDM23342	1	90	0.8	1	1	1
	MDM23342	2	110	1.1	2	2	2
	MDM23342	3	137	3.0	3	3	3
	MDM23342	4	106	1.4	2	1	1
	MDM23342	5	127	1.9	2	2	2
6/19/2023	MDM23349	2	132	2.4	3	3	3
	MDM23349	3	94	0.8	1	1	1
	MDM23349	5	124	2.4	3	3	3
	MDM23349	6	91	0.7	1	1	1
	MDM23349	7	131	2.6	3	3	3

Date	Collection #	Eel #	Length (mm)	Weight (g)	Age 1-ERS	Age 2-CAF	Consensus
6/26/2023	MDM23356	1	134	2.8	3	3	3
	MDM23356	3	120	2.4	2	2	2
	MDM23356	4	99	0.8	1	1	1
	MDM23356	5	150	3.4	4	3	3
	MDM23356	6	104	1.4	1	1	1
7/3/2023	MDM23363	1	135	3.2	3	3	3
	MDM23363	2	112	1.4	NR	NR	NR
	MDM23363	3	134	3.0	3	3	3
	MDM23363	4	98	0.9	1	1	1
	MDM23363	5	101	1.2	1	1	1
7/10/2023	MDM23370	2	120	1.8	2	2	2
	MDM23370	3	107	1.3	1	1	1
	MDM23370	4	102	1.2	1	1	1
	MDM23370	6	115	1.7	2	2	2
	MDM23370	7	94	1.1	1	1	1
7/17/2023	MDM23377	2	118	1.9	2	1	1
	MDM23377	6	122	1.8	2	2	2
	MDM23377	23	100	0.9	2	2	2
	MDM23377	24	122	1.2	2	2	2
	MDM23377	25	99	0.9	1	1	1
7/24/2023	MDM23384	1	132	2.0	3	3	3
	MDM23384	2	136	2.5	3	3	3
	MDM23384	3	106	1.6	2	2	2
	MDM23384	4	107	1.3	2	2	2
	MDM23384	5	126	1.6	3	3	3
7/31/2023	MDM23391	3	108	1.2	2	2	2
	MDM23391	4	112	1.0	2	2	2
	MDM23391	5	103	1.1	1	1	1
	MDM23391	6	98	0.8	1	1	1
	MDM23391	7	115	1.1	2	2	2
8/7/2023	MDM23398	21	135	2.0	3	3	3
	MDM23398	22	106	1.0	2	2	2
	MDM23398	23	103	1.3	1	1	1
	MDM23398	24	123	1.3	3	3	3
	MDM23398	25	128	2.2	2	2	2

Date	Collection #	Eel #	Length (mm)	Weight (g)	Age 1-ERS	Age 2-CAF	Consensus
8/14/2023	MDM23405	1	99	1.5	1	1	1
	MDM23405	2	126	2.3	2	2	2
	MDM23405	4	98	1.1	NR	NR	NR
	MDM23405	5	111	1.7	1	1	1
	MDM23405	6	101	0.8	1	1	1
8/21/2023	MDM23412	1	97	0.8	2	2	2
	MDM23412	2	128	2.2	2	2	2
	MDM23412	3	105	1.1	2	2	2
	MDM23412	4	140	3.1	3	3	3
	MDM23412	5	115	1.6	2	2	2
8/28/2023	MDM23419	21	98	1.1	2	2	2
	MDM23419	22	97	1.0	1	1	1
	MDM23419	23	133	2.4	3	3	3
	MDM23419	24	136	2.1	3	3	3
	MDM23419	25	112	1.8	2	2	2
9/4/2023	MDM23426	1	117	1.6	2	2	2
	MDM23426	2	110	1.4	2	2	2
	MDM23426	3	147	2.6	3	3	3
	MDM23426	4	125	2.3	2	2	2
	MDM23426	5	132	2.4	3	2	2
9/11/2023	MDM23433	1	124	1.6	3	3	3
	MDM23433	2	115	1.8	NR	NR	NR
	MDM23433	3	140	2.5	3	3	3
	MDM23433	4	134	2.5	3	3	3
	MDM23433	5	114	0.9	2	2	2
9/14/2023	MDM23436	1	119	1.4	2	2	2
	MDM23436	2	107	0.9	2	2	2
	MDM23436	5	126	2.1	3	3	3
	MDM23436	6	112	1.3	2	2	2
	MDM23436	7	121	1.5	3	2	2

Appendix B:
Weekly Biological Data and Environmental Conditions for Conowingo West Eel Collection Facility, 2017-2023

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)

2021 Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Octoraro Eels	0	5	9	13	29	77	1050	1201	21	238	519	14925	154	4836	452
Conowingo Eels	5	44640	15851	17528	42848	29424	23335	18176	2711	5659	75609	63442	59128	50982	26007
Creek flow (cfs) (wk avg)	19500	57229	78400	37500	20071	28114	26786	22114	15314	73371	67429	30057	17900	13486	51014
Lunar Fraction (wk avg)	0.76	0.35	0.05	0.52	0.96	0.49	0.04	0.39	0.94	0.64	0.09	0.26	0.89	0.77	0.18
Water temp (°C) (wk avg)	14.00	15.93	13.39	15.13	20.71	20.43	22.90	24.81	24.91	26.41	27.96	27.89	24.94	24.93	25.91
Dissolved Oxygen (mg/L) (wk avg)	9.30	10.02	9.89	10.53	9.01	8.45	8.45	7.50	7.35	7.30	9.18	8.84	8.24	7.66	7.54

2021 Week (cont.)	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Octoraro Eels	112	2920	17350	1319	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Conowingo Eels	12628	3747	19265	58774	23814	14170	29424	23335	18176	2711	5659	75609	63442	59128
Creek flow (cfs) (wk avg)	51571	16880	26843	62671	51843	23525	28114	26786	22114	15314	73371	67429	30057	17900
Lunar Fraction (wk avg)	0.16	0.81	0.88	0.31	0.09	0.57	0.49	0.04	0.39	0.94	0.64	0.09	0.26	0.89
Water temp (°C) (wk avg)	26.64	28.19	25.67	24.19	20.57	22.03	20.43	22.90	24.81	24.91	26.41	27.96	27.89	24.94
Dissolved Oxygen (mg/L) (wk avg)	7.71	7.02	7.28	7.83	8.33	8.04	8.45	8.45	7.50	7.35	7.30	9.18	8.84	8.24

2022 Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Octoraro Eels															
Conowingo Eels	796	8621	13336	12834	9313	8616	959	1832	555	10074	4862	11221	17245	3441	1286
Creek flow (cfs) (wk avg)	46429	110314	45314	32014	2206	20214	21600	15100	14643	10203	7320	6839	6216	6264	6143
Lunar Fraction (wk avg)	0.17	0.77	0.88	0.25	0.08	0.64	0.94	0.38	0.04	0.49	0.096	0.52	0.05	0.36	0.93
Water temp (°C) (wk avg)	13.8	14.2	17.8	21.3	22.7	24.8	24.3	23.6	24.6	26.7	27.4	28.4	29.4	29.0	29.4
Dissolved Oxygen (mg/L) (wk avg)	10.45	10.43	9.09	7.67	8.11	7.72	7.96	7.39	6.82	6.80	7.34	6.66	6.24	6.90	6.79

2022 Week (cont.)	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Octoraro Eels				4240	46	91	272	1526	175	646	78	26	49	10	0
Conowingo Eels	1768	4612	838	747	11478	7353	3631	1035	665	2514	73	69	23	1	0
Creek flow (cfs) (wk avg)	4656	6147	5596	17724	20200	11513	14329	18829	15371	12971	9641	8809	8433	59357	41200
Lunar Fraction (wk avg)	0.667	0.103	0.234	0.871	0.8	0.202	0.137	0.787	0.9	0.344	0.074	0.672	0.96	0.507	0.138
Water temp (°C) (wk avg)	28.5	28	28.4	27.5	24.8	24.1	21.6	17.3	15.5	15.5	15.1	14.8	16.5	11.4	7.3
Dissolved Oxygen (mg/L) (wk avg)	6.88	6.76	6.91	6.95	7.97	8.02	8.73	9.72	10.39	10.25	10.33	9.42	9.29	10.16	12.9

2023 Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Octoraro Eels	493	2812	1767	7503	844	417	447	1216	1246	9471	35387	184	82	117	61
Conowingo Eels	33	2441	24747	6310	3119	3493	879	928	4499	37844	69566	20518	5805	1110	395
Creek flow (cfs) (wk avg)	126533	53429	25271	15829	10939	8203	10354	11614	14443	21743	25400	21829	21657	18029	19757
Lunar Fraction (wk avg)	0.96	0.73	0.09	0.27	0.85	0.82	0.17	0.15	0.74	0.90	0.28	0.07	0.61	0.94	0.41
Water temp (°C) (wk avg)	12.0	14.9	19.3	20.5	22.2	24.2	24.2	23.9	24.4	26.4	28.1	28.6	28.3	27.5	27.0
Dissolved Oxygen (mg/L) (wk avg)	10.53	9.67	9.08	8.97	8.95	8.01	7.32	7.92	7.67	7.57	7.61	7.20	7.86	7.74	7.64

2023 Week (cont.)	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Octoraro Eels	35	15	0	9	7	-	-	-	-	-	-	-	-	-	-	-
Conowingo Eels	142	4047	11624	2907	5658	2092	406	4069	4118	133	25	76	42	4	5	0
Creek flow (cfs) (wk avg)	37429	41557	28129	18071	30200	21900	25757	16300	20929	21614	17871	21729	20400	13914	24396	35250
Lunar Fraction (wk avg)	0.04	0.46	0.95	0.55	0.055	0.323	0.923	0.701	0.121	0.203	0.851	0.830	0.236	0.112	0.751	0.997
Water temp (°C) (wk avg)	26.6	24.0	24.5	25.3	26.1	22.7	19.8	19.2	19.6	16.2	14.1	14.2	12.5	11.6	11.0	7.9
Dissolved Oxygen (mg/L) (wk avg)	8.18	8.57	8.17	8.16	7.95	8.71	9.11	9.32	8.78	10.61	10.20	10.13	10.38	10.52	10.98	11.76

Appendix C:
Fish Health Inspection Report, Conowingo West Eel Collection Facility, 2023

DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service
FISH HEALTH INSPECTION REPORT[1]

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

Fish Source & Facility Contact	Fish Examined	Water Supply[2]	5 year facility classification
Octoraro Creek/Stone Run, MD (trib of Susquehanna, below Connowingo Dam) Michael Martinek, collector, Normandeau Associates, Inc	☐ Hatchery ☑ Wild	☑ Unsecured: Open Spring, Stream ☐ Secured: Well, sterilized	Last sample date / Classification 1 03/06/2023 2 03/16/2022 3 03/15/2021 4 03/26/2020 5 03/19/2019

Species[3]	Lot Identity	Age[4]	# in lot	Eggs (E) or fish (F) Obtained From	Pathogens inspected[3] & results[5]												
					EI	AS	YR	RS	MC	IH	IP	IS	LM	OM	SV	VH	A	B
AME	2023 collection	y	wild stock	(F) Octoraro Creek, MD	40	40	40			60	60			60		60	60	
					--	--	--	NT	NT	--	--	NT	NT	--	NT	--	+	

Remarks[6]: Lab Case 23-103; AME = American eel; A = swimbladder nematode (Anguillicola crassus)

Inspecting Biologist Signature: Gavin Glenney
Print: Gavin Glenney Date: 05/09/2023

Concurred (signature & title): John Coll Path Leader LFHC
Print: John Coll Date: 05/09/2023

Lamar Fish Health Center
400 Washington Ave; PO Box 155
Lamar, PA 16848
(570_726-6611

[1] Done in accordance with the AFS Fish Health Section Bluebook *Suggested Procedures for the Detection and Identification of Certain Finfish and Shellfish Pathogens* and the U.S. Fish and Wildlife Service Fish Health Policy 713 FW 1-5. [2] Secure = free of all aquatic pathogens or sterilized, Unsecured = aquatic pathogens may be present. [3] FWS abbreviations (see back of this page). [4] For hatchery fish give age in months; for feral fish, use symbols: e=eggs or fry; f=fingerling; y=yearlings; b=older fish. [5] Findings reported as number examined over results; (-) = undetected, (+) = positive, and NT= not tested, A,B = other pathogens as listed in remarks [6] Additional remarks can be made on back page.

DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service
FISH HEALTH INSPECTION REPORT[1]
This report is NOT evidence of future disease status. To determine status, contact the inspecting biologist below.

Additional Inspection Information
Laboratory Case Number:

23-103 received March 7, 2023. Collection of 60 American eels occurred on 3/06/23 by Michael Martinek.

Bacterial cultures - primary inoculum from kidney onto Brain Heart Infusion Agar (BHIA), negative for AS, YR, EI. 35 fish were of adequate size to obtain kidney inoculum for bacterial sampling.

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 an incidence of 45% (27/60), typical level as reported in previous years.

Previous sampling and testing of American Eels in this watershed consisted of Octoraro Creek/Stone Run (2022); Stone Run (2021); Herring Run (2020, 2019); Octoraro Creek (2018, 2017); Susquehanna River (2016, 2015); and Octoraro Creek (2014, 2013, 2012, 2011, 2010).

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

Appendix D:
Chain of Custody Sheet, Conowingo West Eel Collection Facility, 2023

NORMANDEAU
environmental consultants

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

Date: 9-5-23 **Time:** 9:20

No. of eels provided from CECF Collection Tank: 300

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: ____________

SIGNATURES:

Normandeau/Exelon Representative: [signature]

Agency Representative: [signature]

Agency (circle one): USFWS PADEP PFBC SRBC (circled) MDNR

Appendix E:

Agency Comments on Draft 2023 Conowingo West Eel Collection Report, May 1-November 27, and Comments on the Revision 1 of the 2023 Conowingo West Eel Collection Report, September 16-November 27

2023 Conowingo West Eel Collection Facility Report (May 1- November 27) Comments Received by Resource Agency and Date	
Resource Agency	**Date of Receipt by Constellation**
Susquehanna River Basin Commission	January 29, 2024
Pennsylvania Fish and Boat Commission	No Comments Received
United States Fish and Wildlife Service	December 18, 2023
Maryland Department of the Environment Maryland Department of Natural Resources	January 12, 2024
Pennsylvania Department of Environmental Protection	December 18, 2023

Responses to Resource Agency Comments for the MDE Conowingo West Eel Collection Report, 2023

SRBC
- No Comment

USFWS
- No Comment

PFBC
- No Comments were received

MDE
- No Comment

PA DEP
- No Comment

Mike Martinek

From: Mike Martinek
Sent: Monday, January 29, 2024 11:46 AM
To: Mike Martinek
Subject: FW: Conowingo West Eel Collection report (MDE version)

From: Henning, Aaron <ahenning@srbc.gov>
Sent: Monday, January 29, 2024 11:40 AM
To: Mike Martinek <mmartinek@normandeau.com>
Subject: RE: Conowingo West Eel Collection report (MDE version)

SRBC has no comments on that study.

From: Mike Martinek <mmartinek@normandeau.com>
Sent: Monday, January 29, 2024 11:37 AM
To: Henning, Aaron <ahenning@srbc.gov>
Subject: Conowingo West Eel Collection report (MDE version)

Hello Aaron,
I was wondering if SRBC had any comment to the MDE (full season) CWECF report for 2023.
I have received emails from the other agencies, but was waiting on SRBC to full complete this report.

Thanks,
Mike

Michael Martinek
Senior Fisheries Scientist
Normandeau Associates, Inc.
1854 Lancaster Pike, P.O. Box 111
Peach Bottom, PA 17563
717-207-8846 (direct) 410-937-6461 (cell)
mmartinek@normandeau.com

Mike Martinek

From: Mike Martinek
Sent: Friday, January 12, 2024 8:51 AM
To: Mike Martinek
Subject: FW: [EXTERNAL] Conowingo West Eel Collection Facility (MDE/FOMP) draft Report for the period May 1 through November 27

From: Eyler, Sheila <sheila_eyler@fws.gov>
Sent: Monday, December 18, 2023 6:49 AM
Subject: Re: [EXTERNAL] Conowingo West Eel Collection Facility (MDE/FOMP) draft Report for the period May 1 through November 27

Mike et al.,

Thank you for the opportunity to review the Conowingo West Eel Collection Facility (MDE/FOMP) draft report for 2023. The Service has no comments on this report.

Sheila Eyler
U.S. Fish and Wildlife Service
Mid-Atlantic Fish & Wildlife Conservation Office
717-387-2117

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Mike Martinek

From: Mike Martinek
Sent: Friday, January 12, 2024 12:30 PM
To: Mike Martinek
Subject: FW: Conowingo West Eel Collection Facility (MDE/FOMP) draft Report for the period May 1 through November 27

From: David Seaborn -MDE- <david.seaborn@maryland.gov>
Sent: Friday, January 12, 2024 12:29 PM
Subject: Re: Conowingo West Eel Collection Facility (MDE/FOMP) draft Report for the period May 1 through November 27

CAUTION: This email originated from outside your organization. Exercise caution when opening attachments or clicking links, especially from unknown senders.

Hello,

Maryland Department of Natural Resources and Maryland Department of the Environment have no comments on this report.

Thank you,

David Seaborn

David Seaborn, Ph.D.
Deputy Program Manager, Wetlands and Waterways Protection Program
Water and Science Administration
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, Maryland 21230
david.seaborn@maryland.gov
410-537-4465 (O)
443-621-1009 (C)
Website | Facebook | Twitter

Click here to complete a three question customer experience survey.

Mike Martinek

From:	Mike Martinek
Sent:	Friday, January 12, 2024 8:51 AM
To:	Mike Martinek
Subject:	FW: [External] Conowingo West Eel Collection Facility (MDE/FOMP) draft Report for the period May 1 through November 27

From: Eberts, Ron <reberts@pa.gov>
Sent: Monday, December 18, 2023 10:01 AM
Subject: RE: [External] Conowingo West Eel Collection Facility (MDE/FOMP) draft Report for the period May 1 through November 27

Andrea,

PADEP has received (12/14/2023) and reviewed the attached Conowingo West Eel Collection Facility (MDE/FOMP) DRAFT report for 2023. PADEP has no comments.

Thank you for the opportunity to review and comment.

Ronald C. Eberts, Jr. | Environmental Protection Compliance Specialist
Department of Environmental Protection
Southcentral Regional Office
Waterways & Wetlands Program
909 Elmerton Avenue | Harrisburg, PA 17110
Phone: 717.705.4819| Fax: 717.705.4760

THE SOUTHCENTRAL REGIONAL OFFICE AFTER HOURS REPORTING & 24 HOUR EMERGENCY RESPONSE NUMBER: 1-800-541-2050.

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