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ENVIRONMENTAL CONSULTANTS

Muddy Run Pumped Storage Project and Conowingo Hydroelectric Project Conowingo West Eel Collection Facility, 2022

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).

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 2022. 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).

The Conowingo License addresses American Eel passage in Article 414, Article 415, and Appendix 1 (United States Department of the Interior Modified Fishway Prescription for the Conowingo Hydroelectric Project). Paragraph (a) of Conowingo License Article 414, *Additions to the American Eel Passage Prescription*, directs Constellation to operate the existing CWECF and extends the operating season of the CWECF described in the Eel Plan from May 1 until mean daily water temperature, as determined by hourly readings at Constellation's monitoring station 643 (located 0.6 mile downstream of Conowingo Dam), is 10° Celsius (C) or less for three consecutive days. This schedule is in line with the Joint Offer of Settlement and Explanatory Statement between Constellation and MDE. Conowingo License Article 415, *American Eel Passage and Restoration Plan*, required Constellation to prepare an American Eel Passage and Restoration Plan (EPRP) in consultation with the USFWS, MDE, and other members of EPAG. Constellation filed the final EPRP with FERC on September 16, 2021. This 2022 report discusses the results of the operation of the CWECF during the 2022 collection season required by Conowingo License Articles 414 and Article 415. Additionally, Conowingo License Article 401 and Appendix 1 require Constellation to prepare a Fishway Operations and Maintenance Plan (FOMP) annual report including American Eel operations. This report fulfills the FOMP annual report requirements for American Eel operations.

Specifically, the objectives of the 2022 collection season were to:

> 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 April 30, 2022, and operated for a total of 204 consecutive days from May 1 to November 20. A total of 139,798 juvenile eels were collected at the CWECF. Daily juvenile eel collections were greater than 1,000 individuals on 22.4% (46 days) of the 204days of operation. The greatest number of juvenile eels collected in a single day occurred on July 8, 2022, when the CWECF collected 4,158 eels or 3.0% of the total season catch. Collectively, eels collected between May 20 through 22, June 3 through 6, July 7 through 10, July 20 through 22, July 25 through 28, and September 14 through 16 accounted for 42.5% (59,347 of 139,798) of the total eels collected in 2022. These six peak periods, totaling 21 days, accounted for only 10.3% of the 2022 operational period. Volumetric estimations were used to quantify the number off eels collected on 34 days or 16.7% of the operational period 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 996 juvenile eels. Lengths of juvenile eels ranged from 65-176 millimeter (mm) with an average length of 114.3 mm. The average weight of juvenile eels was 1.7 grams (g) and ranged from 0.3-4.3 g. Only seven of the 966 eels (0.7%) showed any form of external injury (condition factor) such as lacerations, abrasions, scrapes, or hemorrhage.

Over 10% (101 of 966) of the eels sampled were examined internally for presence of the eel swim bladder parasite *Anguillicoloides crassus*. Parasites were found in 54 (53.5%) of the 101 examined eels. The number of parasites per eel ranged from one to three. Ninety-nine of these eels were examined for age, and it was determined that the average age was 2.4 years old with a range of 1-4 years old.

The CWECF collected a total of 139,798 juvenile eels in 2022 with a total collection mortality rate of 0.04% (53 individuals) in the collection tank. Constellation examined 101 eels for biological analysis. A total of 216 (0.44%) juvenile eels were recovered dead from the holding tanks over the entire season. The Susquehanna River Basin Commission (SRBC) removed a total of 270 juvenile eels, including 165 individuals on September 6, 85 individuals on September 7, 10 individuals on September 13, and 10 individuals on September 27, 2022, for an “Eels in the Classroom” program. A total of 3,465 juvenile eels were removed by The State University of New York (SUNY) on July 27, 2022, and used for research purposes. Additionally, 879 eels were used for testing the efficiency of the CWECF, of which 175 were transported from this facility.

Eels were held no longer than one week prior to transport from the CWECF. A combined total of 142,148 eels from CWECF and the OCEF were transported to designated locations in the Susquehanna River watershed. Shikellamy State Park (Site 7) was stocked with 55,871 juvenile eels. City Island Boat Ramp (Site 12) received a stocking of 28,784 juvenile eels. Fort Hunter Access (Site 6) received a stocking of 28,715 juvenile eels. West Fairview Access (Site 5) was stocked with 28,743 eels. A total of 35 (0.02%) juvenile eels died during the 113 transport trips from the CWECF in 2022. Daily transports occurred from July 7 to October 2 due to elevated water temperatures. Biweekly transports occurred from May 1 through July 6 and from October 4 until November 1, then weekly

transports occurred until the last transport on November 21, 2022. No eels were collected during the last week of operation at the CWECF from November 13-20.

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). 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)[1]. Constellation designed, installed, and began operation of the CWECF in 2017 and has operated this facility each year through 2022. 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).

The Conowingo License addresses American Eel passage in Article 414, Article 415, and Appendix 1 (the United States Department of the Interior (DOI) Modified Fishway Prescription for Conowingo Hydroelectric Project). Paragraph (a) of the Conowingo License Article 414, *Additions to the American Eel Passage Prescription*, directs Constellation to operate the existing CWECF and extends the operating season of the CWECF as described in the Eel Plan starting May 1 until mean daily water temperature, as determined by hourly readings at Constellation's monitoring station 643 (located 0.6 mile downstream of Conowingo Dam), is 10° Celsius (C) or less for three consecutive days. This schedule is in line with the Joint Offer of Settlement and Explanatory Statement of Constellation Energy Generation, LLC, and The Maryland Department of the Environment. Conowingo License Article 415, *American Eel Passage and Restoration Plan*, required Constellation to prepare an American Eel Passage and Restoration Plan (EPRP) in consultation with the USFWS, MDE, and other members of EPAG. Constellation filed a final plan with FERC on September 16, 2021. This 2022 report discusses the results of the operation of the CWECF during the 2022 collection season required by Conowingo License Articles 414 and Article 415.

Additionally, Conowingo License Article 401 and Appendix 1 require Constellation to prepare a Fishway Operations and Maintenance Plan (FOMP) annual report including American Eel operations. The 2022 CWECF operating season followed the FERC-approved FOMP dated January 24, 2022. This report fulfills FOMP annual report requirements for American Eel operations.

[1] 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.

Specifically, the objectives of the 2022 CWECF operations in the FOMP were to:

Operate, maintain, and monitor the eel collection and holding facility (daily) from May 1 until mean daily water temperature is 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 made 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, and 2022). 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 2022 season 1,333,974 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 2022 CWECF was identical to the one used since 2017 (Normandeau Associates, Inc. 2018, 2019, 2020, 2021, and 2022). 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 28, 2022, 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 April 30, 2022.

Post-season Maintenance

After the season ended on November 20, 2022, 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 2022 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 2017-2021 and described in the EPRP (Normandeau Associates, Inc. 2018, 2019, 2020, 2021 and 2022).

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, 2022, when Station 643 was taken out of service and DO was recorded from the tailrace using a bucket and a YSI water quality meter.

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 wetted 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 2022 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 and 2022). 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 and 2022).

4 Results

The CWECF commenced operation on May 1, 2022, and operated continuously until November 20, 2022, 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 Conowingo FERC License. This facility operated for 204 days and collected a total of 139,798 juvenile eels during the 2022 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 139,798 juvenile eels were captured at the CWECF during the 2022 season. Counts (either estimated or actual) were recorded daily. Volumetric estimates were taken from the CWECF on 34 of the 204 days of operation (16.7% 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 92 to 182 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 139.4 eels with a median of 143 eels.

The highest single-day collection of 4,158 juvenile eels occurred on July 8, when 3.0% of the total number of eels collected in 2022 were captured (Table 4.0-1 and Figure 4.1-1). For the 2022 season, daily collections of eels were greater than 1,000 individuals on 46 days, or 22.4% of the time (Table 4.0-1).

Of the 139,798 juvenile eels that were captured at the CWECF, 53 eels died in the collection tank (0.04% 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 966 juvenile eels (0.7% of the seasonal catch) were evaluated from these biweekly subsamples during 40 of the 138 sample days during this period (Table 4.2-1).

The average length of juvenile eels was 114.3 mm and the median was 114.0 mm (Table 4.2-1). The length of juvenile eels ranged from 65-176 mm. One hundred seventy-one juvenile eels (17.7%) 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 0.3-4.3 g (Table 4.2-2). Greater than 85% of the 966 juvenile eels weighed between 1.0-3.0 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 0.7% (7 of 966 individuals) of the examined eels. All injuries were documented as hemorrhages, abrasions, scrapes, or lacerations. Two eels were observed with hemorrhages, two eels showed

abrasions, two eels had scrapes, and one showed a laceration. 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. Greater than 10% (101 of the 966 individuals) were dissected for the parasite analysis and later examined for age (Tables 4.3-1 and 4.3-2).

Of the 101 juvenile eels that were inspected for the parasite, 47 (46.5%) eels were uninfected (Table 4.3-1 and Normandeau Associates, Inc. 2018, 2019, 2020, 2021 and 2022). The other 54 (53.5%) eels were infected by the swim bladder parasite. The infected eels contained one, two or three parasites per individual (40, 11, and 3 eels, respectively). Table 4.3-2 provides detailed information by length frequency (five mm interval groups) of the 101 examined eels with information including weight, age, and number that were infected by the parasite. The average length of a sacrificed eels was 116.6 mm (range: 82-176 mm), the average weight was 1.8 g (range: 0.6-4.3g), and the average number of parasites was 0.7 (range: 0-3; Table 4.3-1).

Age of the juvenile eels was determined from 99 eels; two additional eel otoliths could not be read for aging. The 99 juvenile eels analyzed for age were determined to be ages 1-4 (average age = 2.37 Table 4.3-1). Detailed information of the 99 aged eels is shown on Table 4.3-1 and Appendix A. Of the 99 aged eels, 8 eels (8.1%) were age 1, 53 eels (53.5%) were age 2, 31 eels (31.1%) were age 3, and 7 eels (7.1%) were age 4. Age agreement between Normandeau biologists (a quality control measure) occurred 100% (99 of the 99 eels) of the time (Appendix A). The average length of the aged eels was 116.6 mm (range: 82-176 mm), the average weight was 1.8 g (range: 0.6-4.3 g), and the average number of parasites was 0.7 (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 13 (July 24-30) when the CWECF collected 12.34% (17,245 individuals) of the season total (Table 4.4-1 and Figure 4.4-1). Week 3 (May 15-21) and Week 4 (May 22-28) were the only other weeks during the 2022 season when greater than 9% of the season total (9.54 and 9.18%, respectively) were collected. These peak weeks of collection combined accounted for a substantial proportion of the juvenile eels caught in 2022 (31.1% or 43,415 individuals; Table 4.4-1 and Figure 4.4-1).

Eel collections during Weeks 1, 7, 9, 15, 18, 19, 23, 24, and 26-30 each accounted for less than 1.0% of the season total, which cumulatively accounted for 5.0% (7,047 individuals) of the season total (Table 4.4-1 and Figure 4.4-1). Only one individual was collected during the last two weeks of the season (the last eight days of collection), while only 114 individuals were captured during the entirety of the last four weeks of the season (October 24 – November 20).

During the season, there were six large peak periods of collection. A peak period was defined as a period of two or more consecutive days each with a collection of 2,000 or more individuals. The largest peak (July 25-28, 4 days) yielded 9.2% of the season total of collected eels (12,916 of 139,798; Table 4.0-1). Two slightly smaller peaks occurred from June 3-6 (4 days) and July 7-10 (4 days), which accounted for

8.1% (11,277 individuals) and 8.3% (11,543 individuals) of all juvenile eels collected during the entire season, respectively. During the three smaller peaks, the CWECF collected between 4.7 and 6.5% (6,639-9,036 individuals) of all juvenile eels collected, and these peaks occurred from three days each during September 14-16, July 20-22, and May 20-22, respectively. When all six of these peak periods are combined, 42.5% (59,347 individuals) of the juvenile eels collected at the CWECF occurred during these 18 days or 8.8% of the operating days.

Aside from the six peak periods, the CWECF also collected more than 2,000 individuals on five single-day events: May 9 (3,465 eels), May 24 (2,398 eels), May 26 (2,640 eels), August 26 (2,016 eels), and September 23 (2,420 eels). These days are noted but not considered as peak periods as they were only single day occurrences (Table 4.0-1).

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 2022 season. Generally, there was very little variance in the river flow during the 2022 season, so a 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 (173,000 cubic feet per second [cfs]) occurred on May 8, 2022 (Tables 4.0-1 and 4.5-1). The daily average river flow was above the generation capacity of Conowingo (86,000 cfs) on six days during the 2022 season. The lowest daily average river flow (3,750 cfs) occurred on August 21, 2022, during which time collections of eels at the CWECF were minimal. The average river flow did not exceed 20,000 cfs during 70.6% of the 2022 season (144 of the 204 days), and flows were less than 10,000 cfs during 40.7% of the season (83 of the 204 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 2022 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 2022 season. The largest peak (July 25-28) of 12,916 eels occurred heading into a new moon period during Week 13 (Table 4.0-1 and Appendix B). The other peaks of the season occurred just before or after a full moon phase in May, June, July, and September (Table 4.5-2 and Figure 4.5-2, Date and Time Website 2021). 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) on May 22, 2022. By this time, the CWECF collected 25,750 eels (18.4% of the season total; Tables 4.0-1 and 4.5-3). Nearly 44% (61,423 of the 139,798 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 30.0° C in mid-August to a low of 7.3° 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 5.57 and 12.9 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 139,798 juvenile eels that were captured at the CWECF, 48,616 eels were held in holding tank(s) prior to being transported upriver, which equates to nearly 35% of the eels captured over the season (Table 4.6-1). Eels were placed into holding tanks on 84 days from May 1 until July 7, 2022, and October 3 until November 14, 2022. 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 2022 eel season.

Eels were typically held in one holding tank during the 2022 season unless the number of eels held was greater than 12,500 eels. When eel holding numbers were greater then 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 216 juvenile eels (0.44% of the held eel total) died in holding (Table 4.6-2). On June 6, a total of 152 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 2,325 eels in the collection tank that day were found dead, and there were 11,004 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 July 7 when water temperature was above 26.0 °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 16, 2022, 59 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 59 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 270 eels were supplied to the SRBC, with 165 individuals on September 6, 85 individuals on September 7, 10 individuals on September 13, and 10 individuals on September 27, 2022, from the CWECF for the "Eels in the Classroom" program. The chain of custody sheets for these events can be found in Appendix D, which relinquishes Constellation's responsibility for these eels.

A total of 3,465 eels were supplied to The State University of New York (SUNY) on July 28, 2022, from the CWECF for stocking a tributary in New York. The chain of custody sheet for this event is 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 142,113 juvenile eels were transported upstream, including eels collected at OCEF (Tables 4.6-2 and 4.7-1). Daily transports occurred from July 7 to October 2, 2022. Biweekly transports occurred prior to and after daily transports from May 1 to July 6 and October 4 until November 1, and weekly transports occurred after November 1 until the last transport on November 21, 2022. No eels were collected during the last week of operation at the CWECF from November 13 through 20.

Eels were transported to Shikellamy State Park, West Fairview Access, Fort Hunter Access, and City Island Boat Ramp (Table 3.6-1). The 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 Shikellamy State Park (Site 7) were completed in approximately three hours (± 30 minutes). Eel transports from the CWECF to Fort Hunter Access (Site 6) were completed in approximately two and a half hours (± 30 minutes). Eel transports from the CWECF to City Island Boat Ramp (Site 12) and West Fairview Access (Site 5) were completed in approximately two hours (± 30 minutes).

Of the 55,875 eels that were transported to Shikellamy State Park (Site 7), 55,871 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-2). This location was stocked nine times from May 10 to October 21. Detailed data from each of the transports are found on Table 4.7-1.

Of the 28,728 eels that were transported to Fort Hunter Access (Site 6), 28,715 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-3). This location was stocked 27 times from June 13 to November 21. Detailed data from each of the transports are found on Table 4.7-1.

Of the 28,788 eels that were transported to City Island Boat Ramp (Site 12), 28,784 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-4). This location was stocked 38 times from May 6 to November 8. Detailed data from each of the transports are found on Table 4.7-1.

Of the 28,757 eels that were transported to West Fairview Access (Site 5), 28,743 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-5). This location was stocked 29 times from June 17 to November 15. Detailed data from each of the transports are found on Table 4.7-1.

Mortality

Mortality during the 103 transport trips from the CWECF at Conowingo Dam totaled 35 eels (0.02%; Table 4.6-2). Four eels died (0.01%) during transports from the CWECF to Shikellamy State Park (Site 7). Thirteen eels (0.05%) died during transports to Fort Hunter Access (Site 6). Four eels (0.01%) died during transports to City Island Boat Ramp (Site 12). Fourteen eels (0.05%) died during transports to West Fairview Access (Site 5).

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 was 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 2022 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 gallons per minutes (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 2022 season: July 22 and September 14. 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 (-0.4%), no further changes to this method were warranted.

6 Conclusions and Discussion

The CWECF captured 139,798 eels compared to the OCEF that captured 7,159 juvenile eels during the 2022 season. The CWECF operated for 204 days (May 1 through November 20) compared to the OCEF which only operated 73 days (September 5 through 10, and September 14 through November 20) with a difference of 131 days. The CWECF captured over three times (21,879 versus 7,159 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 2022 season. Another difference between the two facilities is the entrance of each ramp in relationship to the tailwater. In 2022 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 2022 was consistent with the previous years that Constellation has operated the facility. During the 2022 season, the size range of the juvenile eels caught at the CWECF was 65-176 mm with an average length of 114.3 mm, compared to the size range of 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 2020, 2019, 2018 and 2017, respectively (Table 6.0-1 and Normandeau Associates, Inc. 2018, 2019, 2020, and 2021).

Environmental factors, including lunar fraction and river flow, did not appear to have a measurable effect on the number of eels collected in 2022. The highest daily average river flow value per the USGS gage station occurred on May 8, 2022 (173,000 cfs) and the lowest daily average river flow occurred on August 21, 2022 (3,750 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. In 2022, as in 2021 and 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 2022. Most of the peak collection periods occurred just before or just after the full moon in May, June, July, and September. 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, and 2022 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.

7 References

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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	Susquehanna River	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, 2022

Date	Number of Eels	Date	Number of Eels	Date	Number of Eels	Date	Number of Eels	Date	Number of Eels
5/1/2022	0	6/13/2022	225	7/26/2022	***3,942***	9/7/2022	115	10/20/2022	297
5/2/2022	1	6/14/2022	168	7/27/2022	*2,295*	9/8/2022	25	10/21/2022	259
5/3/2022	7	6/15/2022	89	7/28/2022	*3,469*	9/9/2022	32	10/22/2022	18
5/4/2022	18	6/16/2022	163	7/29/2022	*1,273*	9/10/2022	374	10/23/2022	52
5/5/2022	42	6/17/2022	91	7/30/2022	*1,066*	9/11/2022	908	10/24/2022	9
5/6/2022	79	6/18/2022	83	7/31/2022	709	9/12/2022	1,018	10/25/2022	3
5/7/2022	649	6/19/2022	163	8/1/2022	1,065	9/13/2022	1,430	10/26/2022	0
5/8/2022	755	6/20/2022	200	8/2/2022	693	9/14/2022	**2,316*	10/27/2022	3
5/9/2022	*3,465*	6/21/2022	252	8/3/2022	355	9/15/2022	2,127	10/28/2022	3
5/10/2022	871	6/22/2022	232	8/4/2022	85	9/16/2022	2,196	10/29/2022	3
5/11/2022	438	6/23/2022	338	8/5/2022	101	9/17/2022	*1,483*	10/30/2022	0
5/12/2022	669	6/24/2022	349	8/6/2022	433	9/18/2022	392	10/31/2022	0
5/13/2022	767	6/25/2022	298	8/7/2022	290	9/19/2022	969	11/1/2022	0
5/14/2022	*1,656*	6/26/2022	203	8/8/2022	234	9/20/2022	864	11/2/2022	0
5/15/2022	1,742	6/27/2022	126	8/9/2022	109	9/21/2022	995	11/3/2022	4
5/16/2022	*1,903*	6/28/2022	129	8/10/2022	101	9/22/2022	1,095	11/4/2022	38
5/17/2022	1,057	6/29/2022	30	8/11/2022	145	9/23/2022	2,420	11/5/2022	27
5/18/2022	1,669	6/30/2022	22	8/12/2022	128	9/24/2022	618	11/6/2022	3
5/19/2022	926	7/1/2022	20	8/13/2022	279	9/25/2022	531	11/7/2022	0
5/20/2022	2,894	7/2/2022	25	8/14/2022	1,033	9/26/2022	251	11/8/2022	1
5/21/2022	*3,145*	7/3/2022	91	8/15/2022	196	9/27/2022	247	11/9/2022	4
5/22/2022	*2,997*	7/4/2022	122	8/16/2022	61	9/28/2022	791	11/10/2022	4
5/23/2022	*1,221*	7/5/2022	163	8/17/2022	201	9/29/2022	793	11/11/2022	8
5/24/2022	*2,398*	7/6/2022	507	8/18/2022	55	9/30/2022	555	11/12/2022	3
5/25/2022	*1,772*	7/7/2022	2,441	8/19/2022	89	10/1/2022	463	11/13/2022	1
5/26/2022	*2,690*	7/8/2022	***4,158***	8/20/2022	133	10/2/2022	223	11/14/2022	0
5/27/2022	*986*	7/9/2022	2,592	8/21/2022	33	10/3/2022	58	11/15/2022	0
5/28/2022	*770*	7/10/2022	*2,352*	8/22/2022	18	10/4/2022	9	11/16/2022	0
5/29/2022	782	7/11/2022	570	8/23/2022	39	10/5/2022	7	11/17/2022	0
5/30/2022	636	7/12/2022	434	8/24/2022	309	10/6/2022	188	11/18/2022	0
5/31/2022	488	7/13/2022	717	8/25/2022	815	10/7/2022	345	11/19/2022	0
6/1/2022	389	7/14/2022	346	8/26/2022	*2,016*	10/8/2022	205	11/20/2022	0
6/2/2022	1,665	7/15/2022	273	8/27/2022	1,382	10/9/2022	140		
6/3/2022	*2,113*	7/16/2022	170	8/28/2022	397	10/10/2022	69		
6/4/2022	*3,240*	7/17/2022	389	8/29/2022	103	10/11/2022	27	TOTAL	139,798
6/5/2022	***3,599***	7/18/2022	562	8/30/2022	43	10/12/2022	99		
6/6/2022	2,325	7/19/2022	1,154	8/31/2022	157	10/13/2022	274		
6/7/2022	859	7/20/2022	*2,480*	9/1/2022	99	10/14/2022	34		
6/8/2022	875	7/21/2022	*2,669*	9/2/2022	29	10/15/2022	22		
6/9/2022	593	7/22/2022	**2,787*	9/3/2022	10	10/16/2022	109		
6/10/2022	222	7/23/2022	*1,180*	9/4/2022	7	10/17/2022	753		
6/11/2022	143	7/24/2022	*1,990*	9/5/2022	31	10/18/2022	382		
6/12/2022	140	7/25/2022	*3,210*	9/6/2022	163	10/19/2022	696		

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, 2022

Date	Number of Eels in 200 mL	Date	Number of Eels in 200 mL
5/9/2022	129	7/10/2022	162
5/14/2022	144	7/20/2022	160
5/16/2022	118	7/21/2022	163
5/20/2022	144	7/22/2022	145
5/21/2022	145	7/23/2022	131
5/22/2022	111	7/24/2022	159
5/23/2022	92	7/25/2022	182
5/24/2022	137	7/26/2022	156
5/25/2022	129	7/27/2022	148
5/26/2022	130	7/28/2022	154
5/27/2022	116	7/29/2022	134
5/28/2022	110	7/30/2022	142
6/3/2022	132	8/26/2022	153
6/4/2022	135	9/14/2022	152
6/5/2022	122	9/17/2022	129
6/6/2022	114		
7/7/2022	151	Average	139.4
7/8/2022	154	Median	143
7/9/2022	157	Range	92-182

Table 4.2-1: Number of Juvenile Eels Captured with Length and Weight Measurements, Conowingo West Eel Collection Facility, 2022

	Total
Number eels collected	139,798
Number measured	966
Data Collection Days	40
Range of lengths (mm)	65-176
Average length (mm)	114.3
Median length (mm)	114.0
Range of weights (g)	0.3-4.3
Average weight (g)	1.7
Median weight (g)	1.6

Table 4.2-2: Juvenile Eel Length Frequency, Conowingo West Eel Collection Facility, 2022

Total Length (mm)	Number
65-69	1
75-79	3
80-84	11
85-89	18
90-94	39
95-99	99
100-104	103
105-109	120
110-114	110
115-119	157
120-124	95
125-129	75
130-134	44
135-139	32
140-144	19
145-149	20
150-154	14
155-159	3
160-164	2
175-179	1
Total	**966**

Table 4.2-3: Juvenile Eel Weight Frequency, Conowingo West Eel Collection Facility, 2022

Weight (g)	Number
0.0-0.4	4
0.5-0.9	87
1.0-1.4	297
1.5-1.9	272
2.0-2.4	175
2.5-2.9	78
3.0-3.4	33
3.5-3.9	15
4.0-4.4	5
Total	**966**

Table 4.2-4: Observed Injuries of Juvenile American Eel, Conowingo West Eel Collection Facility, 2022

Date	Length	Weight	Condition Factor
5/12/2022	94	1.5	Mild hemorrhage near urogenital opening
	105	1.5	Abrasion on operculum
	109	1.5	Mild hemorrhage on caudal fin
6/27/2022	96	1.2	Scrape on side
8/4/2022	131	2.9	Laceration
9/5/2022	129	2.4	Scratch on back
9/12/2022	109	0.5	Caudal fin abrasion

Table 4.3-1: Sacrificed Eel Data, Conowingo West Eel Collection Facility, 2022

Date	Length (mm)	Weight (g)	Parasite	Age
5/2/2022	127	2.2	1	2
5/9/2022	132	2.9	1	3
	115	1.7	0	2
	92	0.8	1	2
	109	2.3	0	2
	124	1.8	0	2
5/16/2022	113	1.3	2	2
	118	1.5	1	3
	85	1.1	1	1
	150	3.6	0	4
	108	1.9	0	2
5/23/2022	102	1.2	0	2
	150	3.2	0	4
	110	2.0	0	3
	117	1.9	2	2
	148	3.6	0	4
5/30/2022	115	1.6	0	2
	134	2.4	1	3
	114	1.5	0	2
	141	2.4	0	3
	95	1.1	1	1
6/6/2022	89	0.6	0	1
	133	2.7	0	3
	115	1.7	1	2
	120	1.7	1	3
	108	1.2	0	2
6/13/2022	139	2.6	0	3
	94	0.7	0	1
	176	4.4	0	4
	117	1.6	1	2
	101	1.4	2	2
6/20/2022	103	1.3	1	2
8/1/2022	120	1.8	1	3
	123	1.8	0	3
	124	1.6	1	3
	115	1.4	3	2
	105	0.9	1	2
8/8/2022	136	2.4	1	4
	119	1.8	0	3
	118	1.5	0	2
	145	2.6	0	3
	121	1.7	1	3
8/15/2022	100	1.3	1	2
	122	2.3	1	2
	132	1.8	0	3
	122	2.2	0	3
	116	1.8	1	3
8/22/2022	146	3.8	0	4
	120	2.5	1	NR
	117	4.3	1	2
	122	1.9	2	3
	97	1.0	1	2
8/29/2022	119	2.1	2	2
	132	2.9	3	3
	140	3.3	0	3
	89	0.9	1	2
	115	1.8	1	2
9/5/2022	141	3.1	0	3
	97	1.1	1	2
	111	1.5	0	2
	101	1.0	0	2
	132	2.1	1	3
9/12/2022	114	1.3	2	NR
	120	2.2	0	3

(continued)

Table 4.3-1. (Continued)

Date	Length (mm)	Weight (g)	Parasite	Age
6/20/2022	154	3.5	0	4
	143	2.7	1	3
	99	1.1	2	2
	115	1.8	0	2
6/27/2022	130	2.5	0	3
	119	1.6	0	2
	113	1.2	1	2
	108	0.8	0	2
	135	2.9	2	3
7/4/2022	87	0.7	1	1
	118	1.9	0	2
	100	0.9	2	2
	108	1.3	0	2
	106	1.3	1	2
7/11/2022	109	1.5	0	2
	95	0.8	1	1
	111	1.3	1	2
	123	2.2	1	3
	103	1.4	0	2
7/18/2022	82	1.0	1	1
	123	1.7	1	3
	100	1.6	0	1
	106	1.3	0	2
	124	1.9	1	3
7/25/2022	111	1.4	0	2
	107	1.2	0	2
	111	2.3	1	3
	114	1.4	0	2
	107	1.5	2	2
9/12/2022	106	1.4	0	2
	116	1.8	1	2
	119	1.9	0	2
9/15/2022	101	1.1	1	2
	99	1.1	0	2
	122	2.2	1	2
	118	2.4	0	2
	114	1.7	2	2
Average	116.6	1.8	0.7	2.4
Range	82 - 176	0.6 - 4.3	0 - 3	1 - 4

Total Sacrificed	101
0 Parasites	47 (46.5%)
1 Parasite	40 (39.6%)
2 Parasites	11 (10.9%)
3 Parasites	3 (3.0%)
Eels without parasites	47 (46.5%)
Eels with parasites	54 (53.5%)
Total Aged	99
Year 1	8 (8.1%)
Year 2	53 (53.5%)
Year 3	31 (31.3%)
Year 4	7 (7.1%)
Not Able to be Read (NR)	2 (2.0%)

Table 4.3-2: Sacrificed Eels Length Frequency with Detailed Info, Conowingo West Eel Collection Facility, 2022

TL (mm)	Weight (g)	Number	Contained Parasite	Age
80-84	1.0	1	1	1
85-89	0.6-1.1	4	0,1,1,1	1,1,1,2
90-94	0.7-0.8	2	0,1	1,2
95-99	0.8-1.1	6	0,0,1,1,1,2	1,1,2,2,2,2
100-104	0.9-1.6	9	0,0,0,0,1,1,1,2,2	1,2,2,2,2,2,2,2,2
105-109	0.8-1.8	12	0,0,0,0,0,0,0,0,1,1,2	2,2,2,2,2,2,2,2,2,2,2
110-114	1.2-2.0	11	0,0,0,0,0,1,1,1,2,2,2	2,2,2,2,2,2,2,2,3,3,NR
115-119	1.4-4.3	19	0,0,0,0,0,0,0,0,1,1,1,1,1,1,1,2,2,3,3	2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,3,3,3
120-124	1.6-2.5	15	0,0,0,0,1,1,1,1,1,1,1,1,1,1,2	2,2,3,3,3,3,3,3,3,3,3,3,3,3,NR
125-129	2.2	1	1	2
130-134	1.8-2.9	7	0,0,0,1,1,1,3	3,3,3,3,3,3,3
135-139	2.4-2.9	3	0,1,2	3,3,4
140-144	2.4-3.3	4	0,0,1,1	3,3,3,3
145-149	2.6-3.8	3	0,0,0	3,4,4
150-154	3.2-3.5	3	0,0,0	4,4,4
175-179	4.1	1	0	4
Total		**101**	**101**	**101**

NR – age could not be determined

Table 4.4-1: Juvenile Eel Collection by Week with Associated Ranks, Conowingo West Eel Collection Facility, 2022

	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10
Total	796	8621	13336	12834	9313	8616	959	1832	555	10074
Rank	22	8	2	3	7	9	20	16	25	6
Percent Catch (%)	0.57	6.17	9.54	9.18	6.66	6.16	0.69	1.31	0.40	7.21

	Wk 11	Wk 12	Wk 13	Wk 14	Wk 15	Wk 16	Wk 17	Wk 18	Wk 19	Wk 20
Total	4862	11221	17245	3441	1286	1768	4612	838	747	11478
Rank	11	5	1	14	18	17	12	21	23	4
Percent Catch (%)	3.48	8.03	12.34	2.46	0.92	1.26	3.30	0.60	0.53	8.21

	Wk 21	Wk 22	Wk 23	Wk 24	Wk 25	Wk 26	Wk 27	Wk 28	Wk 29	Wk 30
Total	7353	3631	1035	665	2514	73	69	23	1	0
Rank	10	13	19	24	15	26	27	28	29	30
Percent Catch (%)	5.26	2.60	0.74	0.48	1.80	0.05	0.05	0.02	0.00	0.00

Top 3 ranked weeks are shown in boxes **Week 30 = 1 day**

Wk 1: May 1 - May 7
Wk 2: May 8 - May 14
Wk 3: May 15 - May 21
Wk 4: May 22 - May 28
Wk 5: May 29 - June 4
Wk 6: June 5 - June 11
Wk 7: June 12 - June 18
Wk 8: June 19 - June 25
Wk 9: June 26 - July 2
Wk 10: July 3 - July 9
Wk 11: July 10 - July 16
Wk 12: July 17 – July 23
Wk 13: July 24 – July 30
Wk 14: July 31 - August 6
Wk 15: August 7 – August 13
Wk 16: August 14 – August 20
Wk 17: August 21 – August 27
Wk 18: August 28 – September 3
Wk 19: September 4 – September 10
Wk 20: September 11 – September 15
Wk 21: September 16 – September 22
Wk 22: September 23 – September 29
Wk 23: September 30 – October 5
Wk 24: October 6 – October 12
Wk 25: October 13 – October 19
Wk 26: October 20 – October 26
Wk 27: October 27 – November 5
Wk 28: November 6 – November 12
Wk 29: November 13 – November 19
Wk 30: November 20

Table 4.5-1: Daily Average River flows (cfs), USGS 01576000 – Marietta, PA Gage Station, 2022

Day	May	June	July	August	September	October	November
1	42,100	20,800	12,100	6,700	5,230	13,600	9,290
2	39,300	20,000	11,200	6,930	4,530	13,700	9,060
3	36,700	19,900	10,600	6,440	4,310	13,400	8,280
4	35,700	21,100	9,790	6,090	5,530	14,700	8,340
5	36,300	22,200	10,400	5,840	5,290	16,800	8,430
6	41,600	20,300	10,800	5,810	8,250	22,700	8,480
7	93,300	18,000	10,300	5,380	10,500	26,000	8,080
8	**173,000**	16,600	9,820	6,100	29,300	24,500	7,660
9	166,000	16,600	9,710	6,110	35,700	20,000	7,830
10	126,000	22,400	9,050	6,330	29,500	17,300	7,560
11	96,400	25,400	8,110	6,680	27,000	15,600	8,620
12	83,300	24,200	7,550	6,580	23,200	14,300	10,800
13	69,300	23,600	7,350	5,820	19,200	13,100	30,200
14	58,200	23,400	6,790	5,160	18,600	13,300	87,900
15	52,400	21,000	6,220	5,000	19,200	14,000	82,900
16	48,400	19,100	6,170	4,800	17,800	16,900	65,200
17	45,100	20,600	6,880	4,500	16,400	14,800	54,000
18	44,100	19,300	8,210	4,760	15,300	13,500	49,900
19	43,900	17,200	7,580	4,110	13,400	12,700	45,400
20	42,700	15,200	6,290	4,260	12,700	11,800	41,200
21	40,600	16,200	6,460	3,750	10,800	10,900	
22	38,900	14,600	6,460	4,630	10,000	10,200	
23	38,800	14,100	5,990	6,060	9,030	9,810	
24	34,200	13,400	6,330	6,970	9,360	9,900	
25	31,000	15,000	6,130	7,490	10,200	10,100	
26	28,600	17,900	5,860	7,470	15,200	9,740	
27	26,400	18,100	5,700	6,660	16,300	9,480	
28	26,200	15,800	6,610	7,030	16,100	9,190	
29	26,200	14,300	6,610	6,450	14,500	9,270	
30	23,800	13,100	6,270	5,830	14,400	9,170	
31	22,800		6,040	5,790		9,090	

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, 2022 EST (*1.0 equals full moon*)

Day	May	June	July	August	September	October	November
1	0.008	0.049	0.066	0.156	0.299	0.377	0.583
2	0.035	0.099	0.123	0.239	0.408	0.495	0.695
3	0.081	0.165	0.196	0.336	0.524	0.614	0.795
4	0.143	0.245	0.283	0.443	0.642	0.727	0.878
5	0.218	0.335	0.381	0.557	0.753	0.826	0.941
6	0.304	0.434	0.487	0.671	0.850	0.906	0.982
7	0.398	0.538	0.597	0.779	0.927	0.963	0.999
8	0.497	0.644	0.706	0.872	0.952	0.979	0.997
9	0.599	0.747	0.808	0.944	0.977	0.994	0.994
10	0.699	0.841	0.894	0.965	0.998	0.998	0.967
11	0.793	0.918	0.959	0.986	0.990	0.978	0.922
12	0.876	0.973	0.976	0.998	0.956	0.936	0.860
13	0.943	0.986	0.993	0.978	0.899	0.876	0.785
14	0.964	0.998	0.995	0.930	0.825	0.801	0.700
15	0.985	0.99	0.964	0.860	0.739	0.716	0.608
16	1.000	0.95	0.904	0.774	0.645	0.623	0.51
17	0.983	0.881	0.823	0.678	0.546	0.526	0.411
18	0.935	0.79	0.727	0.577	0.448	0.429	0.314
19	0.859	0.686	0.622	0.475	0.352	0.333	0.221
20	0.762	0.575	0.516	0.377	0.262	0.242	0.138
21	0.652	0.465	0.413	0.285	0.180	0.161	
22	0.537	0.360	0.315	0.201	0.100	0.091	
23	0.423	0.263	0.227	0.129	0.055	0.039	
24	0.316	0.179	0.150	0.071	0.018	0.008	
25	0.221	0.109	0.088	0.029	0.001	0.001	
26	0.140	0.055	0.041	0.006	0.008	0.021	
27	0.076	0.020	0.012	0.003	0.039	0.069	
28	0.031	0.002	0.002	0.021	0.094	0.142	
29	0.006	0.005	0.011	0.061	0.171	0.237	
30	0.001	0.026	0.041	0.122	0.267	0.347	
31	0.015		0.089	0.202		0.465	

Table 4.5-3: Water Temperature (˚C) Recorded in the Collection Tank, Conowingo West Eel Collection Facility, 2022

Day	May	June	July	August	September	October	November
1	12.6	22.8	25.0	28.0	28.4	20.1	14.5
2	12.9	22.8	25.0	28.8	28.3	19.3	14.4
3	12.9	24.0	25.5	28.9	28.3	18.6	14.5
4	14.3	24.7	26.0	29.2	27.4	17.4	15.4
5	14.8	24.6	26.8	29.0	28.4	16.5	15.8
6	14.3	24.7	26.6	29.1	28.1	16.0	16.1
7	14.7	24.2	27.3	29.0	27.0	16.3	16.5
8	14.6	24.8	27.3	29.3	27.9	16.9	17.3
9	12.4	25.0	27.1	29.4	27.7	15.5	16.5
10	12.7	25.1	27.9	29.7	25.9	15.6	16.4
11	13.3	25.2	27.6	29.5	25.6	15.1	16.4
12	14.3	24.7	27.4	30.0	25.2	15.2	16.6
13	15.5	23.9	27.3	29.2	24.4	15.3	15.5
14	16.4	24.0	27.6	29.0	25.1	15.9	14.5
15	17.1	24.2	27.7	28.8	24.7	16.1	11.8
16	17.9	24.0	26.6	28.5	24.4	16.3	11.1
17	18.2	24.4	28.0	28.3	24.5	14.5	9.4
18	18.3	25.0	28.5	28.2	24.8	16.6	8.9
19	19.0	23.4	28.3	28.2	23.9	16.0	8.4
20	14.2	22.9	28.2	28.2	24.3	15.3	7.3
21	19.8	23.0	28.8	28.1	24.8	14.9	
22	20.0	23.4	27.8	27.8	24.7	14.9	
23	22.5	23.4	28.9	27.7	23.8	14.8	
24	21.0	24.6	29.4	27.8	22.5	15.0	
25	21.1	24.2	29.3	28.2	22.4	15.0	
26	21.5	24.3	29.4	28.2	22.0	15.1	
27	21.6	23.8	29.3	28.4	22.4	15.6	
28	21.3	25.4	29.6	28.7	22.0	15.2	
29	21.4	23.6	29.3	28.6	21.6	14.7	
30	21.7	24.9	29.3	28.0	21.0	14.6	
31	21.6		29.7	28.4		14.3	

Table 4.5-4: Dissolved Oxygen (mg/L) Readings from the Control Room (Station 643), Conowingo West Eel Collection Facility, 2022

Day	May	June	July	August	September	October	November
1	11.13	8.93	6.95	6.60	6.79	9.63	9.47
2	10.67	8.87	6.33	7.34	6.79	9.83	9.68
3	10.57	8.70	6.67	7.37	7.51	9.67	8.88
4	10.32	8.70	6.55	7.04	7.52	10.48	8.28
5	10.41	8.61	6.51	6.75	7.21	8.44	9.22
6	10.04	8.32	6.70	6.58	7.10	8.90	9.45
7	10.01	7.50	7.10	6.25	6.88	10.32	10.00
8	10.02	6.69	7.09	6.59	6.20	10.38	9.40
9	10.78	6.48	6.97	7.75	6.65	10.57	9.68
10	10.89	8.16	7.41	6.53	7.11	9.77	8.60
11	10.62	8.30	7.45	6.65	6.98	10.22	8.82
12	10.42	8.59	7.49	6.83	7.58	10.83	9.11
13	10.25	8.38	7.34	6.93	8.20	10.56	9.68
14	10.01	7.77	7.41	6.88	8.52	10.53	9.72
15	9.69	8.10	7.13	6.76	8.61	10.26	9.81
16	9.20	8.09	7.17	6.68	8.51	11.01	10.24
17	9.13	7.50	6.94	7.01	7.40	8.88	10.80
18	9.30	7.31	6.87	6.95	8.55	10.24	10.50
19	9.01	7.71	6.83	6.99	7.47	9.90	10.34
20	8.84	8.11	6.85	6.89	8.31	10.44	12.90
21	8.48	7.91	6.51	6.50	8.00	10.50	
22	8.12	7.15	6.34	6.40	7.79	10.80	
23	7.81	6.72	6.26	6.43	7.87	10.75	
24	8.08	7.10	6.28	6.83	8.12	10.84	
25	7.84	7.02	5.91	6.94	7.76	10.57	
26	7.73	7.19	5.95	7.05	8.61	10.00	
27	7.28	6.80	5.80	7.16	8.56	9.92	
28	6.83	6.98	6.84	7.15	8.35	10.1	
29	6.80	7.95	6.36	7.10	8.51	10.1	
30	6.89	5.57	6.53	6.52	9.67	9.90	
31	7.91		6.61	6.51		10.48	

Table 4.6-1: Number of Juvenile American Eel placed in Holding, Conowingo West Eel Collection Facility, 2022

Day	May	June	July	August	September	October	November
1	-	388	-	-	-	-	
2	1	1665	25	-	-	-	11
3	7	2112	91	-	-	477	9
4	18	3240	117	-	-	-	39
5	42	3599	-	-	-	261	29
6	-	-	505	-	-	188	9
7	649	859	-	-	-	-	3
8	755	875	-	-	-	267	-
9	3460	-	-	-	-	156	6
10	-	221	-	-	-	78	5
11	438	143	-	-	-	-	8
12	669	140	-	-	-	106	29
13	767	-	-	-	-	181	9
14	1656	168	-	-	-	-	1
15	1742	89	-	-	-	69	-
16	-	163	-	-	-	139	-
17	1057	-	-	-	-	801	-
18	1669	83	-	-	-	-	-
19	926	163	-	-	-	767	-
20	2894	-	-	-	-	218	-
21	3145	252	-	-	-	-	
22	-	232	-	-	-	26	
23	1216	338	-	-	-	59	
24	2398	-	-	-	-	30	
25	1772	298	-	-	-	-	
26	-	203	-	-	-	10	
27	986	-	-	-	-	14	
28	770	108	-	-	-	-	
29	782	30	-	-	-	9	
30	631	22	-	-	-	3	TOTAL
31	-		-	-		-	48,616

Table 4.6-2: Eel Transport and Stocking Data, 2022

Parameter	Number of eels	Mortality (No. dead eels by location)			Removed for Analysis	Removed for SRBC or SUNY	Removed for efficiency testing	Number Stocked
		Collection Tank	Holding Tank	Transport Tank				
OCEF Eels Collected	7,159	0 (0.00%)						
OCEF eels Transported to CWECF	7,159			0 (0.00%)				7,159
CWECF Eels Collected	139,798	53 (0.04%)	**216 *(0.44%)***		101	3,735	879[1]	134,814
Total Transported from CWECF	142,148			35 (0.02%)				142,113
Location of stocking								
Shikellamy State Park (Site 7)	55,875			4 (0.01%)				55871
Fort Hunter Access	28,728			13 (0.05%)				28,715
West Fairview Access (Site 5)	28,757			14 (0.05%)				28,743
City Island boat ramp (Site 12)	28,788			4 (0.01%)				28,784

Bolded value is assumed as worst case; the facility (OCEF or CWECF) where dead eels were collected could not be determined
[1]Of the 879 American Eel used for testing; 175 known test eels were eventually transported upriver

Table 4.7-1: Detailed Individual Eel Transport and associated water quality Data, 2022

Transport to Shikellamy State Park (Site 7)

Date	Number of eels stocked	Holding Facility			Transport Tank (Prior to Departure)			Transport Tank (Prior to Stocking)			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
5/10	5,735	913	13.8	9.9	1025	14.0	13.2	1315	14.1	12.3	14.2	10.5
5/16	7,170	949	19.0	8.2	1226	19.6	9.4	1535	19.7	9.4	19.7	9.3
5/22	12,686	916	20.0	7.5	1016	21.6	12.3	1318	22.3	9.7	21.2	9.5
5/26	8,055	815	22.5	6.6	913	22.9	9.6	1235	22.2	15.7	18.6	9.2
5/31	3,636	924	22.9	8.0	935	23.4	11.6	1255	24.3	12.6	25.1	8.8
6/6	13,172	816	24.7	7.9	1017	25.8	13.7	1315	26.0	13.0	23.1	7.5
6/9	2,312	747	25.0	5.7	854	26.2	11.7	1140	26.1	6.9	23.0	7.5
10/18	1,844	745	14.0	9.0	945	13.1	8.8	1244	13.1	10.5	11.6	10.5
10/21	1,261	745	14.2	9.2	935	14.8	13.0	1230	14.7	10.2	10.8	11.2
Total	**52,768**											

Table 4.7-1 (Continued)

Transport to City Island boat ramp (Site 12)

Date	Number of eels stocked	Holding Facility			Transport Tank (Prior to Departure)			Transport Tank (Prior to Stocking)			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
5/6	146	752	15.3	9.5	823	15.0	9.1	1010	14.8	11.2	14.3	10.0
6/20	440	817	24.0	12.1	929	24.6	8.3	1120	24.5	10.0	24.6	8.4
6/27	614	824	24.9	5.9	955	25.5	15.8	1147	25.5	12.6	26.0	7.3
7/7	2,946	815	28.2	8.8	1030	28.3	15.2	1230	28.2	7.3	27.4	8.2
7/10	2,352	851	27.9	8.6	940	29.1	12.9	1151	28.9	11.7	26.5	7.8
7/20	2,480	800	28.2	7.0	900	30.0	17.3	1050	29.9	8.7	28.1	7.2
7/23	1,180	855	29.9	5.3	858	29.9	5.3	1046	30.1	12.6	29.6	7.4
7/25	3,203	939	29.3	6.2	957	30.5	7.1	1141	30.4	12.8	28.8	6.4
7/29	1,273	810	29.3	7.2	900	30.4	11.4	1100	30.0	9.1	27.0	6.3
8/1	1,059	820	28.0	6.7	845	28.2	5.1	1100	23.5	6.1	24.3	8.2
8/8	229	815	29.3	9.8	849	30.1	9.1	1050	29.9	7.0	27.4	8.3
8/11	145	800	29.5	6.7	830	30.0	8.7	1030	24.3	11.4	27.9	7.2
8/15	191	810	28.8	5.2	900	28.9	6.7	1030	27.9	14.1	23.8	6.2
8/16	61	811	28.5	10.0	840	28.3	7.2	1029	26.0	7.8	24.8	7.8
8/18	55	800	28.2	10.3	830	28.9	8.3	1010	28.4	8.0	23.6	6.4
8/19	89	800	28.2	10.0	820	28.4	6.0	1000	27.1	6.5	24.6	6.7
8/20	133	835	28.5	6.1	900	28.3	6.0	1030	28.6	6.1	26.0	6.0
8/25	808	806	28.2	7.0	845	29.1	8.0	1120	29.6	10.2	26.0	5.8
8/28	397	823	28.7	8.2	906	29.8	7.7	1100	29.4	13.2	27.3	7.9
8/29	98	804	28.6	8.5	845	29.3	12.3	1030	29.0	11.2	26.9	6.5
8/31	157	818	28.4	8.4	900	26.5	13.8	1046	27.0	12.5	25.0	6.1
9/1	99	808	28.4	9.0	838	28.4	10.0	1045	27.6	10.4	24.0	4.6
9/2	29	758	28.3	10.2	809	28.5	8.2	1000	27.8	11.6	23.2	5.6
9/3	10	839	28.3	9.4	850	28.5	7.6	1025	26.7	7.6	23.8	6.9
9/4	7	757	28.4	9.4	845	28.6	7.2	1050	28.9	7.4	23.8	7.8
9/5	26	1023	28.4	9.0	1108	28.4	7.8	1330	29.3	7.2	23.7	7.6
9/7	461	950	27.0	8.0	1011	25.0	9.8	1210	24.7	7.3	24.0	6.0
9/9	630	947	27.7	8.5	1001	23.7	14.4	1144	23.2	14.0	24.1	7.7
9/11	908	840	25.6	7.0	930	25.6	6.2	1110	25.4	17.5	22.6	5.7

Table 4.7-1 (Continued)

Transport to City Island Boat Ramp (Site 12; continued)

Date	Number of eels stocked	Holding Facility			Transport Tank (Prior to Departure)			Transport Tank (Prior to Stocking)			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)
9/13	1,420	803	24.4	6.7	930	24.7	6.3	1104	24.5	11.8	23.4	7.6
9/16	2,206	900	24.8	8.6	1022	22.7	7.2	1310	23.4	7.6	22.4	10.4
9/19	980	740	24.8	7.7	941	23.9	16.7	1115	23.8	10.6	23.4	8.0
9/22	1,005	934	24.7	9.3	1003	25.3	8.7	1154	25.3	16.7	22.8	5.6
9/26	169	1012	22.2	8.3	1015	22.2	9.8	1224	27.6	6.4	19.2	8.4
9/27	252	914	22.4	8.4	957	20.6	11.3	1155	20.5	12.3	17.8	9.2
9/28	841	935	22.0	7.9	1030	19.9	9.7	1220	19.9	22.8	17.3	7.9
9/30	615	901	21.0	8.7	939	19.9	10.2	1135	19.7	19.4	10.1	15.9
10/4	792	911	18.0	10.3	950	15.2	14.8	1145	15.1	29.4	13.3	11.1
10/25	136	915	15.9	11.0	950	15.7	12.8	1200	15.8	16.9	14.1	9.0
10/28	27	830	12.9	9.8	930	12.9	10.1	1122	12.8	9.8	12.7	9.7
11/8	112	846	17.3	10.6	930	17.6	9.1	1105	16.4	10.0	14.2	10.4
Total	28,784											

Table 4.7-1 (Continued)

Transport to Fort Hunter Access (Site 6)

Date	Number of eels stocked	Holding Facility			Transport Tank (Prior to Departure)			Transport Tank (Prior to Stocking)			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)
6/13	721	750	25.0	5.5	910	24.1	8.8	1125	25.4	10.3	22.3	9.8
7/1	216	835	25.0	6.5	950	27.1	16.4	1204	27.2	9.1	27.0	7.3
7/5	394	826	26.8	5.8	930	28.4	13.0	1145	28.1	7.2	26.4	7.9
7/8	4,155	800	27.3	7.4	920	28.6	15.9	1100	28.4	7.4	27.1	7.7
7/14	344	825	27.0	9.6	945	29.0	8.5	1145	28.8	8.6	28.0	6.8
7/15	271	850	27.7	9.2	850	28.3	8.6	1050	28.6	8.7	26.6	6.6
7/17	389	855	28.8	6.8	910	28.8	6.8	1100	28.7	5.9	24.7	8.2
7/19	1,154	800	28.3	7.1	845	29.3	7.1	1045	29.3	18.2	26.2	8.6
7/22	2,787	900	27.8	6.3	1030	30.3	12.1	1203	30.3	14.2	30.1	8.6
7/26	3,939	800	29.4	6.5	915	30.6	19.6	1118	30.1	9.0	27.0	8.3
7/31	707	801	29.7	7.7	830	29.3	8.1	1020	29.3	9.4	26.9	7.8
8/3	355	750	28.9	7.6	852	30.1	11.1	1050	29.9	9.6	27.4	6.4
8/5	101	738	29.0	5.6	800	29.3	8.4	1030	28.8	6.9	27.9	5.1
8/7	290	825	29.0	9.3	845	30.0	7.2	1035	29.8	18.6	27.6	9.8
8/9	108	800	29.4	6.2	830	29.4	7.8	1045	25.6	10.8	29.3	5.6
8/12	126	804	30.0	7.8	830	24.2	10.7	1030	23.1	9.9	25.3	8.5
8/14	1,032	815	29.4	7.2	845	29.4	7.2	1055	29.2	6.3	24.7	8.9
8/27	1,382	800	28.4	8.7	839	29.4	12.3	1100	29.3	19.9	27.0	7.3
8/30	43	811	28.0	6.1	840	29.0	6.6	1020	29.5	6.1	27.1	5.8
9/8	2,958	1011	27.9	8.5	1100	23.8	9.6	1248	23.4	15.0	23.3	7.8
9/15	2,216	912	24.7	7.9	1042	26.4	6.2	1328	23.3	12.4	23.2	8.4
9/18	400	930	23.1	7.9	950	23.1	7.7	1145	23.4	5.9	22.7	8.8
9/20	873	847	24.4	7.3	925	24.2	10.1	1115	24.6	15.0	22.3	8.1
9/23	2,436	905	23.8	7.7	1005	23.5	9.4	1155	22.8	11.4	18.3	9.8
10/2	469	900	19.3	9.0	930	17.2	15.2	1125	16.9	25.7	15.1	9.8
10/11	537	907	15.0	8.6	952	14.5	11.9	1200	15.0	17.1	14.4	11.1
10/14	401	850	15.9	9.2	920	15.7	9.4	1130	16.0	13.9	15.2	9.0
11/21	1	1014	7.2	10.6	1030	7.1	10.5	1245	5.6	9.6	5.2	11.7
Total	28,728											

Table 4.7-1 (Continued)

Transport to West Fairview Access (Site 5)

Date	Number of eels stocked	Holding Facility			Transport Tank (Prior to Departure)			Transport Tank (Prior to Stocking)			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)
6/17	501	1042	26.1	5.4	1130	25.3	8.1	1336	25.8	7.9	27.3	7.8
6/24	1,148	845	24.6	8.8	940	25.1	7.6	1125	24.5	11.9	21.5	8.0
7/9	2,591	800	27.1	7.4	856	28.1	19.7	1055	28.3	11.1	25.7	8.3
7/11	565	818	27.6	8.2	936	28.5	9.4	1125	28.5	9.9	23.7	8.7
7/12	428	845	27.4	10.9	923	28.4	12.3	1142	28.5	12.3	26.5	9.8
7/13	717	815	27.3	11.9	1005	28.6	10.1	1100	28.7	8.5	26.5	8.9
7/16	170	751	26.6	6.6	900	29.0	13.5	1030	29.0	8.0	25.0	7.8
7/18	557	934	28.0	6.8	935	29.9	17.1	1154	29.0	11.2	25.3	8.5
7/21	2,664	800	28.8	7.1	850	30.2	11.0	1030	30.0	14.1	27.9	7.6
7/24	1,987	816	29.4	8.3	852	30.5	16.3	1155	30.3	9.0	27.6	7.7
7/27	2,294	800	29.3	8.9	830	30.7	10.9	1046	30.4	8.9	25.8	8.6
7/30	1,064	800	29.3	8.0	845	30.1	14.0	1045	29.8	9.5	24.8	8.1
8/2	692	830	28.8	7.3	900	24.5	12.7	1050	26.6	17.2	25.8	8.1
8/4	84	830	29.2	6.4	845	29.3	7.4	1045	31.1	11.3	27.5	7.2
8/6	432	750	29.1	8.2	825	29.9	6.1	1030	9.2	5.9	26.4	7.2
8/10	101	800	29.7	7.8	835	28.6	6.2	1035	28.5	14.0	27.2	7.3
8/13	279	730	29.2	8.8	850	29.6	10.1	1042	29.4	13.6	22.8	7.6
8/17	201	800	28.3	10.7	830	28.8	9.8	1045	28.7	17.1	23.4	9.2
8/21	33	809	28.1	9.5	835	28.6	6.9	1012	27.6	7.0	25.2	6.9
8/22	13	819	27.8	9.7	914	26.5	7.7	1040	25.3	7.4	25.0	6.9
8/23	39	759	27.7	7.3	815	27.8	6.9	1002	26.0	6.7	22.2	6.0
8/24	309	800	27.8	9.0	900	28.7	5.8	1103	28.8	11.2	23.7	6.9
8/26	2,011	823	28.2	9.5	915	27.8	14.7	1109	25.0	8.8	25.7	7.7
9/10	649	955	25.9	9.2	1000	23.8	9.1	1152	24.0	7.3	21.7	8.3
9/12	813	820	25.2	10.2	920	26.2	11.0	1120	26.1	7.5	20.8	8.7
9/14	2,314	946	25.1	7.0	1145	26.8	10.0	1345	26.4	10.0	23.1	10.2
9/17	1,515	740	22.0	7.3	950	23.7	15.2	1143	23.7	10.8	20.9	8.9

Table 4.7-1 (Continued)

Transport to West Fairview Access (Site 5)

Date	Number of eels stocked	Holding Facility			Transport Tank (Prior to Departure)			Transport Tank (Prior to Stocking)			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)
9/21	1,015	820	21.9	7.6	1045	25.8	8.9	1305	26.8	7.8	23.5	10.8
9/24	632	745	22.5	8.1	939	21.4	9.4	1130	21.1	6.9	16.6	10.5
9/25	554	856	22.4	8.0	921	22.9	10.8	1111	22.4	15.2	17.8	7.7
9/29	866	905	21.6	8.3	1015	21.5	13.7	1208	21.4	17.4	16.1	10.5
10/1	498	840	20.1	8.7	901	20.0	8.1	1042	19.7	12.3	14.7	9.0
10/7	933	830	17.1	9.2	930	15.0	11.8	1121	15.8	14.9	16.1	9.0
11/1	16	810	13.0	9.2	1040	16.2	9.5	1225	17.2	7.2	14.4	10.9
11/15	58	1020	12.6	12.4	1050	12.2	10.2	1245	10.3	10.9	6.5	11.3
Total	28,743											

Table 4.7-2: Constellation's Eel Stocking Totals by Location and Year, 2015 - 2022

Location	2015	2016	2017	2018	2019	2020	2021	2022	TOTAL
Conowingo Creek boat ramp (USFWS request)	847	-	-	-	-	-	-	-	**847**
North Branch Muddy Creek	-	22,004	-	-	-	-	-	-	**22,004**
Conewago Creek	-	378	16,502	-	-	-	-	-	**16,880**
Beaver Creek	-	-	9,738	-	-	-	-	-	**9,738**
Etter's boat ramp	-	-	103,662	-	-	-	-	-	**103,662**
West Fairview Access	-	-	-	22,586	40,950	-	233,593	28,743	**325,872**
Fort Hunter Access	-	-	-	22,348	41,116	-	-	28,715	**92,179**
City Island boat ramp	-	-	-	24,869	41,132	-	231,694	28,784	**326,479**
Bloomsburg boat 0ramp	-	-	-	-	-	109,308	-	-	**109,308**
Lock Haven boat ramp	-	-	-	-	-	109,123	-	-	**109,123**
Wrightsville boat ramp	-	-	-	-	-	19,319	-	-	**19,319**
Columbia boat ramp	-	-	-	-	-	17,660	-	-	**17,660**
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**	**1,392,551**

Table 5.0-1: Specified Operating Ranges of Conowingo West Eel Collection Facility, 2022

	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, 2022

	DATE									
	5/4	**5/11**	5/18	5/25	6/1	6/8	6/15	6/22	6/29	7/6
Collection Tank Fill	24.5	17.5	17.5	20.0	18.0	16.5	12.0	12.0	12.5	14.0
Collection Tank Drain	22.0	17.0	20.0	20.0	21.0	15.5	12.5	12.0	14.5	14.5
Holding Tank #1 Drain	16.0	18.0	22.5	19.0	24.5	11.5	12.5	9.0	11.0	11.5
Holding Tank #2 Drain			20.0	20.0	23.0				7.5	14.0
Holding Tank #3 Drain	26.25	25.25	18.0	22.5	23.0	33.75	49.5	28.5	49.5	18.75
Spray Bar	7.35	6.45	7.0	6.6	6.6	6.3	8.7	8.85	9.0	8.85
Scent line	2.6	1.75	1.75	1.75	1.7	1.75	1.25	1.2	1.6	1.5
Backside of Ramp	0.3	1.25	2.25	1.75	2.7	0.75	1.75	1.2	3.6	2.0
Top Attraction	7.25	5.2	4.75	4.85	4.0	5.55	7.05	7.65	5.4	6.85
Bottom of Ramp Attraction	64.25	70.25	80.5	81.5	91.5	60.75	74.5	49.5	82.5	58.75
Total Attraction	**74.1**	**77.2**	**85.0**	**88.1**	**95.1**	**68.05**	**82.7**	**58.35**	**89.5**	**67.1**

	DATE									
	7/13	7/20	7/27	8/3	8/10	8/17	8/24	8/31	9/6	9/14
Collection Tank Fill	7.5	16.5	17.0	15.15	15.0	11.1	11.7	8.0	14.0	12.0
Collection Tank Drain	7.5	16.5	19.0	17.5	15.0	11.8	14.0	10.3	15.0	13.5
Holding Tank #1 Drain										7.2
Holding Tank #2 Drain	14.0									10.8
Holding Tank #3 Drain	40.5	46.5	56.0	71.67	36.75	10.2	23.25	16.95	51.0	25.5
Spray Bar	8.7	8.4	8.7	8.2	8.55	8.3	8.25	8.85	8.7	8.7
Scent line	1.15	1.8	1.85	1.5	1.3	1.15	0.75	0.7	1.7	1.4
Backside of Ramp	1.15	1.8	3.85	3.85	1.3	1.85	3.05	1.55	2.7	2.9
Top Attraction	7.55	6.6	4.85	4.85	7.25	6.45	5.2	7.3	6.0	5.8
Bottom of Ramp Attraction	62.0	63.0	75.0	89.2	51.75	22.0	37.25	27.25	66.0	58.5
Total Attraction	**70.7**	**71.4**	**81.7**	**95.0**	**60.3**	**29.6**	**43.2**	**36.1**	**73.7**	**64.2**

Table 5.0-2: (Continued)

	DATE								
	9/21	9/28*	10/5*	10/12	10/19	10/26	11/1	11/9	11/16
Collection Tank Fill	15.0	9.68	10.2	16.5	15.9	18.0	15.0	18.0	27.5
Collection Tank Drain	14.5	11.2	12.0	15.5	14.1	18.5	15.0	18.5	26.5
Holding Tank #1 Drain	17.5	9.9	13.0	14.0	12.2	12.0	18.0	15.0	18.5
Holding Tank #2 Drain					23.5	27.75	33.0	22.5	33.75
Holding Tank #3 Drain	33.0	16.5	17.0	28.0	22.6	35.4	48.7	42.3	47.3
Spray Bar	8.6	8.85	8.7	8.85	8.4	8.7	7.95	8.25	8.0
Scent line	1.9	1.45	1.55	1.7	1.95	2.15	1.7	1.9	2.1
Backside of Ramp	1.4	2.97	3.35	0.7	0.15	2.2	1.7	2.4	1.1
Top Attraction	7.2	5.88	5.35	8.15	8.25	6.5	6.25	5.85	6.9
Bottom of Ramp Attraction	65.0	37.6	42.0	57.5	49.8	58.25	66.0	56.0	78.75
Total Attraction	**74.1**	**44.93**	**48.9**	**67.35**	**60.0**	**66.45**	**73.95**	**63.75**	**87.75**
Temporary Ramp Collection tank fill					15.0	13.5	10.4	12.0	10.5
Temporary Ramp Spray bar					7.2	6.8	6.8	6.0	5.55
Temporary tank scent line					3.0	2.5	2.1	1.9	3.4
Temporary tank discharge					14.0	13.0	11.6	12.5	8.25
Backside of temporary ramp					2.0	2.0	3.3	2.4	1.15
Top Attraction					5.2	4.8	3.5	3.6	4.4
Bottom of Temporary Ramp Attraction					36.6	48.4	60.3	54.8	55.55
Total Temporary Ramp Attraction**					**44.8**	**55.7**	**65.9**	**60.3**	**63.35**
Overall Attraction					**104.8**	**122.15**	**139.85**	**124.05**	**151.1**

*Tank flows were reduced to get accurate flow measurement and to calibrate. Flow returned to normal operating condition after calibration was complete.

**Temporary Ramp total attraction is Temporary ramp spray bar, temporary ramp collection tank fill and Holding tank #3 discharge.

Table 5.0-3: Quality Control Checks on Volumetric Estimates, Conowingo West Eel Collection Facility, 2022

Date	Number of eels in:		Displacement of Water	Volumetric Estimate	Actual Counts	Variance (%)
	200 mL	1 L				
7/22/2022	145	725	3.6	2767	2787	-0.72
9/14/2022	152	760	2.9	2356	2316	1.73
Average				**5123**	**5103**	**-0.4**

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, 2017-2022

Year		2017	2018	2019	2020	2021	2022	Average	Total
Eels Collected		122,300	67,949	126,181	254,651	623,095	139,798	222,329	1,333,974
Peak	Number	7,280	5,572	10,166	14,137	16,004	4,158	9,553	
	Date	July 30	July 30	July 5	May 30	July 7	July 8		
Days of Operation		138	138	138	138	193	204	158.2	949
Average eels per day		886.2	492.4	914.4	1,845.3	3,228.5	685.3	1,405.7	
Daily collections > 1,000 eels		31	22	26	60	111	46	49.3	296
Volumetric Estimation Days		40	25	31	56	112	34	49.7	298
Accuracy of Volumetric Estimates (±)		-1.0%	+1.6%	-1.1%	-2.3%	+1.4%	-0.4%	-1.8%	
Biological Data									
Sample Size		926	857	909	851	975	966	914	5484
Length (mm)	Average	122.3	121.6	114.4	112.2	115.7	114.3	116.8	
	Range	78-192	84-173	64-165	71-186	66-184	65-176		64-192
	Median	122.0	120.0	115.0	112.0	115.0	114.0		
Weight (g)	Average	2.1	2.0	1.8	1.5	1.6	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		0.2-6.0
	Median	2.0	2.0	1.7	1.4	1.5	1.6		
Sacrificed	Number	193	93	91	96	100	101		674
	Contained Parasites	53.9%	48.4%	52.7%	62.5%	61.0%	56.5%	55.8%	
	Average Age	2.2	2.3	1.65	1.97	2.3	2.4		
	Age Range	1 - 4	1 - 4	1 - 4	1 - 4	1 - 5	1 - 4		
River Flows (cfs, daily avg. flows at Conowingo)	Average	37,053	62,036	40,214	14,256	43,466	20,251	40,911	
	Min	6,000	11,100	4,560	3,970	8,560	3,750		
	Max	178,000	329,000	157,000	58,400	219,000	173,000		

Figure 3.6-1: Sample Location (Stone Run) of American Eel Collected for Wild Health Screening, Conowingo West Eel Collection Facility, 2022

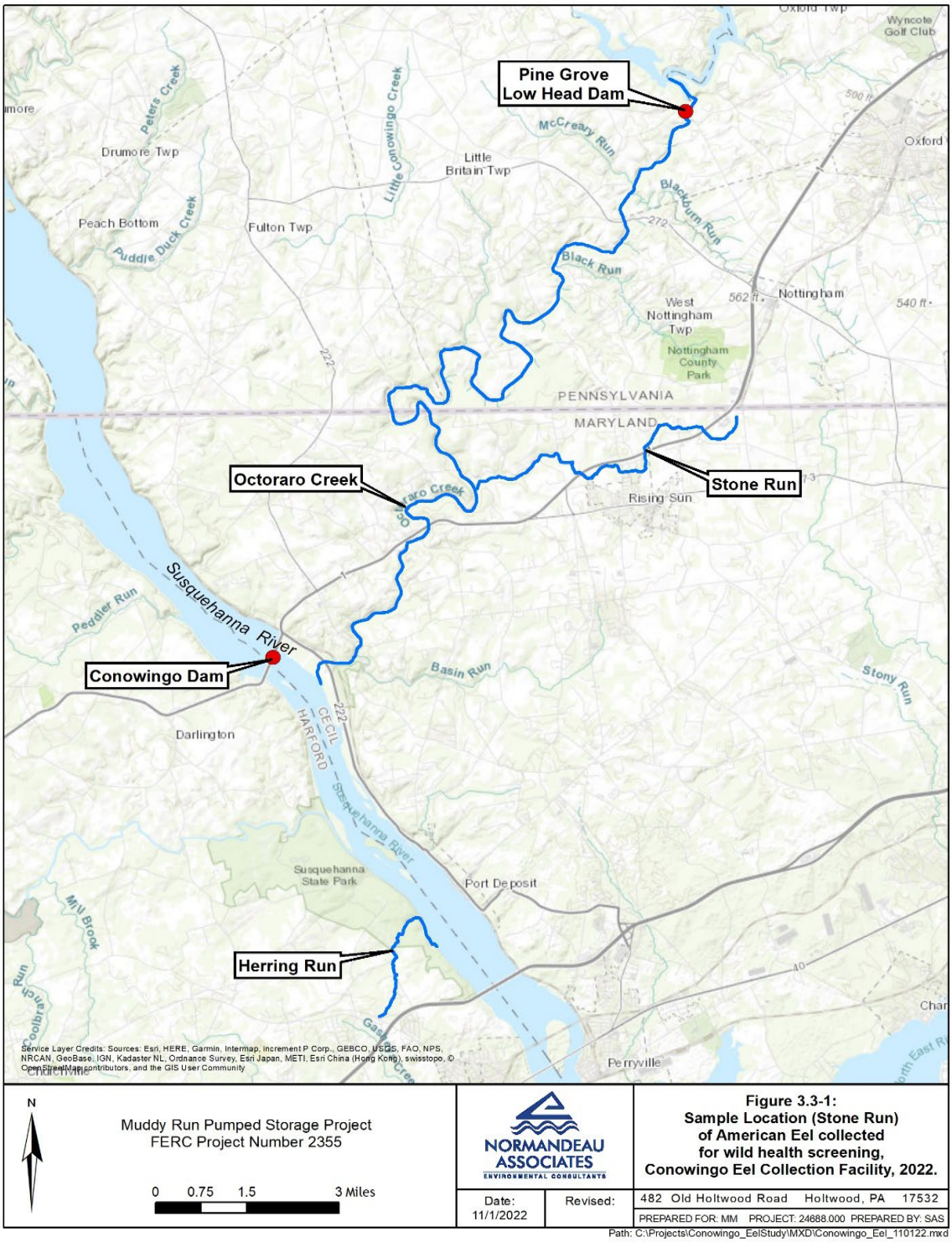

Figure 3.6-2: Stone Run, a Tributary of Octoraro Creek used for the Wild Health Screening, Conowingo Dam, 2022

Figure 4.1-1: Daily Eel Catch, Conowingo West Eel Collection Facility, 2022

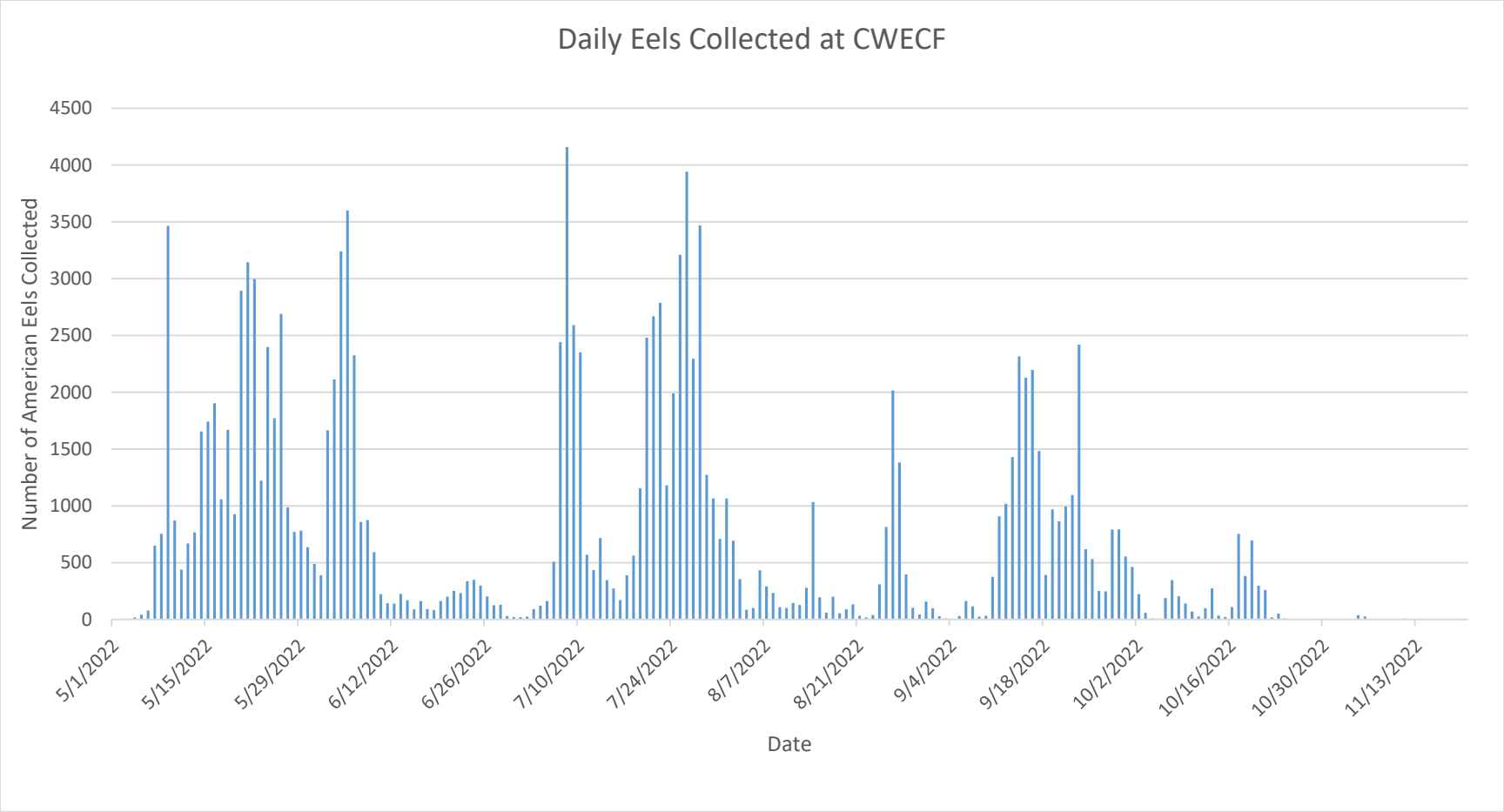

Figure 4.2-1: Eel with repeated dorsal to ventral abrasions along posterior portion of the specimen, Conowingo West Eel Collection Facility, 2022

Figure 4.2-2: Eel with Hemorrhaged Caudal/anal fin (above) and near vent (below), Conowingo West Eel Collection Facility, 2022

Figure 4.2-3: Eel with Abrasion on Operculum, Conowingo West Eel Collection Facility, 2022

Figure 4.4-1: Proportion of Eels Collected per Week, Conowingo West Eel Collection Facility, 2022

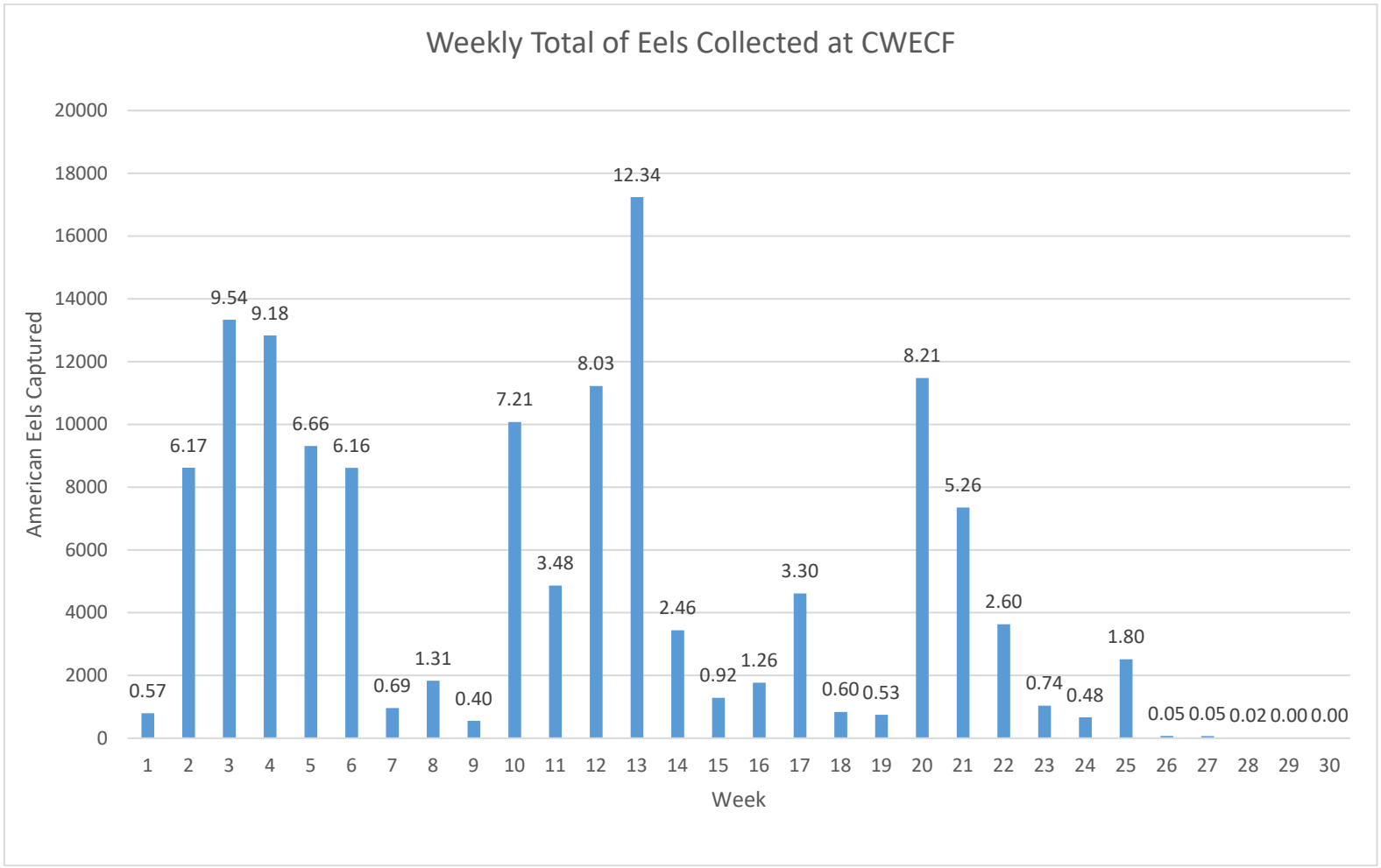

Figure 4.5-1: Daily Eel Catch and Daily Average River Flow (cfs, top graph) and Weekly Eel Catch and Weekly Average River Flow (cfs, bottom graph), Conowingo West Eel Collection Facility, 2022

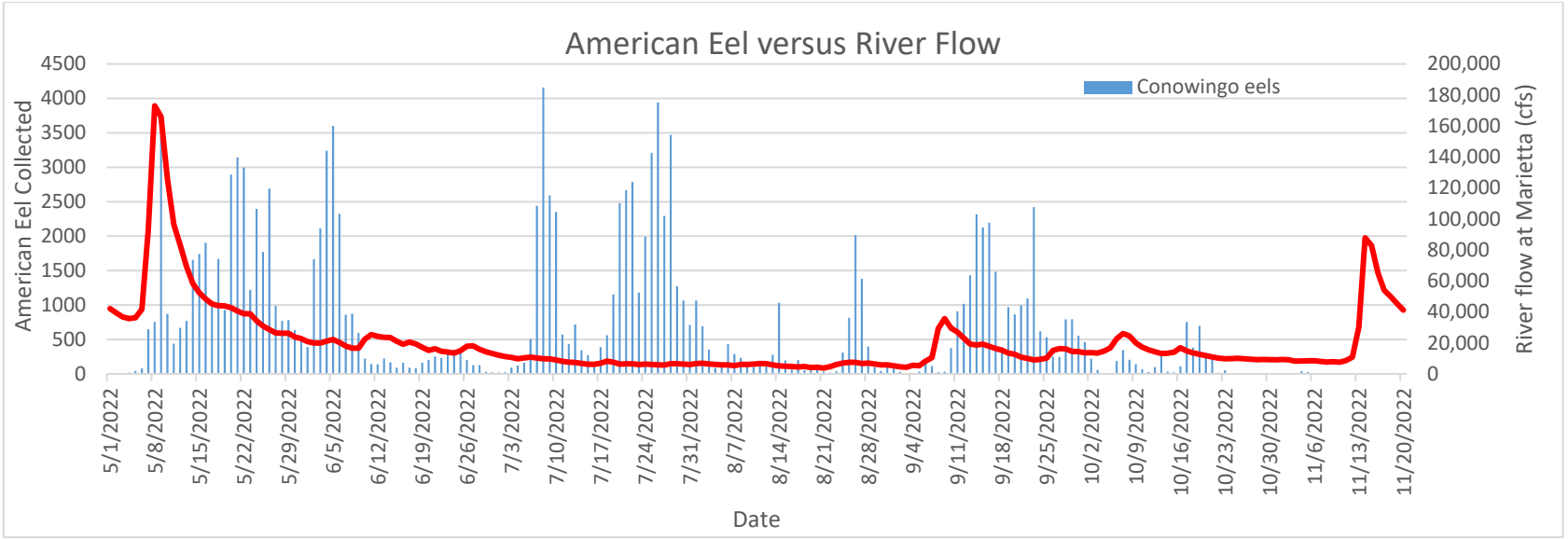

Figure 4.5-2: Eel Catch and Lunar Fraction (Daily above, Weekly Average below), Conowingo West Eel Collection Facility, 2022
(1.0 Equals Full Moon)

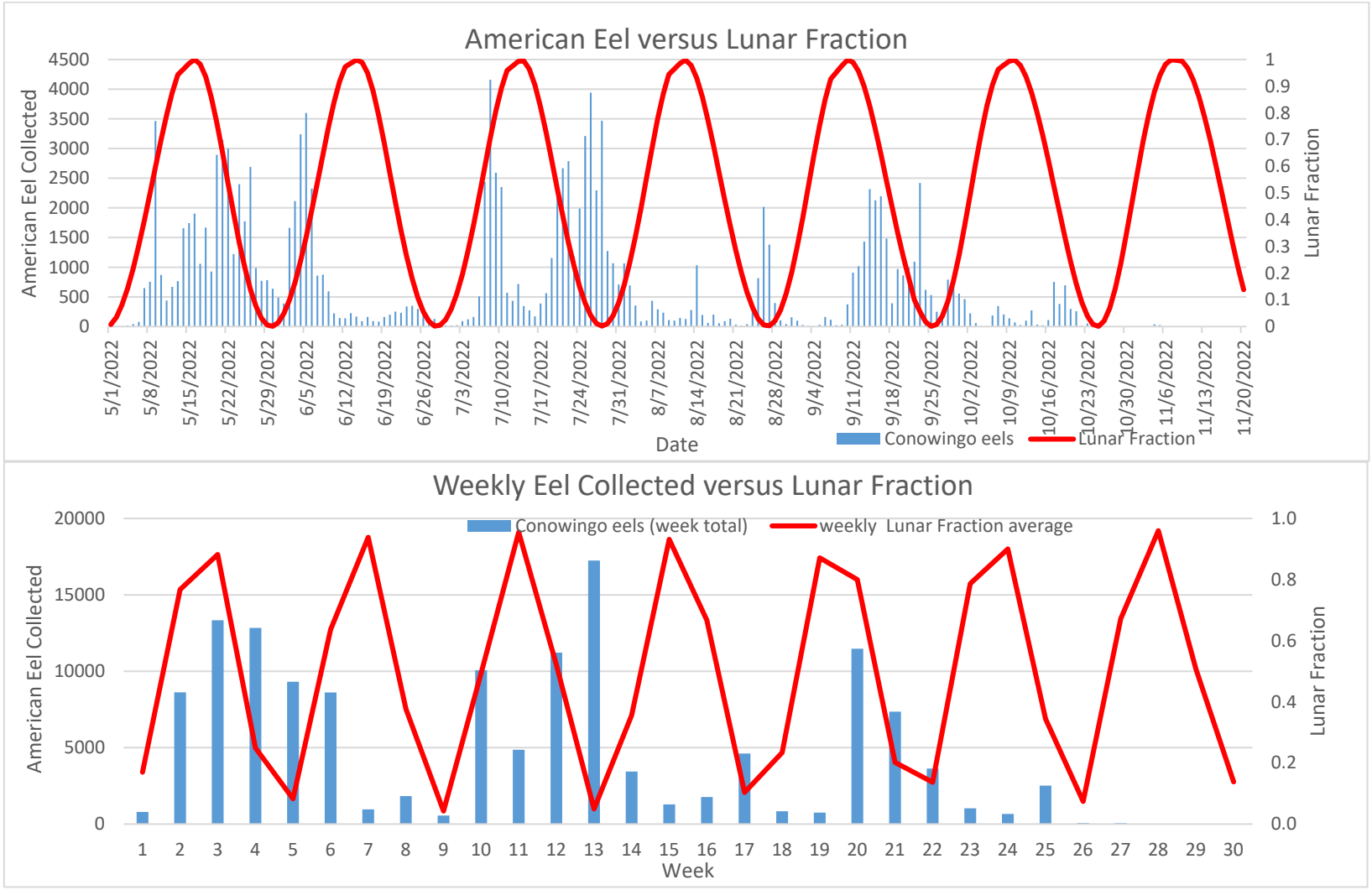

Figure 4.5-3: Eel Catch and Water Temperature, Conowingo Eel Collection Facility, 2022

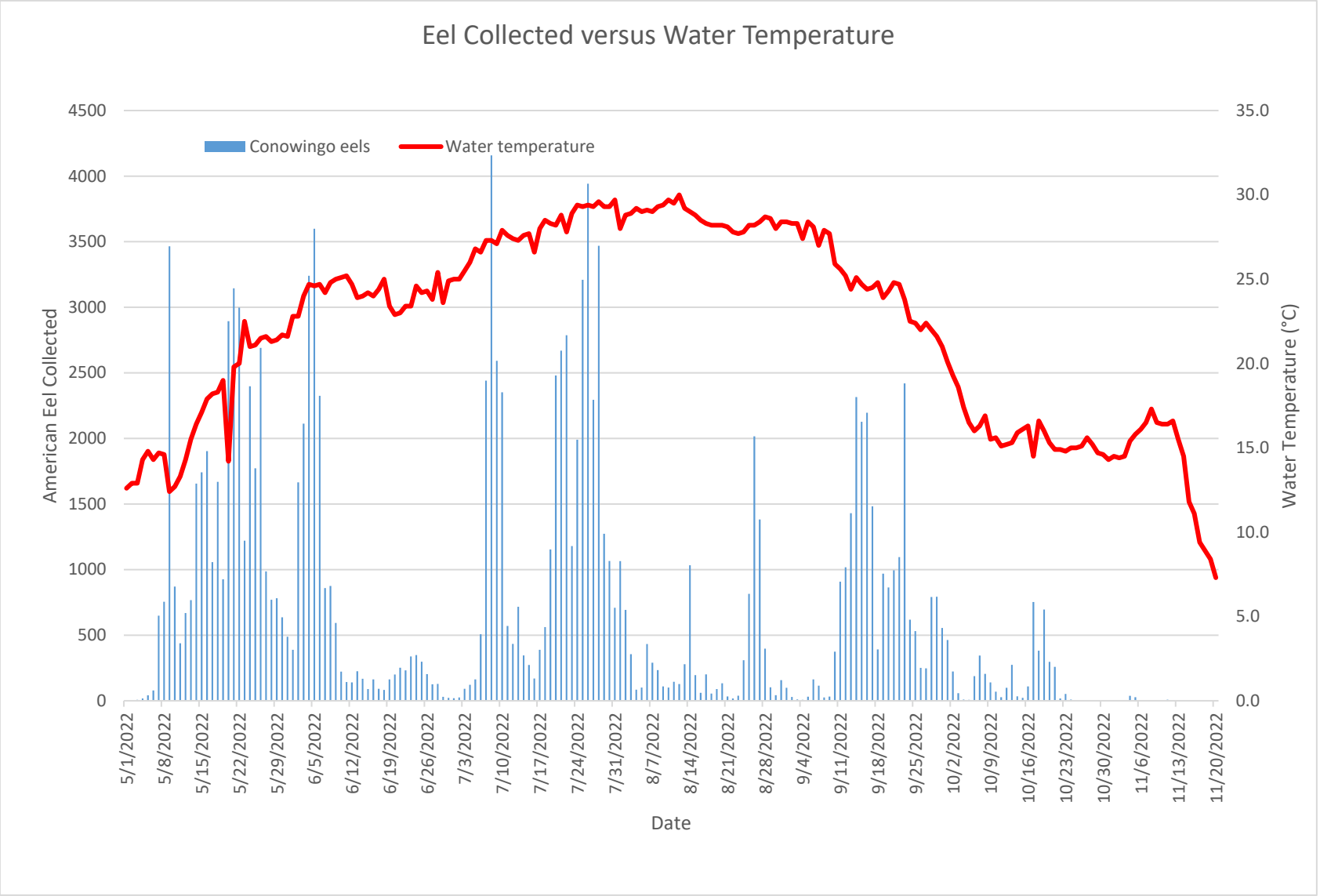

Figure 4.5-4: Eel Catch and Dissolved Oxygen, Conowingo West Eel Collection Facility, 2022

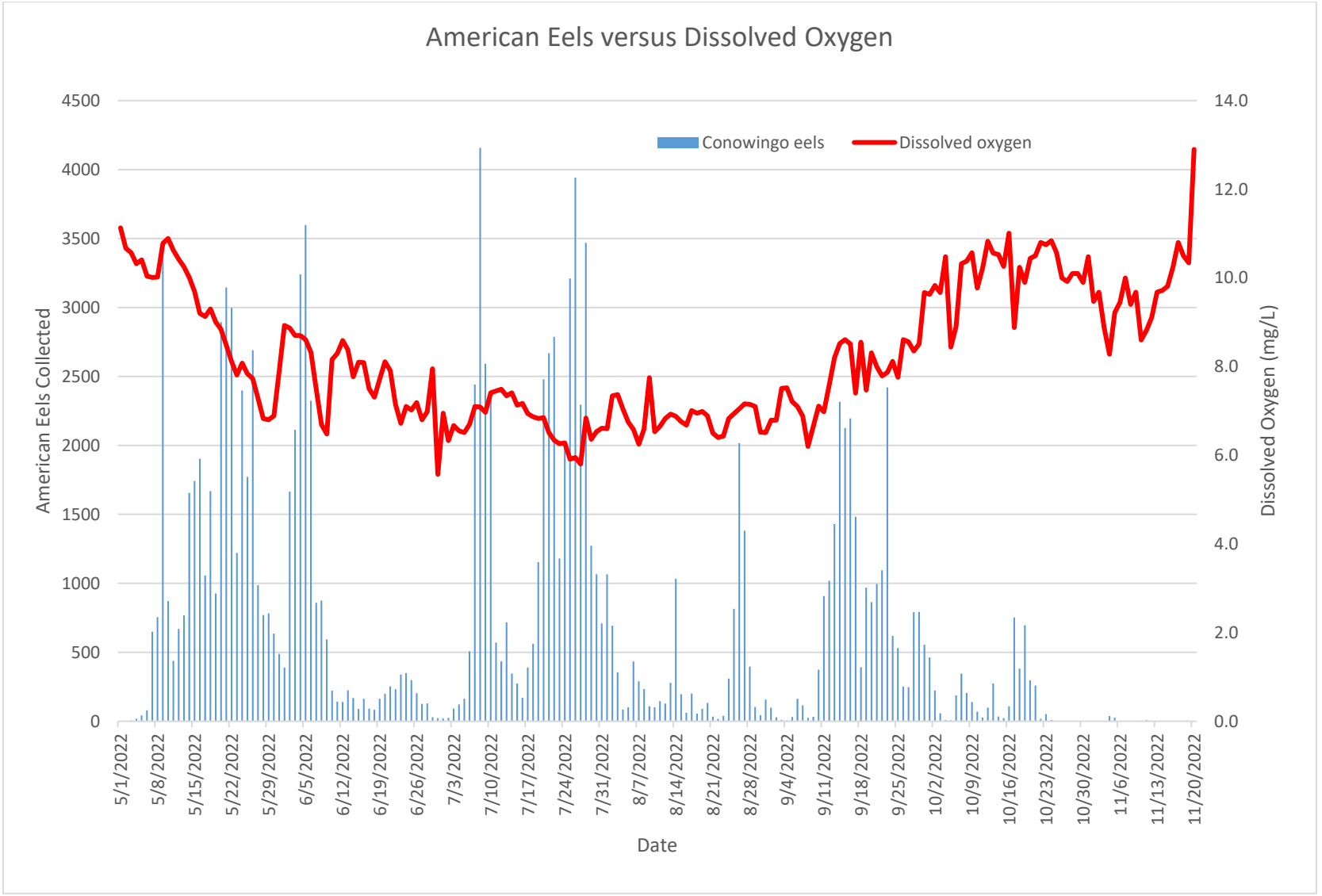

Figure 4.7-1: Eel Stocking Sites, 2015-2022

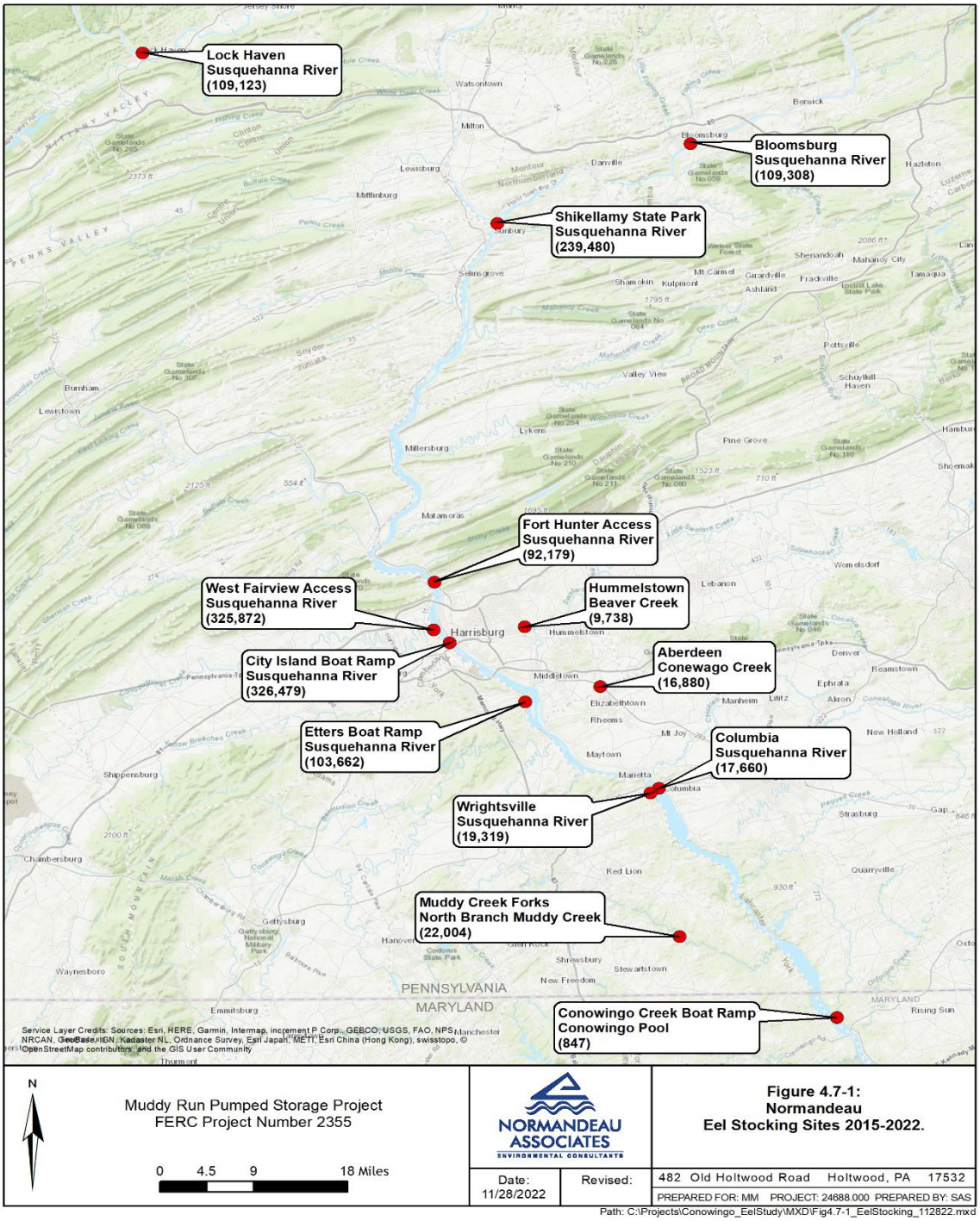

Figure 4.7-2: Shikellamy State Park (Site 7) Stocking Site, 2022

Figure 4.7-3: Fort Hunter Access (Site 6) Stocking Site, 2022

Figure 4.7-4: West Fairview Access (Site 5) Stocking Site, 2022

Figure 4.7-5: City Island Boat Ramp (Site 12) Stocking Site, 2022

Figure 5.0-1: Transition from Riprap Shoreline to Ramp Entrance, Conowingo West Eel Collection Facility, 2022

Appendix A:
Method of Aging Eel Otolith, Conowingo West Eel Collection Facility, 2022

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 #	Batch #	Eel #	Total Length (mm)	Age 1 - ERS*	Age 2- CAF*	Age consensus
5/2/2022	MDM22002	1	1	127	2	2	2
5/9/2022	MDM22009	3	1	132	3	3	3
	MDM22009	3	2	115	2	2	2
	MDM22009	3	3	92	2	2	2
	MDM22009	3	4	109	2	2	2
	MDM22009	3	5	124	2	2	2
5/16/2022	MDM22016	5	1	113	2	2	2
	MDM22016	5	2	85	1	1	1
	MDM22016	5	3	150	4	4	4
	MDM22016	5	4	118	3	3	3
	MDM22016	5	5	108	2	2	2
5/23/2022	MDM22023	7	1	102	2	2	2
	MDM22023	7	2	150	4	4	4
	MDM22023	7	3	110	3	3	3
	MDM22023	7	4	117	2	2	2
	MDM22023	7	6	148	4	4	4
5/30/2022	MDM22030	9	1	115	2	2	2
	MDM22030	9	2	134	3	3	3
	MDM22030	9	3	114	2	2	2
	MDM22030	9	4	141	3	3	3
	MDM22030	9	5	95	1	1	1
6/6/2022	MDM22037	11	1	89	1	1	1
	MDM22037	11	2	133	3	3	3
	MDM22037	11	3	115	2	2	2
	MDM22037	11	4	120	3	3	3
	MDM22037	11	5	108	2	2	2
6/13/2022	MDM22044	13	1	137	3	3	3
	MDM22044	13	2	94	1	1	1
	MDM22044	13	3	176	4	4	4
	MDM22044	13	4	117	2	2	2
	MDM22044	13	5	101	2	2	2
6/20/2022	MDM22051	15	1	103	2	2	2
	MDM22051	15	2	154	4	4	4
	MDM22051	15	3	143	3	3	3
	MDM22051	15	4	99	2	2	2
	MDM22051	15	5	115	2	2	2
6/27/2022	MDM22058	17	1	130	3	3	3
	MDM22058	17	2	119	2	2	2
	MDM22058	17	3	113	2	2	2
	MDM22058	17	4	108	2	2	2

Date	Collection #	Batch #	Eel #	Total Length (mm)	Age 1 - ERS*	Age 2- CAF*	Age consensus
6/27/2022	MDM22058	17	5	135	3	3	3
7/4/2022	MDM22065	19	1	87	1	1	1
	MDM22065	19	2	118	2	2	2
	MDM22065	19	3	100	2	2	2
	MDM22065	19	4	108	2	2	2
	MDM22065	19	5	106	2	2	2
7/11/2022	MDM22072	21	1	109	2	2	2
	MDM22072	21	2	95	1	1	1
	MDM22072	21	3	111	2	2	2
	MDM22072	21	4	123	3	3	3
	MDM22072	21	5	103	2	2	2
7/18/2022	MDM22079	23	1	82	1	1	1
	MDM22079	23	2	123	3	3	3
	MDM22079	23	3	100	1	1	1
	MDM22079	23	4	106	2	2	2
	MDM22079	23	5	124	3	3	3
7/25/2022	MDM22087	25	1	111	2	2	2
	MDM22087	25	2	107	2	2	2
	MDM22087	25	3	111	3	3	3
	MDM22087	25	4	114	2	2	2
	MDM22087	25	5	107	2	2	2
8/1/2022	MDM22095	27	1	120	3	3	3
	MDM22095	27	2	123	3	3	3
	MDM22095	27	3	124	3	3	3
	MDM22095	27	4	115	2	2	2
	MDM22095	27	5	105	2	2	2
8/8/2022	MDM22101	29	1	136	4	4	4
	MDM22101	29	2	119	3	3	3
	MDM22101	29	3	118	2	2	2
	MDM22101	29	4	145	3	3	3
	MDM22101	29	5	121	3	3	3
8/15/2022	MDM22108	31	1	100	2	2	2
	MDM22108	31	2	122	3	3	3
	MDM22108	31	3	132	3	3	3
	MDM22108	31	4	122	3	3	3
	MDM22108	31	5	116	3	3	3
8/22/2022	MDM22115	33	1	146	4	4	4
	MDM22115	33	2	120	NR	NR	NR
	MDM22115	33	3	117	2	2	2
	MDM22115	33	4	122	3	3	3

Date	Collection #	Batch #	Eel #	Total Length (mm)	Age 1 - ERS*	Age 2- CAF*	Age consensus
8/22/2022	MDM22115	33	5	97	2	2	2
8/29/2022	MDM22121	35	1	119	2	2	2
	MDM22121	35	2	132	3	3	3
	MDM22121	35	3	140	3	3	3
	MDM22121	35	4	89	2	2	2
	MDM22121	35	5	115	2	2	2
9/5/2022	MDM22128	37	1	141	3	3	3
	MDM22128	37	2	97	2	2	2
	MDM22128	37	3	111	2	2	2
	MDM22128	37	5	113	3	3	3
	MDM22128	37	6	101	2	2	2
9/12/2022	MDM22135	39	1	114	2	NR	NR
	MDM22135	39	2	120	3	3	3
	MDM22135	39	3	106	2	2	2
	MDM22135	39	4	116	2	2	2
	MDM22135	39	5	119	2	2	2
9/15/2022	MDM22139	40	1	101	2	2	2
	MDM22139	40	2	99	2	2	2
	MDM22139	40	3	122	2	2	2
	MDM22139	40	4	118	2	2	2
	MDM22139	40	5	114	2	2	2

Appendix B:
Weekly Biological Data and Environmental Conditions for Conowingo West Eel Collection Facility, 2017-2022

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

Appendix C:
Fish Health Inspection Report, Conowingo West Eel Collection Facility, 2022

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 03/16/2022 2 03/15/2021 3 03/26/2020 4 03/19/2019 5 03/26/2018

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	2022 collection	y	wild stock	(F) Octoraro Creek, MD	35	35	35			59	59			59		59	59	
					--	--	--	NT	NT	--	--	NT	NT	--	NT	--	+	

Remarks[6]: Lab Case 22-93; AME = American eel; A = swimbladder nematode (Anguillicola crassus)

Inspecting Biologist Signature	Concurred (signature & title)	
Print: Gavin Glenney Date: 04/14/2022	Print: John Coll Date: 04/14/2022	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:

22-93 received March 16, 2022. Collection of 59 American eels occurred on 3/15/22 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 59% (35/59), typical level as reported in previous years. Also observed and reported in previous years was low level occurence of two Myxozoan parasites, Myxidium sp. and Myxobolus sp.

Previous sampling and testing of American Eels in this watershed consisted of 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
AS Aeromonas salmonicida
EI Edwardsiella ictaluri
RS Renibacterium salmoninarum
YR Yersinia ruckeri
MC Myxobolus cerebralis
IH Infectious Hematopoietic Necrosis Virus
IP Infectious Pancreatic Necrosis Virus
IS Infectious Salmon Anemia Virus
LM Largemouth Bass Virus
OM Oncorhynchus masou Virus
SV Spring Viremia of Carp Virus
VH Viral Hemorrhagic Septicemia Virus

SPECIES ABBREVIATIONS			
Amur Pike AMP	Colorado Pikeminnow CPM	Kokanee KUE	Rainbox Trout X Steelhead
Apache Trout APT	Comanche Springs pupfish CSP	Landlocked ATS LAS	RBTSTT
Arctic Grayling ARG	Cutthroat Trout CUT	Leon Springs pupfish LSP	Razorback Sucker RBS
Atlantic Salmon ATS	Darters DAR	Lake Trout LAT	Redear Sunfish RSF
Beautiful Shiner GBS	Desert Pupfish DEP	Lampreys LAY	Rio Grande Silvery Minnow RGSM
Big Bend Gambusia BBG	Desert Sucker DES	Largemouth Bass LMB	Sanora Sucker SOS
Bigmouth Buffalo BIB	Devils Hole Pupfish DHP	Livebearers LIR	Sauger SAR
Black Bullhead BLB	Dolly Varden DOV	Miscellaneous Warm Water MSC	Smallmouth Buffalo SAB
Black Crappie BLC	Dolly Varden X BKT DOVBKT	Mooneyes MOE	Silver Carp SVC
Blue Catfish BCF	Fall Chinook Salmon FCS	Mudminnows MUW	Smallmouth Bass SMB
Blue X Channel BCFCCF	Fathead Minnow FHM	Muskellunge MUE	Sockeye Salmon SOS
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 BON	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 WDF

Appendix D:
Chain of Custody Sheet, Conowingo West Eel Collection Facility, 2022

NORMANDEAU
environmental consultants

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

Date: 7/28/22 **Time:** 1530

No. of eels provided from CECF Collection Tank: 3465

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: 3,465

SIGNATURES:

Normandeau/Exelon Representative: Michael Mayfield

Agency Representative: _____ Sarah Coney

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

NORMANDEAU
environmental consultants

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

Date: 9/6/22 **Time:** 0955

No. of eels provided from CECF Collection Tank: 163

No. of eels provided from ~~Holding Tank # 1~~: Oct. Creek Eel facility 2

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

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

Total number of eels provided for Transport: 165

SIGNATURES:

Normandeau/Exelon Representative: Michael Martinelli

Agency Representative: Aaron Hennous

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

NORMANDEAU
environmental consultants

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

Date: 9-7-22 **Time:** 9:20 am

No. of eels provided from CECF Collection Tank: 85

No. of eels provided from Holding Tank # 1: 0

No. of eels provided from Holding Tank # 2: 0

No. of eels provided from Holding Tank # 3: 0

Total number of eels provided for Transport: 85

SIGNATURES:

Normandeau/Exelon Representative: Matthew T. Fisher

Agency Representative: Aaron Henning

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

NORMANDEAU
environmental consultants

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

Date: 9/13/22 **Time:** 1000

No. of eels provided from CECF Collection Tank: 10

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: 10

SIGNATURES:

Normandeau/Exelon Representative: _____

Agency Representative: _____

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

NORMANDEAU
environmental consultants

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

Date: 09/27/22 **Time:** 0921

No. of eels provided from CECF Collection Tank: 10

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: 10

SIGNATURES:

Normandeau/Exelon Representative: Ashley Pickus/Steven Adams

Agency Representative: Johnna Hupto

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

Appendix E:
Agency Comments on Draft 2022 Conowingo West Eel Collection Report, May 1-November 21

2022 Conowingo West Eel Collection Facility Report (May 1- November 21) Comments Received by Resource Agency and Date	
Resource Agency	**Date of Receipt by Constellation**
Susquehanna River Basin Commission	Monday, January 9, 2023
Pennsylvania Fish and Boat Commission	No Comments were received
United States Fish and Wildlife Service	Monday, December 19, 2022
Maryland Department of the Environment Maryland Department of Natural Resources	Thursday, January 5, 2023
Pennsylvania Department of Environmental Protection	Monday, December 19, 2022

Responses to Resource Agency Comments for the MDE Conowingo West Eel Collection Report, 2022

SRBC

- No Comments

USFWS

- No Comments

PFBC

- No Comments

MDE

- No age data is provided for individuals eels

  Constellation response: Ages were received after the draft was sent to the Agencies; age data has been added to the final draft.

PA DEP

- No Comments

From: Henning, Aaron
To: Martinek, Michael; bniewinski@pa.gov
Cc: Danucalov, Andrea H:(Constellation Power); Kirk Smith
Subject: EXTERNAL EMAIL -RE: Comments to the Constellation reports
Date: Monday, January 9, 2023 3:50:36 PM

Mike et al,

SRBC does not to plan to offer formal comments beyond what has already been provided by the other RAs.

Aaron

Aaron Henning
Fisheries Biologist
Susquehanna River Basin Commission
4423 North Front St.
Harrisburg, PA 17110
Office: (717) 238-0423 ext.1184
Mobile: (717) 884-5937
ahenning@srbc.net
https://www.srbc.net/our-work/american-eels/

From: Mike Martinek <mmartinek@normandeau.com>
Sent: Monday, January 9, 2023 11:39 AM
To: bniewinski@pa.gov; Henning, Aaron <ahenning@srbc.net>
Subject: Comments to the Constellation reports

Hello,
Constellation, Normandeau, and Gomez and Sullivan have not seen any comments to the 2022 Constellation report concerning collection of eels, efficiency, or sampling.

Some of these reports are due by the end of the week, some have a later date.
Please send email with comments or an email stating no comments to each of the reports.
Send these emails to Andrea, and copy Kirk smith, Mike Martinek.

Thanks,
Mike

From: Eyler, Sheila
To: Martinek, Michael; Kirk Smith; Danucalov, Andrea H:(Constellation Power); Bleistine, Ray; Mike.Cox@ERM.com; David Frazier; Eberts, Ron; "Henning, Aaron"; Morales, Jesus J; McCorkle, Richard; "Miller, Jeremy"; Minkkinen, Steve; "Sadzinski, Robert"; "Seaman, Shawn"; Smith, Fred; lsteffy@srbc.net; "Tryninewski, Joshua"; "Williamson, Scott"; Heather Nelson -MDE-; tony.prochaska@maryland.gov; Brett Coakley -DNR-; David Seaborn -MDE-; don.pugh; Matthew Jargowsky -DNR-; emily.zollweg-horan@dec.ny.gov
Subject: EXTERNAL EMAIL -Re: [EXTERNAL] Conowingo West Eel Collection Facility FOMP report
Date: Monday, December 19, 2022 1:27:57 PM

Ms. Danucalov,

Thank you for the opportunity to review the Conowingo West Eel Collection Facility FOMP report. 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

From: Mike Martinek <mmartinek@normandeau.com>
Sent: Monday, December 5, 2022 2:58 PM
To: Kirk Smith <ksmith@gomezandsullivan.com>; Danucalov, Andrea H:(Constellation Power) <u000ahd@constellation.com>; Ray Bleistine <rbleistine@normandeau.com>; Mike.Cox@ERM.com <Mike.Cox@ERM.com>; David Frazier <dfrazier@gomezandsullivan.com>; Eberts, Ron <reberts@pa.gov>; Eyler, Sheila <sheila_eyler@fws.gov>; 'Henning, Aaron' <ahenning@srbc.net>; Morales, Jesus J <jesus_morales@fws.gov>; Mike Martinek <mmartinek@normandeau.com>; McCorkle, Richard <richard_mccorkle@fws.gov>; 'Miller, Jeremy' <jeremmille@pa.gov>; Minkkinen, Steve <steve_minkkinen@fws.gov>; 'Sadzinski, Robert' <bob.sadzinski@maryland.gov>; 'Seaman, Shawn' <shawn.seaman@maryland.gov>; Smith, Fred <fredp.smith@exeloncorp.com>; lsteffy@srbc.net <lsteffy@srbc.net>; 'Tryninewski, Joshua' <jtryninews@pa.gov>; 'Williamson, Scott' <scwilliams@pa.gov>; Heather Nelson -MDE- <hnelson@maryland.gov>; tony.prochaska@maryland.gov <tony.prochaska@maryland.gov>; Brett Coakley -DNR- <brett.coakley@maryland.gov>; David Seaborn -MDE- <david.seaborn@maryland.gov>; don.pugh <don.pugh@outlook.com>; Matthew Jargowsky -DNR- <matthew.jargowsky@maryland.gov>; emily.zollweg-horan@dec.ny.gov <emily.zollweg-horan@dec.ny.gov>
Subject: [EXTERNAL] Conowingo West Eel Collection Facility FOMP report

Hello,
The Constellation Conowingo West Eel Collection Facility full season report is attached for review

Constellation is requesting that comments be provided to Andrea Danucalov by January 5, 2023, so that the final report can be filed with FERC.

Thank you,
Mike Martinek

From:	David Seaborn -MDE-
To:	Martinek, Michael
Cc:	Kirk Smith; Danucalov, Andrea H:(Constellation Power); Bleistine, Ray; Mike.Cox@ERM.com; David Frazier; Eberts, Ron; Eyler, Sheila; Henning, Aaron; jesus_morales@fws.gov; McCorkle, Richard; Miller, Jeremy; Minkkinen, Steve; Sadzinski, Robert; Seaman, Shawn; Smith, Fred; 'Steffy, Luanne'; Tryninewski, Joshua; Williamson, Scott; Heather Nelson -MDE-; Tony Prochaska -DNR-; Brett Coakley -DNR-; Donald Pugh; Matthew Jargowsky -DNR-; emily.zollweg-horan@dec.ny.gov
Subject:	EXTERNAL EMAIL -Re: Conowingo West Eel Collection Facility FOMP report
Date:	Thursday, January 5, 2023 4:31:10 PM

Thank you for the opportunity to comment. Maryland (MDNR and MDE, together) only have one comment, which is that
no age data is provided for individual eels.

Thank you,

On Mon, Dec 5, 2022 at 4:47 PM Mike Martinek <mmartinek@normandeau.com> wrote:

> Hello,
>
> The Constellation Conowingo West Eel Collection Facility full season report is attached for review
>
> Constellation is requesting that comments be provided to Andrea Danucalov by January 5, 2023, so that the final report can be filed with FERC.
>
> Thank you,
>
> Mike Martinek
>
>

--

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.

Click here to complete a three question customer experience survey.

From:	Eberts, Ron
To:	Martinek, Michael; Kirk Smith; Danucalov, Andrea H:(Constellation Power); Bleistine, Ray; Mike.Cox@ERM.com; David Frazier; Sheila Eyler; Aaron Henning; jesus_morales@fws.gov; McCorkle, Richard; Miller, Jeremy; "Minkkinen, Steve"; "Sadzinski, Robert"; "Seaman, Shawn"; Smith, Fred; 'Steffy, Luanne'; Tryninewski, Joshua; Williamson, Scott; Heather Nelson -MDE-; Tony Prochaska -DNR-; Brett Coakley -DNR-; David Seaborn -MDE-; Donald Pugh; Matthew Jargowsky -DNR-; emily.zollweg-horan@dec.ny.gov
Subject:	EXTERNAL EMAIL -RE: [External] Conowingo West Eel Collection Facility FOMP report
Date:	Wednesday, January 4, 2023 3:03:41 PM
Attachments:	MDE_2022_Conowingo_Eel_Ramp_Collection_Report_FOMP_12222.pdf

Andrea,

PA DEP has reviewed the Muddy Run Pumped Storage Project and Conowingo Hydroelectric Project Conowingo West Eel Collection Facility, 2022, and have no comments or suggested edits.

Regards,

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.

From: Mike Martinek <mmartinek@normandeau.com>
Sent: Monday, December 5, 2022 2:58 PM
To: Kirk Smith <ksmith@gomezandsullivan.com>; Danucalov, Andrea H:(Constellation Power) <u000ahd@constellation.com>; Ray Bleistine <rbleistine@normandeau.com>; Mike.Cox@ERM.com; David Frazier <dfrazier@gomezandsullivan.com>; Eberts, Ron <reberts@pa.gov>; Sheila Eyler <Sheila_Eyler@fws.gov>; Aaron Henning <ahenning@srbc.net>; jesus_morales@fws.gov; Mike Martinek <mmartinek@normandeau.com>; McCorkle, Richard <richard_mccorkle@fws.gov>; Miller, Jeremy <jeremmille@pa.gov>; 'Minkkinen, Steve' <steve_minkkinen@fws.gov>; 'Sadzinski, Robert' <bob.sadzinski@maryland.gov>; 'Seaman, Shawn' <shawn.seaman@maryland.gov>; Smith, Fred <fredp.smith@exeloncorp.com>; 'Steffy, Luanne' <lsteffy@srbc.net>; Tryninewski, Joshua

<jtryninews@pa.gov>; Williamson, Scott <scwilliams@pa.gov>; Heather Nelson -MDE- <hnelson@maryland.gov>; Tony Prochaska -DNR- <tony.prochaska@maryland.gov>; Brett Coakley -DNR- <brett.coakley@maryland.gov>; David Seaborn -MDE- <david.seaborn@maryland.gov>; Donald Pugh <don.pugh@outlook.com>; Matthew Jargowsky -DNR- <matthew.jargowsky@maryland.gov>; emily.zollweg-horan@dec.ny.gov
Subject: [External] Conowingo West Eel Collection Facility FOMP report

Hello,
The Constellation Conowingo West Eel Collection Facility full season report is attached for review

Constellation is requesting that comments be provided to Andrea Danucalov by January 5, 2023, so that the final report can be filed with FERC.

Thank you,
Mike Martinek