NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

Muddy Run Pumped Storage Project and Conowingo Hydroelectric Project Conowingo West Eel Collection Facility, 2024

FERC Project Numbers 2355 and 405

Prepared for:

Constellation

Submitted On:
February 18, 2025

Prepared By:
Normandeau Associates, Inc.
1854 Lancaster Pike
Peach Bottom, Pennsylvania 17563

www.normandeau.com

Table of Contents

Page

EXECUTIVE SUMMARY I

LIST OF ABBREVIATIONS IV

1 INTRODUCTION 1

2 BACKGROUND 3

3 METHODS 4

3.1 DESIGN, CONSTRUCTION, AND INSTALLATION OF THE FACILITY 4
3.2 STAFFING 4
3.3 MAINTENANCE 4
Pre-season Maintenance 4
Post-season Maintenance 4
3.4 OPERATION 4
3.5 DATA COLLECTION 4
3.6 JUVENILE EEL TRANSPORT 5

4 RESULTS 7

4.1 JUVENILE EEL COLLECTION AND MORTALITY 7
4.2 JUVENILE EEL BIOLOGICAL DATA 7
4.3 EEL SACRIFICE AND INTERNAL ANALYSIS 8
4.4 SEASONAL VARIABILITY OF EEL COLLECTION 8
4.5 JUVENILE EEL CATCH IN RELATION TO ENVIRONMENTAL FACTORS 9
River Flow 9
Lunar Fraction 9
Water Temperature 9
Dissolved Oxygen 10
4.6 JUVENILE EEL HOLDING AND MORTALITY 10
4.7 JUVENILE EEL TRANSPORT AND MORTALITY 11
Mortality 12

5 QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES 13

6 CONCLUSIONS AND DISCUSSION 15

7 REFERENCES 17

8 TABLES AND FIGURES 18

List of Appendices

Appendix A: Method of Aging Eel Otolith, Conowingo West Eel Collection Facility, 2024
Appendix B: Weekly Biological Data and Environmental Conditions for Conowingo West Eel Collection Facility, 2017-2024
Appendix C: Fish Health Inspection Report, Conowingo West Eel Collection Facility, 2024
Appendix D: Chain of Custody Sheets, Conowingo West Eel Collection Facility, 2024
Appendix E: Agency Comments on Draft 2024 Conowingo West Eel Collection Report, May1-December 3

List of Tables

Page

Table 3.6-1: Stocking Locations for Juvenile Eel in the Susquehanna River Watershed 18

Table 4.0-1: Number of Juvenile Eels Caught Daily, Conowingo West Eel Collection Facility, 2024 19

Table 4.1-1: Counted Eel Numbers in the 200 Milliliter Subsamples during Days of Volumetric Estimates, Conowingo West Eel Collection Facility, 2024 20

Table 4.2-1: Number of Juvenile Eels Captured with Length and Weight Measurements, Conowingo West Eel Collection Facility, 2024..... 21

Table 4.2-2: Juvenile Eel Length Frequency, Conowingo West Eel Collection Facility, 2024 22

Table 4.2-3: Juvenile Eel Weight Frequency, Conowingo West Eel Collection Facility, 2024 23

Table 4.2-4: Observed Injuries of Juvenile American Eel, Conowingo West Eel Collection Facility, 2024 24

Table 4.3-1: Sacrificed Eel Data, Conowingo West Eel Collection Facility, 2024 25

Table 4.3-2: Sacrificed Eels Length Frequency with Detailed Info, Conowingo West Eel Collection Facility, 2024..... 27

Table 4.4-1: Juvenile Eel Collection by Week with Associated Ranks, Conowingo West Eel Collection Facility, 2024..... 28

Table 4.5-2: Fraction of Moon Illumination, 2024 EST (*1.0 equals full moon*) 30

Table 4.5-3: Water Temperature (˚C) Recorded in the Collection Tank*, Conowingo West Eel Collection Facility, 2024..... 31

Table 4.5-4: Dissolved Oxygen (mg/L) Readings from the Control Room (Station 643*), Conowingo West Eel Collection Facility, 2024..... 32

*Starting November 2[2] dissolved oxygen was taken from the Darlington USGS gage at 1100 hour..... 32

Table 4.6-1: Number of Juvenile American Eel placed in Holding, Conowingo West Eel Collection Facility, 2024..... 33

Table 4.6-2: Eel Transport and Stocking Data, 2024 34

Table 4.7-1: Detailed Individual Eel Transport and associated water quality Data, 2024 35

Table 4.7-2: Constellation's Eel Stocking Totals by Location and Year, 2015 – 2024 42

Table 5.0-1: Specified Operating Ranges of Conowingo West Eel Collection Facility, 2024 43

Table 5.0-2: Calibration of Flows (Gallons per Minute), Conowingo West Eel Collection Facility, 2024 44

Table 5.0-3: Quality Control Checks on Volumetric Estimates, Conowingo West Eel Collection Facility, 2024 46

Table 6.0-1: Summary of Eel Collections and Biological Data, Conowingo West Eel Collection Facility, 2017-2024 47

List of Figures

Page

Figure 3.6-1: Sample Location (Stone Run) of American Eel Collected for Wild Health Screening, Conowingo West Eel Collection Facility, 2024 48

Figure 3.6-2: Stone Run, a Tributary of Octoraro Creek used for the Wild Health Screening, Conowingo Dam, 2024 49

Figure 4.1-1: Daily Eel Catch, Conowingo West Eel Collection Facility, 2024..... 50

Figure 4.2-1: Eel with Scrapes on Right Side, Conowingo West Eel Collection Facility, 2024 51

Figure 4.2-2: Eel with Hemorrhage Caudal Tail, Conowingo West Eel Collection Facility, 2024 52

Figure 4.2-3: Eel with Abrasion on Operculum, Conowingo West Eel Collection Facility, 2024 53

Figure 4.4-1: Percent of Eels Collected per Week, Conowingo West Eel Collection Facility, 2024 54

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, 202 55

Figure 4.5-2: Eel Catch and Lunar Fraction (Daily above, Weekly Avg. below), Conowingo West Eel Collection Facility, 2024 (*1.0 Equals Full Moon)*..... 56

56

Figure 4.5-3:Temperature, Conowingo West Eel Collection Facility, 2024 57

Figure 4.5-4: Eel Catch and Dissolved Oxygen, Conowingo West Eel Collection Facility, 2024 57

Figure 4.7-1: Eel Stocking Sites, 2015-2024 58

Figure 4.7-2: Williamsport boat ramp (Site 10) Stocking Site, 2024 59

Figure 4.7-3: Fort Hunter Access (Site 6) Stocking Site, 2024 60

Figure 4.7-4: Etters boat ramp (Site 4) Stocking Site, 2024 61

Figure 4.7-5: City Island boat ramp (Site 12) Stocking Site, 2024..... 62

Figure 4.7-6: Conowingo Creek boat ramp (Site 1) Stocking Site, 2024..... 63

Figure 5.0-1: Transition from Riprap Shoreline to Ramp Entrance, Conowingo West Eel Collection Facility, 2024..... 64

Executive Summary

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

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

The CWECF is located on the Susquehanna River immediately downstream of the West Fish Lift (WFL) at Conowingo where a previous United States Fish and Wildlife Service (USFWS) eel collection facility was located from 2005 through 2016. This site was approved by PA DEP and other members of the Eel Passage Advisory Group (EPAG). Constellation designed, installed, and began operation of the CWECF in 2017 and has operated this facility each year through 2024. American Eels collected at CWECF and those transported from OCEF are held and then transported and released at designated stocking locations in the Susquehanna River watershed as approved by PA DEP, EPAG, and Maryland Department of the Environment (MDE).

This report discusses the results of the operation of the CWECF during the period May 1 to December 3, 2024[2]. Specifically, the objectives of the 2024 collection season were to[3]:

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

[1] Note the Conowingo Hydroelectric Project (P-405) license issued on March 19, 2021 was vacated by a DC Circuit Court Decision on December 22, 2022. The operation of the Conowingo Eel Facility is therefore governed under the Muddy Run License (P-2355) issued December 22, 2015. During the August 17, 2023, EPAG call, the Resource Agencies requested that Constellation run the Conowingo Eel Facility longer than the May 1 to September 15 season specified in the Muddy Run License.
[2] The report dated November 5, 2024, and filed with FERC on January 16, 2024, contained data from May 1 to September 15, 2024. This report has been revised to include data from September 16 to December 3, 2024. This report will not be filed with FERC but will be sent to the Resource Agencies.
[3] These are the objectives of the FOMP which is no longer required under the vacated Conowingo Hydroelectric Project (P-405) license issued on March 19, 2021. This report includes data collected from September 16 until December 3, 2024.

The CWECF was placed in service on May 1, 2024, and operated for a total of 217 consecutive days from May 1 to December 3. A total of 371,655 juvenile eels were collected at the CWECF. Juvenile eel numbers greater than 10,000 individuals were recorded on eight of the 217 collection days (3.7%), and juvenile eel numbers greater than 1,000 individuals were recorded on 68 of the 217 collection days (31.3%).The greatest number of juvenile eels collected in a single day occurred on August 19, 2024, when the CWECF collected 34,076 eels or 9.2% of the total season catch. The peak period of daily eels collected occurred from August 17-22 (6 days) and yielded 34.2% (127,048 of the 371,655 individuals) of the total eels collected in 2024. The two peak periods of eel collections, totaling 12 days, accounted for 45.6% (169,616 of the 371,655 individuals) of the collection season. Volumetric estimation methodology was utilized on 67 of the 217 collection days (30.9%) 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 954 juvenile eels. Lengths ranged from 62 to 173 millimeter (mm) with an average length of 118.9 mm. The average weight of the subsampled eels was 1.9 grams (g) and ranged from 0.2 to 4.5 g. Only 24 of the 954 eels (2.5%) showed any form of external injury (condition factor) such as hemorrhage, fungus, abrasion, scrape, or bruise.

Nearly 11% (100 of 954) of the eels sampled were examined internally for presence of the eel swim bladder parasite *Anguillicoloides crassus*. Parasites were found in 48 (48%) of the 100 examined eels. The number of parasites per eel ranged from one to four. One Hundred of these eels were examined for age, and it was determined that the average age was 2.21 years old with a range of 0-5 years old.

The CWECF collected a total of 371,655 juvenile eels in 2024 with a total collection mortality rate of 0.02% (71 individuals) in the collection tank. Constellation examined 100 eels for biological analysis. A total of 639 (0.17%) juvenile eels were recovered dead from the holding tanks over the entire season. The Susquehanna River Basin Commission (SRBC) removed a total of 500 juvenile eels on August 26, 2024, and 100 juvenile eels on September 23, 2024, for an “Eels in the Classroom” program.

Eels were held no longer than one week prior to transport from the CWECF. A combined total of 455,136 eels from CWECF and the OCECF were transported to designated locations in the Susquehanna River watershed. Williamsport boat ramp (Site 10) was stocked with 62,712 juvenile eels. City Island boat ramp (Site 12) received a stocking of 130,424 juvenile eels. Fort Hunter Access (Site 6) received a stocking of 130,588 juvenile eels. Etters boat ramp (Site 4) was stocked with 130,334 juvenile eels. Conowingo Creek boat ramp (Site 1) was stocked with 943 juvenile eels. A total of 135 (0.03%) juvenile eels died during the 130 transport trips from the CWECF in 2024. Daily transport occurred from June 9 to September 15 and September 23 to September 26 due to elevated water temperatures. Weekly transport occurred from May 8 through May 28 and from November 8 until December 3. Biweekly transport occurred from May 29 to June 6, September 16 to 22, and September 27 to November 7. The last day of transport was December 3, 2024. No eels were collected during the last day of operation, December 3, at the CWECF.

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
OCECF	Octoraro Creek Eel Collection Facility
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
WFL	West Fish Lift
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

1 Introduction

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

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

The CWECF is located on the Susquehanna River immediately downstream of the West Fish Lift (WFL) where a previous United States Fish and Wildlife Service (USFWS) eel collection facility was located from 2005 through 2016. This site was approved by PA DEP and other members of the Eel Passage Advisory Group (EPAG)[5]. Constellation designed, installed, and began operation of the CWECF in 2017 and has operated this facility each year through 2024. 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 PA DEP, EPAG, and Maryland Department of the Environment (MDE).

This report discusses the results of the operation of the CWECF during the period May 1 to December 3rd, 2024[6]. Specifically, the objectives of the 2024 collection season were to[7]:

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

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

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

[6] The report dated November 5, 2024, and filed with FERC on January 16, 2024, contained data from May 1 to September 15, 2024. This report has been revised to include data from September 16 to December 3, 2024. This report was sent to the Resource Agencies for review and comment and is shown in Appendix E. This report will not be filed with FERC but will be sent to the Resource Agencies.

[7] These are the objectives of the FOMP which is no longer required under the vacated Conowingo Hydroelectric Project (P-405) license issued on March 19, 2021. This revision report includes data collected from September 16 until December 3, 2024.

- 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 season to improve functionality.

2 Background

The American Eel is a catadromous species of eel in North America. Catadromous describes a migratory life cycle in which the eels 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, 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 2018, 2019, 2020, 2021, 2022, 2023, and 2024). 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 2024 season 1,922,664 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 2024 CWECF was identical to the one used since 2017 (Normandeau Associates, Inc. 2018, 2019, 2020, 2021, 2022, and 2023). Complete designs descriptions can be found in Section 3 of the Normandeau Associates, Inc. 2018 and 2019 reports and in the American Eel Passage and Restoration Plan (EPRP).

3.2 Staffing

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

3.3 Maintenance

Pre-season Maintenance

On April 26, 2024, all CWECF components, including the eel ramp, collection, overflow, and holding tanks, as well as the associated water lines, were installed and tested. All components were in working order before the CWECF was placed into service on May 1, 2024.

Post-season Maintenance

After the season ended on December 3, 2024, 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 2024 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 in 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 in an electronic format. Rainfall amounts are not taken or recorded at the CWECF.

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

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

Length and weight measurements, along with condition factors, were recorded biweekly from a maximum of 25 individuals (when available) from May 1 through September 15 to satisfy the PA DEP 401 WQC conditions for the MRPSP. Eels were measured and weighed after being anesthetized. Once per week, a portion of these eels were sacrificed to be later 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 1, 2024, when Station 643 was taken out of service and DO was recorded from the USGS Darlington Gauge at 11:00 till the end of season.

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

3.6 Juvenile Eel Transport

A wild health screening was required by the PA DEP 401 WQC for the MRPSP prior to the transport of eels upstream into the Susquehanna River watershed, which ensures that eels are free of undesirable pathogens. Juvenile eels were collected by a backpack electrofishing unit on March 12,2024 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 was ≥150 but less than 2,500 individuals, a small enclosed transport tank (250 L) with a supplemental oxygen supply was used to transport eels to designated locations (Normandeau Associates, Inc. 2021, 2022, and 2023). When

>2,500 eels needed to be transported, a custom-made transport truck equipped with a 2,500-liter tank and supplemental oxygen supply was used to deliver eels efficiently and safely to designated stocking locations (Normandeau Associates, Inc. 2021, 2022, and 2023).

4 Results

The CWECF commenced operation on May 1, 2024, and operated continuously until December 3, 2024, which is when the water temperature was 10° C or less for three consecutive days, as described in the EPRP, FOMP, and required by the now vacated Conowingo FERC License. This facility operated for 217 days and collected a total of 371,655 juvenile eels during the 2024 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 371,655 juvenile eels were captured at the CWECF during the 2024 season. Counts (either estimated or actual) were recorded daily. Volumetric estimates were taken from the CWECF on 67 of the 217 days of operation (30.9% of the season), which can be used as a metric to understand how frequently the daily abundance of eels at the CWECF was high (Table 4.1-1). The number of eels in the 200 mL subsample varied daily throughout the season, ranging from 85 to 300 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 131.5 eels with a median of 122.5 eels.

The highest single-day collection of 34,076 juvenile eels occurred on August 19 when 9.2% of the total number of eels collected in 2024 were captured (Table 4.0-1 and Figure 4.1-1). For the 2024 season, daily collections of eels were greater than 1,000 eels on 68 days, or 31.3% of the time (Table 4.0-1).

Of the 371,655 juvenile eels that were captured at the CWECF, 71 eels died in the collection tank (0.02% mortality). All mortalities from the collection tank were recorded over the course of the season and were not attributed to an identifiable cause, such as low DO or loss of water flow to collection tank.

4.2 Juvenile Eel Biological Data

Biological data (length, weight, and condition factor) were recorded from biweekly subsamples from May 1 to September 15. A total of 954 juvenile eels (0.3% of the seasonal catch) were evaluated from these biweekly subsamples during 39 of the 138 sample days during this period (Table 4.2-1).

The average length of juvenile eels was 118.9 mm, and the median was 117.0 mm (Table 4.2-1). The length of juvenile eels ranged from 62-173 mm. One hundred one (101) juvenile eel (10.6%) measured less than 100 mm, and four eels measured greater than 170 mm (Table 4.2-2). The average weight of juvenile eels was 1.9 grams (g) and the median weight was 1.7 g (Table 4.2-1). The weight of juvenile eels ranged from 0.2-4.5 g (Table 4.2-1). Greater than 90% of the 954 juvenile eels weighed between 0.5-3.0 g (Table 4.2-3).

Eels from each biweekly subsample were examined for external injuries. Individual condition factors, date, and detailed biological data for these are shown on Table 4.2-4. External injuries were noted on 2.5% (24 of 954 individuals) of the examined eels. All injuries were coded as a hemorrhage, scrape, fungus, or abrasion. Fifteen eels had fungus, seven eels were observed with hemorrhages (bruise included), while one eel showed abrasions, and one eel had a laceration. Photos of these types of injuries are shown in Figures 4.2-1 through 4.2-3.

4.3 Eel Sacrifice and Internal Analysis

From each biweekly subsample from May 1 to September 15, a portion of juvenile eels were retained and inspected for the presence of the swim bladder parasite and examined for age determination. Nearly 11% (100 of the 954 individuals) were dissected for the parasite analysis and later examined for age (Tables 4.3-1 and 4.3-2).

Of the 100 juvenile eels that were inspected for the parasite, 52 (52%) eels were uninfected (Table 4.3-1 and Normandeau Associates, Inc. 2018, 2019, 2020, 2021, 2022 and 2023). The other 48 (48%) eels were infected by the swim bladder parasite. The infected eels contained one, two, three, or four parasites per individual (38, 5, 3, and 2, respectively). Table 4.3-2 provides detailed information by length frequency (five mm interval groups) of the 100 examined eels with information including weight, age, and number that were infected by the parasite. The average length of a sacrificed eels was 120.2 (range 62-170) mm, average weight of 2.0 (range 0.2-4.2) g, and average number of parasites was 0.7 (range 0-4; Table 4.3-1).

The age of the juvenile eels was determined from 92 eels; Eight additional eel otoliths could not be read for aging. The 92 juvenile eels analyzed for age were determined to be ages 0-5 (average age = 2.21, Table 4.3-1). Detailed information of the 100 aged eels is shown on Table 4.3-1 and Appendix A. Of the 100 to be aged eels, 7 eels (7.0%) were age 0, 8 eels (8.0%) were age 1, 41 eels (41.0%) were age 2, 32 eels (32.0%) were age 3, 3 eels (3.0%) were age 4, 1 eel (1.0%) was age 5, and 8 eels (8.0%) were not able to be read. Age agreement between Normandeau biologists (a quality control measure) occurred 92.0% (92 of the 100 eels) of the time (Appendix A). The average length of the aged eels was 120 mm (range: 62-170 mm), the average weight was 1.9 g (range: 0.2-4.2 g), and the average number of parasites was 0.7 (range: 0-4). 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 percentage of juvenile eels was collected during Week 17 (August 18-24) when the facility collected 33.8% (125,604 individuals) of the season total (Table 4.4-1 and Figure 4.4-1).). The second highest percentage of juvenile eels was collected during Week 18 (August 25-31) when the CWECF collected 14.5% (54,025 individuals) of the season total. Week 19 (September 1-7) was the only other week during the 2024 season when > 10% of the season total (11.1%) were collected. Weeks 17 and 18 combined accounted for a large portion of the juvenile eels caught in 2024 (48.3%), 179,629 individuals; Table 4.4-1 and Figure 4.4-1).

Eel collections during Weeks 1, 6-8, 10, 12, 13, and 21-32 of sampling collected no greater than 1.0% of the season total, accounting for 5.8% (21,609 individuals) combined (Table 4.4-1 and Figure 4.4-1). Only 304 individuals were collected during the last twenty days of the season, while only 505 individuals were captured during November, the last full month of the season (November 1 – November 30).

During the season, there was a large peak period, a medium peak period, and three smaller peak periods. A peak period was defined as a period of two or more consecutive days each with a collection of 4,500 or more individuals. . The largest peak (August 17-22, 6 days) yielded 34.2% (127,048 of the 371,655) juvenile eels Table 4.0-1). The medium peak period occurred directly after the largest peak period from August 30-Septmeber 4 (6 days, 11.5%, 42,568 individuals). Three other smaller peak periods occurred May 4-11 (8 days, 3.8%, 14,251 individuals). May 25-31 (7 days ,5.5%, 20,320

individuals), and June 24-29 (6 days, 3.2%, 11,968 individuals) of the 371,655 eels collected at the facility. When the five peaks are combined, 58.2% (216,155 individuals) of the juvenile eels collected at this facility occurred during these 33 days or 15.2% of the sampling days.

4.5 Juvenile Eel Catch in Relation to Environmental Factors

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

River Flow

River flow and juvenile eel catch did appear to have a slight correlation during the 2024 season. There seems to be a two-week delay in eel numbers following a higher river flow event. Daily average river flow was taken from the United States Geological Survey (USGS) 01576000 Susquehanna River at Marietta, PA gage located one mile downstream of Marietta which is upstream of Conowingo Dam (Table 4.5-1). The highest daily average river flow value per the USGS gage station occurred on August 11, 2024 (215,000 cubic feet per sec, (cfs), (Tables 4.0-1 and 4.5-1). The lowest daily average river flow value per the USGS gage station occurred on November 2, 2024 (4,910 cfs) during a low catch period of the 2024 season. The majority of the American Eel captured at the CWECF in 2024 occurred when average river flow values were between 20,000 and 30,000 cfs. The average river flow did not exceed 30,000 cfs during 83.4% of the 2024 season (181 of the 217 days), but flows were less than 10,000 cfs during only 34.6% of the season (75 of the 217 operational days; (Figure 4.5-1). The variation of eel collection abundance during the season could not be explained by river flow.

Lunar Fraction

The lunar phase was assessed by examining the fraction of the visible lunar disk illuminated by the sun each night (lunar fraction) during the 2024 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 2024 season. The largest peak (August 17-22) of 127,048 eels occurred around a full moon period in Week 17 (Table 4.0-1 and Appendix B). The medium peak period that occurred from August 30-September 4 coincided with a new moon period, but the smaller peak periods (May 4- 11, May 25-31, and June 24- June 29) coincided with neither new moon nor full moon periods. The lowest catches of the 2024 season occurred during the new moon period in June, July, and August but an increase in eel catches occurred during the new moon periods in May and September (Table 4.5-2 and Figure 4.5-2, Date and Time Website 2024). Typically, the lower illuminance during lower lunar fraction periods, (new moon) has been associated with increases in eel catch at eel traps (Welsh *et al*. 2015, and Schmidt *et al*. 2009), but peak periods of eel collection at the CWECF occurred over a wide range of lunar fraction.

Water Temperature

Water temperature and eel catch did not appear to be correlated this season. Water temperatures reached 20.0° Celsius (C) consistently on May 22, 2024. By this time, the CWECF collected nearly 30,000 (14.4% of the season total; Tables 4.0-1 and 4.5-3). Nearly 62.6% (232,729 of the 371,655 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 32.3° C in mid-July to a low of 8.5° C in

December (Table 4.5-3 and Figure 4.5-4). Starting November 1 to the end of season the USGS Darlington gauge was used for temperature.

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 at the station prior to starting the daily work, which is taken from Station 643. Starting November 1 to the end of season the USGS Darlington gauge was used for DO. The attraction flow from the CWECF has additional aeration and diffused compressed oxygen supplied to each of the enabled tanks for most of the season, therefore no relationship between eel collection and DO values could be derived. Daily DO values ranged between 6.04 and 12.3 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 455,775 juvenile eels that were captured at the CWECF and OCEF, 98,728 eels were held in holding tank(s) prior to being transported upriver, which equates to nearly 21.7% of the eels captured over the season (Table 4.6-1). Eels were placed into holding tanks for 89 days from May 1 until June 8, 2024, and September 16 until December 3, 2024. 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 2024 eel season.

Eels were typically held in one holding tank during the 2024 season unless the number of eels held was greater than 12,500 eels. When eel holding numbers were greater than 12,500, eels were placed into Holding Tanks 1 and 2. The capacity of a holding tank is approximately 17,000 eels, but only 12,500 eels can be placed into each side of the large transport tank. When eels are placed into a holding tank, that tank is 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 639 juvenile eels (0.6% of the held eel total) died in holding (Table 4.6-2). On September 23, a total of 349 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 204 eels in the collection tank that day were found dead, and there were 769 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 soaked in a salt antiseptic. Daily transport was initiated on September 23 until holding tanks were clean.

4.7 Juvenile Eel Transport and Mortality

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

On March 12, 2024, 60 juvenile eels less than 200 mm in length were collected via backpack electrofishing from Stone Run, which is a tributary of the Octoraro Creek near Richardsmere in Cecil County, MD. All 60 of the juvenile eels were used to provide an adequate sample for health screening, which showed that no bacterial or viral pathogens of concern were detected. The results of The Fish Health Inspection Report provided authorization to transport and stock eels upstream of Conowingo Dam and is presented in Appendix C.

A total of 600 eels were supplied to the SRBC, 500 on August 26,2024 and 100 on September 23, 2024, for the CWECF for the "Eels in the Classroom" program. The chain of custody sheet for these events can be found in Appendix D, which relinquishes Constellation's responsibility for these eels.

All transported eels were released at designated locations in the Susquehanna River watershed (Table 3.6-1 and Figure 4.7-1). A total of 455,136 juvenile eels were transported upstream, including eels collected at OCEF (Tables 4.6-2 and 4.7-1). Daily transport occurred from June 9 to September 15, 2024. Biweekly transport occurred prior to and after daily transport from May 29 to June 9 and between September 16 to November 26, and weekly transport occurred May 8 to May 28 and November 8 until December 3. The last transport occurred on December 3, 2024. No eels were collected during the last day of operation at the CWECF on December 3, 2024.

Eels were transported to Williamsport boat launch, Etters boat ramp, Fort Hunter Access, City Island boat ramp, and Conowingo Creek boat ramp (Table 3.6-1).Total elapsed time of transport from the holding facility at Conowingo Dam to each stocking location varied between trips. Eel transport from the CWECF to Williamsport (Site 10), was completed in approximately three hours and thirty minutes (± 30 minutes). Eel transport from the CWECF to Fort Hunter Access (Site 6), was completed in approximately two hours and fifteen minutes (± 30 minutes). Eel transport from the CWECF to City Island boat launch (Site 12) and Etter boat ramp (Site 4), were completed in approximately two hours (± 30 minutes). Eel transport from the CWECF to Conowingo Creek boat launch (Site 1), was completed in approximately thirty minutes (± 10 minutes).

Of the 62,718 eels that were transported to Williamsport boat ramp (Site 10), 62,712 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-2). This location was stocked eight times from May 8 to September 18. Detailed data from each of the transports are found on Table 4.7-1.

Of the 130,615 eels that were transported to Fort Hunter Access (Site 6), 130,588 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-3). This location was stocked 41 times from June 9 to September 30. Detailed data from each of the transports are found on Table 4.7-1.

Of the 130,465 eels that were transported to City Island boat ramp (Site 12), 130,424 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-5). This location was stocked 42 times from June 10 to November 26. Detailed data from each of the transports are found on Table 4.7-1.

Of the 130,395 eels that were transported to Etters boat ramp (Site 4), 130,334 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-4). This location was stocked 19 times from June 9 to November 20. Detailed data from each of the transports are found on Table 4.7-1.

Of the 943 eels that were transported to Conowingo Creek boat ramp (Site 1), 943 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-6). This location was stocked 20 times from July 19 to December 3. Detailed data from each of the transports are found on Table 4.7-1.

Mortality

Mortality during the 130 transport trips from the CWECF at Conowingo Dam totaled 135 eels (0.02% Table 4.6-2). Six eels (0.01%) during transport from the CWECF to Williamsport boat ramp (Site 10). Forty-one eels (<0.03%) died during transports to City Island boat ramp (Site 12). Sixty-one eels (<0.05%) died during transports to Etters boat ramp (Site 4). Twenty-seven eels (0.02%) died during transports from the CWECF to Fort Hunter Access (Site 6). Zero eels died during transports to Conowingo Creek boat launch (Site 1).

5 Quality Assurance/Quality Control Activities

The CWECF required oversight to ensure its reliability and effectiveness. The area below the ramp entrance was covered with a shade cloth to approximately the normal high-water tailrace elevation to protect the juvenile eels ascending the attraction flow over or through the rip-rap shoreline. The area below the normal high-water line (full generation tailrace level) was not covered with a shade cloth, as covering this area may impede eels that were free swimming in the tailrace from finding the attraction flow of the CWECF, and possibly trap other organisms such as fish. Small areas had to be filled in or secured to keep small birds from climbing under the cloth periodically during the season. The shade cloth over the riprap on the shoreline below the entrance of the ramp was a major help in deterring birds and animals from preying on juvenile eels as they ascended the wetted substrate. The entire ramp was covered with a sheet of aluminum to protect the juvenile eels while climbing.

The transition from the riprap to the ramp entrance was inspected periodically to ensure a smooth transition for eels climbing the substrate. The transition of the riprap to the ramp was photographed at the beginning and the end of the season, the photos are presented in Figure 5.0-1.

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

The control panel of the CWECF provides an instantaneous readout of DO and water temperature and is connected to the flow meters for all the tanks and fill lines. When a one-minute average was outside the range of specification, an alarm would be sent to the control room, followed ten minutes later by an alarm sent to Normandeau via a text or e-mail message. The alarm to the control room was a general alarm but the alarm to Normandeau was a detailed message stating the cause of the alarm. Conowingo operations handled most of the alarms with guidance from Normandeau. Supplemental aeration from the bubblers and the compressed oxygen diffusers were necessary during times of low DO levels in the water supply line from the forebay. Periodically throughout the season, low DO alarms did occur. Slight adjustments were made to the oxygen management system to increase oxygen concentration to resolve this issue, or an empty oxygen bottle was exchanged. No mechanical or physical repairs to the CWECF were needed during the 2024 passage season.

The total attraction flow of the CWECF varied throughout the season dependent upon which tanks were in-service, but an attraction flow was always being discharged down the ramp and shoreline. Total attraction flows were set for approximately 70 gpm. Periodically throughout the season, low flow alarms did occur. Slight adjustments made to the individual tank supply pipes to adjust the output to obtain a constant water flow into the tanks resolved this issue. Since the alarms were addressed within a few minutes, no mortality events were related to 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 2024 season: June 27 and August 6. 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 (< 0.1%), no further changes to this method were warranted.

6 Conclusions and Discussion

The CWECF captured 371,655 eels compared to the OCEF that captured 84,895 juvenile eels during the 2024 season. The CWECF operated for 217 days (May 1 through December 3) compared to the OCEF which only operated 130 days (May 1 through September 15) with a difference of 87 days. The CWECF captured over four times (84,895 versus 371,655 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 2024 season. Another difference between the two facilities is the entrance of each ramp in relationship to the tailwater. In 2024 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 2024 was consistent with the previous years that Constellation has operated the facility. During the 2024 season, the size range of the juvenile eels caught at the CWECF was 62-173 mm with an average length of 118.9 mm, compared to the size range of 79-176 mm (average: 117.1 mm), 65-176 mm (average: 114.3 mm), 66-184 mm (average: 115.7 mm), 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 2023, 2022, 2021, 2020, 2019, 2018, and 2017, respectively (Table 6.0-1 and Normandeau Associates, Inc. 2018, 2019, 2020, 2021, 2022, 2023, and 2024).

Environmental factors, including lunar fraction and river flow, did not appear to have a measurable effect on the number of eels collected in 2024. The highest daily average river flow value per the USGS gage station occurred on August 11, 2024 (215,000 cfs) and the lowest daily average river flow occurred on September 2, 2024 (4,910 cfs). The discharge at Conowingo Dam can change hourly, sometimes quicker, depending on energy demand, and may not be a reliable metric to use to compare eel collection numbers in a given season. Since 2020, the DO readings were obtained from the Conowingo Control Room when the crew arrived at the site for work until November 2 and did not show an obvious correlation with eel collection. The lower lunar fraction is one environmental factor typically related to the number of eels collected, but this relationship was not apparent in 2024. Most of the peak collection period occurred just after the full moon in August. Other smaller peak periods in eel collection occurred near moon phases in May 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, 2022, 2023, and 2024 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 transport will be instituted regardless of the forecasted air temperature.

During the period September 16 through December 3, 2024, no biological data including length, weight, condition factors was recorded. Additionally, no sacrifices were made to determine swim bladder parasites or age. The facility operated with no changes in operation or equipment between September 16 and December 3, 2024. The Resource Agencies (USFWS, SRBC, PA DEP, and MDNR/MDE) comments on this document between January 9, 2025, and January 31, 2025 (Appendix E).

7 References

Hedgepeth, M. V. 1983. Age, Growth and Reproduction of American eels, Anguilla rostrata, from the Chesapeake Bay Area. Master of Arts Thesis, College of William and Mary/Virginia Institute of Marine Science, Gloucester Point, Virginia.

Minkkinen, S., and I. Park. 2014. American eel sampling at Conowingo Dam, 2013. USFWS Technical Report, February 2014.

Normandeau Associates, Inc. 2023. Muddy Run Pumped Storage Project. Conowingo West Eel Collection Facility, FERC Project No. 2355. Prepared for Exelon.

Normandeau Associates, Inc. 2022. Muddy Run Pumped Storage Project. Conowingo West Eel Collection Facility, FERC Project No. 2355. Prepared for Exelon.

Normandeau Associates, Inc. 2021. Muddy Run Pumped Storage Project. Conowingo Eel Collection Facility, FERC Project No. 2355. Prepared for Exelon.

Normandeau Associates, Inc. 2020. Muddy Run Pumped Storage Project. Conowingo Eel Collection Facility, FERC Project No. 2355. Prepared for Exelon.

Normandeau Associates, Inc. 2019. Muddy Run Pumped Storage Project. Conowingo Eel Collection Facility, FERC Project No. 2355. Prepared for Exelon.

Normandeau Associates, Inc. 2018. Muddy Run Pumped Storage Project. Conowingo Eel Collection Facility, FERC Project No. 2355. Prepared for Exelon.

Schmidt, R.E., C.M. O'Reilly, D. Miller. 2009. Observations of American eels using an upland passage facility and effects of passage on the population structure. North American Journal of Fisheries Management, 29: 715-720.

Time and Date website. 2023. Philadelphia, Pennsylvania, USA — Moonrise, Moonset, and Moon Phases. https://www.timeanddate.com/moon/usa/philadelphia?month=5&year=2021

Welsh S.A., J.L. Aldinger, M.A. Braham, J.L. Zimmerman. 2015. Synergistic and singular effects of river discharge and lunar illumination on dam passage of upstream migrant yellow-phase American eels. ICES Journal of Marine Science. Doi:10.1093/icesjms/fws052.

8 Tables and Figures

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

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

Table 4.0-1: Number of Juvenile Eels Caught Daily, Conowingo West Eel Collection Facility, 2024

Date	Number of Eels	Date	Number of Eels	Date	Number of Eels	Date	Number of Eels	Date	Number of Eels
5/1/2024	0	6/14/2024	145	7/28/2024	645	9/10/2024	*2346*	10/24/2024	15
5/2/2024	4	6/15/2024	197	7/29/2024	1309	9/11/2024	*3545*	10/25/2024	36
5/3/2024	44	6/16/2024	206	7/30/2024	*1944*	9/12/2024	*1609*	10/26/2024	12
5/4/2024	*1286*	6/17/2024	213	7/31/2024	*3262*	9/13/2024	*1463*	10/27/2024	25
5/5/2024	*1209*	6/18/2024	102	8/1/2024	*1556*	9/14/2024	*2175*	10/28/2024	7
5/6/2024	*1779*	6/19/2024	241	8/2/2024	1267	9/15/2024	*1090*	10/29/2024	5
5/7/2024	*2525*	6/20/2024	168	8/3/2024	*1476*	9/16/2024	934	10/30/2024	2
5/8/2024	*2428*	6/21/2024	288	8/4/2024	861	9/17/2024	313	10/31/2024	2
5/9/2024	*1969*	6/22/2024	512	8/5/2024	*1065*	9/18/2024	171	11/1/2024	4
5/10/2024	*1728*	6/23/2024	573	8/6/2024	**1531*	9/19/2024	141	11/2/2024	1
5/11/2024	1327	6/24/2024	*2964*	8/7/2024	*1007*	9/20/2024	151	11/3/2024	5
5/12/2024	679	6/25/2024	*2002*	8/8/2024	*771*	9/21/2024	162	11/4/2024	0
5/13/2024	703	6/26/2024	*2439*	8/9/2024	752	9/22/2024	666	11/5/2024	2
5/14/2024	*595*	6/27/2024	**1380*	8/10/2024	1004	9/23/2024	204	11/6/2024	10
5/15/2024	35	6/28/2024	*1891*	8/11/2024	572	9/24/2024	81	11/7/2024	7
5/16/2024	58	6/29/2024	*1292*	8/12/2024	1146	9/25/2024	86	11/8/2024	14
5/17/2024	192	6/30/2024	635	8/13/2024	1369	9/26/2024	411	11/9/2024	6
5/18/2024	211	7/1/2024	*901*	8/14/2024	*3854*	9/27/2024	239	11/10/2024	36
5/19/2024	315	7/2/2024	735	8/15/2024	*5611*	9/28/2024	154	11/11/2024	36
5/20/2024	432	7/3/2024	434	8/16/2024	*5908*	9/29/2024	227	11/12/2024	63
5/21/2024	383	7/4/2024	429	8/17/2024	***17852***	9/30/2024	265	11/13/2024	22
5/22/2024	448	7/5/2024	151	8/18/2024	***21976***	10/1/2024	159	11/14/2024	5
5/23/2024	539	7/6/2024	114	8/19/2024	***34076***	10/2/2024	192	11/15/2024	12
5/24/2024	700	7/7/2024	549	8/20/2024	***18902***	10/3/2024	66	11/16/2024	41
5/25/2024	*1846*	7/8/2024	*1403*	8/21/2024	***16748***	10/4/2024	21	11/17/2024	22
5/26/2024	*1608*	7/9/2024	*804*	8/22/2024	***17494***	10/5/2024	30	11/18/2024	7
5/27/2024	*2818*	7/10/2024	815	8/23/2024	*7900*	10/6/2024	129	11/19/2024	12
5/28/2024	*4024*	7/11/2024	374	8/24/2024	*8508*	10/7/2024	38	11/20/2024	12
5/29/2024	*5719*	7/12/2024	191	8/25/2024	*6342*	10/8/2024	46	11/21/2024	6
5/30/2024	*2673*	7/13/2024	1241	8/26/2024	*10902*	10/9/2024	33	11/22/2024	12
5/31/2024	*1632*	7/14/2024	780	8/27/2024	*6287*	10/10/2024	14	11/23/2024	2
6/1/2024	*840*	7/15/2024	589	8/28/2024	*11644*	10/11/2024	10	11/24/2024	15
6/2/2024	954	7/16/2024	498	8/29/2024	*5044*	10/12/2024	11	11/25/2024	53
6/3/2024	718	7/17/2024	312	8/30/2024	*7590*	10/13/2024	3	11/26/2024	16
6/4/2024	557	7/18/2024	238	8/31/2024	*6216*	10/14/2024	10	11/27/2024	46
6/5/2024	333	7/19/2024	32	9/1/2024	*7735*	10/15/2024	14	11/28/2024	11
6/6/2024	193	7/20/2024	70	9/2/2024	*8255*	10/16/2024	2	11/29/2024	11
6/7/2024	293	7/21/2024	28	9/3/2024	*6062*	10/17/2024	6	11/30/2024	16
6/8/2024	113	7/22/2024	668	9/4/2024	*6710*	10/18/2024	3	12/1/2024	2
6/9/2024	712	7/23/2024	62	9/5/2024	*5002*	10/19/2024	3	12/2/2024	3
6/10/2024	151	7/24/2024	31	9/6/2024	*4338*	10/20/2024	3	12/3/2024	0
6/11/2024	100	7/25/2024	71	9/7/2024	*3365*	10/21/2024	5		
6/12/2024	74	7/26/2024	205	9/8/2024	*2856*	10/22/2024	6	Total 371,655	
6/13/2024	280	7/27/2024	7	9/9/2024	*2861*	10/23/2024	22		

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, 2024

Date	Number of Eels in 200 mL	Date	Number of Eels in 200 mL	Date	Number of Eels in 200 mL
5/4/2024	105	**7/9/2024**	146	**8/29/2024**	132
5/5/2024	115	**7/30/2024**	125	**8/30/2024**	138
5/6/2024	117	**7/31/2024**	133	**8/31/2024**	112
5/7/2024	101	**8/1/2024**	113	**9/1/2024**	130
5/8/2024	117	**8/3/2024**	123	**9/2/2024**	141
5/9/2024	105	**8/5/2024**	108	**9/3/2024**	117
5/10/2024	96	**8/6/2024**	120	**9/4/2024**	110
5/14/2024	85	**8/7/2024**	105	**9/5/2024**	122
5/25/2024	123	**8/8/2024**	96	**9/6/2024**	106
5/26/2024	109	**8/14/2024**	144	**9/7/2024**	114
5/27/2024	114	**8/15/2024**	132	**9/8/2024**	112
5/28/2024	133	**8/16/2024**	139	**9/9/2024**	109
5/29/2024	133	**8/17/2024**	170	**9/10/2024**	102
5/30/2024	98	**8/18/2024**	268	**9/11/2024**	139
5/31/2024	102	**8/19/2024**	300	**9/12/2024**	96
6/1/2024	93	**8/20/2024**	210	**9/13/2024**	117
6/24/2024	152	**8/21/2024**	203	**9/14/2024**	105
6/25/2024	143	**8/22/2024**	207	**9/15/2024**	98
6/26/2024	128	**8/23/2024**	158		
6/27/2024	127	**8/24/2024**	181	**Average**	131.5
6/28/2024	122	**8/25/2024**	151	**Range**	85-300
6/29/2024	123	**8/26/2024**	167	**Median**	122.5
7/1/2024	128	**8/27/2024**	127		
7/8/2024	122	**8/28/2024**	164		

Table 4.2-1: Number of Juvenile Eels Captured with Length and Weight Measurements, Conowingo West Eel Collection Facility, 2024

Length and Weight Measurements	
Number collected	371,655
Number measured	954
Days collected	39
Range of lengths (mm)	62-173
Average length (mm)	118.9
Median length (mm)	117
Range of weight (g)	0.2-4.5
Average weight (g)	1.9
Median weight (g)	1.7

Table 4.2-2: Juvenile Eel Length Frequency, Conowingo West Eel Collection Facility, 2024

Total Length (mm)	Amount
60-64	1
70-74	1
75-79	10
80-84	11
85-89	18
90-94	19
95-99	41
100-104	52
105-109	100
110-114	137
115-119	135
120-124	114
125-129	93
130-134	56
135-139	60
140-144	39
145-149	20
150-154	22
155-159	12
160-164	6
165-169	3
170-174	4
Total	954

Table 4.2-3: Juvenile Eel Weight Frequency, Conowingo West Eel Collection Facility, 2024

Weight (g)	Amount
0.0-0.4	16
0.5-0.9	88
1.0-1.4	221
1.5-1.9	253
2.0-2.4	181
2.5-2.9	105
3.0-3.4	54
3.5-3.9	21
4.0-4.4	14
4.5-4.9	1
Total	954

Table 4.2-4: Observed Injuries of Juvenile American Eel, Conowingo West Eel Collection Facility, 2024

Date	Length (mm)	Weight (g)	Condition Factor
5/13/2024	113	1.8	Hemorrhage on right pectoral fin
6/13/2024	101	1.5	Hemorrhage on caudal fin
7/18/2024	128	1.4	Fungus
7/18/2024	104	1.0	Fungus
7/18/2024	112	1.7	Laceration on right side
7/18/2024	111	1.2	Fungus
7/18/2024	104	1.0	Fungus
7/18/2024	128	2.2	Fungus
8/5/2024	124	2.9	Hemorrhage on right operculum
8/5/2024	111	1.5	Fungus
8/5/2024	124	2.4	Fungus
8/5/2024	118	1.9	Hemorrhage on vent
8/5/2024	115	1.7	Fungus
8/8/2024	139	3.1	Fungus
8/8/2024	128	2.6	Hemorrhage on left operculum
8/8/2024	121	2.0	Fungus
8/8/2024	129	2.2	Hemorrhage on operculum
8/8/2024	127	2.1	Fungus
8/8/2024	128	1.7	Fungus
8/22/2024	115	1.4	Abrasion left pectoral fin
9/2/2024	136	1.9	Fungus
9/2/2024	116	1.0	Fungus
9/2/2024	97	0.7	Fungus
9/12/2024	146	3.2	Hemorrhage right operculum

Table 4.3-1: Sacrificed Eel Data, Conowingo West Eel Collection Facility, 2024

Date	Length (mm)	Weight (g)	Parasite	Age	Date	Length (mm)	Weight (g)	Parasite	Age
5/6/2024	117	1.7	0	2	7/15/2024	139	3.5	0	3
	98	1.0	1	1		119	1.4	0	2
	128	2.4	1	2		146	3.5	1	3
	113	1.5	0	2		115	1.1	1	2
	123	1.8	0	2		123	1.2	2	3
5/13/2024	130	2.7	2	2	7/22/2024	108	1.4	0	2
	144	2.2	0	3		120	2.0	1	2
	112	1.6	1	2		99	1.2	1	1
	151	3.8	1	3		131	1.6	0	2
	128	2.3	0	2		119	1.9	0	2
5/20/2024	157	3.7	0	3	7/29/2024	105	1.4	0	2
	130	2.1	1	3		91	1.0	0	1
	154	1.9	2	No Consensus		124	1.8	1	2
	121	2.3	0	3		108	1.4	1	2
	115	3.8	1	No Consensus		96	1.0	0	1
5/27/2024	140	3.0	2	3	8/5/2024	109	1.5	1	2
	131	0.8	0	2		135	2.9	1	3
	105	2.7	1	No Consensus		114	1.8	1	2
	135	1.4	1	2		120	1.6	0	3
	92	2.8	1	3		118	2.5	0	2
6/3/2024	110	1.1	4	2	8/12/2024	143	3.4	1	3
	110	1.4	0	4		75	0.4	0	0
	126	2.6	3	3		120	1.8	1	2
	165	3.4	0	5		110	1.7	0	3
	135	2.1	0	3		132	2.8	2	No Consensus
6/10/2024	170	4.2	1	4	8/19/2024	76	0.5	1	0
	134	2.3	0	2		85	0.6	0	0
	110	1.5	0	2		62	0.2	1	0
	149	3.6	0	3		96	1.1	3	0
	104	1.4	0	2		104	1.5	0	1
6/17/2024	111	1.0	0	2	8/26/2024	82	0.6	0	0
	124	0.7	0	3		123	1.8	0	2
	101	1.0	1	2		96	0.8	0	2
	143	3.0	0	3		81	0.5	0	0
	100	1.0	0	2		126	2.2	1	3
6/24/2024	84	0.6	4	1	9/2/2024	115	1.7	0	2
	121	2.0	0	2		140	3.3	0	3
	108	1.4	1	2		106	2.6	0	2
	108	1.3	0	2		158	3.1	1	3
	109	1.7	0	3		139	3.0	1	3
7/1/2024	124	1.9	0	2	9/9/2024	157	3.3	1	3
	106	1.3	1	3		129	2.4	0	3
	142	2.7	3	3		112	1.6	0	No Consensus
	126	2.8	0	3		136	2.3	1	2
	119	2.3	1	2		155	3.7	1	No Consensus
7/8/2024	124	1.9	1	No Consensus	9/16/2024	167	4.1	0	4
	95	1.1	0	1		144	3.0	1	3
	135	3.0	0	3		128	1.9	1	1
	100	1.2	1	No Consensus		121	1.6	0	2
	112	1.6	0	2		137	2.3	1	3

Table 4.3-1. (Continued)

Conowingo Eel Parasites	
Total Sacrificed	100
0 Parasites	52 (52%)
1 Parasite	38 (38%)
2 Parasites	5 (5%)
3 Parasites	3 (3%)
4 Parasites	2 (2%)
Without parasites	52
With parasites	48
Total Aged	100
Year 0	7
Year 1	8
Year 2	41
Year 3	32
Year 4	3
Year 5	1
Not Able to be Read (NR)	8

Table 4.3-2: Sacrificed Eels Length Frequency with Detailed Info, Conowingo West Eel Collection Facility, 2024

TL (mm)	Weight (g)	Number	Contained Parasite	Age
60-64	0.2	1	1	0
75-79	0.4-0.5	2	0,1	0,0
80-84	0.5-0.6	3	0,0,4	0,0,1
85-89	0.6	1	0	0
90-94	1.0-2.8	2	0,1	1,3
95-99	0.8-1.2	6	0,0,0,1,1,3	0,1,1,1,1,2
100-104	1.0-1.5	5	0,0,0,1,1	NR,1,2,2,2
105-109	1.3-2.6	10	0,0,0,0,0,1,1,1,1,1	NR,2,2,2,2,2,2,2,3,3
110-114	1.0-1.8	10	0,0,0,0,0,0,0,1,1,1,4	NR,2,2,2,2,2,2,2,3,4
115-119	1.4-3.8	8	0,0,0,0,0,1,1,1	NR,2,2,2,2,2,2,2
120-124	0.7-2.3	13	0,0,0,0,0,0,0,0,1,1,1,1,2	NR,2,2,2,2,2,2,2,2,3,3,3,3
125-129	1.9-2.8	7	0,0,0,1,1,1,3	1,2,2,3,3,3,3
130-134	0.8-2.8	6	0,0,0,1,2,2	NR,2,2,2,2,3
135-139	2.1-3.5	8	0,0,0,1,1,1,1,1	2,2,3,3,3,3,3,3
140-144	2.2-3.4	7	0,0,0,1,1,2,3	3,3,3,3,3,3,3
145-149	3.5-3.6	2	0,1	3,3
150-154	1.9-3.8	2	1,2	NR,3
155-159	3.1-3.7	4	0,1,1,1	NR,3,3,3
165-169	3.4-4.1	2	0,0	4,5
170-174	4.2	1	1	4
Total		**100**	**100**	**100**

NR – age could not be determined

Table 4.4-1: Juvenile Eel Collection by Week with Associated Ranks, Conowingo West Eel Collection Facility, 2024

Week	1	2	3	4	5	6	7	8	9	10	11
Total	1,334	12,965	2,473	4,663	19,314	3,161	1,659	1,730	12,541	3,399	5,377
Rank	21	7	17	13	5	14	20	19	8	12	11
Percent Catch	0.36	3.49	0.67	1.25	5.20	0.85	0.45	0.47	3.37	0.91	1.45

Week	12	13	14	15	16	17	18	19	20	21	22
Total	2,519	1,072	11,459	6,991	36,312	125,604	54,025	41,467	16,855	2,962	1,841
Rank	16	22	9	10	4	1	2	3	6	15	18
Percent Catch	0.68	0.29	3.08	1.88	9.77	33.80	14.54	11.16	4.54	0.80	0.50

Week	23	24	25	26	27	28	29	30	31	32
Total	960	281	41	99	46	44	215	73	168	5
Rank	23	24	31	27	29	30	25	28	26	32
Percent Catch	0.26	0.08	0.01	0.03	0.01	0.01	0.06	0.02	0.05	0.00

Top 3 ranked weeks are shown in boxes

Week	Dates	Week	Dates	Week	Dates
1	May 1- May 4	12	July 14- July 20	23	September 29- October 5
2	May 5-May 11	13	July 21-July 27	24	October 6- October 12
3	May 12-May 18	14	July 30-August 3	25	October 13-October 19
4	May 19-May 25	15	August 4-August 10	26	October 20- October26
5	May 26-June 1	16	August 11-August 17	27	October 27- November 2
6	June 2-June 8	17	August 18-August 24	28	November 3- November 9
7	June 9-June 15	18	August 25-August 31	29	November 10- November 16
8	June 16-June 22	19	September 1-September 7	30	November 17- November 23
9	June 23-June 29	20	September 8-Septmber 14	31	November 24- November 30
10	June 30-July 6	21	September 15-September 21	32	December 1-December 3
11	July 7-July 13	22	September 22- September 28		

Table 4.5-1: Daily Average River flows (cfs), USGS 01576000 – Marietta, PA Gage Station, 2024

Day	May	June	July	August	September	October	November	December
1	32,700	30,000	14,300	11,600	22,500	11,200	5,890	30,100
2	30,100	27,900	13,800	11,400	21,900	11,200	4,910	28,700
3	28,500	25,500	13,900	10,800	18,900	11,200	5,630	26,300
4	28,200	23,200	13,200	11,300	16,700	11,500	5,670	
5	29,400	20,900	13,600	18,000	15,400	12,000	5,640	
6	29,700	24,100	13,300	24,700	13,700	11,300	5,570	
7	28,500	21,600	12,300	28,100	12,600	11,100	5,500	
8	28,900	19,500	11,400	25,900	11,600	10,300	5,490	
9	29,500	17,500	10,900	44,700	11,000	9,130	5,370	
10	31,500	16,100	10,000	113,000	10,600	8,730	5,220	
11	43,400	15,300	10,100	**215,000**	10,300	8,430	5,400	
12	56,300	15,400	10,200	164,000	10,200	7,990	5,530	
13	67,600	15,000	11,500	113,000	9,390	8,930	5,550	
14	70,400	15,200	11,100	79,900	9,030	9,130	5,640	
15	69,200	15,300	10,500	60,600	8,800	8,380	5,890	
16	74,500	15,400	9,210	46,100	8,570	6,930	6,110	
17	69,500	14,800	9,110	37,500	8,160	7,210	6,170	
18	60,000	13,700	9,030	32,400	7,890	8,440	6,350	
19	53,300	12,700	8,340	29,300	7,670	8,020	6,390	
20	49,500	11,900	8,820	39,500	7,500	8,230	6,570	
21	46,100	11,500	9,430	44,800	7,020	9,150	7,050	
22	39,900	11,100	9,340	36,400	7,950	8,700	7,330	
23	35,700	10,800	9,350	31,100	7,530	7,300	7,450	
24	38,300	10,600	9,350	26,900	9,450	7,700	7,490	
25	37,500	10,400	9,390	23,200	8,000	7,720	8,740	
26	34,700	10,100	15,000	20,500	9,030	7,290	10,600	
27	31,500	11,800	19,000	18,400	9,180	6,790	12,600	
28	29,900	11,800	17,500	16,800	9,280	6,570	15,500	
29	29,200	12,700	17,400	15,500	9,440	6,500	21,900	
30	28,300	14,400	14,000	15,000	10,300	6,200	27,900	
31	29,300		12,600	23,600		6,350		

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, 2024 EST (*1.0 equals full moon*)

Day	May	June	July	August	September	October	November	December
1	0.501	0.298	0.218	0.085	0.019	0.011	0.001	0.004
2	0.384	0.195	0.131	0.036	0.002	0.000	0.015	0.025
3	0.272	0.109	0.064	0.008	0.004	0.008	0.048	0.068
4	0.170	0.047	0.021	0.020	0.025	0.035	0.101	
5	0.088	0.010	0.003	0.017	0.065	0.080	0.172	
6	0.031	0.002	0.009	0.052	0.120	0.142	0.260	
7	0.003	0.02	0.037	0.103	0.191	0.219	0.360	
8	0.006	0.062	0.085	0.169	0.274	0.310	0.470	
9	0.037	0.124	0.149	0.248	0.368	0.412	0.584	
10	0.092	0.200	0.225	0.337	0.47	0.521	0.696	
11	0.167	0.287	0.312	0.432	0.576	0.632	0.801	
12	0.255	0.380	0.405	0.533	0.682	0.740	0.889	
13	0.351	0.477	0.502	0.635	0.783	0.838	0.955	
14	0.450	0.574	0.600	0.734	0.872	0.918	0.992	
15	0.549	0.668	0.696	0.826	0.942	0.973	0.995	
16	0.645	0.757	0.786	0.904	0.965	0.986	0.997	
17	0.734	0.838	0.867	0.962	0.987	0.999	0.972	
18	0.815	0.906	0.932	0.978	1.000	0.991	0.920	
19	0.885	0.958	0.955	0.994	0.980	0.952	0.847	
20	0.941	0.974	0.977	0.996	0.929	0.885	0.758	
21	0.979	0.990	0.998	0.967	0.853	0.799	0.661	
22	0.989	0.998	0.989	0.908	0.757	0.699	0.561	
23	0.998	0.980	0.952	0.824	0.649	0.594	0.461	
24	0.994	0.936	0.887	0.722	0.538	0.488	0.364	
25	0.967	0.867	0.799	0.610	0.428	0.386	0.274	
26	0.917	0.776	0.694	0.495	0.325	0.291	0.193	
27	0.844	0.67	0.580	0.383	0.232	0.206	0.123	
28	0.752	0.555	0.462	0.279	0.153	0.133	0.066	
29	0.646	0.436	0.349	0.188	0.880	0.075	0.026	
30	0.530	0.322	0.245	0.114	0.041	0.032	0.005	
31	0.412		0.156	0.057		0.007		

Table 4.5-3: Water Temperature (˚C) Recorded in the Collection Tank*, Conowingo West Eel Collection Facility, 2024

Day	May	June	July	August	September	October	November	December
1	20.0	26.2	29.9	30.2	26.9	25.4	17.5	9.7
2	19.7	26.1	29.3	30.5	26.9	25.3	16.1	8.6
3	20.4	26.3	29.2	30.5	27.4	24.8	16.5	8.5
4	20.4	26.8	29.2	30.9	27.3	24.3	16.5	
5	21.4	26.2	29.3	30.8	27.3	24.3	18.2	
6	21.9	26.6	29.8	31.3	27.1	24.3	18.9	
7	22.4	27.3	29.6	31.3	27.1	24.1	18.8	
8	21.8	27.2	29.9	30.5	26.3	23.9	17.7	
9	22.6	27.2	30.1	29.4	25.9	23.6	15.7	
10	21.7	27.2	29.9	29.4	25.8	23.1	15.5	
11	21.7	26.6	30.3	26.1	26.0	22.4	18.5	
12	21.2	26.5	31.3	24.0	25.8	22.0	16.0	
13	21.2	26.6	31.0	23.5	26.1	21.9	15.3	
14	19.8	26.6	31.3	23.9	26.3	22.3	15.0	
15	19.4	27.0	31.0	24.2	26.5	21.6	15.6	
16	19.6	28.1	31.2	24.3	26.2	20.9	15.6	
17	19.6	27.7	31.6	24.4	26.8	20.2	14.9	
18	19.6	27.3	32.3	25.0	26.7	19.8	15.7	
19	19.9	28.2	32.2	25.8	26.9	19.2	15.3	
20	20.2	27.7	32.0	25.3	26.9	19.3	16.1	
21	20.4	28.4	31.7	24.9	26.8	19.4	14.6	
22	19.8	28.7	31.6	24.4	26.2	19.6	14.1	
23	22.6	29.5	31.4	24.6	26.4	19.8	14.7	
24	23.8	30.1	31.4	24.5	25.1	19.7	14.7	
25	24.4	30.5	31.1	24.7	24.4	19.9	14.4	
26	24.7	30.1	31.2	25.9	25.3	19.6	14.2	
27	26.2	30.0	31.3	26.4	25.5	19.2	14.2	
28	27.2	30.3	31.1	25.4	25.5	18.7	14.2	
29	27.2	30.4	30.7	29.5	25.3	18.4	13.7	
30	26.8	30.1	30.2	26.3	25.2	18.2	12.5	
31	26.1		30.3	26.4		18.2		

*Starting November 2 temperature was taken from the Darlington USGS gage at 1100 hour

Table 4.5-4: Dissolved Oxygen (mg/L) Readings from the Control Room (Station 643*), Conowingo West Eel Collection Facility, 2024

Day	May	June	July	August	September	October	November	December
1	11.7	7.7	7.7	7.6	8.8	8.7	9.8	11.2
2	10.7	7.2	7.6	7.3	8.9	8.0	11.1	11.6
3	10.8	7.6	7.9	7.7	7.1	8.7	12.1	12.1
4	9.7	7.0	7.5	7.4	7.3	8.2	12.2	
5	9.0	7.1	7.3	7.1	8.0	8.8	12.0	
6	8.6	7.3	7.3	7.5	8.5	8.4	11.3	
7	8.3	7.4	7.3	7.4	8.4	9.1	11.0	
8	7.9	7.2	7.1	7.5	8.1	8.7	11.2	
9	8.3	6.8	6.9	7.6	7.6	9.2	11.8	
10	8.3	7.9	6.7	7.2	8.3	9.8	11.3	
11	8.5	8.5	6.6	8.3	7.9	11.1	11.1	
12	8.5	8.4	7.1	8.8	7.7	10.1	11.3	
13	8.4	7.9	7.4	8.7	7.9	10.6	11.9	
14	9.1	7.5	7.3	8.6	7.7	11.6	10.1	
15	9.2	8.3	6.7	8.5	7.6	9.9	11.6	
16	9.3	8.5	6.0	9.1	7.5	10.0	11.7	
17	9.5	8.3	6.1	8.9	8.6	11.2	12.3	
18	9.4	8.5	6.3	8.8	8.7	10.2	12.2	
19	9.1	8.0	6.6	8.2	8.8	10.5	12.0	
20	8.9	7.4	6.6	7.6	8.6	9.5	11.7	
21	9.2	7.5	6.6	7.2	8.7	10.1	11.8	
22	9.0	6.8	6.8	7.4	8.4	9.3	9.7	
23	9.4	6.7	7.2	8.2	7.7	10.4	10.1	
24	8.8	7.1	6.8	8.9	7.6	8.8	11.7	
25	7.9	7.5	7.4	8.8	7.7	11.0	10.7	
26	7.5	7.0	8.3	8.8	7.7	11.0	10.8	
27	6.8	7.3	8.3	8.3	8.2	11.0	10.5	
28	7.0	7.5	8.3	8.4	8.2	10.9	9.1	
29	7.3	7.9	7.6	8.9	7.8	11.2	10.1	
30	7.5	8.0	8.2	8.6	7.5	11.7	10.4	
31	7.2		7.6	8.9		11.3		

*Starting November 2 dissolved oxygen was taken from the Darlington USGS gage at 1100 hour

Table 4.6-1: Number of Juvenile American Eel placed in Holding, Conowingo West Eel Collection Facility, 2024

Day	May	June	July	August	September	October	November	December
1	-	848	-	-	-	158	4	85
2	5	1806	-	-	-	350	5	88
3	49	2530	-	-	-	-	10	
4	1335	-	-	-	-	21	-	
5	2543	336	-	-	-	51	2	
6	4317	1877	-	-	-	180	12	
7	6843	-	-	-	-	-	-	
8	-	16892	-	-	-	46	13	
9	1970	-	-	-	-	79	19	
10	3698	-	-	-	-	-	55	
11	5025	-	-	-	-	10	91	
12	5,704	-	-	-	-	20	154	
13	6401	-	-	-	-	23	176	
14	-	-	-	-	-	-	-	
15	35	-	-	-	-	14	12	
16	93	-	-	-	929	16	53	
17	284	-	-	-	1241	-	75	
18	495	-	-	-	-	3	82	
19	810	-	-	-	141	6	94	
20	1,235	-	-	-	292	9	-	
21	-	-	-	-	452	-	6	
22	450	-	-	-	1118	6	12	
23	990	-	-	-	-	28	20	
24	1,689	-	-	-	-	-	35	
25	3,535	-	-	-	-	36	88	
26	5,143	-	-	-	-	48	-	
27	7981	-	-	-	239	72	46	
28	-	-	-	-	393	-	57	
29	6	-	-	-	620	5	68	
30	5745	-	-	-	-	7	83	
31	-	-	-	-	-	-	Total = 98,728	

Table 4.6-2: Eel Transport and Stocking Data, 2024

Parameter	Number of eels	Mortality (No. dead eels by location)			Removed for Analysis	Removed for SRBC	Number Stocked
		Collection Tank	Holding Tank	Transport Tank			
OCEF Eels Collected	84,895	4 (.005%)					
OCEF eels Transported to CWECF	84,891			0 (0%)			84,891
CWECF Eels Collected	371,655	71	639		100	600	370,245
Total Transported from CWECF	455,136			135			455,001
Location of stocking							
Williamsport boat ramp (Site 10)	62,718			6 (.01%)			62,712
Fort Hunter Access (Site 6)	130,615			27 (.02%)			130,588
Etters boat ramp (Site 4)	130,395			61 (.05%)			130,334
City Island boat ramp (Site 12)	130,465			41 (.03%)			130,424
Conowingo Creek boat ramp (Site 1)	943			0 (0.0%)			943

Table 4.7-1: Detailed Individual Eel Transport and associated water quality Data, 2024

Date (2024)	Number of Eels Stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
Transport to Williamsport, Upstream of Hepburn Street Dam (Site 10)												
8-May	9,270	9:47	20.4	13.6	10:00	20.4	13.6	13:44	21.4	13.6	20.1	8.48
14-May	6,992	9:04	18.3	7.6	9:55	18.0	13.05	13:46	18.1	13.58	16.2	9.41
21-May	1,618	9:04	15.9	9.97	9:28	18.9	10.81	13:17	18.9	12.91	19.8	9.76
28-May	11,995	8:50	27.2	6.9	10:55	25.5	8.4	14:54	25.7	9.42	21.8	8.14
31-May	9,921	9:30	26.1	7.36	11:00	22.2	9.63	14:50	21.8	14.23	19.5	9.17
4-Jun	3,019	9:30	22.3	14.63	9:55	25.0	10.02	14:02	26.1	10.46	21.2	9.10
7-Jun	18,495	10:10	27.3	8.82	11:00	23.4	10.33	14:48	24.0	13.75	23.2	7.94
18-Sep	1,402	7:55	26.7	8.43	8:30	26.7	4.87	12:20	24.9	9.74	22.2	7.40
Total	**62,712**											

Date (2024)	Number of Eels Stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking Site	
		Time	Temp (°C)	DO(mg/L)	Time	Temp (°C)	DO(mg/L)	Time	Temp (°C)	DO(mg/L)	Temp (°C)	DO(mg/L)
Transport to Etters boat ramp, Goldsboro, PA (Site 4)												
9-Jun	24,882	8:37	22.7	5.87	10:25	25.2	19.8	13:30	25.3	13.95	24.0	10.8
5-Aug	11,809	8:21	30.8	7.63	10:27	29.9	5.23	12:17	29.9	5.61	27.9	8.75
9-Aug	751	7:56	29.4	9.08	8:44	28.0	9.62	10:30	27.9	11.0	23.7	8.1
11-Aug	571	8:10	26.1	11.36	8:38	24.9	6.54	10:16	24.6	12.5	22.0	6.76
14-Aug	3,852	8:10	23.9	10.37	8:45	23.2	4.87	11:20	23.6	8.78	22.6	7.83
17-Aug	17,851	8:00	24.4	8.74	10:25	23.5	18.5	12:30	23.3	14.05	24.1	6.85
19-Aug	15,250	8:06	25.8	7.79	9:02	24.9	10.18	12:23	24.9	17.11	23.9	7.79
22-Aug	17,499	8:18	24.4	8.84	9:36	22.3	8.25	12:40	23.2	15.39	22.1	10.45
27-Aug	6,287	7:25	26.4	8.85	10:17	25.1	18.97	2:50	25.7	9.65	26.8	10.1
29-Aug	5,045	7:57	29.5	7.85	8:53	25.3	11.94	11:15	25.4	10.5	27.7	9.09
31-Aug	6227	7:48	26.4	7.88	8:22	25.4	7.23	11:01	25.1	10.91	24.5	5.11
3-Sep	6063	8:19	27.4	7.67	10:40	25.7	14.54	12:12	25.4	17.64	23.0	10.76
4-Sep	6711	8:10	27.3	8.47	8:43	25.6	8.62	11:21	25.1	13.95	21.5	8.45
9-Sep	2854	8:39	25.9	8.28	9:14	24.3	5.34	10:58	14.14	24.7	20.9	9.79
12-Sep	1608	7:59	25.8	7.01	9:01	24.4	8.78	11:48	24.1	12.34	22.8	8.74
13-Sep	1463	9:16	26.1	15.5	9:39	25.2	8.34	11:50	25.2	13.82	22.5	9.87
15-Sep	1090	8:34	26.5	7.80	9:00	23.4	6.74	10:53	23.4	11.67	23.3	7.43
3-Oct	415	8:56	24.8	8.67	8:58	23.5	9.35	10:50	23.1	11.56	18.6	6.84
20-Nov	106	9:54	16.4	8.54	10:45	15.6	16.50	13:00	15.7	10.40	14.3	11.60
Total	**130,334**											

Date (2024)	Number of Eels Stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking Site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
Transport to Conowingo Creek boat ramp (Site 1)												
19-Jul	34	8:20	32.2	7.56	9:02	29.9	7.80	9:36	29.6	8.11	27.6	7.57
20-Jul	70	8:30	32.0	5.60	9:00	30.1	7.28	9:30	28.6	16.72	29.2	7.36
21-Jul	29	9:00	31.7	12:14	9:15	31.7	8.51	9:35	29.1	6.56	30.7	5.50
23-Jul	62	8:39	31.4	6.96	8:56	31.4	6.97	9:25	27.1	4.85	27.3	7.72
24-Jul	32	10:52	31.0	6.23	10:52	31.7	8.27	11:45	28.3	7.9	30.7	9.06
25-Jul	75	9:40	31.1	20:24	9:45	28.6	6.98	10:30	28.9	6.27	28.1	6.06
27-Jul	10	8:04	31.3	7.28	8:20	23.5	6.36	8:45	23.5	6.39	28.3	6.58
7-Aug	54	11:45	31.5	8.25	11:50	31.3	7.68	12:13	31.4	7.61	29.5	8.38
24-Sep	81	8:29	25.1	9.03	8:46	25.1	6.35	9:08	23.4	6.71	24.3	5.42
25-Sep	86	8:41	24.2	9.60	8:50	23.3	9.97	9:03	22.6	4.6	23.4	6.88
10-Oct	93	10:01	23.1	9.16	10:18	21.3	6.71	10:48	21.3	6.54	18.4	6.70
14-Oct	33	8:04	22.3	11.62	8:22	21.7	7.18	8:53	21.7	7.05	19.1	7.05
17-Oct	22	8:25	20.2	11.28	8:52	18.7	7.82	9:15	16.8	7.00	18.7	7.0.
21-Oct	14	9:26	19.1	9.92	9:47	18.0	7.70	10:00	17.9	8.14	17.1	7.03
24-Oct	43	8:38	19.7	8.86	8:58	18.5	7.18	9:15	18.1	8.76	18.5	8.17
28-Oct	79	8:18	18.7	10.99	8:32	18.6	9.78	9:00	18.7	9.84	16.8	7.54
31-Oct	9	9:00	18.2	11.31	9:15	17.9	10.58	9:40	17.8	7.61	17.0	7.70
4-Nov	10	9:00	17.6	14.04	9:30	16.5	8.97	10:00	15.6	7.92	16.0	7.62
7-Nov	19	8:39	17.9	9.32	9:10	18.0	8.59	9:26	18.3	7.80	17.6	8.76
3-Dec	88	9:15	9.3	14.34	10:05	7.5	10.65	10:28	1.7.0	11.09	5.0	12.11
Total	**943**											

Date (2024)	Number of Eels Stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
Transport to City Island boat ramp (Site 12)												
10-Jun	4897	8:30	27.2	6.12	10:00	25.0	14.46	11:51	25.0	14.15	22.9	8.81
11-Jun	185	8:06	26.6	7.96	9:45	25.6	12.47	11:30	25.1	10.70	21.7	8.51
13-Jun	289	9:04	26.6	8.05	9:31	24.8	10.36	11:35	25.0	20.14	23.6	9.93
14-Jun	207	9:05	26.6	7.36	9:31	25.6	14.34	11:45	26.3	17.25	25.4	11.37
16-Jun	341	9:45	27.2	12.74	9:50	27.1	13.5	11:42	24.3	9.54	24.3	9.54
18-Jun	122	8:51	27.3	9.98	8:58	27.4	8.55	10:45	26.7	13.53	27.2	7.25
20-Jun	165	9:20	27.7	8.15	9:46	28.7	4.46	11:20	28.4	11.6	29.1	7.26
22-Jun	528	8:39	28.7	5.62	9:03	26.9	7.73	10:45	27.1	7.55	30.4	5.9
24-Jun	2956	9:49	30.1	5.17	10:38	30.0	7.35	12:44	29.0	17.20	27.8	7.78
27-Jun	1382	10:00	30.0	4.59	11:11	29.3	15.77	12:50	29.2	13.03	27.6	7.84
28-Jun	1,897	8:41	30.3	8.88	9:10	26.5	9.51	11:00	26.4	15.7	25.8	6.90
1-Jul	1677	10:00	29.9	9:42	10:45	24.1	10.57	12:54	24.3	10.15	23.8	9.14
3-Jul	538	8:50	29.2	9.77	9:18	25.5	12:.34	11:03	26.1	11.82	25.2	7.22
5-Jul	164	8:44	29.3	8.25	9:03	26.0	14.9	10:50	26.3	9.71	27.4	8.03
8-Jul	1407	9:15	29.9	6.26	9:35	29.1	6.94	11:00	29.6	9.13	29.7	8.26
11-Jul	376	9:30	30.3	6.91	9:30	29	8.56	11:20	29	12.08	27.8	6.79
12-Jul	198	8:53	31.3	6.04	9:16	29.9	8.08	9:50	28.9	15.25	27.1	6.74
13-Jul	1,245	9:03	30.0	10.02	9:44	30.4	12:14	11:30	30.4	16.00	27.7	7.59
15-Jul	576	9:00	31.0	8.4	10:00	30.8	6.7	12:00	31.1	14.64	30.9	7.95
18-Jul	244	1021	32.3	9.19	10:25	31.5	6.95	12:15	31.3	18.50	28.7	7.77
28-Jul	650	9:04	31.1	10.1	9:34	29.8	7.16	11:17	29.5	11.64	25.9	7.79
30-Jul	1946	8:50	30.2	6.53	9:17	28.8	9.00	11:08	28.5	15.50	26.9	6.30
1-Aug	1,557	8:50	30.2	8.02	9:35	29.6	13.78	11:30	29.8	15.56	28.8	8.51
2-Aug	1,268	8:40	30.5	6.79	9:18	30.0	5.51	11:05	30.1	13.07	29.6	6.00
4-Aug	7,061	8:37	30.9	7.11	8:37	30.0	9.99	11.41	29.4	10.70	2.60	7.61
7-Aug	6,102	8:22	31.3	7.17	10:17	30.1	11.01	12:07	29.8	16.60	26.5	8.74
13-Aug	1,369	8:50	23.5	11.55	9:13	22.9	9.72	11:05	23.5	9.84	22.1	4.03
16-Aug	5,908	8:38	24.3	9.57	9:38	23.4	9.45	12:45	23.8	13.77	23.4	8.89

18-Aug	18,819	19:29	25.4	8.15	20:06	25.0	14.9	21:45	24.9	18.26	24.0	8.26
20-Aug	18,893	7:51	25.3	7.39	8:31	24.3	10.42	11:20	23.8	17.12	21.7	8.28
23-Aug	7,931	8:05	24.6	9.40	8:40	23.4	13.12	12:13	23.5	16.61	24.8	8.06
25-Aug	6,342	7:25	24.7	8.54	8:10	23.7	7.48	10:30	23.5	10.17	22.2	8.84
28-Aug	11,646	7:48	25.4	8.21	12:10	24.9	11.45	2:00	25.4	17.60	24.5	5.11
1-Sep	7,741	8:00	26.9	7.82	8:35	25.9	12.04	11:10	25.9	14.90	23.5	7.18
5-Sep	5,002	9:15	27.3	8.26	10:10	25.8	7.52	12:05	25.6	13.93	22.3	8.78
7-Sep	3,363	8:25	27.1	9.01	8:50	25.8	6.76	10:35	25.7	4.97	21.9	7.30
10-Sep	2,344	8:16	25.8	8.25	10:00	24.3	7.11	12:18	24.4	12.28	21.8	8.35
14-Sep	2,174	8:27	26.3	6.19	8:53	23.6	4.93	10:45	23.8	8.55	23.1	7.14
26-Sep	411	9:00	25.5	8.92	9:30	24.3	8.2	10:58	23.8	9.61	18.8	8.41
7-Oct	218	8:30	23.9	7.19	8:50	22.5	7.19	10:50	22.9	14.40	19.7	8.10
14-Nov	181	8:23	17.0	10.79	8:47	15.5	14.7	10:40	15.1	10.45	12.48	8.20
26-Nov	104	8:28	15.1	11.76	8:54	14.0	17.64	10:45	14.2	11.67	9.20	11.11
Total	**130,424**											

Date (2024)	Number of Eels Stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
Transport to Fort Hunter Access (Site 6)												
9-Jun	4,972	8:37	22.2	6.45	17:00	26.3	8.80	19:00	26.1	15.1	24.8	9.32
12-Jun	515	9:11	26.5	7.89	9:37	23.1	9.33	12:15	23.2	8.58	22.0	8.15
15-Jun	200	9:23	27.0	6.89	9:31	25.4	9.65	11:38	25.8	18.78	24.0	7.70
17-Jun	243	10:38	29.5	12.29	10:45	27.5	13.42	12:45	29.9	11.82	24.6	7.64
19-Jun	253	9:15	28.2	7.30	10:00	26.9	6.84	12:00	27	8.40	29.0	7.87
21-Jun	301	8:27	28.4	6.81	8:44	27.6	8.63	10:46	27.6	9.26	28.0	7.09
23-Jun	582	9:23	29.5	8.49	9:53	28.0	5.60	11:50	29.6	11.90	30.2	7.30
25-Jun	2,021	8:15	30.4	6.27	10:34	29.3	15.70	12:00	29.2	10.65	25.7	6.60
26-Jun	2,444	8:11	30.1	5.03	9:30	29.5	11.60	2:50	29.4	12.43	27.7	8.96
29-Jun	1,299	7:55	30.4	9.64	8:20	29.2	7.32	11:30	29	9.59	24.7	7.74
30-Jun	638	8:35	30.1	9.06	8:50	29.2	9.97	10:29	28.5	10.35	25.5	8.25
1-Jul	1,310	10:00	29.3	12.36	10:00	27.1	10.28	11:35	27.5	14.34	25.1	8.05
4-Jul	435	8:30	29.2	7.77	9:00	27.7	6.31	11:50	27.7	12.68	25.9	7.72
6-Jul	120	8:08	29.8	9.61	8:22	27.5	7.07	10:20	27.5	12.34	27.6	6.32
7-Jul	549	9:00	29.6	6.67	9:30	29.1	8.75	11:00	29.0	19.98	29.1	8.22
9-Jul	814	8:45	30.1	6.77	9:18	29.4	8.30	11:05	28.2	12.70	29.8	7.05
10-Jul	812	8:53	29.9	7.38	9:22	29.0	9.79	10:23	28.9	14.70	29.9	7.31
14-Jul	781	9:24	31.1	5.89	10:05	31.0	7.15	11:47	31.0	16.50	30.0	10.03
16-Jul	496	9:00	31.2	6.04	9:22	30.1	6.20	11:15	30.9	15.79	29.6	8.75
17-Jul	312	9:00	31.6	6.91	10:00	31.3	5.91	12:18	31.4	12.27	30.7	8.86
22-Jul	664	9:01	31.6	8.64	9:45	30.0	9.55	11:58	29.5	9.65	26.8	6.60
26-Jul	210	8:38	31.2	7.28	9:00	28.9	8.44	10:45	28.8	10.72	25.6	5.82
29-Jul	1308	9:43	30.7	9.40	10:20	26.8	5.65	12:05	29.8	8.72	26.4	11.75
31-Jul	3260	8:37	30.3	9.66	9:08	29.4	9.34	11:04	29.3	8.45	27.4	7.25
3-Aug	3431	9:44	30.5	5.62	12:02	29.8	12.21	1:45	29.9	11.08	29.4	7.45
6-Aug	8181	8:15	31.3	10:15	13:32	30.6	9.08	13:24	30.6	9.37	29.1	7.69
8-Aug	768	7:50	30.5	8.51	8:37	28.5	8.88	11:04	27.4	17.42	23.9	7.79
10-Aug	1003	8:05	29.4	6.45	8:45	28.3	5.97	10:45	28.3	9.86	26.9	7.61

12-Aug	1141	7:53	24.0	11.48	8:35	23.0	4.67	10:30	23.0	12.08	21.6	6.30
15-Aug	5610	8:22	24.2	9.85	9:53	23.3	12.38	11:16	23.4	13.29	22.4	6.44
18-Aug	21979	7:25	25.0	9.01	8:30	24.2	10.85	11:25	24.1	16.58	23.0	7.53
21-Aug	16750	7:57	24.9	9.41	9:45	23.5	16.01	12:48	23.3	16.17	20.5	8.77
24-Aug	8510	7:54	24.5	11.87	8:38	23.0	13.00	11:10	23.1	16.59	22.1	8.74
26-Aug	10397	9:00	25.9	9.31	10:00	24.8	6.47	12:55	24.9	12.27	25.5	7.97
30-Aug	7597	8:13	26.3	8.16	9:38	25.3	10.11	12:15	25.0	13.43	24.7	7.27
2-Sep	8250	7:50	26.9	7.85	8:39	26.0	10.01	11:30	25.6	9.17	24.5	7.31
6-Sep	4338	8:15	27.1	8.26	10:17	25.6	13.30	11:55	25.1	11.45	22.1	8.27
8-Sep	2857	8:18	26.3	7.68	8:57	24.6	8.97	11:50	24.0	10.37	19.8	9.40
11-Sep	3543	9:20	26.0	7.34	9:20	24.9	3.75	11:22	24.9	9.50	21.1	7.95
23-Sep	866	8:20	25.9	7.41	10:00	24.6	8.97	12:15	22.1	12.36	20.8	7.41
30-Sep	828	8:00	25.2	8.11	8:36	23.6	9.65	11:05	23.4	15.06	19.1	8.15
Total	**130,588**											

Table 4.7-2: Constellation's Eel Stocking Totals by Location and Year, 2015 - 2024

Location	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	TOTAL
Conowingo Creek boat ramp	847	-	-	-	-	-	-	-	862	943	**2,652**
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	-	-	-	-	-	-	130,334	**233,996**
West Fairview Access	-	-	-	22,586	40,950	-	233,593	28,743	71,796		**397,668**
Fort Hunter Access	-	-	-	22,348	41,116	-	-	28,715	71,564	130,588	**294,331**
City Island boat ramp	-	-	-	24,869	41,132	-	231,694	28,784	72,189	130,424	**529,092**
Bloomsburg boat ramp	-	-	-	-	-	109,308	-	-	-		**109,308**
Lock Haven boat ramp	-	-	-	-	-	109,123	-	-	62,134		**171,257**
Wrightsville boat ramp	-	-	-	-	-	19,319	-	-	-		**19,319**
Columbia boat ramp	-	-	-	-	-	17,660	-	-	-		**17,660**
Shikellamy State Park	-	-	-	-	-	-	183,609	55,871	-		**239,480**
Williamsport boat ramp	-	-	-	-	-	-	-	-	-	62,712	**62,712**
TOTAL	**847**	**22,382**	**129,902**	**69,803**	**123,198**	**255,410**	**648,896**	**142,113**	**278,545**	**455,001**	**2,126,097**

Table 5.0-1: Specified Operating Ranges of Conowingo West Eel Collection Facility, 2024

Parameters of CWECF			
	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, 2024

	May, June, July									
	1-May	8-May	15-May	22-May	29-May	5-Jun	12-Jun	19-Jun	26-Jun	3-Jul
Collection Tank Fill	10.0	15.0	17.0	17.5	9.0	9.5	13.0	9.9	14.5	8.5
Collection Tank Drain	13.5	15.5	16.5	17.5	12.0	10.0	14.0	11.2	15.0	9.0
Holding Tank #1 Drain	17.0		17.5							
Holding Tank #2 Drain	17.5	21.5	17.0	21.5	13.5					
Holding Tank #3 Drain	20.0	22.0	17.5	41.25	21.0	30.0	36.75	28.0	39.0	30.0
Spray Bar	6.3	7.5	7.35	7.5	6.75	7.5	9.0	7.8	4.35	7.5
Scent line	1.1	1.4	1.25	1.4	0.6	0.7	1.45	1.25	1.55	1.5
Backside of Ramp	4.6	1.9	0.75	1.4	3.6	1.2	2.45	2.55	2.05	2.0
Top Attraction	1.7	5.6	6.6	6.1	3.15	6.3	6.55	5.25	2.3	5.5
Bottom of Ramp Attraction	68.0	59.0	68.5	80.25	46.5	40.0.	50.75	39.2	54.0	39.0
Total Attraction*	**70.8**	**66.0**	**76.35**	**87.75**	**50.25**	**47.0**	**58.75**	**45.7**	**57.85**	**46.0**

	July, August, September									
	10-Jul	17-Jul	24-Jul	31-Jul	6-Aug	14-Aug	21-Aug	28-Aug	11-Sep	18-Sep
Collection Tank Fill	11.0	14.5	13.8	11.0	12.0	9.0	15.5	15.6	12.5	10.0
Collection Tank Drain	12.0	18.75	18.0	11.5	12.0	7.5	15.0	20.25	12.0	15.0
Holding Tank #1 Drain										
Holding Tank #2 Drain										7.0
Holding Tank #3 Drain	30.0	37.5	19.5	34.5	41.25	33.75	49.5	59.0	30.0	35.0
Spray Bar	7.2	8.4	8.7	6.75	7.05	7.05	7.65	7.8	6.0	7.8
Scent line	1.1	1.65	2.0	1.5	1.7	1.75	2.1	1.8	1.8	1.3
Backside of Ramp	2.1	5.9	6.2	2.0	1.7	0.25	1.6	6.45	1.3	6.3
Top Attraction	5.1	2.5	2.5	4.75	5.35	6.8	6.05	1.35	4.7	1.5
Bottom of Ramp Attraction	42.0	56.25	37.5	46.0	53.25	41.25	64.5	79.25	42.0	57.0
Total Attraction*	**48.2**	**60.4**	**42.0**	**52.25**	**60.3**	**49.8**	**72.65**	**82.4**	**48.5**	**59.8**

	September, October, November									
	25-Sep	2-Oct	9-Oct	16-Oct	23-Oct	30-Oct	6-Nov	13-Nov	20-Nov	27-Nov
Collection Tank Fill	12.5	15.5	13.5	9.0	11.1	15.0	12.0	12.0	15.0	14.0
Collection Tank Drain	13.0	17.0	14.0	12.0	11.1	15.5	11.0	13.0	14.0	13.5
Holding Tank #1 Drain		5.7								
Holding Tank #2 Drain			18.5	12.0	8.4	15.0	16.0	9.0	16.0	34.5
Holding Tank #3 Drain	37.5	33.75	42.75	43.5	42.0	25.5	45.0	30.0	37.5	34.5
Spray Bar	6.5	6.75	6.75	6.9	7.8	6.9	7.05	12.5	6.9	6.75
Scent line	1.35	1.55	0.8	1.0	1.5	1.45	1.5	1.4	1.6	1.5
Backside of Ramp	0.85	3.05	1.3	4.0	1.5	1.95	0.5	2.4	0.6	1.0
Top Attraction	5.65	3.7	5.45	2.9	6.3	4.95	7.0	10.1	6.3	5.75
Bottom of Ramp Attraction	50.0	56.45	75.25	67.5	61.5	59.0	72.0	52.0	67.5	82.5
Total Attraction*	**57.0**	**61.7**	**81.5**	**74.4**	**69.3**	**65.4**	**80.05**	**63.5**	**75.4**	**89.25**

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

Table 5.0-3: Quality Control Checks on Volumetric Estimates, Conowingo West Eel Collection Facility, 2024

Date	Number of eels in:		Displacement of Water	Volumetric Estimate	Actual Counts	Difference
	200 mL	1 L				
6/27/2024	127	635	1.9	1,352	1,380	28
8/6/2024	120	600	2.6	1,560	1,531	-29
Total				**2,912**	**2,911**	**-1**
						< 0.1%

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, 2017-2024

Year		2017	2018	2019	2020	2021	2022	2023	2024	Average	Total
Eels Collected		122,300	67,949	126,181	254,651	623,095	139,798	217,035	371,655	240,333	1,922,664
Peak	Number	7,280	5,572	10,166	14,137	16,004	4,158	17,326	34,076	13,589.88	108,719
	Date	30-Jul	30-Jul	5-Jul	30-May	7-Jul	8-Jul	7-Jul	19-Aug		
Days of Operation		138	138	138	138	193	204	211	217	172.13	1,377
Average eels per day		886.2	492.4	914.4	1,845.30	3,228.50	685.3	1033.5	1712.7	1,396.79	10,798.3
Daily collections > 1,000 eels		31	22	26	60	111	46	44	68	51	408
Volumetric Estimation Days		40	25	31	56	112	34	28	66	49	392
Accuracy of Volumetric Estimates (±)		-1.00%	1.60%	-1.10%	-2.30%	1.40%	-0.40%	0.80%	-0.1%	-1.01	
Biological Data											
Sample Size		926	857	909	851	975	966	919	954	919.625	7357
Length (mm)	Average	122.3	121.6	114.4	112.2	115.7	114.3	117.1	118.9	117.0625	936.5
	Range	78-192	84-173	64-165	71-186	66-184	65-176	79-176	62-173		
	Median	122	120	115	112	115	114	116	117		
Weight (g)	Average	2.1	2	1.8	1.5	1.6	1.7	1.7	1.9	1.7875	14.3
	Range	0.5-6.0	0.5-4.8	0.2-4.7	0.3-5.5	0.2-5.0	0.3-4.3	0.3-5.7	.2-4.5		
	Median	2	2	1.7	1.4	1.5	1.6	1.6	1.7		13.5
Sacrificed	Number	193	93	91	96	100	101	100	100		874
	Contained Parasites	53.90%	48.40%	52.70%	62.50%	61.00%	56.50%	60.00%	48.00%	55.38%	
	Average Age	2.2	2.3	1.65	1.97	2.3	2.4	2.1	2.2		
	Age Range	1-4	1-4	1-4	1-4	1-5	1-4	1-4	0-5		
River Flows	Average	37,053	62,036	40,214	14,256	43,466	20,251	25,121	20,547	32,868	
(cfs, daily avg.	Min	6,000	11,100	4,560	3,970	8,560	3,750	6,820	4,910		
flows at Conowingo)	Max	178,000	329,000	157,000	58,400	219,000	173,000	166,000	215,000		

Figure 3.6-1: Sample Location (Stone Run) of American Eel Collected for Wild Health Screening, Conowingo West Eel Collection Facility, 2024

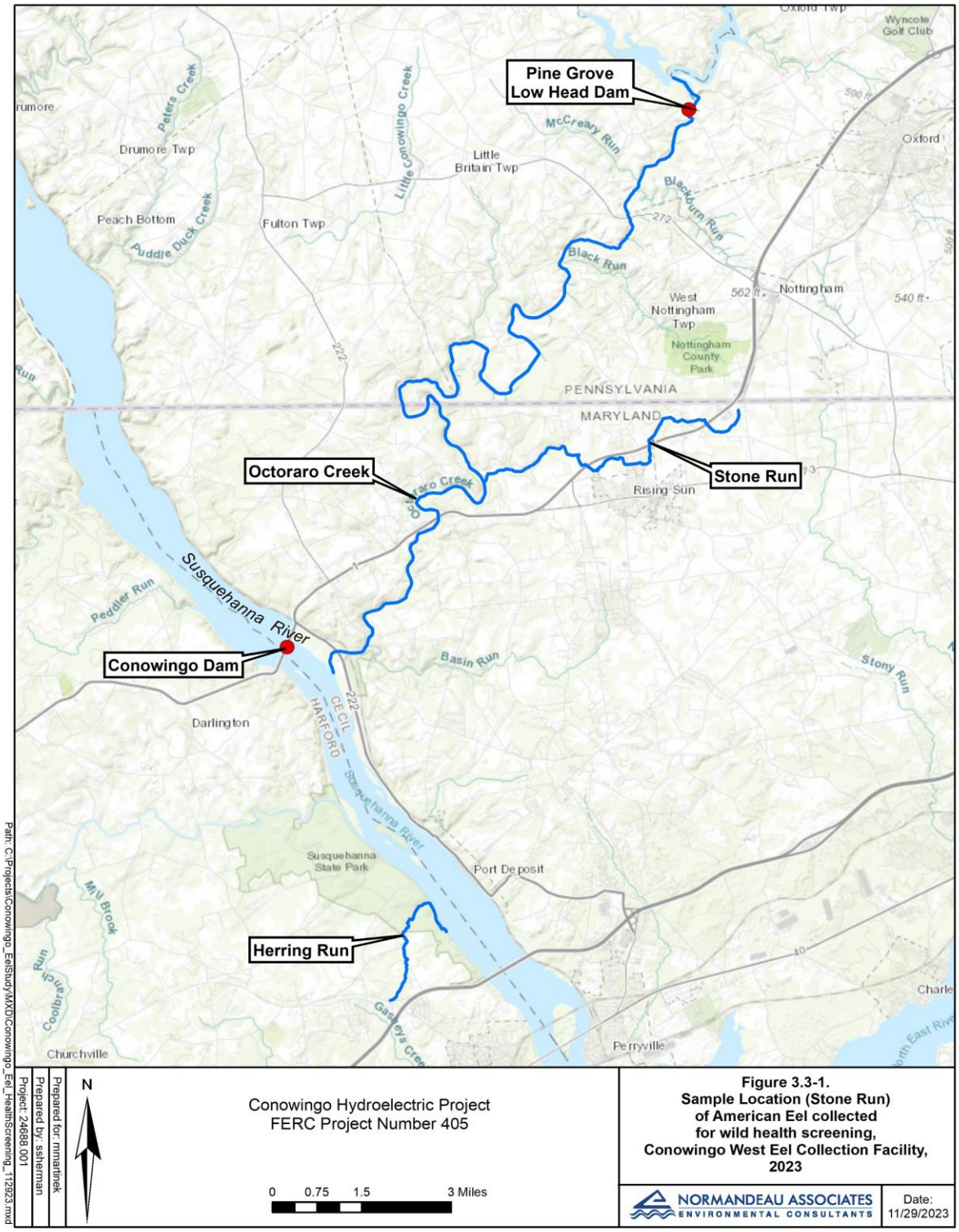


Figure 3.6-2: Stone Run, a Tributary of Octoraro Creek used for the Wild Health Screening, Conowingo Dam, 2024

Figure 4.1-1: Daily Eel Catch, Conowingo West Eel Collection Facility, 2024

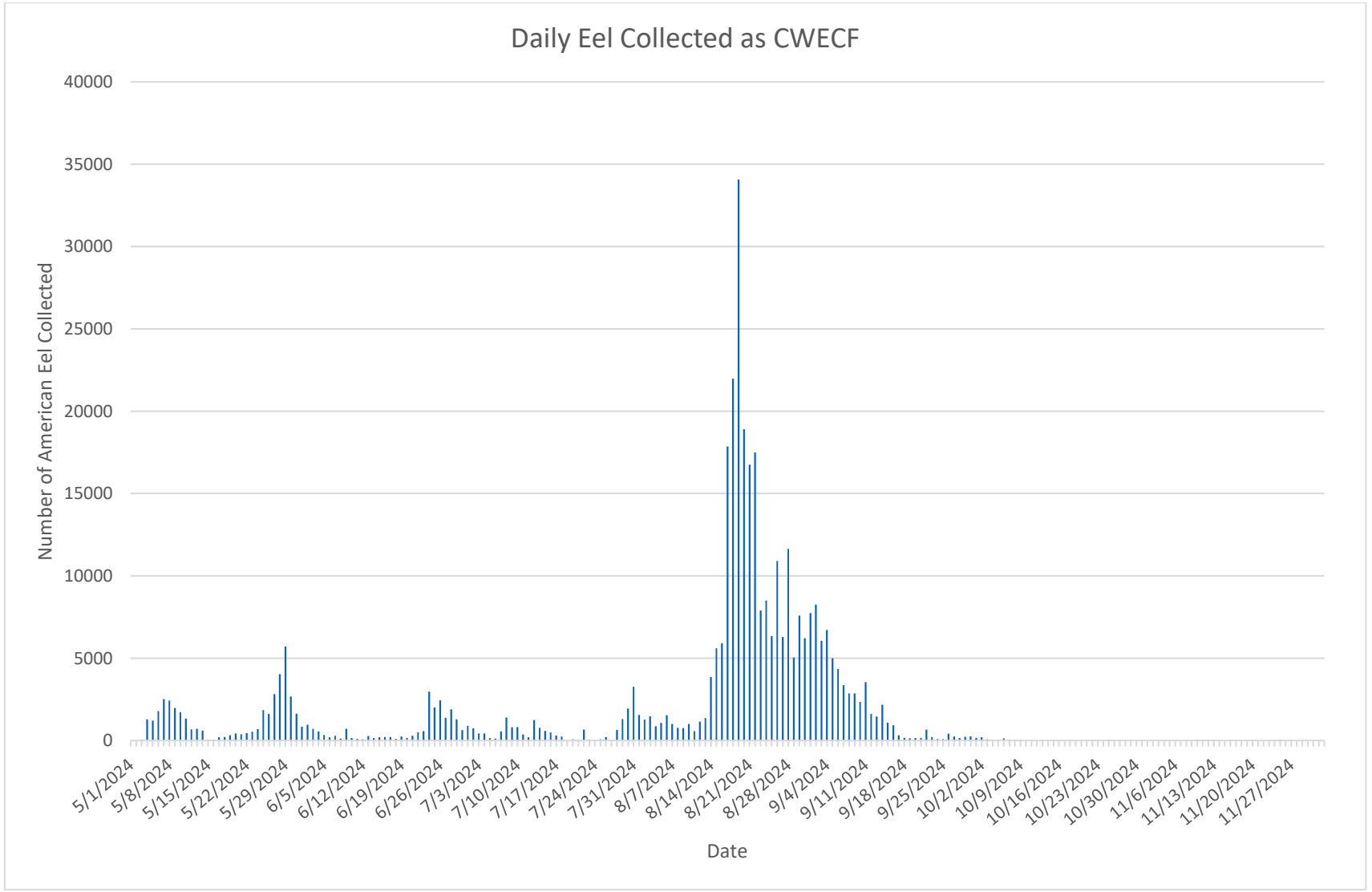


Figure 4.2-1: Eel with Scrapes on Right Side, Conowingo West Eel Collection Facility, 2024

Figure 4.2-2: Eel with Hemorrhage Caudal Tail, Conowingo West Eel Collection Facility, 2024

Figure 4.2-3: Eel with Abrasion on Operculum, Conowingo West Eel Collection Facility, 2024

Figure 4.4-1: Percent of Eels Collected per Week, Conowingo West Eel Collection Facility, 2024

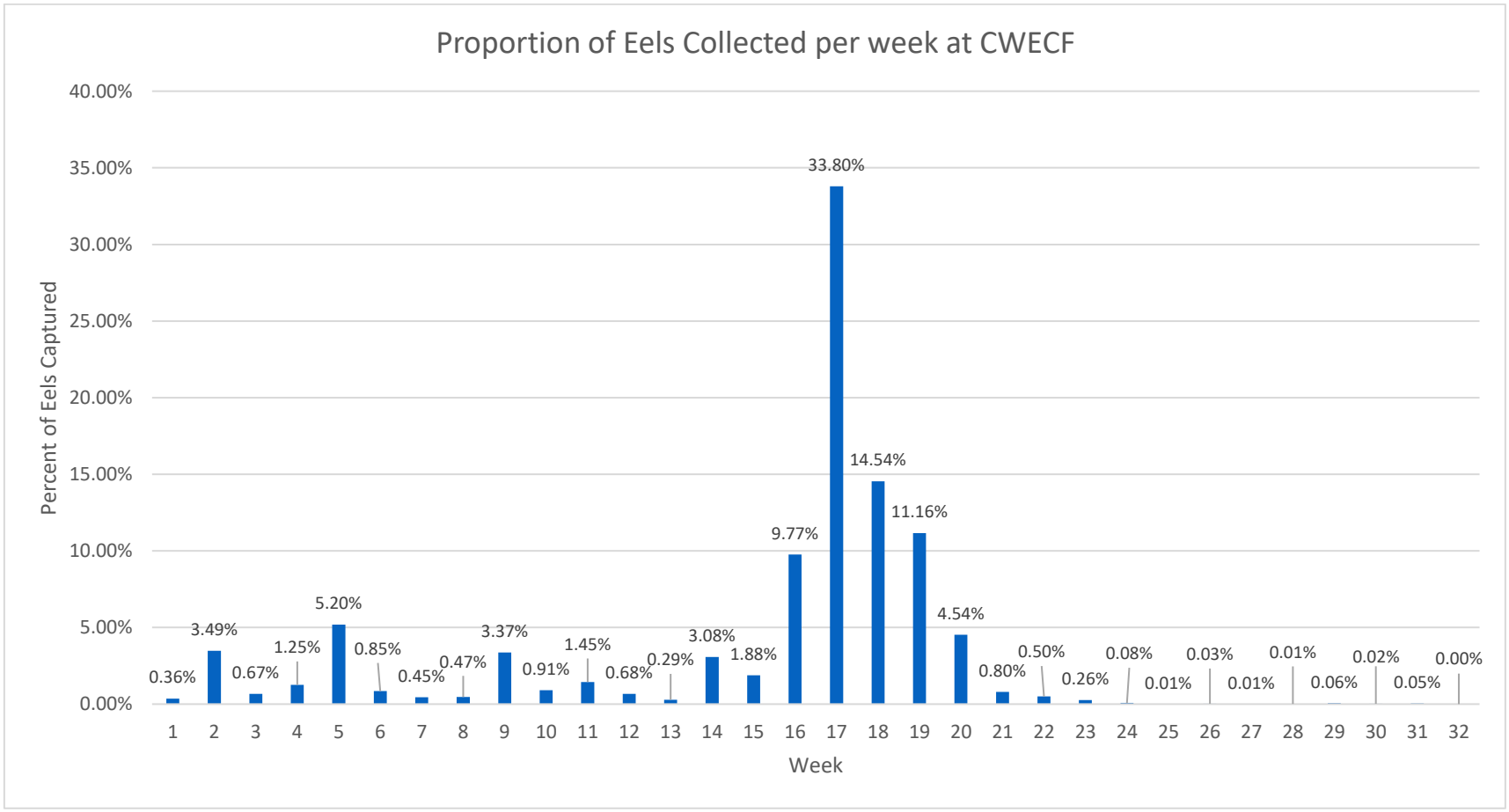
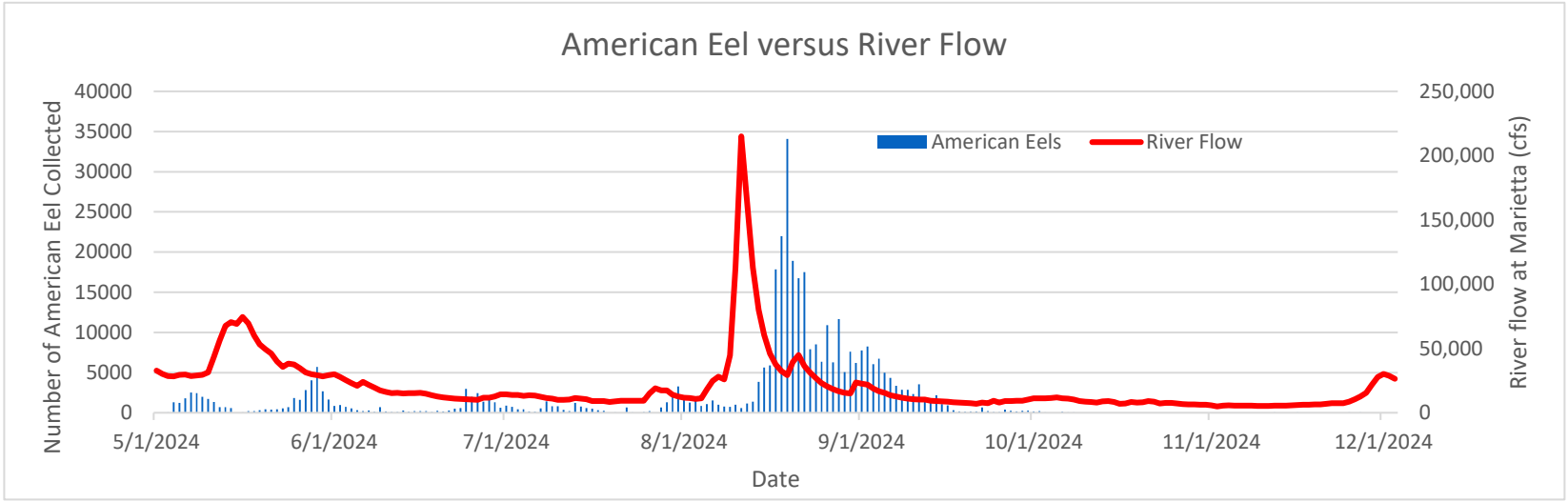


Figure 4.5-1: Daily Eel Catch and Daily Average River Flow (cfs, top graph) and Weekly Eel Catch and Weekly Average River Flow (cfs, bottom graph), Conowingo West Eel Collection Facility, 202



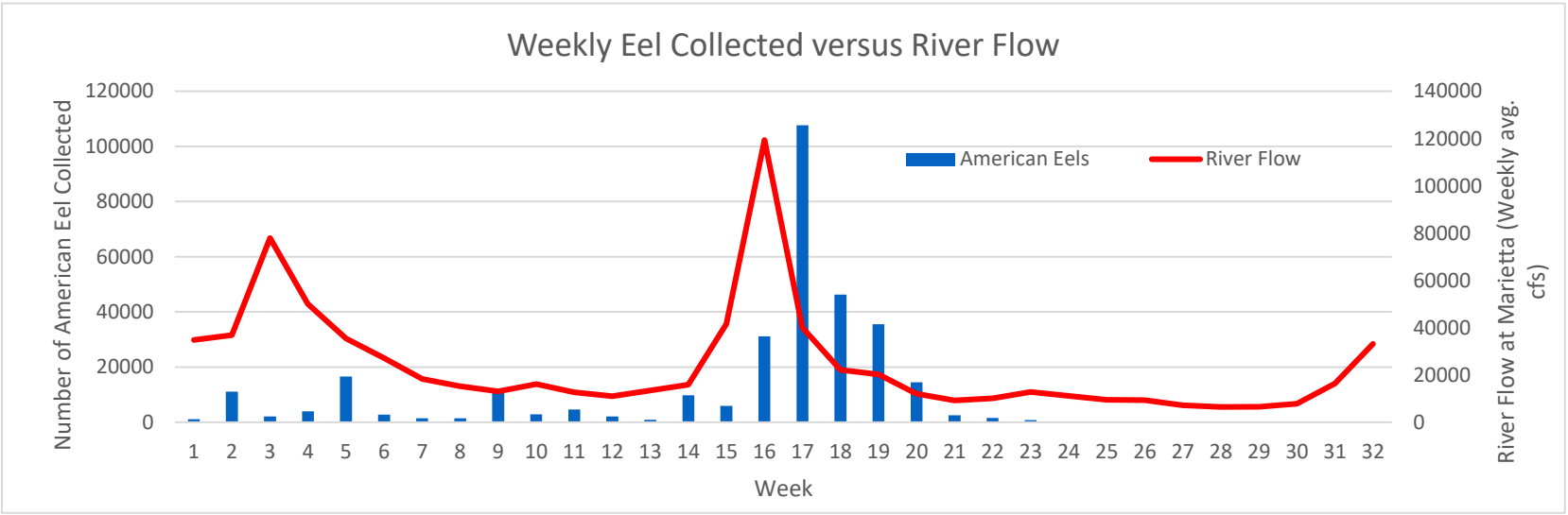
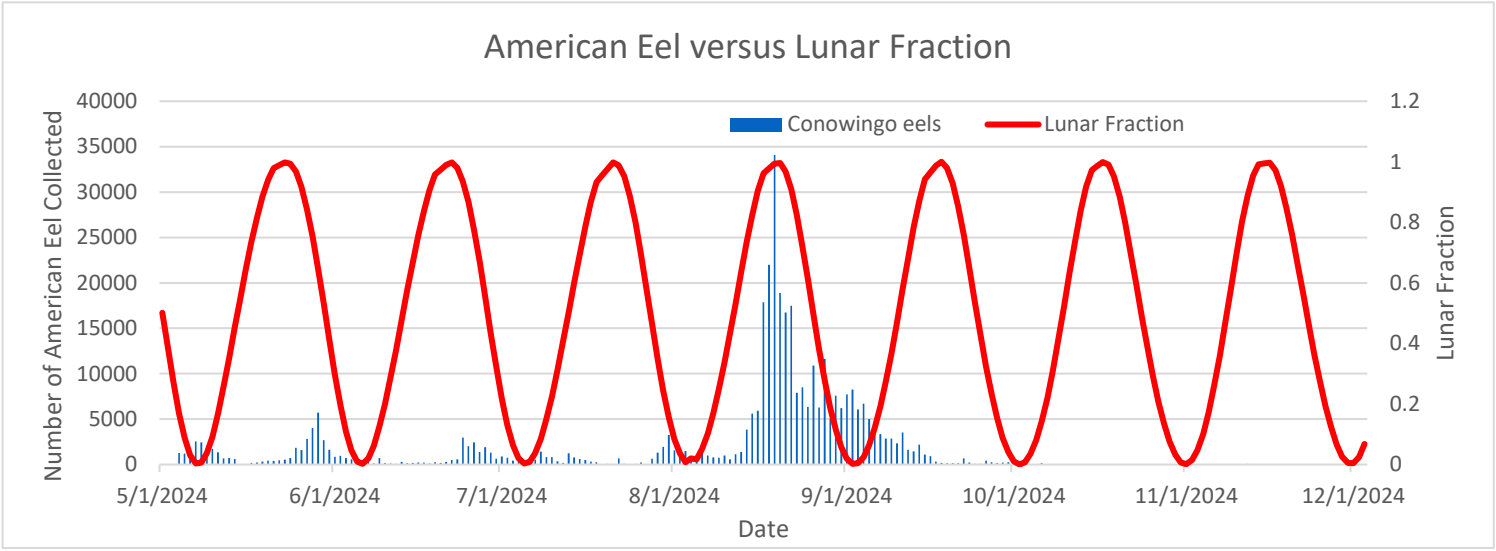


Figure 4.5-2: Eel Catch and Lunar Fraction (Daily above, Weekly Avg. below), Conowingo West Eel Collection Facility, 2024 (*1.0 Equals Full Moon*)



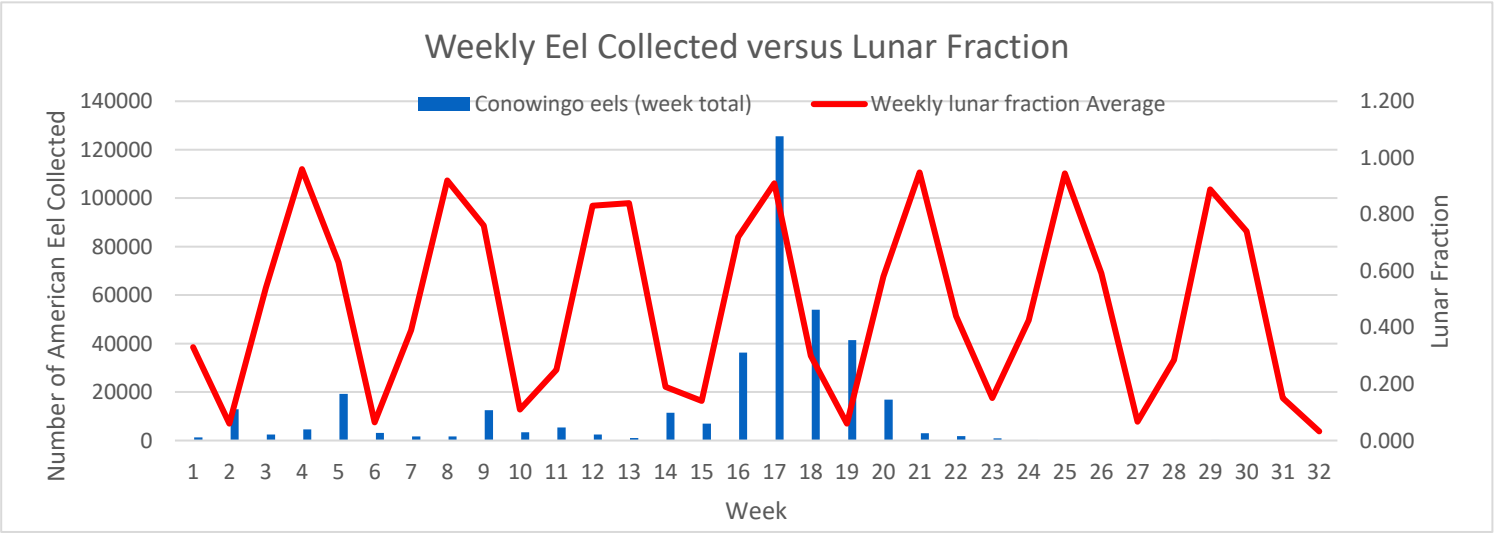


Figure 4.5-3:Temperature, Conowingo West Eel Collection Facility, 2024

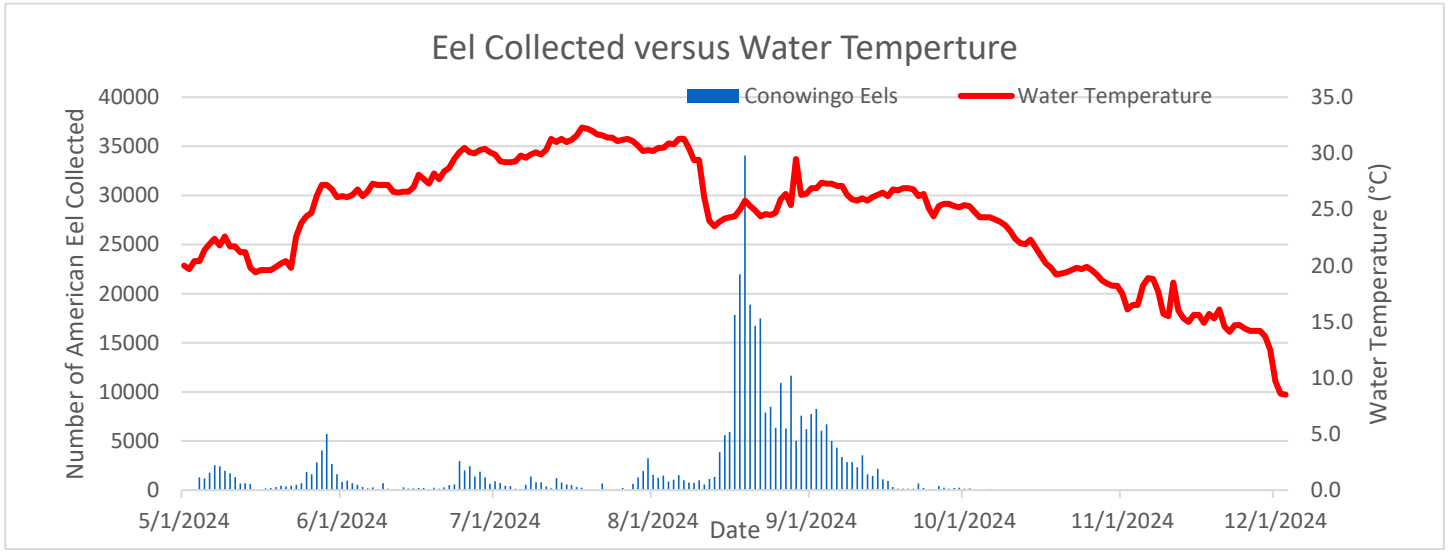


Figure 4.5-4: Eel Catch and Dissolved Oxygen, Conowingo West Eel Collection Facility, 2024

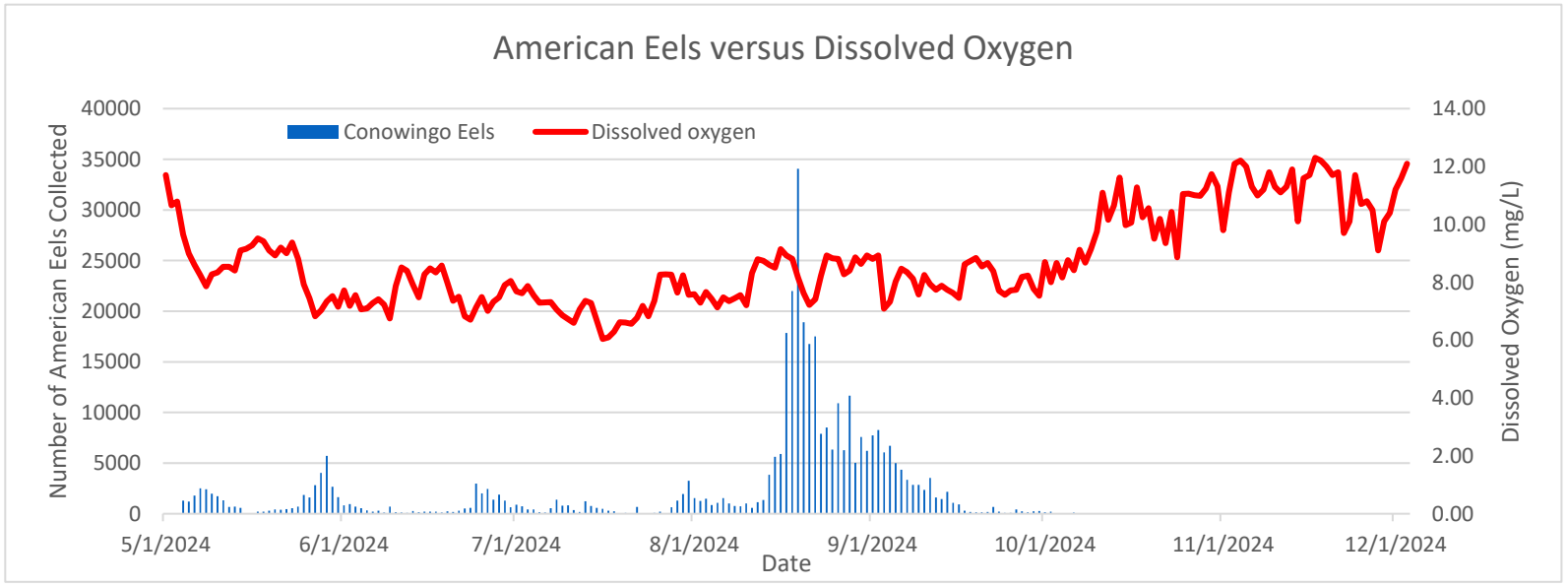


Figure 4.7-1: Eel Stocking Sites, 2015-2024

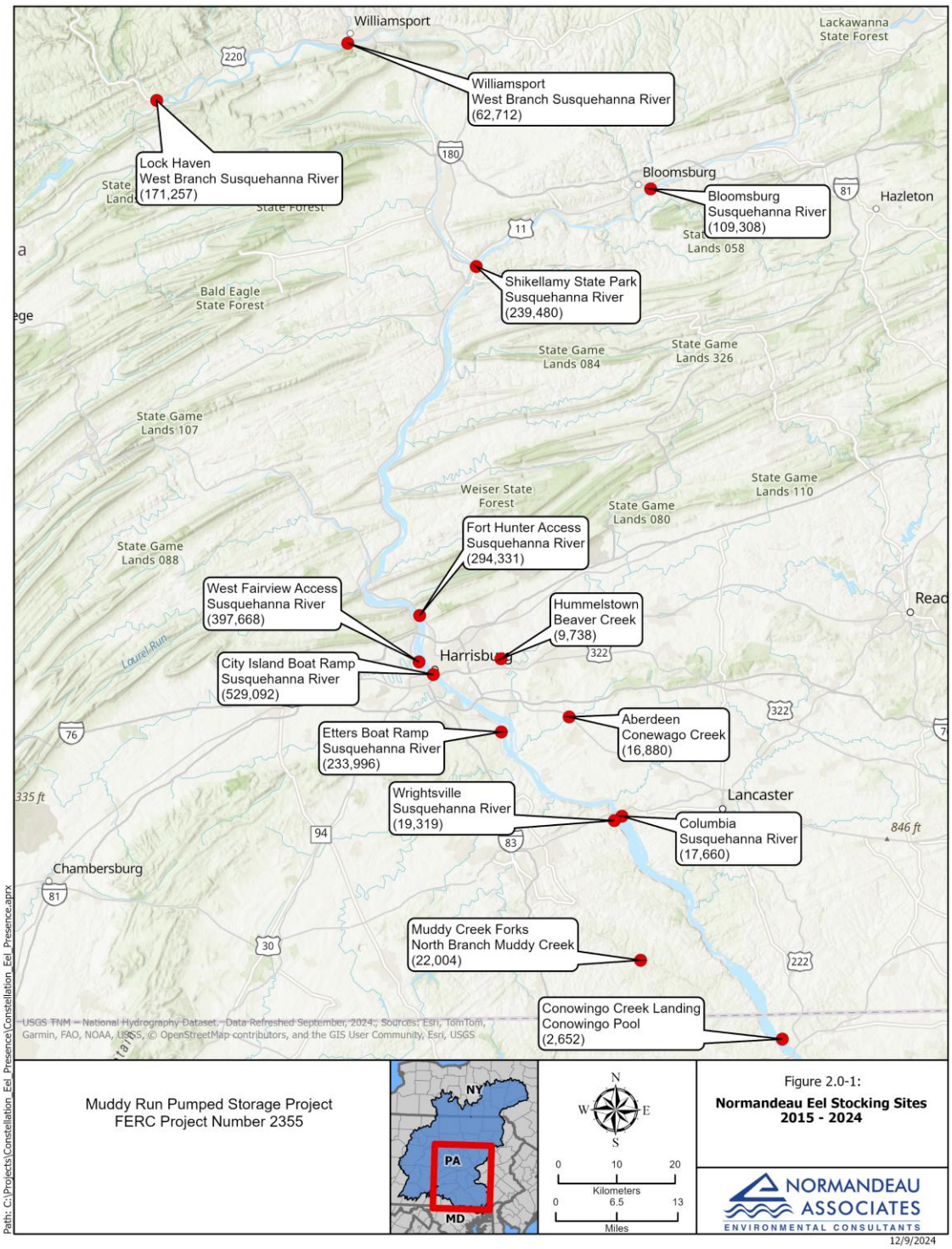


Figure 4.7-2: Williamsport boat ramp (Site 10) Stocking Site, 2024

Figure 4.7-3: Fort Hunter Access (Site 6) Stocking Site, 2024

Figure 4.7-4: Etters boat ramp (Site 4) Stocking Site, 2024

Figure 4.7-5: City Island boat ramp (Site 12) Stocking Site, 2024

Figure 4.7-6: Conowingo Creek boat ramp (Site 1) Stocking Site, 2024

Figure 5.0-1: Transition from Riprap Shoreline to Ramp Entrance, Conowingo West Eel Collection Facility, 2024

Appendix A:
Method of Aging Eel Otolith, Conowingo West Eel Collection Facility, 2024

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 ensure no damage to the otolith section occurred. Following polishing, the mounted sections were etched in a 5% solution of EDTA for 3-5 minutes, rinsed, and then stained in a bath of toluidine blue for approximately 5 minutes to enhance visibility of each annulus.

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

NR- Could not be read

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

Date	Collection #	Eel #	Length (mm)	Weight (g)	Age 1- CNG	Age 2- CAF	Consensus
5/6/2024	MDM24404	1	117	1.7	2	2	2
	MDM24404	4	98	1.0	1	1	1
	MDM24404	5	128	2.4	2	2	2
	MDM24404	8	113	1.5	2	2	2
	MDM24404	9	123	1.8	2	2	2
5/13/2024	MDM24412	1	130	2.7	2	2	2
	MDM24412	2	144	2.2	3	3	3
	MDM24412	3	112	1.6	2	2	2
	MDM24412	4	151	3.8	3	3	3
	MDM24412	5	128	2.3	2	2	2
5/20/2024	MDM24419	1	157	3.7	3	3	3
	MDM24419	2	130	2.1	3	3	3
	MDM24419	3	154	1.9	2	no read	no consensus
	MDM24419	4	121	2.3	3	3	3
	MDM24419	5	115	3.8	4	2	no consensus
5/27/2024	MDM24426	1	140	3.0	3	3	3
	MDM24426	2	131	0.8	2	2	2
	MDM24426	3	105	2.7	3	no read	no consensus
	MDM24426	4	135	1.4	2	2	2
	MDM24426	5	92	2.8	3	3	3
6/3/2024	MDM24433	1	110	1.1	2	1	2
	MDM24433	2	110	1.4	4	4	4
	MDM24433	3	126	2.6	3	3	3
	MDM24433	4	165	3.4	5	5	5
	MDM24433	5	135	2.1	3	3	3
6/10/2024	MDM24440	1	170	4.2	4	4	4
	MDM24440	2	134	2.3	2	2	2
	MDM24440	3	110	1.5	2	2	2
	MDM24440	4	149	3.6	3	3	3
	MDM24440	5	104	1.4	2	2	2
6/17/2024	MDM24447	1	111	1.0	2	2	2
	MDM24447	2	124	0.7	3	3	3
	MDM24447	3	101	1.0	2	2	2
	MDM24447	4	143	3.0	3	3	3
	MDM24447	5	100	1.0	2	2	2
6/24/2024	MDM24454	1	84	0.6	1	1	1
	MDM24454	2	121	2.0	2	2	2
	MDM24454	3	108	1.4	2	2	2
	MDM24454	4	108	1.3	2	2	2
	MDM24454	5	109	1.7	3	3	3

7/1/2024	MDM24461	3	124	1.9	2	2	2
	MDM24461	4	106	1.3	3	2	3
	MDM24461	5	142	2.7	3	3	3
	MDM24461	16	126	2.8	3	3	3
	MDM24461	21	119	2.3	2	2	2
7/8/2024	MDM24468	1	124	1.9	1	no read	no consensus
	MDM24468	2	95	1.1	1	1	1
	MDM24468	3	135	3.0	3	3	3
	MDM24468	4	100	1.2	no read	no read	no consensus
	MDM24468	5	112	1.6	2	2	2
7/15/2024	MDM24475	1	139	3.5	3	3	3
	MDM24475	2	119	1.4	2	2	2
	MDM24475	3	146	3.5	3	3	3
	MDM24475	4	115	1.1	2	2	2
	MDM24475	5	123	1.2	3	3	3
7/22/2024	MDM04482	1	108	1.4	2	2	2
	MDM04482	2	120	2.0	2	2	2
	MDM04482	3	99	1.2	1	1	1
	MDM04482	4	131	1.6	2	2	2
	MDM04482	5	119	1.9	2	2	2
7/29/2024	MDM24489	1	105	1.4	2	2	2
	MDM24489	2	91	1.0	1	1	1
	MDM24489	3	124	1.8	2	2	2
	MDM24489	4	108	1.4	2	2	2
	MDM24489	5	96	1.0	1	1	1
8/5/2024	MDM24496	1	109	1.5	2	2	2
	MDM24496	2	135	2.9	3	3	3
	MDM24496	3	114	1.8	2	2	2
	MDM24496	4	120	1.6	3	3	3
	MDM24496	5	118	2.5	2	2	2
8/12/2024	MDM24403	1	143	3.4	3	3	3
	MDM24403	2	75	0.4	0	0	0
	MDM24403	3	120	1.8	2	2	2
	MDM24403	4	110	1.7	3	3	3
	MDM24403	5	132	2.8	3	no read	no consensus
8/19/2024	MDM24411	1	76	0.5	0	0	0
	MDM24411	2	85	0.6	0	0	0
	MDM24411	3	62	0.2	0	0	0
	MDM24411	4	96	1.1	0	0	0
	MDM24411	5	104	1.5	1	1	1
8/26/2024	MDM24418	1	82	0.6	0	0	0

	MDM24418	2	123	1.8	2	2	2
	MDM24418	3	96	0.8	2	2	2
	MDM24418	4	81	0.5	0	0	0
	MDM24418	5	126	2.2	3	3	3
9/2/2024	MDM25425	1	115	1.7	2	2	2
	MDM25425	2	140	3.3	3	3	3
	MDM25425	3	106	2.6	2	2	2
	MDM25425	4	158	3.1	2	4	3
	MDM25425	5	139	3.0	3	3	3
9/9/2024	MDM24432	1	157	3.3	3	3	3
	MDM24432	2	129	2.4	3	3	3
	MDM24432	3	112	1.6	0	no read	no consensus
	MDM24432	4	136	2.3	2	2	2
	MDM24432	5	155	3.7	2	3	no consensus
9/16/2024	MDM24439	1	167	4.1	4	4	4
	MDM24439	2	144	3.0	3	3	3
	MDM24439	3	128	1.9	1	1	1
	MDM24439	4	121	1.6	2	2	2
	MDM24439	5	137	2.3	3	3	3

Appendix B:
Weekly Biological Data and Environmental Conditions for Conowingo West Eel Collection Facility, 2017-2024

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

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

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

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

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

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

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

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

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

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

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

2024 Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Octoraro Eels	1	2	0	4	80	34480	17609	249	54	1490	32	13	19	1972	28809	1
Conowingo Eels	1334	12965	2473	4663	19314	3161	1659	1730	12541	3399	5377	2519	1072	11459	6991	36312
Creek flow (cfs) (wk avg)	29875	31557	66785	42900	30414	23242	15685	13014	11171	13786	10914	9444	11551	13614	35643	102300
Lunar Fraction (wk avg)	0.330	0.060	0.540	0.960	0.630	0.064	0.390	0.920	0.760	0.110	0.250	0.830	0.840	0.190	0.140	0.720
Water temp (°C) (wk avg)	20.13	21.93	20.06	21.59	26.34	26.64	26.81	28.01	30.13	29.54	30.30	31.66	31.39	30.50	30.51	24.34
Dissolved Oxygen (mg/L) (wk avg)	10.70	8.41	9.06	8.91	7.29	7.26	7.88	7.87	7.29	7.62	7.00	6.52	7.32	7.75	7.37	8.72

2024 Week (cont.)	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Octoraro Eels	48	21	10	1	0											
Conowingo Eels	125604	54025	41467	16855	2962	1841	960	281	41	99	46	44	215	73	168	5
Creek flow (cfs) (wk avg)	34343	19000	17386	10303	7944	8631	10977	9569	8149	8013	6173	5553	5620	6759	14023	28367
Lunar Fraction (wk avg)	0.910	0.300	0.060	0.580	0.95	0.44	0.15	0.43	0.95	0.59	0.07	0.29	0.89	0.74	0.15	0.03
Water temp (°C) (wk avg)	24.93	26.37	27.14	26.03	26.69	25.49	24.94	23.34	20.84	19.61	18.04	17.47	15.93	15.06	13.99	8.93
Dissolved Oxygen (mg/L) (wk avg)	8.05	8.68	8.14	7.89	8.36	7.93	8.23	9.48	10.63	10.06	11.03	11.66	11.29	11.40	10.47	11.63

Appendix C:
Fish Health Inspection Report, Conowingo West Eel Collection Facility, 2024

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 03/12/2024 2 03/06/2023 3 03/16/2022 4 03/15/2021 5 03/26/2020

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	2024 collection	y	wild stock	(F) Octoraro Creek, MD	58	58	58			59	59			59		59	59*	
					--	--	--	NT	NT	--	--	NT	NT	--	NT	--	+	

Remarks[5]: Lab Case 24-112; AME = American eel; A = swimbladder nematode (Anguillicola crassus)* see reverse

Inspecting Biologist Signature	Concurred (signature & title)	
Print: Gavin Glenney Date: 05/02/2024	Print: John Coll, PL-LFHC Date: 05/02/2024	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[5] 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:

24-112 received March 13, 2024. Collection of 59 American eels occurred on 3/12/24 by Michael Martinek.

Bacterial cultures - primary inoculum from kidney onto Brain Heart Infusion Agar (BHIA), negative for AS, YR, EI. 58/59 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 31% (18/59), a typical level as reported in previous years.

Previous sampling and testing of American Eels in this watershed consisted of Octoraro Creek/Stone Run (2023, 2022); Stone Run (2021); Herring Run (2020, 2019); Octoraro Creek (2018, 2017); Susquehanna River (2016, 2015); and Octoraro Creek (2014, 2013, 2012, 2011, 2010).

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

Appendix D:
Chain of Custody Sheets, Conowingo West Eel Collection Facility, 2024

NORMANDEAU
environmental consultants

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

Date: 8/26/24 **Time:** 9:52

No. of eels provided from CECF Collection Tank: 500

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

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

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

Total number of eels provided for Transport: _____

SIGNATURES:

Normandeau/Exelon Representative: Julia Bathem

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: 9/23/24 Time: 940

No. of eels provided from CECF Collection Tank: 100

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: 100

SIGNATURES:

Normandeau/Exelon Representative: [signature]

Agency Representative: [signature]

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

Harrisburg, PA 17110
Office: (717) 238-0423 ext.1184
Mobile: (717) 884-5937
ahenning@srbc.gov
https://www.srbc.gov/our-work/american-eels/

Appendix E:

Agency Comments on Draft 2024 Conowingo West Eel Collection Report, May 1 - December 3

2024 Conowingo West Eel Collection Facility Report (May 1- December 3) Comments Received by Resource Agency and Date	
Resource Agency	**Date of Receipt by Constellation**
Susquehanna River Basin Commission	No comments received
Pennsylvania Fish and Boat Commission	No comments received
United States Fish and Wildlife Service	1/16/2025
Maryland Department of the Environment Maryland Department of Natural Resources	No comments received
Pennsylvania Department of Environmental Protection	1/22/2025

Responses to Resource Agency Comments for the MDE Conowingo West Eel Collection Report, 2024

USFWS: No comments

PADEP: No comments

From: Eyler, Sheila <sheila_eyler@fws.gov>
Sent: Thursday, January 16, 2025 3:04 PM
Subject: Re: [EXTERNAL] Constellation 2024 Conowingo West Eel Collection Facility (full season) draft report

Mike,

Thank you for the opportunity to review the Constellation 2024 Conowingo West Eel Collection Facility Report (full season). The Service has reviewed the report and has no comments.

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

From: Eberts, Ron <reberts@pa.gov>
Sent: Wednesday, January 22, 2025 8:50 AM
Subject: RE: [External] Constellation 2024 Conowingo West Eel Collection Facility (full season) draft report

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

Andrea,

PA DEP has reviewed the attached 2024 Constellation Conowingo West Eel Collection Facility DRAFT (full season) report received on 1/9/25. PADEP has no comments.

Thank you for the opportunity to review and comment.

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

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

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION