NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

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

FERC Project Number 2355
FERC Project Number 405

Prepared for:

Exelon.

Submitted On:
January 14, 2022

Prepared By:
Normandeau Associates, Inc.
482 Old Holtwood Road
Holtwood, Pennsylvania 17532

Table of Contents

Page

List of Appendices

List of Tables

Page

List of Figures

Page

Executive Summary

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

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

The CWECF is located on the Susquehanna River immediately downstream of the West Fish Lift (WFL) where a previous United States Fish and Wildlife Service (USFWS) eel collection facility was located from 2005 through 2016.This site was approved by PADEP and other members of the Eel Passage Advisory Group (EPAG). Exelon designed, installed, and began operation of the CWECF in 2017 and has operated this facility each year through 2021. American Eel 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 PADEP, EPAG, and Maryland Department of the Environment (MDE).

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

Specifically, the objectives of the 2021 collection season were to:

- Operate, maintain, and monitor the eel collection and holding facility (daily) from May 1 until mean daily water temperature is 10° C or less for three consecutive days;
- Transport American Eel collected at the CWECF and OCEF to designated stocking points in the Susquehanna River watershed;

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

The facility was placed in service on April 30, 2021. The facility operated a total of 193 days from May 1 to November 9. A total of 623,095 juvenile eels were collected at the CWECF. Juvenile eel numbers > 1,000 individuals were recorded on 57.7% (111 days) and > 10,000 individuals were recorded on 5.7% (11 days) of the 193 collection days. The greatest number of juvenile eels was collected on July 7, 2021 when the facility collected 16,004 eels or 2.6% of the total season catch. Eels collected between May 27 through 30, July 4 through 8, and August 28 through August 30 accounted for 23.3% (145,361 of 623,095) of the total eels in 2021. The three peak periods, totaling 12 days, accounted for only 6.2% of the collection season. Volumetric estimates were utilized on 112 days or 58.0% during this year.

Biweekly subsamples for biological data were recorded from May 1 until September 15 as a condition of the PADEP 401 WQC for the MRPSP Eel Plan. Length, weight, and condition factor were recorded from biweekly subsamples on 975 juvenile eels. Length of juvenile eels ranged from 66-184 millimeter (mm) with an average length of 115.7 mm. The average weight of juvenile eels was 1.6 grams (g) and ranged from 0.2-5.0 g. Only 15 of the 975 (1.5%) showed any form of external injury (condition factor) such as bruising, scrape, hemorrhage, or fungus.

Over 10% (100 of 975) of the eels sampled were examined internally for presence of the eel swim bladder parasite (*Anguillicoloides crassus*). Parasites were found in 61 (61%) of the 100 sacrificed eels. The number of parasites per eel ranged from one to five. Ninety-six of the one hundred sacrificed eels were examined for age and it was determined that the average age was 2.3 years old (range 1 - 5 years old).

The CWECF collected a total of 623,095 juvenile eels in 2021 with a total of 82 (0.01%) eel mortalities found in the collection tank. Exelon sacrificed 100 eels for biological analysis. A total of 722 (0.11% mortality) juvenile eels were recovered dead from the holding tanks over the entire season. The Susquehanna River Basin Commission (SRBC) removed a total of 165 juvenile eels with 150 individuals on September 8, 2021 and 15 individuals on October 12, 2021, 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 664,340 eels from CWECF and the OCEF were transported to designated locations in the Susquehanna River watershed. Shikellamy State Park (Site 7) was stocked with 183,609 juvenile eels. City Island Boat Ramp (Site 12) received a stocking of 240,288 juvenile eels. West Fairview Access (Site 5) was stocked with 240,302 eels. A total of 141 (0.02%) juvenile eels died during the 120 transport trips from the CWECF in 2021. Daily transports occurred from June 12 to September 17 due to elevated water temperatures. Biweekly transports occurred after daily transports from September 20 until October 5, then weekly transports occurred until the last transport on November 2, 2021. No eels were collected during the last week of the season from November 3 through 9.

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

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
Exelon	Exelon 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
PADEP	Pennsylvania Department of Environmental Protection
USFWS	United States Fish and Wildlife Service
USGS	U.S. Geological Survey
SRBC	Susquehanna River Basin Commission
WQC	Water Quality Certification

Units of Measure

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

1 Introduction

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

The MRPSP License includes the Pennsylvania Department of Environmental Protection (PADEP) Water Quality Certification (WQC), which includes an American Eel Passage Plan (Eel Plan) that requires Exelon to trap, transport, and stock American Eel (*Anguilla rostrata*) in the Susquehanna River. The Eel Plan covers operation of the Octoraro Creek Eel Collection Facility (OCEF) and the Conowingo West Eel Collection Facility (CWECF). The PADEP 401 WQC and Eel Plan requires Exelon 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 PADEP and other members of the Eel Passage Advisory Group (EPAG)[1], Exelon designed, installed, and began operation of the CWECF in 2017 and has operated this facility each year through 2021. American Eel collected at CWECF and those collected at and transported from OCEF are held and then transported and released at designated stocking locations in the Susquehanna River watershed as approved by PADEP, EPAG, and Maryland Department of the Environment (MDE).

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

Additionally, Conowingo License Article 401 and Appendix 1 require Exelon to prepare a Fishway Operations and Maintenance Plan (FOMP) annual report including American Eel operations. The 2021 CWECF operating season followed the FERC-approved FOMP dated February 2021. This report fulfills FOMP annual report requirements for American Eel operations.

[1] EPAG members include PADEP, USFWS, Pennsylvania Fish and Boat Commission, Maryland Department of Natural Resources, Susquehanna River Basin Commission, and Exelon. MDE has been invited to participate in the EPAG since March 19, 2021.

Specifically, the objectives of the 2021 field investigation were to:

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

2 Background

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

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 of the CWECF (Figures 2.0-1 and 2.0-2). Their efforts showed that the bulk of the juvenile eel migration occurs from May to September with most eels collected in June and July (Figure 2.0-3, 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, and holding processes as well as during transport processes. Exelon began to operate the CWECF in 2017, and through the 2021 season, 1,194,176 American Eel have been collected and transported upstream to stocking locations, contributing to the restoration of the species throughout the watershed.

3 Methods

3.1 Design, Construction, and Installation of Facility

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

3.2 Staffing

Trained and qualified individuals operated the facility throughout the eel passage season. A supervising biologist oversaw all operations with the assistance of biologists and biological technicians.

Daily facility checks were completed by a crew of at least two trained personnel. All personnel had reviewed and understood the FOMP.

3.3 Maintenance

Pre-season Maintenance

On April 28, 2021, all eel passage facility 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 facility was placed into service on April 30, 2021.

Post-season Maintenance

After the season ended on November 9, 2021, the eel facility 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 2021 season, the eel passage facility operating crew notifies pertinent Station personnel of their arrival each day, conducts a pre-job safety briefing and COVID-19 check, informs the Station that eel passage check will commence, and asks for a dissolved oxygen (DO) tailrace reading and if any issues have been recorded since completion of the last eel passage facility check. When daily eel sampling was complete, the eel passage facility operating crew notified pertinent Station personnel of any major changes to the facility and that the crew was leaving the site.

3.5 Data Collection

Sample data including date, time of sample, weather, eel counts, flow readings, water temperature, and DO were recorded daily. The data were verified, tabulated, and entered into an electronic format each week as part of a quality control and quality assurance protocol. Environmental conditions such as river flow, lunar fraction, and weather conditions were also recorded, verified, and entered into an electronic format. Rainfall amounts are not taken or recorded at the CWECF.

Eels being used for either biological data collection (up to 25 individuals) or for the 200 milliliter (mL) known number for the volumetric estimates were placed in to an anesthetic solution. The anesthetic solution is 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 were lethargic. This time varied due to water temperature and the time it took to process the anesthetized eels. After the biological data was collected from the eels or the actual count of eels was tallied from the 200 mL subset for the volumetric estimate, the eels were immediately placed into buckets of ambient river water to recover. The eels remained in the ambient water until they fully recovered and were actively swimming in the bucket.

Eel count data included actual counts or volumetric estimates. Volumetric estimates were performed as in 2017 and 2018 (Normandeau Associates, Inc. 2018 and 2019) and described in the EPRP.

Length and weight measurements, along with condition factor were recorded biweekly from a maximum of 25 individuals (when available) from May 1 through September 15 to satisfy the PADEP 401 WQC conditions for the MRPSP. Eels were measured and weighed after being anesthetized (Figures 3.5-1 and 3.5-2). Once a week during this biweekly subsample, a portion of these eels were examined for the presence of a swim bladder parasite (*Anguillicoloides crassus)* and for age analysis. Age analysis methodology is described in Appendix A.

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 in service, as a spot check measurement. The main flow was also recorded daily. The DO was obtained from the Conowingo Dam 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 6, 2021 when Station 643 was taken out of service and DO was recorded from the tailrace using a bucket and a YSI water quality meter when the facility was checked.

Generation (number of Francis and Mixed-flow turbines on) was recorded daily upon arrival to the station and recorded on the daily field sheet. Sequencing of unit operation is performed when the Conowingo East and West Fish Lifts operate in the spring (typically March 1 – June 15). The substrate below the ramp entrance is wetted at all times and provides attraction for eels 24 hours a day when the eel facility is in operation, typically May 1 through mid-November.

3.6 Juvenile Eel Transport

A wild health screening was required by the PADEP 401 WQC for the MRPSP prior to the transport of eels upstream into the Susquehanna River watershed. Juvenile eels were collected by a backpack electroshocker in March 2021 from Stone Run, a tributary of the Octoraro Creek, and sent to the USFWS 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 stocked in the approved locations.

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

When fewer than 150 eels were collected during a sampling event, transport occurred using aerated 19-liter (L) buckets with lids, containing the maximum amount of water to prevent sloshing, with ≤ 50 eels in each bucket. When counts of juvenile eels were ≥ 150 but less than 2,500 individuals, a small enclosed transport tank (250 L) with supplemental oxygen capability was used to transport eels to designated locations (Figure 3.6-3). When large loads (> 2,500) of American Eel were transported, the custom-made

transport truck and tank unit was used to efficiently and safely deliver eels to designated stocking locations (Figure 3.6-4).

4 Results

The CWECF commenced operation on May 1, 2021 and operated continuously until November 9, 2021 when water temperature was 10° C or less for three consecutive days, as described in the EPRP, FOMP, and the Conowingo FERC License. This facility operated for 193 days and collected a total of 623,095 juvenile eels during the 2021 season (Table 4.0-1). Biweekly subsamples of biological data were collected from May 1 until September 15 as a condition of the PADEP 401 WQC for the MRPSP Eel Plan.

4.1 Juvenile Eel Collection and Mortality

A total of 623,095 juvenile American Eel were captured at the CWECF during the 2021 season. Counts or volumetric estimates were recorded daily. Volumetric estimates were taken from the CWECF on 112 of the 193 days of operation (58.0% of the season, Table 4.1-1). The number of eels in the 200 mL subsample varied daily throughout the season, ranging from 92 to 216 eels (Table 4.1-1). The average volumetric estimate in the 200 mL subsample was 145.3 eels with a median of 147 eels.

The highest one-day total of 16,004 juvenile eels occurred on July 7, when 2.6% of the total number of eels collected in 2021 were captured (Table 4.0-1 and Figure 4.1-1). For the 2021 season, 57.5% (111 days) of the 193 daily monitoring checks recorded juvenile eel numbers > 1,000 individuals (Table 4.0-1), while 49 (25.4%) of the sample days recorded eel collection > 5,000 individuals, 11 (5.7%) of the sampling days recorded eel collection > 10,000 individuals.

Of the 623,095 juvenile eels that were captured at this facility, 82 eels died in the collection tank (99.99% survival). All mortalities from the collection tank were recorded over the course of the season, and were not attributed to a single event such as low DO or loss of water flow to 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 975 juvenile eels was collected from these biweekly subsamples (0.2% of total eels collected), during 39 of the 138 sample days (Table 4.2-1).

The average length of juvenile eels was 115.7 mm, with a median size of 115.0 mm (Table 4.2-1). The length of juvenile eels ranged from 66 - 184 mm. One hundred sixty juvenile eels measured less than 100 mm and one eel measured greater than 175 mm (Table 4.2-2). The average weight of juvenile eels was 1.6 grams (g), with a median weight of 1.5 g (Table 4.2-1). The weight of juvenile eels ranged from 0.2 – 5.0 g (Table 4.2-2). Over 81% of the 975 juvenile eels weighed between 1.0 - 3.0 g (Table 4.2-3).

Eels from each biweekly subsample were examined for external injuries. Individual condition factors, date, and detailed biological data for these are shown on Table 4.2-4. External injuries were noted on 1.5% (15 of 975 individuals) of the examined eels. All injuries were coded as a scrape (scratches or marks), bruise, hemorrhage, lesion, fungus, or redness around gills. Two eels contained a lesion, while four eels showed evidence of a hemorrhage, four eels had scrapes, and one showed evidence of fungus. Photos of the previous injury types is shown in Figures 4.2-1 through 4.2-4.

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. Over 10% (100 of the 975 individuals) were dissected for the parasite and later examined for age (Tables 4.3-1 and 4.3-2).

Of the 100 juvenile eels that were inspected for the parasite, 39 (39%) eels did not contain the swim bladder parasite (Table 4.3-1 and Figure 4.3-1). The other 61 (61%) eels contained the swim bladder parasite. The infected eels contained one, two, three, or five parasites per individual; 41, 18, 1, and 1 eels, respectively. Table 4.3-2 provides detailed information by length frequency (five mm interval groups) of the 100 sacrificed eels with information including weight, age, and number that were infected by the parasite. The average length of the sacrificed eels was 117.4 (range 66-184) mm, average weight of 1.7 (range 0.3-5.0) g, and average number of parasites was 0.85 (range 0-5, Table 4.3-1).

Age of the juvenile eels was determined from 96 eels; four additional eel otoliths could not be read for aging. The 96 juvenile eels analyzed for age were determined to be 1 to 5 years old (Average age = 2.30, Table 4.3-1). Detailed information of the 96 sacrificed and aged eels is shown on Table 4.3-1. Of the 96 aged eels, 20 eels (20.8%) were aged 1-year-old, 39 eels (40.6%) were aged 2 years old, 26 eels (27.1%) were aged 3 years old, 10 eels (10.4%) were aged 4 years old, and 1 eel (0.01%) was aged 5 years old. Age agreement between Normandeau biologists occurred 92.7% (89 of the 96 eels) of the time (Appendix A). The average length of the aged eels was 117.4 (range 66-184) mm, average weight of 1.7 (range 0.3-5.0) g, and average number of parasites 0.85 (range 0-5). Length frequency of aged eels with weights, parasites, and age data are found on Table 4.3-2.

4.4 Peak Periods of Eel Collections

The greatest percentage of juvenile eels was collected during Week 11 (July 4-10) when the facility collected 12.1% (75,609 individuals) of the season total (Table 4.4-1 and Figure 4.4-1). Week 12 (July 11-17) was the only other single week during the 2021 season when > 10% of the season total (10.2% or 63,442 individuals) was collected. Weeks 11-14, and 19 combined accounted for a large proportion of the juvenile eels caught in 2021 (49.4%, 307,935 individuals, Table 4.4-1 and Figure 4.4-1).

Weeks 1, 9, 10, 17, and 23-29 of sampling collected no greater than 1.0% of the season total, accounting for 2.2% (13,978 individuals) combined (Table 4.4-1 and Figure 4.4-1). Only five individuals were collected during the first week of the season (first day of collection), while only three individuals were captured during the last full week of the season (Week 28), and zero individuals were collected during Week 29 (last three days) of the season.

During the season, there were three large peak periods. A peak period is defined as a period of time greater than one day with a collection of 10,000 or more individuals on a least two days during the period. The largest peak (July 4-8, 5 days) yielded 10.2% (63,846 of the 623,095) juvenile eels (Table 4.0-1). A slightly smaller peak occurred from August 28-31 (four days), accounting for 8.0% (49,865 of the 623,095) of all juvenile eels collected at the facility. During the smallest peak, the CWECF collected 5.1% (31,650 of the 623,095) of all juvenile eels collected, and occurred from May 28-30 (3 days). When these three peak periods are combined, 23.3% (145,361 individuals) of the juvenile eels collected at this facility occurred during these 12 days or 6.2% of the sampling days.

The CWECF collected more than 10,000 individuals on July 16 (13,611 eels) and on July 29 (10,204 eels). These days are noted but not considered as peak periods as they were only single day occurrences (Table 4.0-1).

4.5 Juvenile Eel Catch in Relation to Environmental Factors

See Appendix B for weekly averages of juvenile eel capture, river flow, lunar fraction, water temperature, and tailrace DO.

River Flow

River flow and juvenile eel catch did not appear to be related during the 2021 season. Daily average river flow was taken from The United States Geological Survey (USGS) 01578310 Susquehanna River at Conowingo, MD gage located at Conowingo Dam (Table 4.5-1). The highest daily average river flow value per the USGS gage station occurred on September 2, 2021 (219,000 cubic feet per second, cfs, Tables 4.0-1 and 4.5-1). This highest daily value occurred from the rainfall that occurred from Tropical Storm Ida. The daily average river flow for Conowingo Dam was above generation capacity (86,000 cfs) on sixteen days during the 2021 season. The lowest daily average river flow value per the USGS gage station occurred on July 1, 2021 (8,560 cfs) a few days prior to the largest daily eel collection of the season. The majority of the American Eel captured at the CWECF in 2021 occurred when average river flow values were below 50,000 cfs (Figure 4.5-1). The variation of catch numbers during the season may be a function of other variables (e.g., migration timing).

Lunar Fraction

Juvenile eel catch did not appear to be strongly associated to lunar fraction (cycle) during the 2021 season. Full moon is equal to 1.0. The largest peak (July 4-8) of 63,846 eels occurred heading into a new moon period between Weeks 6 and 7 (Table 4.0-1 and Appendix B). A consistent collection of American Eel occurred between Weeks 11 and 14, this period spanned a full lunar cycle and contributed nearly 40% (249,161 of the 623,095 eels) of the 2021 season total (Table 4.4-1 and Appendix B). The other two peaks (May 28-30 and August 28-31) of the season occurred just after a full moon phase in May and August (Table 4.5-2 and Figure 4.5-2, Date and Time Website 2021). Typically, the lower illuminance during lower lunar fraction periods, (new moon) has been associated with increases in eel catch at eel traps (Welsh *et al*. 2015, and Schmidt *et al*. 2009).

Water Temperature

Water temperature and eel catch did not appear to be related this season. Water temperatures reached 20.0° Celsius (C) on May 25, 2021. By this time, the CWECF collected 87,761 eels (14.1% of season total, Tables 4.0-1 and 4.5-3). Over 54% (337,014 of the 623,095 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 29.0° C just after the largest peak of the season in early July to a low of 9.2° C in November (Table 4.5-3 and Figure 4.5-3). Water temperature during the 2021 season was ≥ 25.0° C for 25 days (June 27-July 21) and 36 days (July 28-September 1) or 31.6% of the season when 319,466 eels (51.3% of the season total) were captured (Tables 4.0-1 and 4.5-3).

Dissolved Oxygen

Tailrace DO and eel collection numbers did not appear to be related this season. The DO was obtained from the Conowingo Dam Control Room upon arrival to the station prior to starting the daily work. This DO value is taken from Station 643. The attraction flow from the CWECF has additional aeration and diffused compressed oxygen supplied to each of the enabled tanks for most of the season, therefore no relationship between eel catch and DO values could be derived. Daily DO values ranging between 6.19 and 11.37 milligrams per Liter (mg/L) are presented in Table 4.5-4 and displayed in Figure 4.5-4.

4.6 Juvenile Eel Holding and Mortality

Of the 623,095 juvenile eels that were captured at this facility, 118,763 eels were held in holding tank(s) prior to being transported upriver (Table 4.6-1). Only 19.1% of the eels captured over the season were placed in a holding tank. Eels were placed into holding tanks on 68 days from May 1 until June 12, 2021 and September 18 until October 31, 2021, unless 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 2021 eel season.

Eels were typically held in one holding tank during the 2021 season unless the number of eels held were greater than 12,500 eels. When eel holding numbers were greater then 12,500, eels were placed into Holding Tanks 1 and 2. The capacity of a holding tank is roughly 17,000 eels, but only 12,500 eels can be placed into each side of the large transport tank. Only when eels are placed into the holding tank, are the alarms enabled and the holding tank considered in-service. Holding Tank 3 was used to keep the total attraction flow to the facility at about 70 GPM. Although water is running through Holding Tank 3, it is not in-service, so no alarms are enabled. All water used at the facility is passed through a tank and is drained into the overflow tank and is used as the total attraction flow at the entrance of the ramp, besides the spray bar and scent line which 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, and 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 different 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 transport. A total of 722 (0.11% mortality) juvenile eels died in holding (Table 4.6-2). On June 12 and 13, a total of 626 juvenile eels were recovered dead from holding while transferring them to the transport vehicle. Some of these eels showed signs of fungus. During this occasion, three of the 6,843 eels in the collection tank that day were found dead, and there were 14,408 eels that remained in holding that were alive, which were ultimately transported upriver. Because of the unknown cause of mortality, this holding tank was drained, scrubbed clean, and left dewatered. Daily transports were started after this event and continued until September 17 to decrease the potential for mortalities due to higher than ideal holding tank water temperatures. The water temperature of the collection and holding tanks was 25.2° C on June 12.

4.7 Juvenile Eel Transport and Mortality

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

On March 15, 2021, 60 juvenile American Eel (less than 200 mm) were collected by backpack electroshocker from Stone Run, a tributary of the Octoraro Creek near Richardsmere in Cecil County, MD. All 60 of the juvenile eels were used to provide an adequate bacterial sample, in which no bacterial or viral pathogens of concern were detected. The results of The Fish Health Inspection Report was authorization to transport and stock eels upstream of Conowingo Dam and is presented in Appendix C.

A total of 165 eels were supplied to the SRBC, with 150 individuals on September 8 and 15 individuals on October 12, 2021 from the CWECF for the "Eels in the Classroom" program. The chain of custody sheets for this event is located in Appendix D, which relinquishes Exelon's responsibility for these eels.

All eels were transported and released at designated locations in the Susquehanna River watershed (Table 3.6-1 and Figure 4.7-1). A total of 664,340 juvenile eels were transported upstream, including eels collected at OCEF (Tables 4.6-2 and 4.7-1). Daily transports occurred from June 12 to September 17, 2021. Biweekly transports occurred after daily transports from September 20 until October 5, and weekly transports occurred until the last transport on November 2, 2021. No eels were collected during the last week of the season from November 3 through November 9.

Eels were transported to Shikellamy State Park, West Fairview Access, and City Island 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 transports from the CWECF to Shikellamy State Park (Site 7) were completed in approximately three hours (± 30 minutes). Eel transports from the CWECF to City Island Boat Ramp (Site 12) and West Fairview Access (Site 5) were completed in approximately two hours (± 30 minutes).

Of the 183,611 eels that were transported to Shikellamy State Park (Site 7), 183,609 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-2). This location was stocked 16 times from May 6 to June 16. Detailed data from each of the transports are found on Table 4.7-1.

Of the 240,306 eels that were transported to City Island Boat Ramp (Site 12), 240,288 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-3). This location was stocked 63 times from June 17 to November 2. Detailed data from each of the transports are found on Table 4.7-1.

Of the 240,423 eels that were transported to West Fairview Access (Site 5), 240,302 eels were stocked (Tables 4.6-2 and 4.7-2 and Figure 4.7-4). This location was stocked 41 times from June 12 to October 24. Detailed data from each of the transports are found on Table 4.7-1.

Mortality

Mortality during the 120 transport trips from the CWECF at Conowingo Dam totaled 146 eels (0.02%, 146 of 664,199, Table 4.6-2). Two eels died (0.00%, 2 of 183,611 eels) during transports from the CWECF to Shikellamy State Park (Site 7). Eighteen eels (0.01%, 18 of 240,306) died during transports to City Island Boat Ramp (Site 12). One hundred twenty-one eels (0.05%, 121 of 240,423) died during transports to West Fairview Access (Site 5), which occurred on the same day that the largest mortality event occurred in the holding tank at CWECF, when 626 dead eels were removed of the 15,034 eels being held. An additional five eels died during a transport from OCEF to West Fairview Access on August 27,

2021. During this transport, the OCEF eels were placed in one side of the transport tank, while CWECF eels were placed in the other, and the five eels were discovered after the OCEF eels were unloaded at West Fairview Access.

5 Quality Assurance/Quality Control Activities

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

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

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

The control panel of the CWECF provided an instantaneous readout of DO and water temperature and was connected to the flow meters for all the tanks and fill lines. When a one-minute average was outside the range of specification, an alarm would be sent to the control room, followed ten minutes later by an alarm sent to Normandeau via a text or e-mail message. The alarm to the control room was a general alarm but the alarm to Normandeau was a detailed message stating the cause of the alarm. Conowingo operations handled most of the alarms with guidance from Normandeau. Supplemental aeration from the bubblers and the compressed oxygen diffusers were great assets 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 oxygen bottle was exchanged. No mechanical or physical fixes to the eel collection facility were needed during the 2021 passage season.

The total attraction flow of the facility varied throughout the season dependent upon which tanks were in-service, but an attraction flow was always being discharged down the ramp and shoreline. Total attraction flows were set for approximately 70 gallons per minutes (gpm). Periodically throughout the season, low flow alarms did occur. Slight adjustments made to the individual tank feed pipes to adjust the output to these feed pipes to obtain a constant water flow into the tanks resolved this issue. Since the alarms were addressed within a few minutes, no mortality events were related with these alarms. The hardiness of this species and its ability to adjust to parameters outside of those developed for this facility was evidenced by the numbers captured here. Testing and adjustments to this facility will continue to be investigated in future years.

Continuous water temperature and DO readings were taken from each tank in use. A linear piston blower and blower box controlled the air supplied to the collection tank and Holding Tank #1 through a manifold, while the other blower and blower box controlled air to Holding Tanks #2 and #3. An air pump

was in service constantly throughout the season for all tanks that were in-service. Compressed bottled oxygen (125 cubic feet) was also supplied to each of the tanks. As with the air blower, an oxygen manifold was used for the collection tank and Holding Tank #1, while another oxygen manifold controlled Holding Tanks #2 and #3. Compressed oxygen was used for every tank in-service for 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 facility were checked for calibration purposes - the spray bar, the collection tank fill and drain, scent line, and the drains of each of the holding tanks that were in service. Some of the water from the spray bar that was not used for attracting eels up the ramp but used to help slide eels into the collection tank was identified as the backside of ramp flow. The backside of ramp flow was calculated by adding the scent line to the collection tank drain and subtracting the collection tank fill. The attraction flow at the top of the ramp (top attraction) was calculated by subtracting the backside of ramp flow from the spray bar amount. Bottom of ramp attraction is a sum of the collection tank drain and the drains of the in-service holding tanks. Total attraction flow is equal to the collection tank fill, the spray bar and the drains of the holding tanks. Details and calibration records are listed in Table 5.0-2.

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 2021 season: June 18 and August 6. The detailed estimates for 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 (1.4%), no further changes to this method are warranted.

6 Conclusions and Discussion

The CWECF captured 623,095 eels compared to the OCEF that captured 45,230 juvenile eels during the 2021 season. The CWECF operated 69 days longer than the OCEF from May 1 to November 9 compared to May 1 to September 1. The CWECF captured over 12 times (550,175 versus 45,230 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 2021 season. Another difference between the two facilities is the entrance of each ramp in relationship to the tailwater. The CWECF ramp entrance is above the tailwater of Conowingo Dam except during major flood events above 450,000 cfs, but the OCEF entrance is below the tailrace elevation of the Pine Grove Dam even under minimum flow conditions (water flowing only through the notch of the dam). 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, eighth order stream, and the OCEF is located in the Octoraro Creek, 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 2021 was consistent with the previous years that Exelon has operated the facility. During the 2021 season, the size range of the juvenile eels caught at the CWECF was 66-184 mm with an average length of 115.7 mm, compared to the size range of 71-186 mm (average 112.2 mm), 64-165 mm (average 114.4 mm), 84-173 mm (average 121.6) mm, and 78-192 mm (average 122.3 mm) observed in 2020, 2019, 2018 and 2017, respectively (Table 6.0-1 and Normandeau Associates, Inc. 2018, 2019, 2020, and 2021).

No environmental factors including lunar fraction and river flow appeared to have a measurable effect on the number of eels collected in 2021. The highest daily average river flow value per the USGS gage station occurred on September 2, 2021 (219,000 cfs) and the lowest daily average river flow occurred on July 1, 2021 (8,560 cfs). The discharge at Conowingo Dam can change hourly, sometimes quicker, depending on energy demand, and may not be a reliable metric to use to compare eel collection numbers in a given season. In 2021, as in 2020, the DO readings were obtained from the Conowingo Control Room when the crew arrived at the site for work until November 7, and did not show an obvious correlation with eel collection. The lower lunar fraction is one environmental factor typically relating to the number of eels collected, but in 2021, sustained high catches from Weeks 11 (peak week) through 14 covered a full lunar period. The second and third peak collection periods occurred just after the full moon in May and August. 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, and 2021 are in Appendix B.

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

- Transport eels between June 15 and September 1 at least twice a week;

- When excessive air temperature is forecasted to be above 32 °C for three straight days and water temperature is approximately 29 °C, daily transports will be instituted; and
- Ensure proper water flow and DO levels are maintained.

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

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

On June 12, 2021, the water temperature reached 25.0° C, and after being held for two days, 626 American Eel were found dead which accounted for 86.7% (626 of the 722 eels) of total holding mortalities in 2021. As a result, daily transports were implemented and continued until September 17. Biweekly transports occurred after daily transports from September 20 until October 5, and weekly transports occurred until the last transport on November 2, 2021. No eels were collected during the last week of the season from November 3 through 9.

The CWECF designs were approved by the Resource Agencies prior to the 2017 season. The 2019 USFWS inspection report received by Exelon on November 27, 2019 identified salient issues to the eel pass attraction flow at the apex of the ramp and results are compiled in Appendix E and Normandeau Associates, Inc. 2021. The results of the 2020 spray bar assessment survey showed that fallback behavior was displayed by 27.2% of the eels that approached the apex of the ramp. After the review of the 2020 spray bar videos and information, the Resource Agencies requested that Exelon conduct another study to compare eel response at the ramp apex using the current spray bar and a spray nozzle apparatus. Additional testing was performed during the 2021 season comparing the spray bar versus spray nozzles at the CWECF. Prior to the September 2021 EPAG call the resource agencies received a study plan from Exelon describing methodology for comparing the spray bar and spray nozzle apparatuses at the CWECF. The study plan and report are in Appendix E. Due to the small percentage difference between the observed passage and fallback rates between the spray bar and spray nozzle apparatuses, Exelon suggests maintaining the facility as currently designed.

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. 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. 2021. 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	Susquehanna River	Lancaster
2	Between Holtwood and Safe Harbor	Susquehanna River	Lancaster/York
3	Between Safe Harbor and York Haven	Susquehanna River	Lancaster
4	Upstream of York Haven Dam	Susquehanna River	Dauphin
5	West Fairview Access (Route 11/15)	Susquehanna River	Cumberland
6	Fort Hunter Access	Susquehanna River	Dauphin
7	Shikellamy State Park	Susquehanna River	Northumberland
8	Route 48 Bloomsburg	North Branch Susquehanna River	Columbia
9	Route 29 Bridge (Wilkes Barre) Nesbitt Park (Kingston)	North Branch Susquehanna River	Luzerne
10	Upstream of Hepburn Street Dam (Williamsport)	West Branch Susquehanna River	Lycoming
11	Upstream of Grant Street Dam	West Branch Susquehanna River	Clinton
12	City Island (Harrisburg)	Susquehanna River	Dauphin

Table 4.0-1: Number of Juvenile Eel Caught Daily, Conowingo West Eel Collection Facility, 2021

Date	Number of Eels	Date	Number of Eels	Date	Number of Eels	Date	Number of Eels	Date	Number of Eels
5/1/2021	5	6/9/2021	2730	7/18/2021	8497	8/27/2021	5130	10/5/2021	19
5/2/2021	705	6/10/2021	3846	7/19/2021	9389	8/28/2021	10675	10/6/2021	3
5/3/2021	6258	6/11/2021	3381	7/20/2021	9550	8/29/2021	**15802**	10/7/2021	20
5/4/2021	4518	6/12/2021	6843	7/21/2021	9251	8/30/2021	10395	10/8/2021	8
5/5/2021	7025	6/13/2021	7591	7/23/2021	7387	8/31/2021	**12993**	10/9/2021	12
5/6/2021	9825	6/14/2021	4522	7/24/2021	7055	9/1/2021	6001	10/10/2021	17
5/7/2021	8514	6/15/2021	1905	7/25/2021	9660	9/2/2021	5762	10/11/2021	15
5/8/2021	7795	6/16/2021	1904	7/26/2021	5801	9/3/2021	3023	10/12/2021	22
5/9/2021	5716	6/17/2021	790	7/27/2021	4290	9/4/2021	4798	10/13/2021	176
5/10/2021	4025	6/18/2021	*925	7/28/2021	7265	9/5/2021	3455	10/14/2021	105
5/11/2021	3150	6/19/2021	539	7/29/2021	10204	9/6/2021	2874	10/15/2021	209
5/12/2021	1195	6/20/2021	638	7/30/2021	7656	9/7/2021	3360	10/16/2021	109
5/13/2021	821	6/21/2021	766	7/31/2021	6106	9/8/2021	3246	10/17/2021	22
5/14/2021	609	6/22/2021	331	8/1/2021	5181	9/9/2021	3096	10/18/2021	151
5/15/2021	335	6/23/2021	361	8/2/2021	5297	9/10/2021	3895	10/19/2021	155
5/16/2021	736	6/24/2021	211	8/3/2021	4001	9/11/2021	3888	10/20/2021	116
5/17/2021	1212	6/25/2021	207	8/4/2021	4608	9/12/2021	3198	10/21/2021	40
5/18/2021	2220	6/26/2021	197	8/5/2021	2816	9/13/2021	4972	10/22/2021	164
5/19/2021	2334	6/27/2021	129	8/6/2021	*1908	9/14/2021	2720	10/23/2021	147
5/20/2021	3331	6/28/2021	61	8/7/2021	2196	9/15/2021	3280	10/24/2021	56
5/21/2021	3497	6/29/2021	58	8/8/2021	2025	9/16/2021	2628	10/25/2021	38
5/22/2021	4198	6/30/2021	90	8/9/2021	2160	9/17/2021	1561	10/26/2021	16
5/23/2021	4319	7/1/2021	518	8/10/2021	2064	9/18/2021	759	10/27/2021	18
5/24/2021	5418	7/2/2021	962	8/11/2021	1920	9/19/2021	857	10/28/2021	17
5/25/2021	3861	7/3/2021	3841	8/12/2021	1825	9/20/2021	2337	10/29/2021	12
5/26/2021	3623	7/4/2021	9840	8/13/2021	1770	9/21/2021	3034	10/30/2021	1
5/27/2021	4396	7/5/2021	**12671**	8/14/2021	864	9/22/2021	1150	10/31/2021	2
5/28/2021	9923	7/6/2021	9360	8/15/2021	776	9/23/2021	539	11/1/2021	0
5/29/2021	11308	7/7/2021	**16004**	8/16/2021	837	9/24/2021	454	11/2/2021	1
5/30/2021	10419	7/8/2021	**15971**	8/17/2021	683	9/25/2021	222	11/3/2021	0
5/31/2021	5129	7/9/2021	5913	8/18/2021	1102	9/26/2021	53	11/4/2021	0
6/1/2021	4165	7/10/2021	5850	8/19/2021	207	9/27/2021	26	11/5/2021	0
6/2/2021	3190	7/11/2021	8241	8/20/2021	60	9/28/2021	5	11/6/2021	0
6/3/2021	2794	7/12/2021	6542	8/21/2021	82	9/29/2021	1	11/7/2021	0
6/4/2021	2254	7/13/2021	7898	8/22/2021	80	9/30/2021	6	11/8/2021	0
6/5/2021	1473	7/14/2021	9579	8/23/2021	195	10/1/2021	5	11/9/2021	0
6/6/2021	1840	7/15/2021	8457	8/24/2021	673	10/2/2021	12		
6/7/2021	2532	7/16/2021	**13611**	8/25/2021	1017	10/3/2021	12		
6/8/2021	2163	7/17/2021	9114	8/26/2021	1495	10/4/2021	20		
								Total	623,095

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

* Quality control checks

Table 4.1-1: Known Eel Numbers in the 200 Milliliter Subsample during Days of Volumetric Estimates, Conowingo West Eel Collection Facility, 2021

Date	Number of Eels in 200 mL	Date	Number of Eels in 200 mL	Date	Number of Eels in 200 mL	Date	Number of Eels in 200 mL
5/3/2021	152	6/6/2021	92	7/21/2021	185	8/31/2021	183
5/4/2021	130	6/7/2021	109	7/22/2021	172	9/1/2021	169
5/5/2021	156	6/8/2021	103	7/23/2021	178	9/2/2021	167
5/6/2021	141	6/9/2021	124	7/24/2021	166	9/3/2021	155
5/7/2021	132	6/10/2021	141	7/25/2021	161	9/4/2021	149
5/8/2021	131	6/11/2021	147	7/26/2021	150	9/5/2021	147
5/9/2021	126	6/12/2021	171	7/27/2021	156	9/6/2021	154
5/10/2021	121	6/13/2021	151	7/28/2021	167	9/7/2021	168
5/11/2021	123	6/14/2021	145	7/29/2021	174	9/8/2021	144
5/12/2021	111	6/15/2021	119	7/30/2021	174	9/9/2021	151
5/13/2021	100	6/16/2021	119	7/31/2021	142	9/10/2021	147
5/18/2021	111	6/18/2021	134	8/1/2021	148	9/11/2021	162
5/19/2021	114	7/3/2021	167	8/2/2021	127	9/12/2021	153
5/20/2021	116	7/4/2021	160	8/3/2021	121	9/13/2021	162
5/21/2021	111	7/5/2021	163	8/4/2021	128	9/14/2021	147
5/22/2021	115	7/6/2021	156	8/5/2021	128	9/15/2021	160
5/23/2021	157	7/7/2021	173	8/6/2021	124	9/16/2021	137
5/24/2021	128	7/8/2021	169	8/7/2021	122	9/17/2021	130
5/25/2021	117	7/9/2021	146	8/8/2021	135	9/18/2021	138
5/26/2021	115	7/10/2021	156	8/9/2021	122	9/20/2021	160
5/27/2021	133	7/11/2021	154	8/10/2021	129	9/21/2021	148
5/28/2021	135	7/12/2021	181	8/11/2021	120	9/22/2021	155
5/29/2021	155	7/13/2021	168	8/12/2021	120		
5/30/2021	151	7/14/2021	206	8/13/2021	118	Avg.	145.3
5/31/2021	116	7/15/2021	196	8/14/2021	108	Min	92
6/1/2021	119	7/16/2021	216	8/18/2021	116	Max	216
6/2/2021	110	7/17/2021	186	8/27/2021	180	Median	147
6/3/2021	113	7/18/2021	177	8/28/2021	175		
6/4/2021	98	7/19/2021	184	8/29/2021	215		
6/5/2021	95	7/20/2021	175	8/30/2021	198		

Table 4.2-1: Number of Juvenile Eel Captured with Length and Weight Measurements, Conowingo West Eel Collection Facility, 2021

	Total
Number eels collected	623,095
Number measured	975
Data Collection Days	39
Range of lengths (mm)	66-184
Average length (mm)	115.7
Median length (mm)	115.0
Range of weights (g)	0.2-5.0
Average weight (g)	1.6
Median weight (g)	1.5

Table 4.2-2: Juvenile Eel Length Frequency, Conowingo West Eel Collection Facility, 2021

Total Length (mm)	Number
65-69	2
70-74	2
75-79	3
80-84	19
85-89	18
90-94	42
95-99	74
100-104	79
105-109	112
110-114	129
115-119	132
120-124	88
125-129	77
130-134	74
135-139	37
140-144	36
145-149	17
150-154	17
155-159	7
160-164	3
165-169	3
170-174	3
180-184	1
Total	975

Table 4.2-3: Juvenile Eel Weight Frequency, Conowingo West Eel Collection Facility, 2021

Weight (g)	Number
0.0-0.4	14
0.5-0.9	135
1.0-1.4	313
1.5-1.9	249
2.0-2.4	164
2.5-2.9	65
3.0-3.4	27
3.5-3.9	6
4.0-4.4	1
5.0-5.4	1
Total	**975**

Table 4.2-4: Observed Injuries of Juvenile American Eel, Conowingo West Eel Collection Facility, 2021

Date	Length	Weight	Condition Factor
5/3/2021	105	1.2	Hemorrhage on left side *
5/6/2021	111	1.2	Hemorrhage on body
5/11/2021	107	1.4	Mark on left side *
	136	2.4	Hemorrhage on caudal tail
5/24/2021	109	1.2	Hemorrhage on right operculum *
	123	2.0	Scratch on right side *
6/10/2021	135	2.4	Fungus
6/14/2020	135	2.2	Enlarged stomach *
6/21/2021	121	2.1	Red around gills
6/28/2021	118	1.2	Scar from pinch
7/26/2021	108	1.4	Missing left eye
7/29/2021	115	1.5	Lesion under jaw
	109	1.0	Bruise on body
8/23/2021	142	2.1	Red around gills *
9/6/2021	131	2.3	Lesion

* Taken as a sacrifice

15 of 975 eels (1.5%) that were processed had injury

6 of the 14 were sacrificed (42.9%)

Four of the six (66.7%) **Error! Not a valid link.**scarified eels contained parasites

Table 4.3-1: Sacrificed Eel Data, Conowingo West Eel Collection Facility, 2021

Date	Length (mm)	Weight (g)	Parasite	Age
5/3/2021	105	1.2	2	2
	111	1.4	0	2
	92	0.7	1	1
	105	1.2	0	2
	119	2.1	0	2
5/11/2021	134	2.2	1	3
	126	1.8	1	2
	113	1.6	0	2
	95	0.9	1	1
	107	1.4	2	2
5/17/2021	141	2.7	1	3
	134	2.5	2	3
	121	1.9	0	2
	145	3.2	1	3
	120	1.6	0	2
5/24/2021	113	1.3	1	2
	144	3.0	0	2
	138	2.5	0	3
	109	1.2	2	2
	123	2.0	0	3
5/31/2021	184	5.0	0	5
	103	0.9	1	2
	131	2.1	0	3
	150	2.5	0	4
	145	2.6	1	3
6/7/2021	147	3.2	1	4
	151	3.2	0	4
	92	0.8	0	1
	153	2.9	2	4
	108	1.2	1	2
6/14/2021	108	1.4	0	2
	150	2.7	2	3
7/26/2021	91	0.8	1	1
	107	1.3	1	1
	133	2.3	1	3
	106	1.4	1	1
	122	1.7	1	2
8/2/2021	114	1.0	0	2
	150	2.8	0	3
	133	2.1	3	3
	107	0.9	0	NR
	107	1.3	0	3
8/9/2021	140	2.2	0	4
	142	2.5	1	3
	150	2.9	2	4
	121	1.4	1	3
	150	2.3	2	3
8/16/2021	85	0.7	1	1
	91	1.0	0	1
	97	1.4	1	2
	165	3.6	2	4
	144	2.5	1	3
8/23/2021	142	2.1	1	NR
	97	0.9	1	1
	89	0.8	1	1
	150	2.5	0	3
	143	2.6	1	3
8/30/2021	109	1.0	2	2
	98	0.8	0	2
	97	1.0	1	NR
	117	2.6	2	2
	86	0.5	0	1
9/6/2021	122	1.9	1	2
	83	0.5	0	1

(continued)

Table 4.3-1. (Continued)

Date	Length (mm)	Weight (g)	Parasite	Age
6/14/2021	135	2.2	1	3
	95	0.9	0	2
	99	1.0	1	2
6/21/2021	156	3.1	0	4
	85	.6	1	1
	136	2.3	5	NR
	96	0.7	0	2
	118	1.9	2	2
6/28/2021	117	1.5	1	2
	162	2.9	1	4
	131	0.9	0	3
	163	3.2	2	4
	97	0.9	1	2
7/5/2021	107	1.3	0	2
	98	1.1	1	2
	81	0.5	1	1
	99	1.1	2	2
	95	1.0	0	2
7/12/2021	82	0.6	0	1
	97	1.2	2	2
	125	1.8	0	2
	136	2.3	1	3
	89	0.7	2	1
7/19/2021	91	0.7	0	1
	108	1.6	2	2
	80	0.7	0	1
	66	0.3	0	1
	120	1.8	0	3
9/6/2021	75	0.3	1	1
	84	0.6	0	2
	114	1.6	1	2
9/13/2021	96	0.8	0	2
	144	2.9	2	3
	104	1.2	0	2
	131	1.8	1	3
	122	1.7	1	3
Average	117.4	1.7	0.85	2.30
Range	66-184	0.3-5.0	0-5	1-5

Total Sacrificed	100
Total Aged	96
0 Parasites	39 (39%)
1 Parasite	41 (41%)
2 Parasites	18 (18%)
3 Parasites	1 (1%)
5 Parasites	1 (1%)
Eels without parasites	39 (39%)
Eels with parasites	61 (61%)

NR – age could not be determined

Table 4.3-2: Sacrificed Eels Length Frequency with Detailed Info, Conowingo West Eel Collection Facility, 2021

TL (mm)	Weight (g)	Number	Contained Parasite	Age
65-69	0.3	1	0	1
75-79	0.3	1	1	1
80-84	0.5-0.7	5	0,0,0,0,1	1,1,1,1,2
85-89	0.5-0.8	5	0,1,1,1,2	1,1,1,1,1
90-94	0.7-1.0	5	0,0,0,1,1	1,1,1,1,1
95-99	0.7-1.4	14	0,0,0,0,0,1,1,1,1,1,1,1,2,2	1,1,2,2,2,2,2,2,2,2,2,2,2,NR
100-104	0.9-1.2	2	0,1	2,2
105-109	0.9-1.6	13	0,0,0,0,1,1,1,1,2,2,2,2,2	1,1,2,2,2,2,2,2,2,2,2,3,NR
110-114	1.0-1.6	5	0,0,0,1,1	2,2,2,2,2
115-119	1.5-2.6	4	0,1,2,2	2,2,2,2
120-124	1.4-2.0	8	0,0,0,0,1,1,1,1	2,2,2,2,3,3,3,3
125-129	1.8	2	0,1	2,2
130-134	0.9-2.5	7	0,0,1,1,1,2,3	3,3,3,3,3,3,3
135-139	2.2-2.5	4	0,1,1,5	3,3,3,NR
140-144	2.1-3.0	8	0,0,1,1,1,1,1,2	2,3,3,3,3,3,4,NR
145-149	2.6-3.2	3	1,1,1	3,3,4
150-154	2.0-3.2	8	0,0,0,0,2,2,2,2	3,3,3,3,4,4,4,4
155-159	3.1	1	0	4
160-164	2.9-3.2	2	1,2	4,4
165-169	3.6	1	2	4
180-184	5.0	1	0	5
Total		**100**	**100**	**100**

NR – age could not be determined

Table 4.4-1: Juvenile Eel Collection by Week and Ranks, Conowingo West Eel Collection Facility, 2021

	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10
Total	5	46640	15851	17528	42848	29424	23335	18176	2711	5659
Rank	27	6	16	15	7	8	11	14	21	19
Percent Catch (%)	0.00	7.16	2.54	2.81	6.88	4.72	3.75	2.92	0.44	0.91

	Wk 11	Wk 12	Wk 13	Wk 14	Wk 15	Wk 16	Wk 17	Wk 18	Wk 19	Wk 20
Total	75609	63442	59128	50982	26007	12628	3747	19265	58774	23814
Rank	1	2	3	5	9	17	20	12	4	10
Percent Catch (%)	12.13	10.18	9.49	8.18	4.17	2.03	0.60	3.09	9.43	3.82

	Wk 21	Wk 22	Wk 23	Wk 24	Wk 25	Wk 26	Wk 27	Wk 28	Wk 29
Total	19118	8593	108	94	653	795	158	3	0
Rank	13	18	25	26	23	22	24	28	29
Percent Catch (%)	3.07	1.38	0.02	0.02	0.10	0.13	0.03	0.00	0.00

Top 2 ranked weeks are shown in boxes Week 1 = 1 day Week 29 = 3 days

Wk 1: May 1
Wk 2: May 2 - May 8
Wk 3: May 9 - May 15
Wk 4: May 16 - May 22
Wk 5: May 23 - May 29
Wk 6: May 30 - June 5
Wk 7: June 6 - June 12
Wk 8: June 13 - June 19
Wk 9: June 20 – June 26

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

Table 4.5-1: Daily Average River flows (cfs), USGS 01578310 - Conowingo Dam USGS Gage Station, 2021

Day	May	June	July	August	September	October	November
1	19,500	29,000	8,560	18,300	45,900	44,440	136,000
2	47,200	28,800	10,200	28,400	**219,000**	29,300	127,000
3	66,700	32,900	12,100	20,800	198,000	36,300	99,800
4	58,500	26,500	11,800	19,300	101,000	29,800	82,800
5	53,400	28,900	20,900	20,800	77,100	33,700	75,500
6	55,800	29,200	19,300	16,300	64,300	43,400	63,300
7	54,800	23,700	18,800	16,700	58,700	47,000	64,500
8	64,200	29,900	21,400	16,900	53,900	58,200	54,600
9	55,900	26,000	19,000	14,500	62,300	49,200	41,000
10	60,700	26,800	23,700	13,300	54,700	46,800	
11	68,000	21,000	22,800	12,300	40,400	32,000	
12	109,000	30,900	37,300	12,700	36,000	33,800	
13	108,000	28,900	44,900	13,200	36,800	25,700	
14	79,900	23,800	54,200	18,200	22,600	28,800	
15	67,300	26,500	71,600	11,900	27,900	21,100	
16	47,700	23,500	73,600	12,800	28,700	24,600	
17	45,900	15,200	65,000	10,500	33,700	22,500	
18	46,400	15,500	57,500	13,900	30,500	22,300	
19	40,800	21,400	62,900	48,100	30,900	31,900	
20	32,000	14,700	53,900	43,600	28,900	47,900	
21	24,800	16,800	76,600	70,600	26,500	38,400	
22	24,900	13,800	62,500	89,100	26,800	17,900	
23	26,500	17,500	53,400	81,300	35,400	33,000	
24	24,300	13,400	55,900	67,900	121,000	26,800	
25	20,600	14,000	48,600	71,600	150,000	40,800	
26	16,100	17,000	36,500	64,700	117,000	37,500	
27	18,200	14,800	29,400	41,700	93,600	45,500	
28	15,300	12,000	30,100	40,400	70,300	58,000	
29	19,500	11,400	21,300	40,600	62,500	117,000	
30	27,000	12,500	18,800	34,100	58,300	126,000	
31	23,700		23,900	35,300		127,000	

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, 2021 EST (*1.0 equals full moon*)

Day	May	June	July	August	September	October	November
1	0.759	0.590	0.544	0.414	0.296	0.269	0.146
2	0.652	0.484	0.443	0.320	0.208	0.180	0.073
3	0.540	0.382	0.346	0.232	0.131	0.104	0.023
4	0.431	0.287	0.257	0.154	0.068	0.045	0.001
5	0.328	0.202	0.177	0.089	0.024	0.010	0.011
6	0.235	0.129	0.108	0.040	0.003	0.002	0.053
7	0.155	0.071	0.055	0.010	0.008	0.024	0.124
8	0.090	0.029	0.019	0.002	0.040	0.075	0.217
9	0.042	0.005	0.002	0.018	0.098	0.153	0.324
10	0.012	0.001	0.006	0.058	0.180	0.252	
11	0.000	0.016	0.032	0.121	0.280	0.366	
12	0.008	0.051	0.079	0.206	0.393	0.480	
13	0.035	0.106	0.147	0.307	0.512	0.596	
14	0.080	0.179	0.233	0.420	0.629	0.703	
15	0.142	0.267	0.335	0.538	0.738	0.798	
16	0.220	0.369	0.447	0.655	0.832	0.877	
17	0.311	0.479	0.564	0.764	0.907	0.938	
18	0.412	0.593	0.679	0.857	0.961	0.978	
19	0.520	0.706	0.787	0.929	0.976	0.988	
20	0.631	0.810	0.878	0.953	0.991	0.997	
21	0.739	0.897	0.946	0.976	0.998	0.996	
22	0.837	0.961	0.967	0.997	0.983	0.975	
23	0.918	0.978	0.987	0.992	0.947	0.936	
24	0.973	0.995	0.999	0.962	0.894	0.881	
25	0.986	0.997	0.981	0.912	0.826	0.811	
26	0.999	0.967	0.938	0.846	0.747	0.729	
27	0.991	0.911	0.874	0.767	0.658	0.638	
28	0.951	0.835	0.795	0.678	0.563	0.539	
29	0.884	0.744	0.705	0.584	0.464	0.437	
30	0.796	0.646	0.610	0.487	0.365	0.334	
31	0.696		0.511	0.390		0.235	

Table 4.5-3: Water Temperature (°C) Taken in Collection Tank, Conowingo West Eel Collection Facility, 2021

Day	May	June	July	August	September	October	November
1	14.0	20.5	27.2	26.0	26.5	17.3	12.5
2	14.2	20.8	27.2	26.1	24.4	17.2	11.7
3	15.9	20.5	28.2	26.0	20.5	18.0	10.9
4	15.4	19.4	27.6	25.7	19.7	18.3	10.2
5	16.6	19.4	27.4	25.9	19.6	18.8	10.2
6	16.0	20.1	27.4	25.9	19.9	18.9	9.6
7	16.1	21.0	27.6	25.8	20.2	19.0	9.2
8	17.3	21.9	28.2	25.9	20.8	19.5	9.2
9	16.7	23.6	29.0	26.1	21.1	19.2	9.5
10	13.8	24.3	28.5	26.3	21.2	19.1	
11	13.8	24.2	28.0	26.3	21.2	18.4	
12	12.6	25.2	27.8	26.6	21.7	19.1	
13	12.5	25.0	28.4	27.4	22.0	18.9	
14	11.8	24.8	28.2	27.9	22.0	19.5	
15	12.5	24.8	27.7	28.7	22.4	19.1	
16	13.2	25.5	27.7	28.9	23.8	19.0	
17	13.9	24.7	27.4	28.4	23.0	19.3	
18	14.2	24.6	26.1	28.1	23.9	18.4	
19	14.8	24.3	25.1	28.2	24.3	19.3	
20	15.1	25.0	25.4	27.5	24.1	18.0	
21	15.8	24.6	25.1	27.5	23.9	17.8	
22	18.9	24.8	24.6	26.2	24.0	17.0	
23	18.4	25.3	24.0	25.6	23.6	17.1	
24	19.4	25.2	24.3	25.4	21.5	17.0	
25	20.5	24.8	23.9	25.2	20.2	16.4	
26	20.4	24.7	24.2	25.3	17.9	16.5	
27	21.1	25.0	24.9	26.2	17.2	15.6	
28	22.4	25.4	25.2	25.8	17.7	15.0	
29	22.8	25.7	25.1	26.1	17.5	14.3	
30	21.7	26.2	25.4	25.9	17.5	13.3	
31	20.7		25.8	26.2		12.4	

Table 4.5-4: Dissolved Oxygen (mg/L) Reading from the Control Room (Station 643), Conowingo West Eel Collection Facility, 2021

Day	May	June	July	August	September	October	November
1	9.30	8.36	6.49	7.80	7.13	9.99	10.95
2	10.31	8.54	6.85	8.19	7.63	9.75	10.85
3	10.35	8.60	7.13	8.09	8.85	9.52	10.89
4	10.04	9.10	7.27	8.39	9.14	9.52	10.87
5	10.43	8.52	7.02	8.08	9.19	9.65	10.90
6	9.72	8.89	6.78	7.83	8.45	9.24	10.96
7	9.78	9.41	7.13	8.48	8.35	9.18	10.85
8	9.54	7.83	6.74	8.43	9.84	9.07	10.67
9	9.66	8.54	7.31	8.40	9.82	9.02	10.30
10	8.30	8.68	7.32	8.43	9.47	9.13	
11	9.49	8.00	7.20	8.13	9.72	9.25	
12	10.30	7.82	7.60	7.54	9.82	9.26	
13	10.59	7.71	7.64	7.60	9.24	9.29	
14	10.59	7.61	7.68	7.48	8.34	8.78	
15	10.33	6.72	7.70	7.33	8.74	8.84	
16	10.10	6.92	7.90	7.13	9.20	8.73	
17	9.40	7.32	8.03	7.51	8.77	9.44	
18	10.52	8.40	8.14	7.34	8.61	9.61	
19	10.45	7.79	7.60	7.40	8.37	9.04	
20	10.79	7.34	7.78	7.50	7.42	9.00	
21	11.37	6.80	7.30	7.59	7.87	8.62	
22	11.10	6.46	8.62	7.71	7.52	8.72	
23	10.40	8.12	8.22	7.71	7.80	10.04	
24	9.56	7.69	8.67	7.70	8.03	9.90	
25	9.02	7.46	8.60	7.52	9.51	9.89	
26	10.20	7.60	8.50	7.48	9.86	9.59	
27	8.55	7.57	8.40	7.63	9.43	9.74	
28	8.07	6.19	7.89	7.92	9.10	9.51	
29	7.27	6.95	8.08	7.95	9.95	10.24	
30	7.41	6.81	8.11	7.74	9.72	10.80	
31	8.65		8.07	7.60		11.02	

Table 4.6-1: Number of Juvenile American Eel placed in Holding, Conowingo West Eel Collection Facility, 2021

Day	May	June	July	August	September	October	November
1	5	-	-	-	-	-	-
2	705	3190	-	-	-	12	-
3	6253	-	-	-	-	12	-
4	4518	2254	-	-	-	20	-
5	7025	1473	-	-	-	-	-
6	-	-	-	-	-	3	-
7	-	2527	-	-	-	20	-
8	7795	2163	-	-	-	8	-
9	5716	-	-	-	-	12	-
10	-	3843	-	-	-	17	
11	3150	3380	-	-	-	15	
12	1195	6840	-	-	-	-	
13	-	-	-	-	-	176	
14	609	-	-	-	-	105	
15	335	-	-	-	-	209	
16	736	-	-	-	-	109	
17	1207	-	-	-	-	22	
18	-	-	-	-	759	151	
19	2334	-	-	-	857	-	
20	3331	-	-	-	-	16	
21	3497	-	-	-	3034	40	
22	4198	-	-	-	1150	164	
23	-	-	-	-	539	147	
24	5413	-	-	-	-	56	
25	3861	-	-	-	222	38	
26	3623	-	-	-	53	16	
27	4396	-	-	-	-	18	
28	9923	-	-	-	5	17	
29	-	-	-	-	1	12	
30	-	-	-	-	6	1	
31	5124		-	-		2	

Table 4.6-2: Eel Transport/Stocking Data, 2021

Location of stocking	Number of eels	Died (Mortality)			Removed for Analysis	Removed for SRBC	Number Stocked
		Collection Tank	Holding Tank	Transported			
Octoraro Creek Collection Tank	45,230	2,911 (6.44%)					
Transported to Conowingo West Eel Collection Facility	42,319			5 (0.01%)			42,314
Conowingo Collection Tank	623,095	82 (0.01%)	***722 (0.11%)***		100	165	
Total Transported from Conowingo West Eel Collection Facility	664,340			141 (0.02%)			664,199
Stocked at Shikellamy State Park (Site 7)*	183,611			2 (0.00%)			183,609
Stocked at West Fairview Access (Site 5)**	240,423			121 (0.05%)			240,302
Stocked at City Island boat ramp (Site 12)***	240,306			18 (0.01%)			240,288

Bolded value is assumed as worst case, could be eels from Octoraro or Conowingo
* Transported to Shikellamy State Park (Site 7), (May 6, 7, 10, 13, 18, 24, 29, and 30, June 1, 3, 6, 9, and 13-16)
** Transported to West Fairview Access (Site 5), (June 12 and 18, July 5, 7, 9, 10, 12, 14, 16, 19, 21, 23, 25, 27, 29 , and 31, August 2, 4, 7, 9, 11,13, 16, 28, 21, 23, 25, 27, 28, and 30, September 1, 2, 4, 6, 8, 10, 12, 14, 15, 17 and 24)
*** Transported to City Island boat ramp (Site 12), (June 17 and 19-30, July 1-4, 6, 8, 11, 13, 15, 17, 18, 20, 22, 24, 26, 28, and 30, August 1, 3, 5, 6, 8, 10, 12, 14, 15, 17, 19, 20, 22, 24, 26, 27, 29, and 31, September 3, 5, 7, 9, 11, 13, 16, 20, and 27, October 1, 5, 12, 19, and 26, November 2)

Table 4.7-1: Detailed Individual Eel Transport Data, 2021

Transport to Shikellamy State Park (Site 7)

		Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
Date	Number of eels stocked	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
5/6	21,308	956	16.0	9.9	1130	18.0	21.5	1430	18.2	16.3	16.1	8.6
5/7	15,541	1020	16.1	10.2	1045	18.1	17.2	1345	17.8	12.4	14.0	10.5
5/10	17,533	940	13.8	10.5	1140	16.1	14.0	1443	16.1	10.0	12.9	10.4
5/13	5,170	825	12.5	10.5	930	14.6	12.6	1214	14.0	13.8	12.4	9.8
5/18	5,117	849	14.0	9.6	950	16.5	13.0	1228	17.0	10.6	16.9	10.9
5/24	23,100	937	19.1	7.3	1107	21.5	9.2	1413	21.1	12.6	22.0	9.0
5/29	21,826	840	21.3	6.2	1000	23.1	10.8	1308	21.9	10.3	19.1	7.5
5/30	21,733	915	20.4	8.2	1010	22.1	8.4	1246	21.0	8.2	17.6	9.7
6/1	9,302	1003	19.3	8.2	1006	21.3	21.5	1252	21.7	11.6	18.7	10.0
6/3	5,996	844	19.4	7.7	1000	21.7	14.0	1254	21.7	15.2	18.1	10.3
6/6	5,678	900	20.1	7.5	1020	22.0	6.5	1345	23.1	15.6	23.0	12.0
6/9	7,571	845	23.5	6.0	935	25.0	7.4	1230	25.6	13.7	26.2	9.8
6/13	15,019	938	24.8	5.8	1050	24.9	20.5	1330	25.1	8.9	23.5	9.2
6/14	4,753	900	24.8	14.2	1030	24.9	8.9	1341	26.1	16.7	25.1	11.7
6/15	2,047	910	24.8	5.6	945	25.7	12.5	1255	26.1	11.0	23.1	9.9
6/16	1,915	1030	25.5	8.9	1120	27.0	13.2	1454	26.9	16.1	24.5	11.0
Total	**183,609**											

Table 4.7-1 (Continued)

Transport to City Island Boat Ramp (Site 12)

Date	Number of eels stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
6/17	795	820	24.7	9.1	910	26.1	11.9	1105	26.2	7.7	23.7	8.0
6/19	537	920	24.3	8.6	940	25.9	6.8	1200	26.0	9.3	25.6	6.4
6/20	641	855	25.0	9.4	1034	26.8	7.0	1123	26.6	6.5	25.0	8.4
6/21	756	900	24.6	10.2	939	26.5	6.3	1120	26.6	7.4	27.3	6.4
6/22	335	844	24.8	8.2	914	25.8	8.4	1129	25.1	11.3	25.0	5.3
6/23	366	936	25.3	15.0	1045	26.5	9.4	1225	26.5	13.2	23.6	8.1
6/24	212	837	25.2	5.8	916	26.5	7.5	1109	26.1	15.4	23.3	7.5
6/25	210	829	24.8	5.7	854	25.1	5.4	1040	24.8	11.2	23.4	7.8
6/26	200	900	24.7	8.1	935	25.8	8.6	1200	26.0	12.7	24.6	7.3
6/27	143	802	25.0	7.6	825	26.3	7.5	1000	26.1	14.4	26.1	6.4
6/28	64	930	25.4	8.2	1020	27.5	6.0	1205	27.8	10.2	29.5	5.0
6/29	71	825	25.7	8.3	900	27.5	6.7	1030	29.7	6.8	29.4	5.9
6/30	113	740	26.2	7.1	820	27.9	7.1	1124	30.4	6.5	30.9	5.6
7/1	541	910	27.2	7.7	944	28.6	5.5	1135	28.6	6.8	28.6	4.8
7/2	996	845	27.2	7.1	924	27.8	5.4	1054	27.8	6.3	26.3	6.3
7/3	3,957	835	28.2	6.3	915	26.4	6.9	1045	26.4	12.0	24.6	7.2
7/4	10,142	900	27.6	8.6	1030	28.1	12.9	1305	28.1	17.2	26.0	8.4
7/6	9,386	815	27.4	9.5	847	28.8	11.5	1055	30.1	11.7	27.0	7.0
7/8	15,998	902	28.2	4.4	1016	29.7	13.5	1229	28.9	12.2	27.8	6.4
7/11	8,253	908	28.0	9.7	1015	29.1	12.3	1220	28.1	10.7	26.5	6.7
7/13	8,180	930	29.6	7.0	1004	29.6	9.4	1230	30.2	10.1	26.4	6.5
7/15	14,625	910	27.7	8.3	948	26.6	7.8	1151	28.2	11.3	25.2	6.5
7/17	9,711	930	27.4	6.1	1000	28.2	7.8	1130	28.6	14.4	25.4	6.2
7/18	8,561	855	26.1	6.9	940	27.1	12.1	1120	26.0	10.6	24.9	6.9
7/20	9,565	813	25.4	7.1	900	26.9	9.4	1103	27.6	9.5	23.1	7.5
7/22	8,011	827	24.6	10.9	944	26.1	12.0	1200	25.6	14.9	23.0	7.8
7/24	7,066	901	24.3	9.3	955	25.7	10.54	1200	25.6	14.4	24.0	8.0
7/26	6,153	1010	24.2	8.7	1050	25.8	13.2	1230	25.8	13.2	26.1	8.1
7/28	8,546	945	25.2	8.2	1020	25.8	13.8	1215	26.1	5.1	27.6	6.6

Table 4.7-1 (Continued)

Transport to City Island Boat Ramp (Site 12)

Date	Number of eels stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
7/30	8,335	948	25.4	6.3	1050	26.7	11.0	1250	25.6	17.3	26.3	9.5
8/1	5,269	834	26.0	8.6	910	27.0	11.0	1058	26.7	10.2	24.2	9.2
8/3	4,112	809	26.0	11.3	900	27.0	9.5	1045	26.7	12.8	24.0	7.5
8/5	2,866	805	25.9	9.0	902	26.9	6.8	1120	26.8	12.9	25.0	11.2
8/6	1,921	801	25.9	8.4	843	27.2	11.0	1035	27.1	18.0	25.3	6.0
8/8	2,031	750	25.9	7.0	824	26.2	8.5	1010	26.8	16.5	24.5	6.5
8/10	2,072	729	26.3	8.1	749	27.6	4.4	935	27.9	17.6	27.7	5.8
8/12	1,850	750	28.3	7.9	820	28.0	6.8	1000	28.1	9.9	27.5	6.9
8/14	875	725	27.9	7.1	750	28.8	8.9	948	28.4	12.5	28.2	7.3
8/15	780	730	28.7	7.0	745	29.7	6.4	928	29.3	13.2	26.3	7.3
8/17	684	800	28.4	8.3	834	29.1	11.6	1022	28.1	18.2	25.6	7.9
8/19	577	902	28.2	9.8	930	25.9	13.1	1130	26.3	14.2	25.0	7.0
8/20	1,283	935	27.5	8.3	948	26.0	11.8	1129	26.2	15.0	25.3	6.5
8/22	933	751	26.2	8.5	810	25.4	7.2	951	25.0	14.3	24.2	7.0
8/24	2,305	910	25.4	8.5	935	7.7	25.0	1129	25.3	6.0	25.0	7.3
8/26	2,388	920	25.3	7.4	1008	25.3	6.0	1155	25.7	16.0	26.2	6.8
8/27	7,796	1215	26.2	8.3	1310	25.4	17.9	1504	26.3	14.8	28.0	7.7
8/29	16,569	840	26.2	7.1	910	24.2	7.5	1051	24.1	11.3	25.5	6.5
8/31	13,125	805	26.2	5.4	855	27.3	10.1	1050	27.5	10.8	26.2	7.0
9/3	3,023	750	20.5	13.2	820	21.6	8.1	1038	21.5	12.5	20.7	5.8
9/5	3,455	736	19.6	9.5	815	20.9	11.9	1000	20.8	14.5	20.7	8.9
9/7	3,360	732	20.2	8.1	800	21.4	11.8	949	21.4	12.5	21.5	9.2
9/9	3,096	855	21.1	9.5	935	21.8	11.9	1117	22.2	11.7	22.2	8.8
9/11	3,888	737	21.2	12.9	800	22.4	10.7	935	21.9	13.3	21.2	9.2
9/13	4,967	800	22.0	8.6	853	23.2	10.6	1042	23.3	10.8	23.1	7.9

Table 4.7-1 (Continued)

Transport to City Island Boat Ramp (Site 12)

Date	Number of eels stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
9/16	2,628	800	23.8	8.6	850	25.2	8.0	1055	26.5	10.1	24.8	7.2
9/20	3,951	803	22.8	8.6	902	25.0	9.1	1059	24.7	10.3	23.5	9.4
9/27	301	810	17.2	10.7	845	18.7	8.8	1048	18.8	7.7	17.2	8.8
10/1	17	745	17.5	6.8	820	17.7	8.4	1002	17.5	7.9	16.8	9.1
10/5	63	813	18.7	8.2	851	20.9	7.7	1023	21.2	8.5	19.0	8.9
10/12	82	845	18.9	8.2	825	20.6	10.5	1008	20.6	12.9	18.9	8.8
10/19	925	900	19.4	8.3	840	19.4	11.7	1035	18.7	18.8	15.1	9.7
10/26	576	805	16.3	9.3	830	18.0	8.6	1015	18.6	7.6	15.7	9.5
11/2	51	840	11.7	12.8	937	12.3	9.2	1118	11.7	10.5	11.7	9.7
Total	**240,288**											

Table 4.7-1 (Continued)

Transport to West Fairview Access (Site 5)

Date	Number of eels stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
6/12	7466	845	24.0	5.4	1045	25.3	10.5	1305	25.5	19.4	23.6	10.9
7/5	12,751	940	27.4	7.0	1020	28.7	8.1	1212	30.8	10.7	26.7	8.4
7/7	16,033	800	27.6	7.0	1015	29.3	14.0	1318	29.8	11.0	31.0	9.3
7/9	5,915	900	29.0	10.2	1010	29.1	15.8	1205	29.9	15.0	25.3	6.7
7/10	5,864	930	28.5	9.3	945	29.8	11.9	1125	29.8	12.3	24.4	6.7
7/12	6,550	824	27.8	11.4	927	29.3	13.5	1225	30.2	11.6	25.1	7.2
7/14	14,312	930	28.2	7.6	1030	29.0	9.9	1241	29.3	11.8	27.3	5.7
7/16	16,716	900	27.7	8.5	958	28.3	10.7	1155	289.2	10.6	27.6	6.1
7/19	9,421	930	26.3	4.9	1015	26.4	5.9	1205	26.6	12.0	24.4	6.3
7/21	9,254	845	26.7	6.2	930	26.8	7.5	1200	27.1	12.9	24.7	5.9
7/23	796	830	24.0	10.9	900	25.5	8.8	1100	25.1	12.0	233.8	7.1
7/25	9,666	845	21.6	8.4	915	21.6	8.5	1130	24.1	8.7	25.8	6.4
7/27	5,805	916	24.9	11.7	1015	26.1	12.2	1253	26.6	19.5	27.9	9.6
7/29	10,947	855	25.1	7.2	935	26.1	8.4	1156	26.6	12.8	26.0	7.0
7/31	6,355	855	24.3	5.7	915	24.3	6.8	1050	24.2	10.0	23.8	7.5
8/2	5,384	830	26.1	10.4	940	27.1	13.0	1130	26.8	15.5	23.1	7.8
8/4	4,690	855	25.7	7.5	937	26.8	8.2	1155	26.4	11.7	23.5	8.8
8/7	2,202	751	25.8	9.3	830	24.1	7.5	1020	24.5	17.5	26.3	6.4
8/9	2,158	717	26.1	8.0	806	27.2	8.1	930	27.0	17.0	26.0	6.0
8/11	1,972	817	26.3	7.0	845	27.6	6.6	1135	28.0	15.7	27.7	7.9
8/13	1,777	823	27.4	7.7	900	27.9	10.0	1102	29.2	10.3	28.2	8.5
8/16	836	900	28.9	7.6	846	29.9	7.9	1120	30.0	16.6	26.2	8.2
8/18	1,106	1321	28.1	7.6	1415	30.0	10.0	1635	29.3	13.5	26.3	7.1
8/21	1,396	816	27.5	8.0	830	24.1	11.9	1010	24.5	12.1	24.5	6.1
8/23	1,313	920	25.6	10.0	952	25.9	8.1	1132	25.5	10.7	25.8	6.2
8/25	2,521	814	25.2	12.7	855	25.7	9.1	1125	25.9	18.6	26.9	5.5
8/27	3,200	652	24.0	2.0	800	24.4	7.5	1000	24.9	12.5	27.2	5.6

Table 4.7-1 (Continued)

Transport to West Fairview Access (Site 5)

Date	Number of eels stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
8/28	13,243	918	25.8	6.5	1017	25.2	11.0	1220	25.9	13.8	28.1	5.7
8/30	10,732	830	25.9	6.9	938	27.8	12.7	1150	28.1	13.7	26.6	7.2
9/1	6,070	1005	26.5	6.4	1043	26.0	5.1	1240	27.0	21.2	23.0	6.5
9/2	5,762	900	24.4	8.0	942	25.6	15.5	1240	25.2	12.4	20.5	8.2
9/4	4,798	800	19.7	9.3	848	20.8	12.4	1029	20.7	13.3	19.5	7.7
9/6	2,869	757	19.9	13.8	910	21.5	9.1	1115	24.2	14.5	20.8	7.3
9/8	3,096	1045	20.8	8.8	1130	22.4	13.4	1336	22.9	9.0	23.4	9.1
9/10	3,894	753	21.2	10.1	845	22.6	9.1	1053	23.8	11.1	20.6	7.7
9/12	3,198	758	21.7	9.4	801	22.8	11.6	1005	23.5	14.7	20.1	7.9
9/14	2,717	803	22.0	10.4	840	23.2	9.4	1019	23.3	10.9	22.8	8.6
9/15	3,280	816	22.4	8.4	915	23.8	9.1	1138	24.2	9.6	24.4	8.4
9/17	1,560	830	23.0	7.6	918	25.1	10.4	1055	24.8	11.5	23.4	8.3
9/24	5,149	816	23.2	7.6	907	23.1	9.8	1107	22.8	10.7	19.1	8.5
Total	**240,302**											

Table 4.7-2: Exelon's Eel Stocking Locations by Year, 2015 – 2021

Location	2015	2016	2017	2018	2019	2020	2021	TOTAL
Conowingo Creek boat ramp (USFWS request)	847	-	-	-	-	-	-	**847**
North Branch Muddy Creek	-	22,004	-	-	-	-	-	**22,004**
Conewago Creek	-	378	16,502	-	-	-	-	**16,880**
Beaver Creek	-	-	9,738	-	-	-	-	**9,738**
Etter's boat ramp	-	-	103,662	-	-	-	-	**103,662**
West Fairview Access	-	-	-	22,586	40,950	-	240,302	**303,838**
Fort Hunter Access	-	-	-	22,348	41,116	-	-	**63,464**
City Island boat ramp	-	-	-	24,869	41,132	-	240,288	**306,289**
Bloomsburg boat ramp	-	-	-	-	-	109,308	-	**109,308**
Lock Haven boat ramp	-	-	-	-	-	109,123	-	**109,123**
Wrightsville boat ramp	-	-	-	-	-	19,319	-	**19,319**
Columbia boat ramp	-	-	-	-	-	17,660	-	**17,660**
Shikellamy State Park	-	-	-	-	-	-	183,609	**183,609**
TOTAL	**847**	**22,382**	**129,902**	**69,803**	**123,198**	**255,410**	**664,199**	**1,265,741**

Table 5.0-1: Specified Operating Range of Conowingo West Eel Collection Facility, 2021

	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, 2021

	DATE									
	5/5	**5/12**	5/19	5/26	6/2	6/10	6/16	6/23	6/30	7/7
Collection Tank Fill	21.0	27.0	25.5	25.0	11.0	20.0	10.0	9.0	28.0	16.0
Collection Tank Drain	20.0	25.0	26.8	26.4	14.0	17.5	17.5	15	27.5	15.0
Holding Tank #1 Drain		15.6	33.0	22.0	16.8					
Holding Tank #2 Drain	25.0	15.6	14.4	20.5	17.4					
Holding Tank #3 Drain	25.0				16.8	38.25	52.5	49.5	38.25	48.0
Spray Bar	9.3	9.0	8.25	8.55	8.4	8.55	9.05	6.0	8.4	8.4
Scent line	1.5	2.5	2.25	2.2	1.6	2.0	1.55	1.57	2.5	2.25
Backside of Ramp	0.5	0.5	3.55	3.6	4.6	2.0	9.05	4.43	2.0	1.25
Top Attraction	8.8	8.5	4.7	4.95	3.8	6.55	0.25	1.57	6.4	7.15
Bottom of Ramp Attraction	70.0	56.2	74.2	68.9	65.0	75.75	70.0	64.5	65.75	63.0
Total Attraction	**80.3**	**67.2**	**81.15**	**76.05**	**70.4**	**84.3**	**71.8**	**64.5**	**74.65**	**72.4**

	DATE									
	7/14	7/21	7/28	8/4	8/11	8/18	8/25	9/2	9/8	9/15
Collection Tank Fill	10.2	8.5	8.7	11.0	13.2	15.5	13.2	10.5	14.5	10.8
Collection Tank Drain	11.4	9.75	9.0	12.0	13.2	15.0	13.2	11.16	14.5	11.7
Holding Tank #1 Drain										
Holding Tank #2 Drain										
Holding Tank #3 Drain	54.0	52.5	33.0	41.25	48.75	41.5	42.75	43.5	63.0	46.5
Spray Bar	11.4	12	10.5	7.35	6.4	7.8	8.1	8.25	8.25	9.45
Scent line	1.8	1.5	0.9	1.15	1.65	1.9	1.1	1.25	1.5	1.2
Backside of Ramp	3.0	2.75	1.2	2.15	1.65	1.4	1.1	1.91	1.5	2.1
Top Attraction	8.4	9.25	9.3	5.2	4.75	6.4	7.0	6.34	6.75	7.35
Bottom of Ramp Attraction	65.4	62.25	42	53.25	61.95	56.25	55.95	54.66	77.5	58.2
Total Attraction	**75.6**	**73.0**	**52.2**	**59.6**	**81.55**	**64.55**	**64.05**	**62.25**	**85.75**	**66.75**

Table 5.0-2: (Continued)

	DATE						
	9/22	9/29	10/6	10/14	10/20	10/27	11/3
Collection Tank Fill	20.0	10.0	17.0	17.4	20.1	11.4	22.5
Collection Tank Drain	19.5	10.5	17.5	17.7	16.5	13.5	23.0
Holding Tank #1 Drain	17.0	14.0					
Holding Tank #2 Drain			20.0	17.25	17.5	15.0	25.0
Holding Tank #3 Drain	17.5	22.5	32.5	24.75	27.0	17.0	25.0
Spray Bar	8.1	7.95	7.5	10.6	7.65	7.8	6.75
Scent line	1.8	1.0	1.75	1.8	1.9	1.45	1.85
Backside of Ramp	1.3	1.5	2.25	1.5	1.7	3.55	2.35
Top Attraction	6.8	6.45	5.25	9.1	5.95	4.25	4.4
Bottom of Ramp Attraction	54.0	47.0	70.0	59.4	61.0	45.5	73.0
Total Attraction	**62.6**	**54.45**	**77.0**	**70.3**	**72.25**	**51.2**	**79.25**

Table 5.0-3: Quality Control Checks on Counts, Conowingo West Eel Collection Facility, 2021

Date	Number of eels in:		Displacement	Volumetric	Actual	Difference
	200 mL	1 L	of Water	Estimate	Counts	
6/18/2021	134	670	1.3	871	925	54
8/6/2021	124	620	2.9	1922	1908	-14
Total				**2793**	**2833**	**40**
						1.4%

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

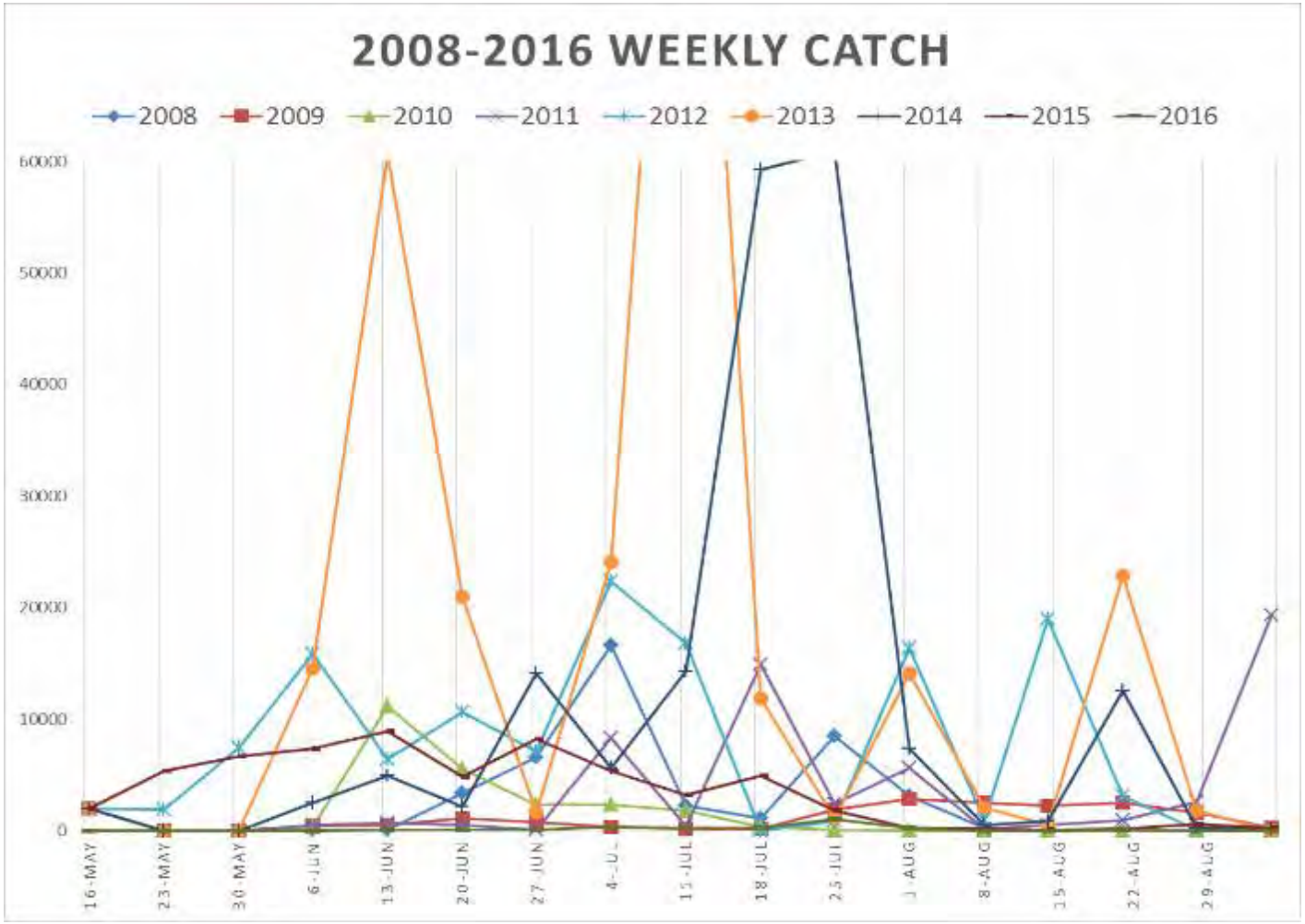
Table 6.0-1: Summary of Eel Collections and Biological Data, Conowingo West Eel Collection Facility, 2017-2021

		2017	2018	2019	2020	2021	Average	Total
Eels Collected		122,300	67,949	126,181	254,651	623,095	238,835.2	1,194,176
Peak	Number	7,280	5,572	10,166	14,137	16,004		
	Day	July 30	July 30	July 5	May 30	July 7		
Days of Operation		138	138	138	138	193	149	
Average eels per day		886.2	492.4	914.4	1,845.3	3,228.5	1,473.3	
Days over 1,000 eels		31	22	26	60	111	50	250
Volumetric Estimate Days		40	25	31	56	112	52.8	264
Accuracy of Volumetric days (±)		-1.0%	+1.6%	-1.1%	-2.3%	+1.4%		-1.4%
Sample Size		926	857	909	851	975	903.6	4,518
Length (mm)	Average	122.3	121.6	114.4	112.2	115.7	117.2	
	Range	78 - 192	84 – 173	64 – 165	71 - 186	66 - 184		64 - 192
	Median	122.0	120.0	115.0	112.0	115.0		
Weight (g)	Average	2.1	2.0	1.8	1.5	1.6	1.8	
	Range	0.5 – 6.0	0.5 – 4.8	0.2 – 4.7	0.3 - 5.5	0.2 – 5.0		0.2 – 6.0
	Median	2.0	2.0	1.7	1.4	1.5		
Sacrificed	Number	193	93	91	96	100		573
	Contained Parasites	53.9%	48.4%	52.7%	62.5%	61.0%		55.7%
	Age	2.2	2.3	1.65	1.97	2.30		
	Age range	1 - 4	1 - 4	1 - 4	1 - 4	1 - 5		
River Flows (cfs, daily average flows at Conowingo)	Average	37,053	62,036	40,214	14,256	43,466	39,405	
	Min	6,000	11,100	4,560	3,970	8,560		
	Max	178,000	329,000	157,000	58,400	219,000		

Figure 2.0-1: Location of the Conowingo West Eel Collection Facility at Conowingo Dam, 2021

Figure 2.0-2: Location of the Conowingo West Eel Collection Facility Just Downstream of the West Fish Lift, Conowingo, MD, 2021

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



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

Figure 3.5-1: Measuring Juvenile Eel to Nearest Millimeter While Sedated, Conowingo West Eel Collection Facility, 2021

Figure 3.5-2: Weighing Juvenile Eel in Grams While Sedated, Conowingo West Eel Collection Facility, 2021

Figure 3.6-1: Sample Location (Stone Run) of American Eel Collected for Wild Health Screening, Conowingo West Eel Collection Facility, 2021

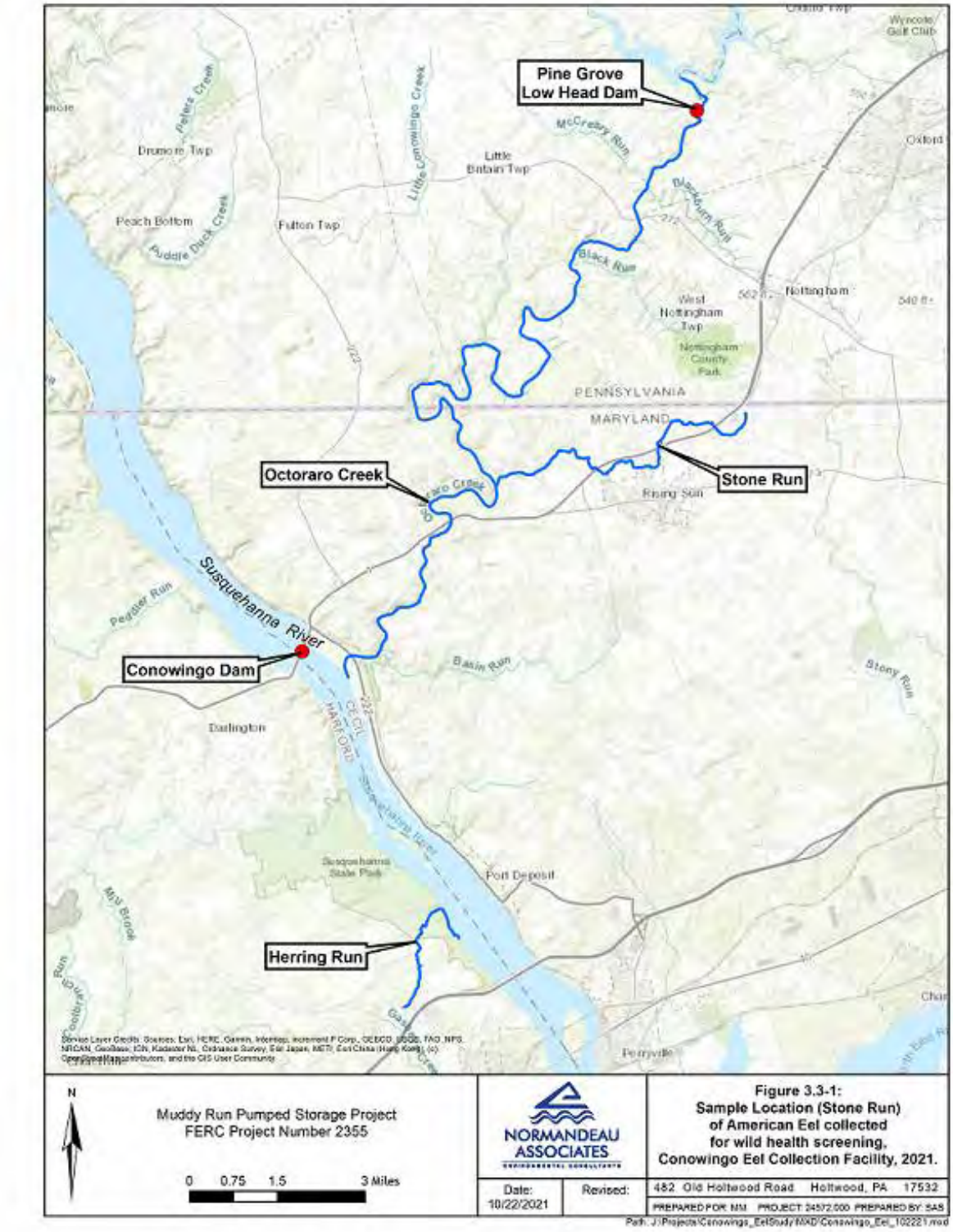


Figure 3.6-2: Stone Run, a Tributary of Octoraro Creek used for the Wild Health Screening, Conowingo Dam, 2021

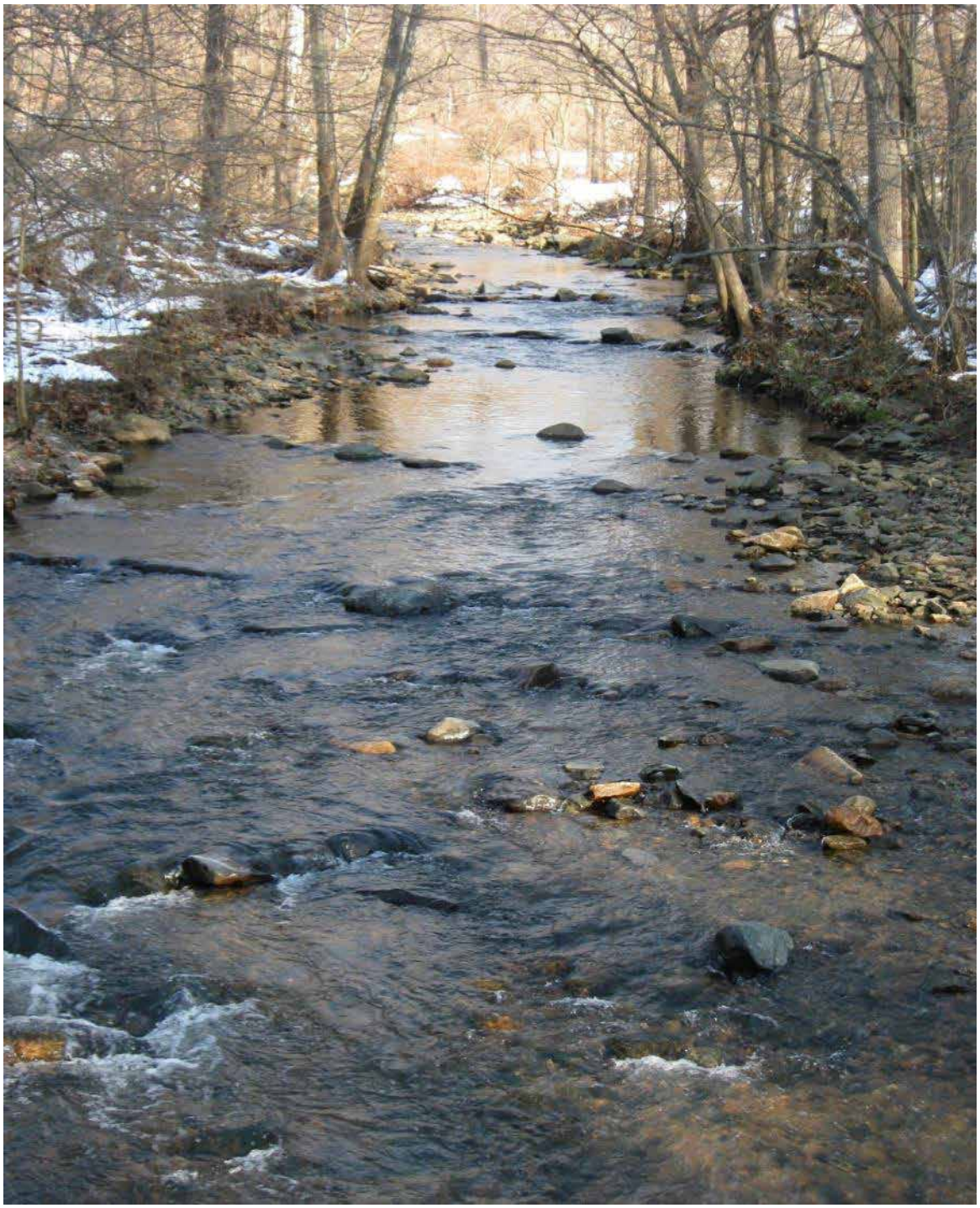


Figure 3.6-3: Small Eel Transport Tank, Conowingo West Eel Collection Facility, 2021

Figure 3.6-4: Large Eel Transport Tank, Conowingo West Eel Collection Facility, 2021

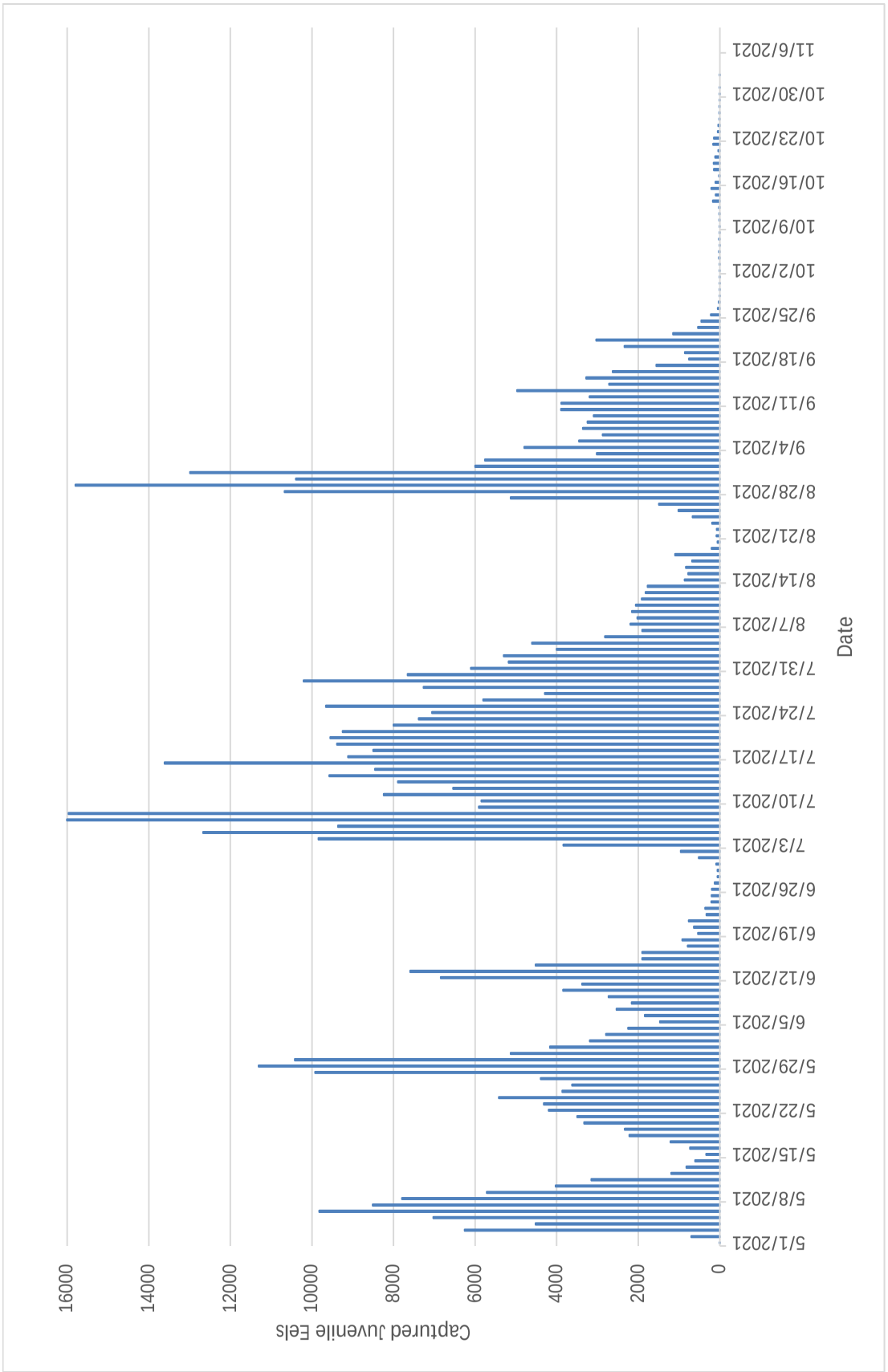


Figure 4.1-1: Daily Eel Catch, Conowingo West Eel Collection Facility, 2021

Figure 4.2-1: Eels with Lesion, Conowingo West Eel Collection Facility, 2021

Figure 4.2-2: Eel with Hemorrhage Tail, Conowingo West Eel Collection Facility, 2021

Figure 4.2-3: Eel with Scrapes/Marks on Side, Conowingo West Eel Collection Facility, 2021

Figure 4.2-4: Eel with Fungus, Conowingo West Eel Collection Facility, 2021

Figure 4.3-1: Swim Bladder Parasite Dissection, Conowingo West Eel Collection Facility, 2021

Figure 4.4-1: Percentage of Eels Collected per Week, Conowingo West Eel Collection Facility, 2021

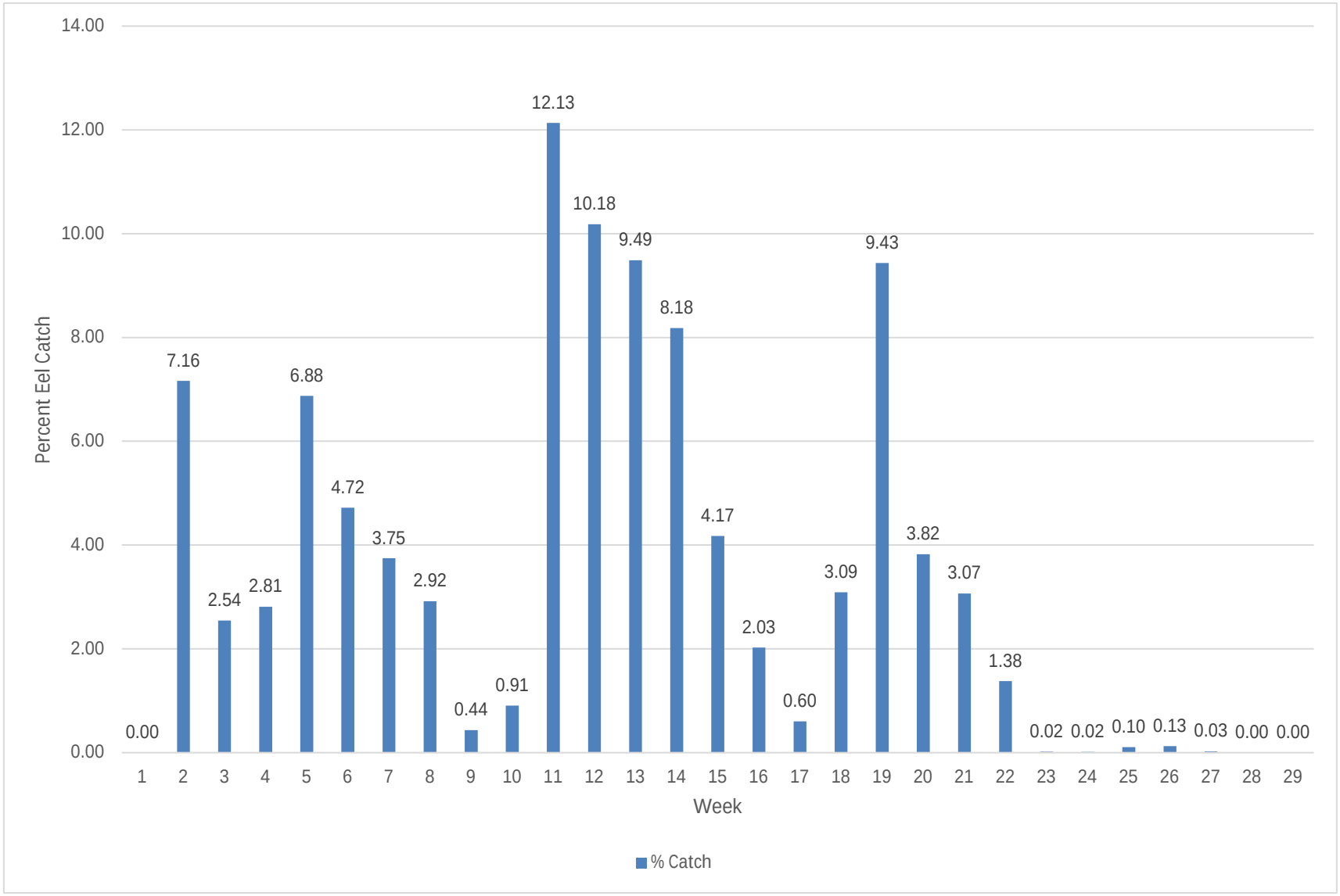


Figure 4.5-1: Daily Eel Catch and Daily Average River Flow (cfs, top graph) and Weekly Eel Catch and Weekly Average River Flow (cfs, bottom graph), Conowingo West Eel Collection Facility, 2021

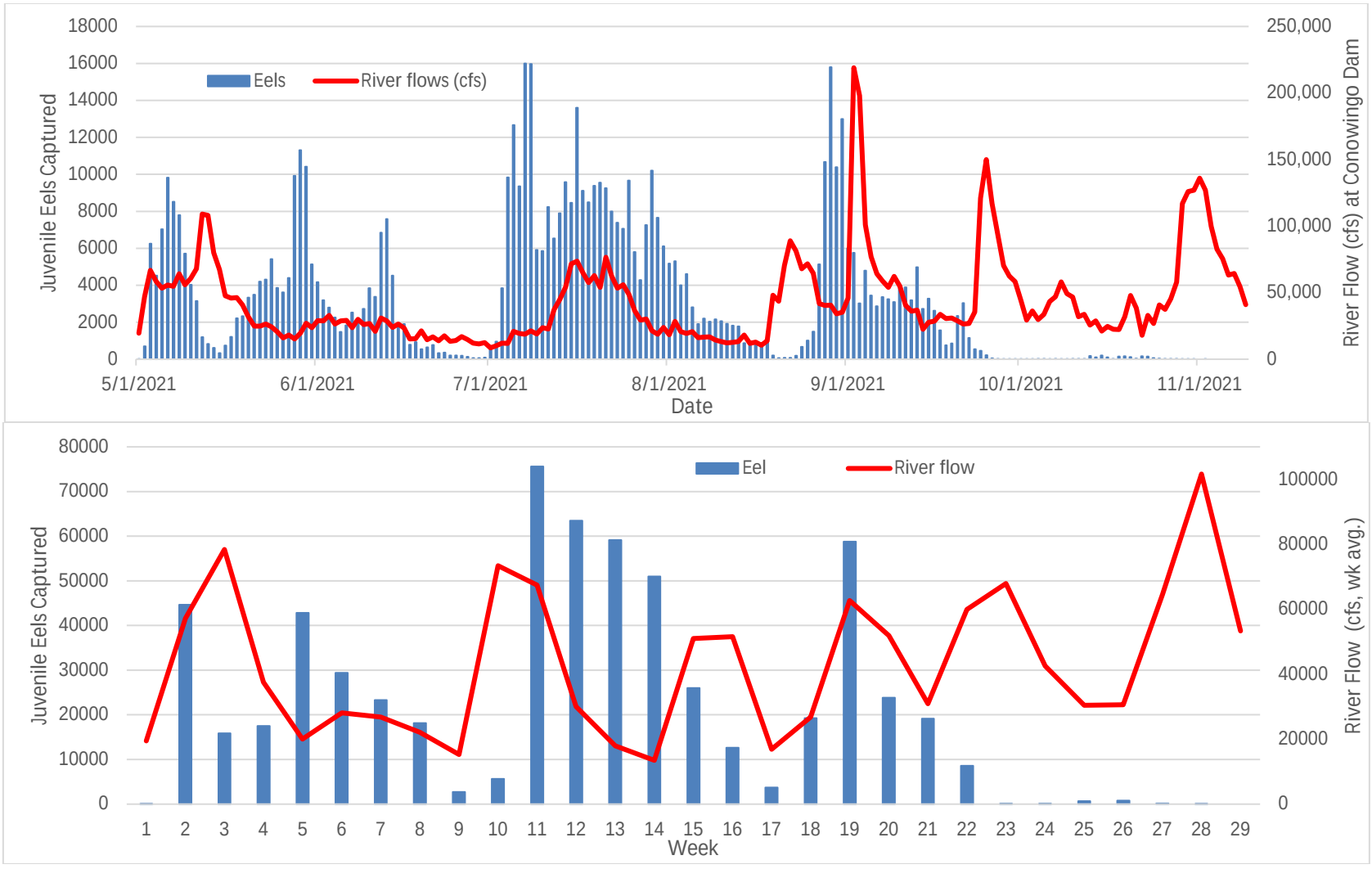


Figure 4.5-2: Eel Catch to Lunar Fraction (Daily above, Weekly Average below), Conowingo West Eel Collection Facility, 2021
(1.0 Equals Full Moon)

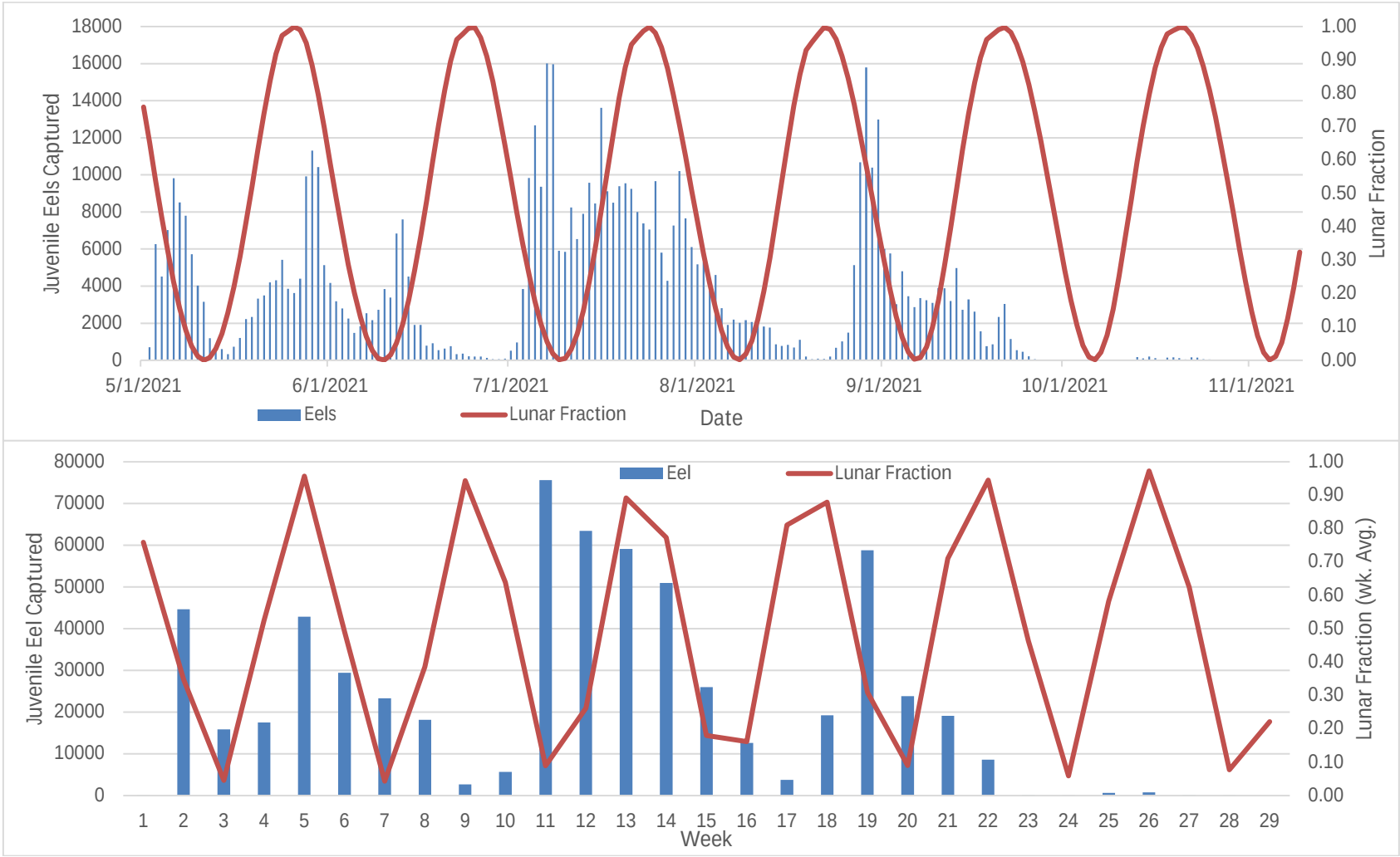


Figure 4.5-3: Eel Catch to Water Temperature, Conowingo Eel Collection Facility, 2021

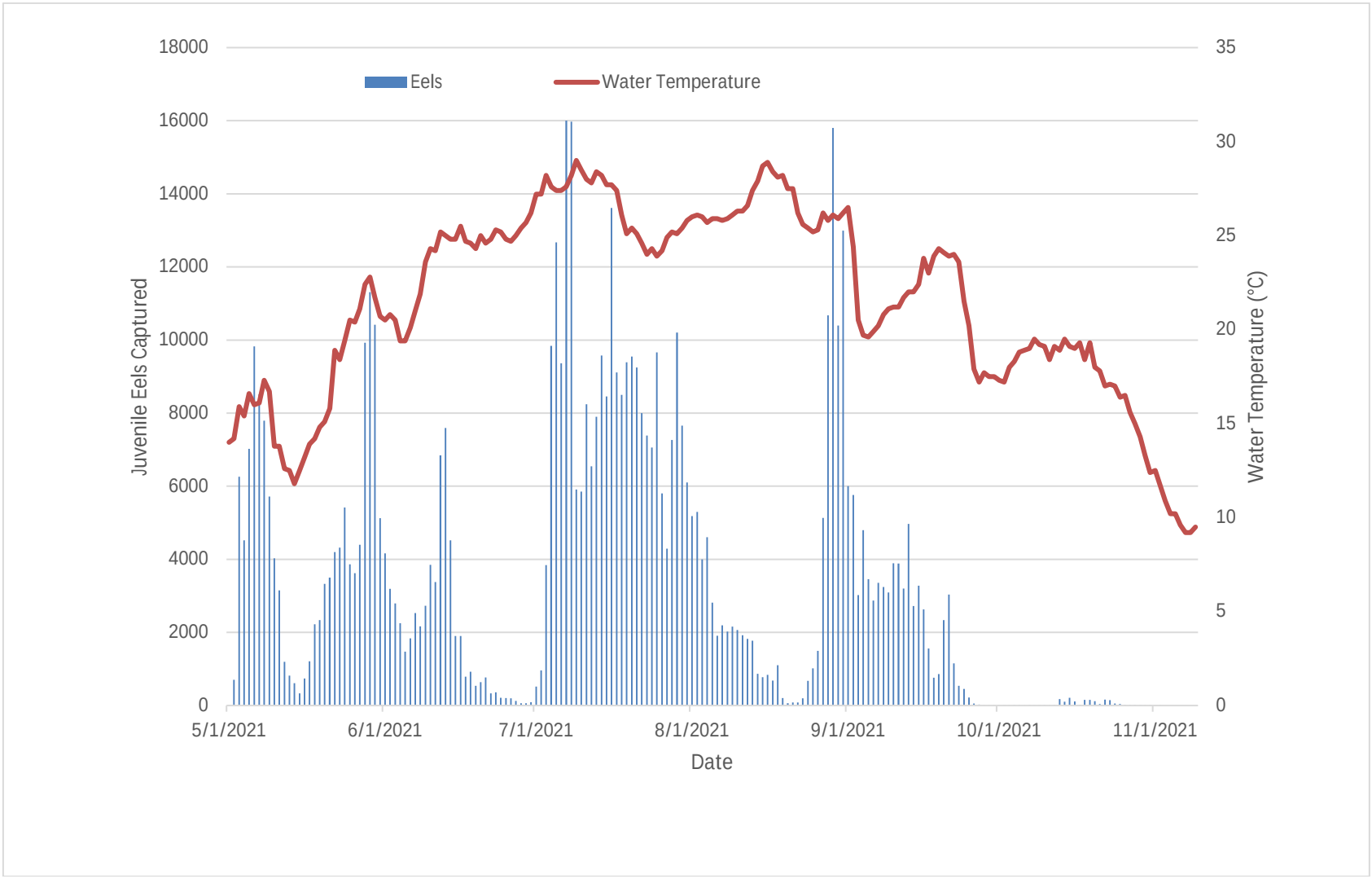


Figure 4.5-4: Eel Catch to Dissolved Oxygen, Conowingo West Eel Collection Facility, 2021

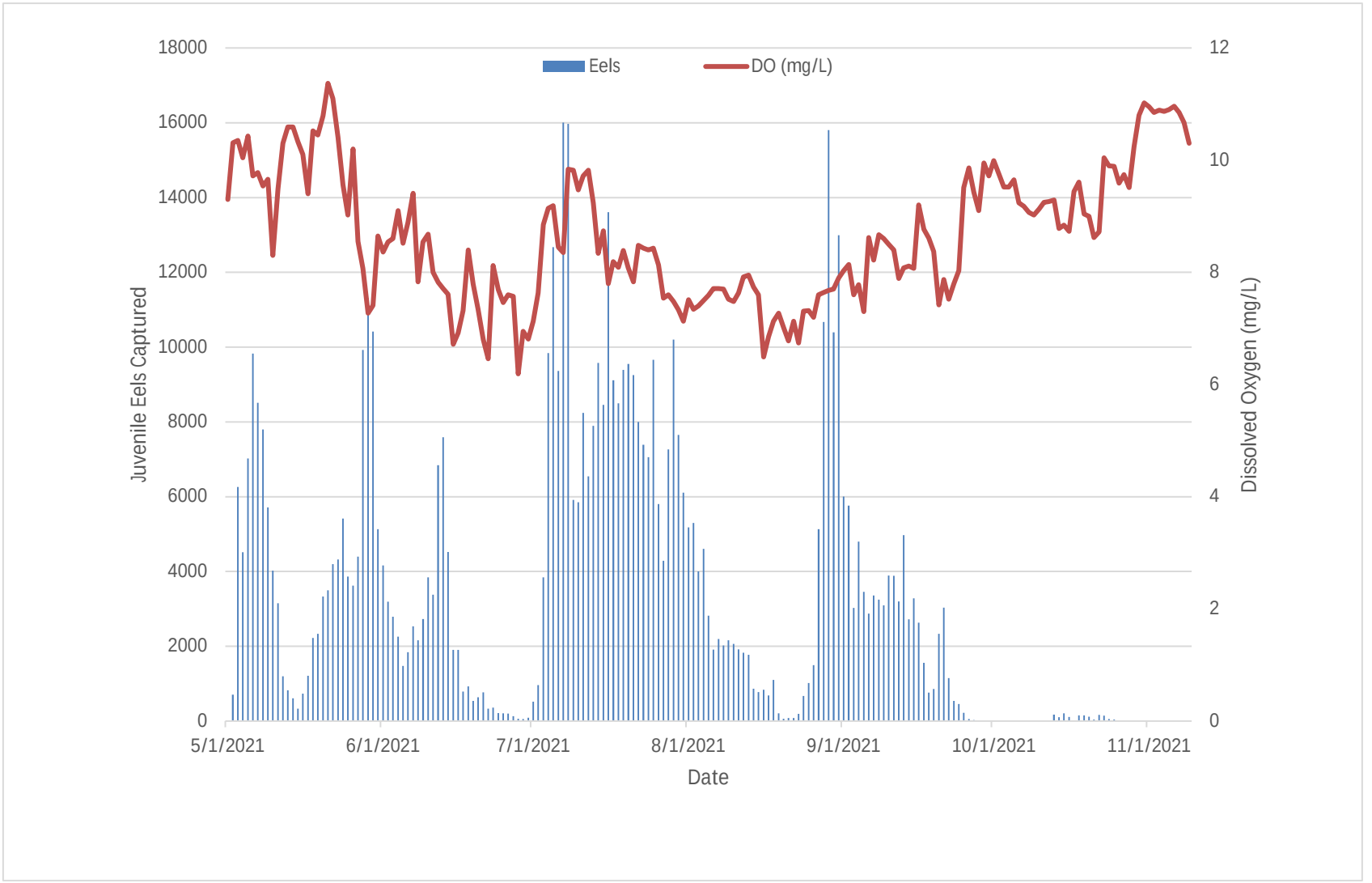
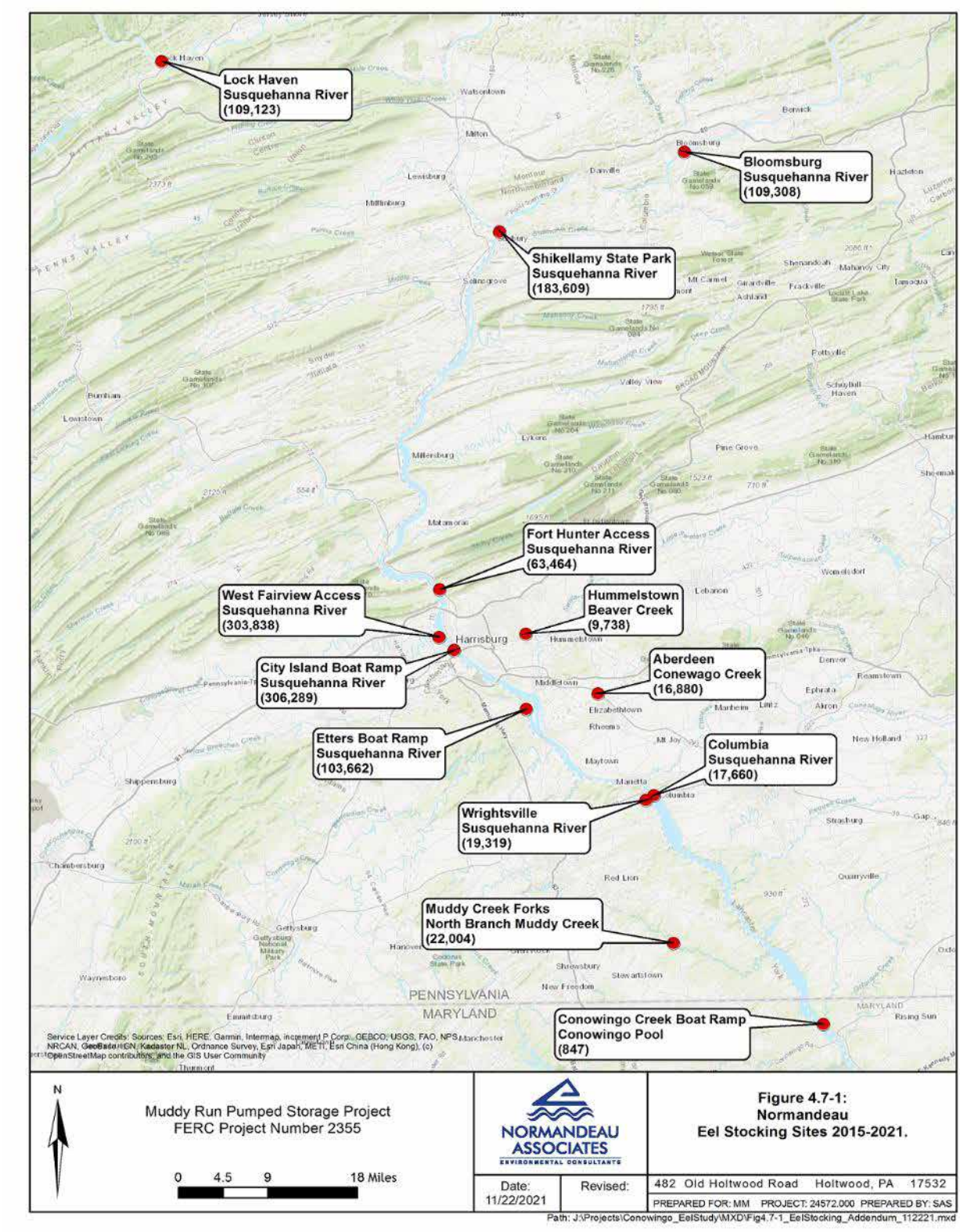


Figure 4.7-1: Eel Stocking Sites, 2015-2021



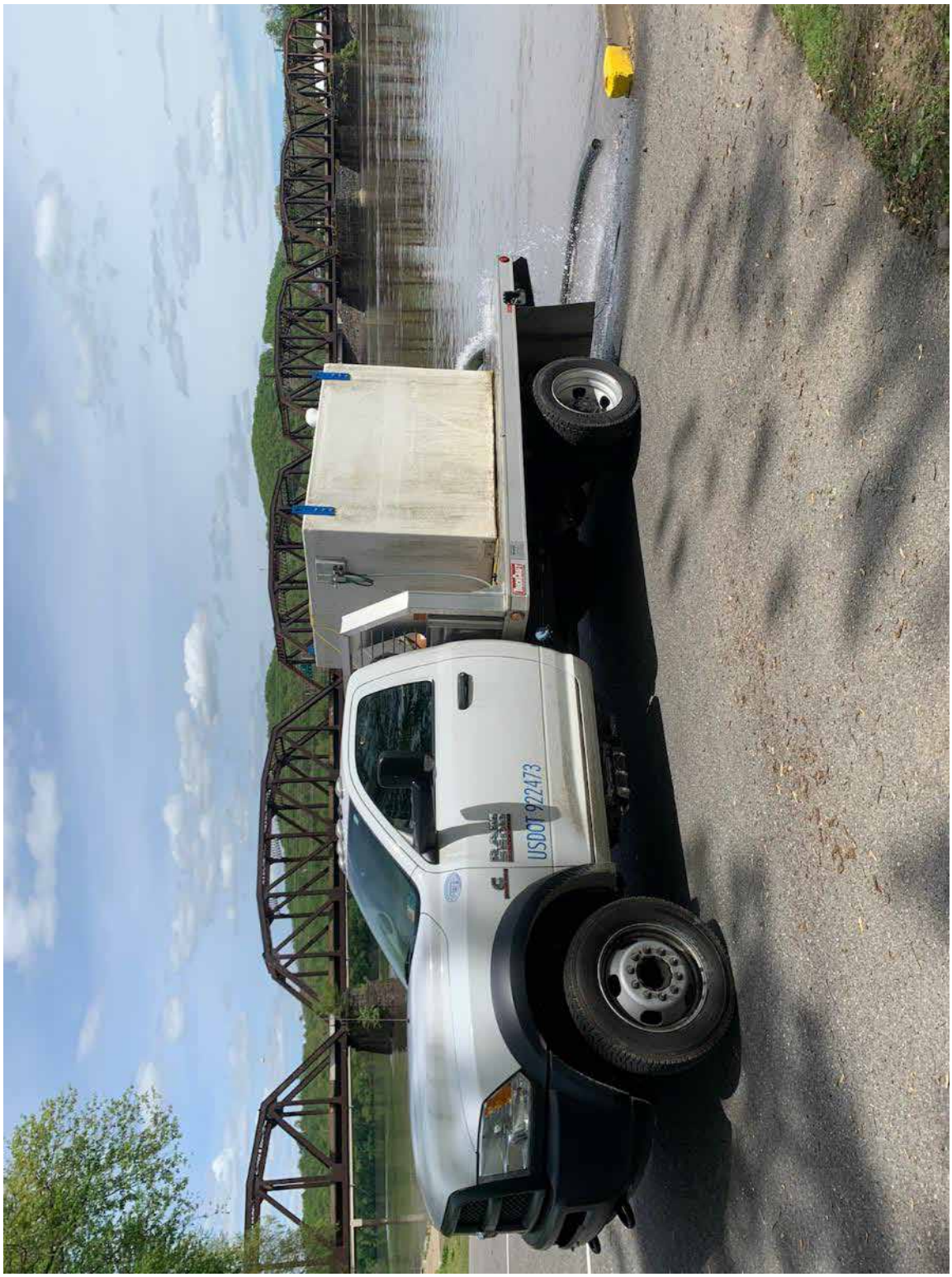


Figure 4.7-2: Shikellamy State Park (Site 7) Stocking Site, 2021

Figure 4.7-3: West Fairview Access (Site 5) Stocking Site, 2021

Figure 4.7-4: City Island Boat Ramp (Site 12) Stocking Site, 2021

Figure 5.0-1: Transition from Rip-Rap Shoreline to Ramp Entrance, Conowingo West Eel Collection Facility, 2021

Appendix A:
Method of Aging Eel Otolith, Conowingo West Eel Collection Facility, 2021

Method of Aging

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

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

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

NR- Could not be read

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

Date	Collection #	Batch #	Eel #	Total Length (mm)	Age 1 - CAF*	Age 2- ERS*	Age consensus
5/3/2021	MDM21303	1	1	105	2	2	2
	MDM21303		2	111	2	2	2
	MDM21303		3	92	1	1	1
	MDM21303		4	105	2	2	2
	MDM21303		5	119	2	2	2
5/10/2021	MDM21310	3	1	134	3	3	3
	MDM21310		3	126	2	2	2
	MDM21310		5	113	2	2	2
	MDM21310		6	96	1	1	1
	MDM21310		8	107	2	2	2
5/17/2021	MDM21317	5	1	141	3	3	3
	MDM21317		5	134	3	3	3
	MDM21317		11	121	2	2	2
	MDM21317		14	145	3	3	3
	MDM21317		22	120	2	2	2
5/24/2021	MDM21324	7	1	113	2	2	2
	MDM21324		3	144	3	2	2
	MDM21324		4	138	3	3	3
	MDM21324		5	109	2	2	2
	MDM21324		6	123	3	2	3
5/31/2021	MDM21331	9	1	184	5	4	5
	MDM21331		2	103	2	2	2
	MDM21331		3	131	3	3	3
	MDM21331		4	150	4	4	4
	MDM21331		5	145	3	3	3
6/7/2021	MDM21338	11	2	147	4	4	4
	MDM21338		3	151	4	4	4
	MDM21338		4	92	1	1	1
	MDM21338		5	153	4	4	4
	MDM21338		6	108	2	2	2
6/14/2021	MDM21345	13	1	108	2	2	2
	MDM21345		2	150	4	3	3
	MDM21345		3	135	3	3	3
	MDM21345		4	95	2	2	2
	MDM21345		5	99	2	2	2
6/21/2021	MDM20352	15	1	156	4	4	4
	MDM20352		2	85	1	1	1
	MDM20352		9	136	NR	NR	NR
	MDM20352		11	96	2	2	2
	MDM20352		21	118	2	2	2

	Collection #	Batch #	Eel #	Total Length (mm)	Age 1 - CAF*	Age 2- ERS*	Age consensus
6/28/2021	MDM21359	17	2	117	2	2	2
	MDM21359		4	162	4	4	4
	MDM21359		9	131	3	3	3
	MDM21359		17	163	4	4	4
	MDM21359		20	97	2	1	2
7/5/2021	MDM21366	19	1	107	2	2	2
	MDM21366		2	98	2	2	2
	MDM21366		3	81	1	1	1
	MDM21366		4	99	2	2	2
	MDM21366		5	95	2	2	2
7/12/2021	MDM21373	21	1	82	1	1	1
	MDM21373		2	97	2	2	2
	MDM21373		3	125	2	2	2
	MDM21373		4	136	3	3	3
	MDM21373		5	89	1	1	1
7/19/2021	MDM21380	23	1	91	1	1	1
	MDM21380		2	108	2	2	2
	MDM21380		3	80	1	1	1
	MDM21380		4	66	1	1	1
	MDM21380		5	120	3	3	3
7/26/2021	MDM21387	25	1	91	1	1	1
	MDM21387		2	107	1	1	1
	MDM21387		3	133	3	3	3
	MDM21387		5	106	1	1	1
	MDM21387		6	122	2	2	2
8/2/2021	MDM21394	27	1	114	2	2	2
	MDM21394		2	150	3	3	3
	MDM21394		3	133	3	3	3
	MDM21394		4	107	2	1	NR
	MDM21394		5	107	3	2	3
8/9/2021	MDM21401	29	1	140	4	4	4
	MDM21401		2	142	3	3	3
	MDM21401		3	150	4	4	4
	MDM21401		4	121	3	3	3
	MDM21401		5	150	3	3	3
8/16/2021	MDM21408	31	1	85	1	1	1
	MDM21408		2	91	1	1	1
	MDM21408		3	97	2	2	2
	MDM21408		4	165	4	4	4
	MDM21408		5	144	3	3	3

	Collection #	Batch #	Eel #	Total Length (mm)	Age 1 - CAF*	Age 2- ERS*	Age consensus
8/23/2021	MDM21415	33	1	142	3	NR	NR
	MDM21415		2	97	1	1	1
	MDM21415		3	89	1	1	1
	MDM21415		4	150	3	3	3
	MDM21415		5	143	3	3	3
8/30/2021	MDM21422	35	1	109	2	2	2
	MDM21422		2	98	2	2	2
	MDM21422		3	97	NR	NR	NR
	MDM21422		4	117	2	2	2
	MDM21422		5	86	1	1	1
9/6/2021	MDM21429	37	1	122	2	2	2
	MDM21429		2	83	1	1	1
	MDM21429		3	75	1	1	1
	MDM21429		4	84	2	1	2
	MDM21429		5	114	2	2	2
9/13/2021	MDM21436	39	7	96	2	2	2
	MDM21436		9	144	3	3	3
	MDM21436		13	104	2	2	2
	MDM21436		15	131	3	3	3
	MDM21436		19	122	3	3	3

Appendix B:
Weekly Biological Data and Environmental Conditions for Conowingo West Eel Collection Facility, 2017-2021

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 (Continued)	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

Appendix C:
Fish Health Inspection Report, Conowingo West Eel Collection Facility, 2021

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
Stone Run, Cecil County, MD (trib of Susquehanna, below Connowingo Dam) Octororo Creek watershed Michael Martinek, collector, Normandeau	☐ Hatchery ☑ Wild	☑ Unsecured: Open Spring, Stream ☐ Secured: Well, sterilized	Last sample date / Classification 1 03/15/2021 2 03/26/2020 3 03/19/2019 4 03/26/2018 5 03/21/2017

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	2021 collection	y		(F) Stone Run, MD	60	60	60			60	60			60		60	60	
					--	--	--	NT	NT	--	--	NT	NT	--	NT	--	+	

Remarks[6]: Lab Case 21-99; AME = American eel; A = swimbladder nematode (Anguillicola crassus)

Inspecting Biologist Signature	Concurred (signature & title)	
Print: Gavin Glenney Date: 05/03/2021	Print: John Coll Project Leader, LFHC Date: 05/03/2021	Lamar Fish Health Center 400 Washington Ave; PO Box 155 Lamar, PA 16848 (570_ 726-6611

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

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

Additional Inspection Information
Laboratory Case Number:

21-99 received March 16, 2021. Collection of 60 American eels occurred on 3/15/19 by Michael Martinek.

Bacterial cultures - primary inoculum from kidney onto BHIA, negative for AS, YR, EI. All 60 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 55% (33/60), typical level as reported in previous years.

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 Sheet, Conowingo West Eel Collection Facility, 2021

NORMANDEAU
environmental consultants

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

Date: 9/8/21 **Time:** 1035

No. of eels provided from CECF Collection Tank: 150

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: _____ Michael Markiewicz

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: 10/12/21 **Time:** 1015

No. of eels provided from CECF Collection Tank: Ø

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

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

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

Total number of eels provided for Transport: 15

SIGNATURES:

Normandeau/Exelon Representative: Adam Slavik, Allison Hill

Agency Representative: Aaron Henning

Agency (circle one): USFWS PADEP PFBC SRBC MDNR