January 15, 2020

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

RE: Muddy Run Pumped Storage Project, FERC Project No. 2355, License Article 401 and Conowingo Hydroelectric Project, FERC Project No. 405 2019 American Eel Collection Facility at Conowingo Hydroelectric Report

Dear Secretary Bose,

Article 401(b) of the Muddy Run Pumped Storage Project (Project) license requires Exelon Generation Company, LLC (Exelon) to file various reports, required by the Pennsylvania Department of Environmental Protection's (PADEP) Water Quality Certification and the U.S. Department of the Interior's (DOI) fishway prescription, with the Federal Energy Regulatory Commission (Commission). In part, Article 401(b) requires Exelon to file an annual American Eel Collection Facility report, documenting the performance of an eel trapping facility at Conowingo Hydroelectric Station.

The enclosed documentation provides the American Eel Collection Facility at Conowingo Hydroelectric Station. The report was previously distributed to the PADEP and the Resource Agencies to review and to solicit comments. Comments were received in December 2019 from the Resource Agencies and are included in Appendix F of the attached report. Resource Agencies comments have been reviewed and addressed in the attached report.

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

Respectfully submitted,

Andrea Danucalov

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Aaron Henning, Susquehanna River Basin Commission
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ENVIRONMENTAL CONSULTANTS

Muddy Run Pumped Storage Project
Conowingo Eel Collection Facility

FERC Project No. 2355

Prepared for:

Exelon.

Submitted On:
January 15, 2020

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Executive Summary

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

Exelon designed, installed, and operated the permanent eel collection and holding facility (Conowingo Eel Collection Facility, CECF) at Conowingo Dam in 2017 and continued operating this facility in the same manner in 2019. Eels collected at Conowingo and those transported from the Octoraro Creek eel facility were held and later transported and released at designated stocking areas in the Susquehanna River watershed as approved by PADEP and the Eel Passage Advisory Group (EPAG).

Specifically, the objectives of the 2019 field investigation were to:

- Operate, maintain, and monitor the eel collection and holding facility (daily) from May 1 through September 15, 2019;
- Collect catch and length data, water quality, stream flow, and moon phase data during the entire sampling period;
- Examine a subsample of juvenile eels for presence of swim bladder parasite and determine age from a portion of subsample;
- Transport eels from the CECF at Conowingo Dam to designated points in the Susquehanna River watershed;
- Conduct weekly quality control (QC) checks and cleaning of the eel collection facility to maintain proper attraction water flow;
- Document any modifications made to the facility during the course of the season to improve functionality.

The facility was placed in service on May 1, 2019. The facility operated a total of 138 days from May 1 to September 15.

A total of 126,181 juvenile eels were collected at the CECF. Juvenile eel numbers > 1,000 individuals were recorded on 19.6% of the collection days. The greatest number of juvenile eels was collected on July 5, 2019 with 10,166 or 8.1% of the total season catch. Eels collected between June 30 and July 6 and August 11-15 accounted for 58% (73,159 of 126,181) of the total eels in 2019. Volumetric estimates were utilized on 31 days this year.

Length, weight, and condition factor were recorded from biweekly subsamples on 909 juvenile eels. Length of juvenile eels ranged from 64-165 mm and an average length of 114.4 mm. The average

weight of juvenile eels was 1.8 grams (g) and ranged from 0.2-4.7 g. Only 8 of the 909 (0.9%) showed any form of external injury (condition factor) such as bruising, scrape, or hemorrhage.

Approximately 10% (91 of 909) of the eels collected were examined internally for presence of the eel swim bladder parasite (*Anguillicoloides crassus*). Parasites were found in 48 (52.7%) of the 91 sacrificed eels. The number of parasites per eel ranged from one to three. Eighty-three of the 91 sacrificed eels were examined for age and it was determined that the average age was 1.65 years old (range 1 - 4 years old).

The CECF collected a total of 126,181 juvenile eels in 2019 with a total of 26 eel mortalities found in the collection tank. A total of 193 (0.15% mortality) juvenile eels were recovered dead from the holding tanks over the entire season. Eels were held no longer than one week prior to transport from the CECF. A combined total of 123,259 eels from CECF and the Octoraro Creek Eel facility were transported to designated locations in the Susquehanna River watershed. A total of 105 juvenile eels were removed by the Susquehanna River Basin Commission (SRBC) on May 6, 8, and 28, for an "eels in the classroom" program. State University of New York at Oneonta (SUNY), was approved by the resource agencies to receive eels from the Conowingo Eel Collection facility. SUNY removed and transported 10,184 and 6,493 eels on August 12 and 14, respectively. West Fairview Access (Site 5) was stocked with 40,950 juvenile eels. Fort Hunter Access (Site 6) received a stocking of 41,116 juvenile eels. The remainder of the juvenile eels (41,132) were stocked in the Susquehanna River at City Island Boat Ramp (Site 12). A total of 61 juvenile eels died during the 72 transport trips from the CECF in 2019. Daily transports occurred from July 15 to August 31 due to elevated water temperatures, except August 11 and 13 when juvenile eels were held overnight for SUNY.

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

List of Abbreviations

Agencies/Groups

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

Units of Measure

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

1 Introduction

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

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

In 2017, Exelon designed, installed, and operated the permanent eel collection and holding facility at Conowingo Dam and continued operation through 2019. Eels collected at Conowingo and those transported from Exelon's Octoraro Creek eel facility were held and later transported and released at designated points in the Susquehanna River watershed.

Specifically, the objectives of the 2019 field investigation were to:

- Operate, maintain, and monitor the eel collection and holding facility (daily) from May 1 through September 15, 2019;
- Collect catch and length data, water quality, stream flow, and moon phase data during the entire sampling period;
- Examine a subsample of juvenile eels for presence of swim bladder parasite and determine age from a portion of subsample;
- Transport eels from the CECF at Conowingo Dam to designated points in the Susquehanna River watershed;
- Conduct weekly quality control (QC) checks and cleaning of the eel collection facility to maintain proper attraction water flow;
- Document any modifications made to the facility during the course of the season to improve functionality.

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

2 Background

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

The CECF is located on the west shore of the Susquehanna River just downstream of the WFL (Figures 2.0-1 and 2.0-2). This report describes the work completed by Normandeau Associates, Inc. for Exelon with oversight from EPAG in 2019 to collect and transport juvenile American Eels past Conowingo Dam.

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

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

3 Methods

3.1 Design, Construction, and Installation of Facility

The 2019 trapping facility was identical to the previous two years trapping facility (Appendix A, Normandeau Associates and Gomez and Sullivan 2018 and 2019). Complete designs descriptions can be found in Section 3: Methods in the Normandeau Associates and Gomez and Sullivan 2018 and 2019 report.

3.2 Data Collection

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

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

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

Flow readings and water quality data (temperature and dissolved oxygen) were recorded daily upon arrival from the control panel readouts for the collection tank and any holding tank in service. The main flow was also recorded daily.

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

3.3 Juvenile Eel Transport

A wild health screening was required prior to the transport of eels upstream into the Susquehanna River watershed. Juvenile eels were collected by a backpack electroshocker in March 2019 from Herring Run, a tributary of the Susquehanna River, and sent to the USFWS Fish Health Center (Lamar, PA) for examination (Figures 3.3-1 and 3.3-2). After the results of the wild health screening were received and reviewed by the EPAG, eels were stocked in the approved locations.

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

When less than 150 eels were collected during a sampling event, transport occurred using aerated 19-liter (L) buckets with lids, containing the maximum amount of water to prevent sloshing, with ≤ 50 eels in each bucket. When counts of juvenile eels were greater than 150 but less than 2,500 individuals, a small enclosed transport tank (250 L) with supplemental oxygen capability was used to transport eels to designated locations (Figure 3.3-3). When large loads (> 2,500) of American Eels were transported, the custom made transport truck and tank unit was used to efficiently and safely deliver eels to designated stocking locations (Figure 3.3-4).

4 Results

The CECF facility was installed and began operation May 1, with continued operation through September 15, 2019. Eels were collected daily during the 138 days that the facility was operated. A total of 126,181 juvenile eels were collected during the 2019 season (Table 4.0-1).

4.1 Juvenile Eel Collection

A total of 126,181 juvenile American Eels were captured at the CECF during the 2019 season. Counts or volumetric estimates were recorded daily. Volumetric estimates were taken from the CECF on 31 of the 138 days of operation (approximately 22.5% of the season, Table 4.0-1).

The highest one-day total of 10,166 juvenile eels occurred on July 5, when 8.1% of the total number of eels collected were captured (Table 4.0-1 and Figure 4.1-1). For the 2019 season, 19.6% (27 days) of the monitoring checks recorded juvenile eel numbers > 1,000 individuals (Table 4.0-1), while seven (5.1%) of the sample days recorded eel collection > 5,000 individuals.

4.2 Juvenile Eel Biological Data

Biological data (length, weight and condition factor) was recorded from biweekly subsamples. A total of 909 juvenile eels was collected from these biweekly subsamples (0.7% of total eels collected), during 39 of the 138 sample days (Table 4.2-1).

The average length of juvenile eels was 114.4 mm, with a median size of 115.0 mm (Table 4.2-1). The length of juvenile eels ranged from 64 – 165 mm. One hundred sixty-three juvenile eels measured less than 100 mm and no eels measured greater than 175 mm (Table 4.2-2). The average weight of juvenile eels was 1.8 grams (g), with a median weight of 1.7 g (Table 4.2-1). The weight of juvenile eels ranged from 0.2 – 4.7 g (Table 4.2-2). Almost 78% of the 909 juvenile eels weighed between 1 – 3 g (Table 4.2-3).

Eels from each biweekly subsample were examined for external injuries. Individual condition factors, date, and detailed biological data for these are shown on Table 4.2-4. External injuries were noted on 0.9% (8 of 909 individuals) of the examined eels. All injuries were coded as a bruise, scrape, hemorrhage, or fungus. Only one eel showed evidence of fungus, which in turn was taken as a sacrifice.

4.3 Eel Sacrifice and Internal Analysis

From each biweekly subsample, a portion of juvenile eels were retained and inspected for the presence of the swim bladder parasite (*Anguillicoloides crassus*) and examined for age determination. Roughly 10% (91 of the 909 individuals) were dissected for the parasite (Table 4.3-1 and Figure 4.3-1) and later examined for age (Table 4.3-2).

Of the 91 juvenile eels that were inspected for the parasite, 43 (47.3%) eels did not contain the swim bladder parasite (Table 4.3-1 and Figure 4.3-2). The other 48 (52.7%) eels contained the swim bladder parasite. The infected eels contained one, two, or three parasites per individual; 28, 17, and 3 eels, respectively. Table 4.3-2 provides detailed information by length frequency (five mm interval groups) of the 91 sacrificed eels with information including weight, age, and number that were infected by the parasite. The average length of the sacrificed eels was 116.4 (range 76-154) mm, average weight of 2.0 (range 0.4-4.0) g, and average number of parasites was 0.8 (range 0-3, Table 4.3-1).

Age of the juvenile eels was determined from 83 eels; eight additional eel otoliths could not be read for aging. The 83 juvenile eels analyzed for age were determined to be 1 to 4 years old (Average age = 1.65, Table 4.3-1). Detailed information of the 83 sacrificed and aged eels is shown on Table 4.3-1. Of the 83 aged eels, 41 eels (49.4%) were aged 1-year-old, 31 eels (37.3%) were aged 2 years old, 10 eels (12.0%) were aged 3 years old, and 1 eel (1.2%) were aged 4 years old. Age agreement between Normandeau biologists occurred 94.0% (78 of the 83 eels) of the time (Appendix B). The average length of the aged eels was 116.4 (range 76-154) mm, average weight of 2.0 (range 0.4-4.0) g, and average number of parasites 0.8 (range 0-3). Length frequency of aged eels with weights, parasites, and age data are found on Table 4.3-2.

4.4 Peak Periods of Eel Collections

The greatest percentage of juvenile eels was collected during Week 10 (June 30-July 6) when the facility collected 31.4% (39,685 individuals) of the season and nearly the same number of eels were collected on Week 16 when 30.2% of the season (38,115 individuals Table 4.4-1 and Figure 4.4-1). During Weeks 10 and 16 combined the majority of the juvenile eels were caught (61.7%, 77,800 individuals, Table 4.4-1 and Figure 4.4-1). Week 5 (May 26 – June 1) was the only other week when ≥ 5% of the season total was collected in a single week, 7.4% (9,359 individuals).

Weeks 1, 15, and 19-21 of sampling collected no greater than 1.0% of the season total, accounting for 1,414 individuals (1.1%) combined. Only 250 individuals (0.2%) were collected during the last three weeks of the season (Table 4.4-1 and Figure 4.4-1).

During the season, there were two large peak periods. The larger peak (June 30 – July 6, 7 days) yielded 39,685 of the 126,181 (31.4%) juvenile eels (Table 4.0-1). The slightly smaller peak occurred from August 11 through 15 (5 days), accounting for 33,474 of the 126,181 (26.5%) juvenile eels collected at the facility. Nearly 58% (73,159 of the 126,181) of the juvenile eels collected at this facility occurred during these 12 days or 8.7% of the sampling days.

4.5 Juvenile Eel Catch in Relation to Environmental Factors

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

River Flow

River flow and juvenile eel catch did not appear to be related during the 2019 season. Daily average river flow was taken from The United States Geological Survey (USGS) 01578310 Susquehanna River at Conowingo, MD gage located at Conowingo Dam (Table 4.5-1). The highest daily average river flow value per the USGS gage station occurred on May 15, 2019 (157,000 cubic feet per second, cfs). This single highest daily value occurred in the middle of Week 3 of eel facility operation, but did not correspond with any increase in eel collection (Table 4.0-1). The lowest daily average river flow value per the USGS gage station occurred on September 15, 2019 (4,560 cfs) during the last week of the season. The majority of the American Eel capture at the CECF in 2019 occurred when average river flow values were below 45,000 cfs (Figure 4.5-1). During the last five weeks of the sampling season (Weeks 17-21) the average weekly flow decreased which corresponded to decreasing weekly eel capture totals at the CECF. Week 1 was the lowest week of eel capture. The higher catch numbers during Weeks 10 and 16 of the study may be a function of other variables (e.g., migration timing).

Lunar Fraction

Juvenile eel catch did not appear to be correlated to lunar fraction (cycle) during the 2019 season. Full moon is equal to 1.0. The largest peak (June 30 – July 6) of 39,685 eels occurred during the darkest week (Week 10) of the season (Table 4.0-1 and Appendix C). This peak occurred during a new moon and a period of lower lunar fraction (lunar fraction near 0.0, Table 4.5-2 and Figure 4.5-2, U.S Naval Observatory website 2018). The second peak (August 11-15) of 33,474 eels occurred during the second brightest week (Week 16) of the season (Table 4.0-1 and Appendix C). This second peak occurred just before a full moon and a period of high lunar fraction (Table 4.5-2 and Figure 4.5-2, U.S Naval Observatory website 2018). Typically, the lower illuminance during lower lunar fraction periods, (new moon) has been associated with increases in eel catch at eel traps (Welsh *et al*. 2015, and Schmidt *et al*. 2009).

Water Temperature

Water temperature and eel catch did not appear to be related this season. Water temperatures did not reach 20.0° Celsius (C) until May 24, 2019. By this time the CECF collected nearly 7,600 eels (6.0% of season total, Tables 4.0-1 and 4.5-3). Over 78% (98,542 of the 126,181 eels) were captured after water temperatures reached 25.0° C on May 30, 2019 (Tables 4.0-1 and 4.5-3). Over the course of the study, the water temperature ranged from a high of 30.9°C during July to a low of 13.8°C during mid-May. (Table 4.5-3 and Figure 4.5-3). Water temperature during the 2019 season was ≥ 28.0° C for 52 continuous days from July 7 until August 24, (37.7% of the season) when 56,578 eels (44.8% of the season total) were captured (Tables 4.0-1 and 4.5-3).

Dissolved Oxygen

Dissolved oxygen (DO) and eel collection numbers did not appear to be related this season. With the additional aeration and diffused compressed oxygen supplied to each of the enabled tanks for most of the season, no relationship between eel catch and dissolved oxygen values could be derived. Daily DO values in 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 126,181 juvenile eels that were captured at this facility, 26 eels died in the collection tank (99.9% survival, Table 4.6-1). All mortalities from the collection tank were recorded over the course of the season, and were not attributed to a single event such as low DO or loss of water flow to holding tanks.

A total of 193 (0.15% mortality) juvenile eels died in holding (Table 4.6-1). On July 8, a total of 107 juvenile eels were recovered dead from holding while transferring them to the transport vehicle. Some of these eels showed signs of fungus. During this occasion, none of the 403 eels in the collection tank that day were found dead, and there were 6,349 eels that remained in holding that were alive, which were ultimately transported upriver. Because of the unknown cause of mortality, this holding tank was drained, scrubbed clean, and left dewatered for a period of two weeks to kill any bacteria that may have been in this tank. The water temperature of the collection tank was recorded above 28°C starting on July 7, and shortly after daily transports began to decrease mortalities due to higher than ideal holding tank water temperatures.

On August 14, while holding eels overnight for SUNY, 57 juvenile eels were discovered dead or displayed fungus when being removed from the holding tank. The collection tank water temperature was near 29°C. The highest water temperatures recorded from the collection tank during the 2019 season

occurred just previous to this event. Eels collected at the CECF and the Octoraro Creek eel facility were held together in the same holding tanks prior to transport, providing no opportunity to determine the source of these dead eels.

4.7 Juvenile Eel Transport and Mortality

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

On March 19, 2019, a Normandeau field crew collected 60 juvenile American Eels (< 200 mm) by backpack electroshocker from Herring Run, a tributary of the Susquehanna River near Lapidum boat ramp in Susquehanna State Park, MD. The following day, these 60 live juvenile American Eels were delivered to John Coll, a USFWS biologist at the Fish Health Center located at Lamar Fish Hatchery, Lamar, Pennsylvania for examination. Due to the smaller sized eels provided, only 26 of the larger eels could provide an adequate bacterial sample, in which no bacterial or viral pathogens of concern were detected. The Fish Health Inspection Report is presented in Appendix D.

A total of 105 eels were supplied to the SRBC on May 6, 8 and 28, 2019 from the CECF for an "eels in the classroom" program. State University of New York at Oneonta (SUNY), was approved by the resource agencies to receive eels from the Conowingo Eel Collection facility. SUNY removed and transported 10,184 and 6,493 eels on August 12 and 14, respectively for a 16,677 juvenile eels (Figure 4.6-1). Chain of custody sheets for these five events are located in Appendix E, which relinquishes Exelon's responsibility for these eels once the sheets are signed.

All juvenile eels that were captured in the CECF at Conowingo Dam, plus any eels collected at the Octoraro Creek eel facility, were held for no longer than one week prior to transport. All eels were transported and released at designated locations in the Susquehanna River watershed (Figure 4.7-1). A total of 123,259 juvenile eels were transported upstream (Tables 4.6-1 and 4.7-1). Daily transports occurred from July 15 to August 31, except August 11 and 13 to hold juvenile eels for SUNY due to elevated water temperatures.

Eels were transported to West Fairview Access, Fort Hunter Access, and City Island Boat Ramp. Total elapsed time of transport from the holding facility at Conowingo Dam to each stocking location varied between trips. Eel transports from the CECF to West Fairview Access (Site 5), Fort Hunter Access (Site 6), and City Island Boat Ramp (Site 12) were completed in approximately two and a half hours (± 30 minutes).

Of the 40,959 eels that were transported to West Fairview Access (Site 5), 40,950 eels were stocked (Tables 4.6-1 and 4.7-2 and Figure 4.7-2). This location was stocked 26 times from May 10 to September 15. Detailed data from each of the transports is found on Table 4.7-1.

Of the 41,120 eels that were transported to Fort Hunter Access (Site 6), 41,116 eels were stocked (Tables 4.6-1 and 4.7-2 and Figure 4.7-3). This location was stocked 28 times from May 6 to August 26. Detailed data from each of the transports is found on Table 4.7-1.

Of the 41,180 eels that were transported to City Island Boat Ramp (Site 12), 40,132 eels were stocked (Tables 4.6-1 and 4.7-2 and Figure 4.7-4). This location was stocked 18 times from May 18 to August 25. Detailed data from each of the transports is found on Table 4.7-1.

Mortality

Mortality during the 72 transport trips from the CECF at Conowingo Dam totaled 61 eels (0.05%, 61 of 123,259, Table 4.6-1). Nine eels died (0.02%, 9 of 40,959 eels) during transports from the CECF to West Fairview Access (Site 5). Four eels (0.01%, 4 of 40,120) died during transports to Fort Hunter Access (Site 6). Forty-eight eels (0.12%, 48 of 40,180) died during transports to City Island Boat Ramp (Site 12).

5 Quality Assurance/Quality Control Activities

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

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

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

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

Continuous water temperature and DO readings were taken from each tank in use. A linear piston blower and blower box controlled the air supplied to the collection tank and holding tank #1 through a manifold, while the other blower and blower box controlled air to holding tanks #2 and #3. An air pump was in service constantly throughout the season for all tanks that were in-service. Compressed bottled oxygen (125 cubic feet) was also supplied to each of the tanks. As with the air blower, an oxygen manifold was used for the collection tank and holding tank #1, while another oxygen manifold controlled holding tanks #2 and #3. After mid-May, the compressed oxygen was used for every tank in-service. Both the air blower manifold and the oxygen manifold were attached to a diffuser by a 6 mm hose. Each tank had one air blower fine pore diffuser and an oxygen micro pore diffuser. These diffusers laid flat on the tank bottom to insure that the full length of the diffuser was expelling bubbles. The micro pore diffusers reduced the amount of oxygen required to supply the tanks with sufficient oxygen levels.

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

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

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

Actual eel counts were compared to volumetric eel estimates to determine accuracy of the volumetric estimates. A quality control comparison on estimates occurred three times during the 2019 season: May 25, July 20, and August 26. The detailed estimates for juvenile eels per 200 milliliter (mL), displacement, total estimated, and actual counts are in Table 5.0-3. With only a small difference observed between estimates and actual counts (-1.1%), no further changes to this method are warranted.

6 Conclusions and Discussion

The Conowingo Eel Collection Facility captured 126,181 eels compared to the Octoraro Creek Eel Facility that captured 14,170 juvenile eels during the 2019 season. With both ramps operating simultaneously from May 1 to September 15, the CECF at Conowingo Dam captured approximately nine times the number of eels collected by the Octoraro Creek Eel Facility. The CECF at Conowingo Dam has one Enkamat substrate ramp compared to the Octoraro Creek Eel Facility which contains one Enkamat substrate and one Milieu substrate ramp. During the season, the size range of the juvenile eels caught at the CECF at Conowingo Dam facility was 64-165 mm with an average length of 114.4 mm, compared to the size range of 84-173 mm with an average length of 121.6 mm, and 78-192 mm with an average size of 122.3 mm observed in 2018 and 2017, respectively (Table 6.0-1 and Normandeau Associates and Gomez and Sullivan 2018 and 2019).

All environmental factors including lunar fraction and river flow did not appear to have a measurable effect on the number of eels collected in 2019. The highest daily average river flow value per the USGS gage station occurred on May 15, 2019 (157,000 cfs) and the lowest daily average river flow occurred on September 15, 2019 (4,560 cfs). The discharge at Conowingo Dam can change hourly, sometimes quicker, depending on energy demand, and may not be a good metric to use to compare eel collection numbers in a given season. The dissolved oxygen is augmented by air pumps and compressed oxygen injected into the tanks. The lower lunar fraction is one environmental factor typically showing the greatest relationship to the number of eels collected, but in 2019, the largest peak of eels collected at Conowingo Dam was during a period of low lunar fraction and the second largest peak occurred during a period of large lunar fraction. 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, and 2019 are in Appendix C.

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

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

The Conowingo Eel Collection Facility designs were approved by the Resource Agencies prior to the 2017 season (Appendix A). The 2019 USFWS inspection report was received by Exelon on November 27, 2019, which identified salient issues to the eel pass attraction flow at the apex of the ramp (Appendix F). Methodology was discussed at a high level during the annual EPAG meeting in December 2019, and EPAG will continue to discuss additional methodology concerning the issue during monthly EPAG calls.

7 References

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8 Tables and Figures

Table 4.0-1: Number of Juvenile Eel Caught Daily, Conowingo Eel Collection Facility, 2019

Date	Number of Eels	Date	Number of Eels	Date	Number of Eels
5/1/2019	0	6/17/2019	375	8/2/2019	310
5/2/2019	1	6/18/2019	455	8/3/2019	295
5/3/2019	1	6/19/2019	355	8/4/2019	187
5/4/2019	4	6/20/2019	235	8/5/2019	68
5/5/2019	22	6/21/2019	442	8/6/2019	163
5/6/2019	101	6/22/2019	151	8/7/2019	70
5/7/2019	330	6/23/2019	353	8/8/2019	231
5/8/2019	646	6/24/2019	218	8/9/2019	251
5/9/2019	*1180*	6/25/2019	119	8/10/2019	188
5/10/2019	*1077*	6/26/2019	254	8/11/2019	***8249***
5/11/2019	*1260*	6/27/2019	108	8/12/2019	***7978***
5/12/2019	*870*	6/28/2019	153	8/13/2019	***6550***
5/13/2019	597	6/29/2019	851	8/14/2019	***6233***
5/14/2019	348	6/30/2019	***5432***	8/15/2019	*4464*
5/15/2019	65	7/1/2019	***9796***	8/16/2019	*2883*
5/16/2019	99	7/2/2019	*3428*	8/17/2019	*1758*
5/17/2019	93	7/3/2019	*2402*	8/18/2019	566
5/18/2019	165	7/4/2019	*3501*	8/19/2019	251
5/19/2019	96	7/5/2019	***10166***	8/20/2019	434
5/20/2019	106	7/6/2019	*4960*	8/21/2019	762
5/21/2019	29	7/7/2019	*1062*	8/22/2019	359
5/22/2019	244	7/8/2019	408	8/23/2019	414
5/23/2019	260	7/9/2019	787	8/24/2019	374
5/24/2019	176	7/10/2019	470	8/25/2019	1191
5/25/2019	*863**	7/11/2019	89	8/26/2019	*1106**
5/26/2019	584	7/12/2019	141	8/27/2019	533
5/27/2019	797	7/13/2019	119	8/28/2019	134
5/28/2019	*1612*	7/14/2019	189	8/29/2019	109
5/29/2019	*1492*	7/15/2019	242	8/30/2019	29
5/30/2019	*1675*	7/16/2019	332	8/31/2019	33
5/31/2019	1619	7/17/2019	249	9/1/2019	43
6/1/2019	*1580*	7/18/2019	695	9/2/2019	43
6/2/2019	*1329*	7/19/2019	*939*	9/3/2019	32
6/3/2019	*605*	7/20/2019	*495**	9/4/2019	15
6/4/2019	39	7/21/2019	271	9/5/2019	46
6/5/2019	26	7/22/2019	770	9/6/2019	10
6/6/2019	29	7/23/2019	*2189*	9/7/2019	3
6/7/2019	37	7/24/2019	*999*	9/8/2019	7
6/8/2019	32	7/25/2019	398	9/9/2019	4
6/9/2019	42	7/26/2019	151	9/10/2019	2
6/10/2019	245	7/27/2019	432	9/11/2019	4
6/11/2019	203	7/28/2019	371	9/12/2019	4
6/12/2019	203	7/29/2019	537	9/13/2019	8
6/13/2019	303	7/30/2019	909	9/14/2019	11
6/14/2019	586	7/31/2019	604	9/15/2019	18
6/15/2019	124	8/1/2019	187		126181
6/16/2019	174				

Volumetric estimates are in Italics (31)
Bolded numbers are peak days

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

Table 4.2-1: Number of Juvenile Eel Captured with Length and Weight Measurements, Conowingo Eel Collection Facility, 2019

	Total
Number eels collected	126,181
Number measured	909
Data Collection Days	39
Range of lengths (mm)	64-165
Average length (mm)	114.4
Median length (mm)	115.0
Range of weights (g)	0.2-4.7
Average weight (g)	1.8
Median weight (g)	1.7

Table 4.2-2: Juvenile Eel Length Frequency, Conowingo Eel Collection Facility, 2019

TL (mm)	Number
60-64	1
65-69	6
70-74	6
75-79	15
80-84	17
85-89	24
90-94	38
95-99	56
100-104	68
105-109	97
110-114	112
115-119	122
120-124	105
125-129	82
130-134	52
135-139	54
140-144	26
145-149	14
150-154	6
155-159	5
160-164	2
165-169	1
Total	**909**

Table 4.2-3: Juvenile Eel Weight Frequency, Conowingo Eel Collection Facility, 2019

Weight (g)	Number
0.0-0.4	33
0.5-0.9	85
1.0-1.4	198
1.5-1.9	244
2.0-2.4	165
2.5-2.9	101
3.0-3.4	45
3.5-3.9	29
4.0-4.4	8
4.5-5.0	1
Total	**909**

Table 4.2-4: Observed Injuries of Juvenile American Eels, Conowingo Eel Collection Facility, 2019

Date	Length	Weight	Condition Factor
5/23/2019	126	2.3	Bruise around head
5/27/2019	112	1.5	Scrape on tail
6/3/2019	129	2.6	Scratches on belly
	122	2.3	Hemorrhage on caudal fin
	124	2.5	Scratches on belly
7/22/2019	98	1.0	Belly scrape, stomach lining looks thin
8/5/2019	96	1.2	Fungus near anal opening *
8/30/2019	134	2.3	Bruise on stomach

* Taken as a sacrifice

8 of 909 eels (0.9%) that were processed had injury

1 of the 8 were sacrificed (12.5%)

Sacrificed eel (96 mm) contained one parasite

Table 4.3-1: Sacrificed Eel Data, Conowingo Eel Collection Facility, 2019

Date	Length (mm)	Weight (g)	Parasite	Age
5/7/2019	116	1.9	2	1
	128	2.5	0	2
	104	1.1	2	1
	142	3.7	2	2
	136	2.4	1	3
5/9/2019	131	2.4	0	1
	118	2.3	0	1
	133	2.6	2	3
5/13/2019	146	3.6	1	3
	115	1.6	1	1
	108	1.6	3	1
	127	2.7	1	2
	115	1.6	0	1
5/16/2019	128	2.6	0	NR
	133	3.1	2	2
	129	2.6	1	2
	136	3.3	2	NR
	124	2.4	0	2
5/20/2019	138	3.0	0	2
	139	3.0	0	3
5/23/2019	131	2.8	2	2
	123	2.7	0	2
	140	3.6	0	2
	134	2.7	1	3
	136	3.6	2	2
5/30/2019	133	3	0	2
	131	2.5	1	2
	121	1.8	0	2
	122	1.9	1	2
	140	3.1	1	2
7/29/2019	107	1.6	1	1
	106	1.6	3	1
	92	0.9	1	1
	106	1.5	0	1
8/5/2019	96	1.2	1	1
	121	2.4	0	2
	83	0.8	0	1
	116	2	0	2
	104	1.5	1	1
	104	1.5	2	1
8/12/2019	108	1.3	1	1
	95	0.9	0	1
	124	2	0	2
	98	1.2	1	1
	113	1.4	2	2
8/19/2019	146	2.9	0	2
	143	2.4	0	3
	136	2.7	2	2
	138	3.1	1	2
	154	4	0	3
	135	2.6	0	2
8/26/2019	117	2.2	0	1
	108	2.1	1	1
	103	1.2	1	1
	123	2.2	0	2
	108	1.8	1	1
	93	0.9	0	1
	94	0.9	2	NR
	111	1.4	1	NR
	114	1.7	0	1

(continued)

Table 4.3-1. (Continued)

Date	Length (mm)	Weight (g)	Parasite	Age
6/6/2019	110	1.7	1	2
	145	3.7	1	3
	137	2.9	0	3
	128	2.2	2	2
	118	1.6	0	1
7/8/2019	120	2.3	3	2
	151	3.7	0	3
	110	1.7	2	1
	88	0.8	0	1
	142	3.5	1	4
7/15/2019	93	1	0	NR
	96	1.1	0	1
	95	1.2	0	1
	93	1.4	1	1
	86	0.9	0	1
7/22/2019	104	0.7	0	1
	119	1.9	1	2
	105	1.5	1	NR
	86	1.1	0	1
	90	0.7	0	1
	104	1	2	1
7/29/2019	81	0.5	0	1
	112	1.5	0	NR
	94	1	1	NR

Date	Length (mm)	Weight (g)	Parasite	Age
9/2/2019	77	0.4	0	1
	126	1.5	2	2
	115	1.3	1	1
	141	2.5	0	2
	110	1.1	0	1
9/9/2019	76	0.4	0	1
	87	0.8	2	1
Average	116.4	2.0	0.8	1.65
Range	76-154	0.4-4.0	0-3	1-4

Total Sacrificed	91
Total Aged	83
0 Parasites	43 (47.3%)
1 Parasite	28 (30.8%)
2 Parasites	17 (18.7%)
3 Parasites	3 (3.3%)
Eels without parasites	43 (47.3%)
Eels with parasites	48 (52.7%)

NR – age could not be determined

Table 4.3-2: Sacrificed Eels Length Frequency with Detailed Info, Conowingo Eel Collection Facility, 2019

TL (mm)	Weight (g)	Number	Contained Parasite	Age
75-79	0.4	2	0	1, 1
80-84	0.5-0.8	2	0	1, 1
85-89	0.8-1.1	4	1	1, 1, 1, 1
90-94	0.7-1.4	7	4	NR, NR, NR, 1, 1, 1, 1
95-99	0.9-1.2	5	2	1, 1, 1, 1, 1
100-104	0.7-1.5	6	5	1, 1, 1, 1, 1, 1,
105-109	1.3-2.1	8	7	NR, 1, 1, 1, 1, 1, 1, 1
110-114	1.1-1.7	7	4	NR, NR, 1, 1, 1, 2, 2
115-119	1.3-2.3	9	4	1, 1, 1, 1, 1, 1, 1, 2, 2,
120-124	1.8-2.7	8	2	2, 2, 2, 2, 2, 2, 2, 2
125-129	1.5-2.7	6	4	NR, 2, 2, 2, 2, 2
130-134	2.4-3.1	7	5	1, 2, 2, 2, 2, 3, 3
135-139	2.4-3.6	9	5	NR, 2, 2, 2, 2, 2, 3, 3, 3,
140-144	2.4-3.7	6	3	2, 2, 2, 2, 3, 4
145-149	2.9-3.7	3	2	2, 3, 3
150-154	3.7-4.0	2	0	3, 3
Total		**91**	**48**	

NR – age could not be determined

Table 4.4-1: Juvenile Eel Collection by Week and Ranks, Conowingo Eel Collection Facility, 2019

	Wk 1	Wk 2	Wk 3	Wk 4	Wk 5	Wk 6	Wk 7	Wk 8	Wk 9	Wk 10
Total	6	4616	2237	1774	9359	2097	1706	2187	2056	39685
Rank	21	5	11	15	3	13	16	12	14	1
Percent Catch (%)	0.00	3.66	1.77	1.41	7.42	1.66	1.35	1.73	1.63	31.45

	Wk 11	Wk 12	Wk 13	Wk 14	Wk 15	Wk 16	Wk 17	Wk 18	Wk 19	Wk 20	Wk 21
Total	3076	3141	5210	3213	1158	38115	3160	3135	192	40	18
Rank	10	8	4	6	17	2	7	9	18	19	20
Percent Catch (%)	2.44	2.49	4.13	2.55	0.92	30.21	2.50	2.48	0.15	0.03	0.01

Top 2 ranked weeks are shown in boxes.

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

Table 4.5-1: Daily Average River flows (cfs), USGS 01578310 - Conowingo Dam USGS Gage Station, 2019

Day	May	June	July	August	September
1	61,600	92,100	38,600	15,000	12,200
2	64,500	82,900	29,000	13,800	15,700
3	59,400	74,200	26,500	13,400	13,200
4	52,200	72,900	28,000	18,400	19,900
5	59,700	60,200	28,200	19,100	6,520
6	78,900	50,300	23,100	17,400	10,600
7	100,000	45,000	26,000	19,500	11,700
8	96,700	28,500	19,500	11,800	11,900
9	70,200	32,600	44,800	16,300	19,300
10	68,000	47,700	44,400	14,000	12,000
11	62,800	32,000	25,000	16,100	14,300
12	63,100	31,600	30,800	16,400	15,700
13	102,000	29,700	21,200	16,200	6,050
14	144,000	33,800	21,000	13,600	6,090
15	**157,000**	32,500	23,300	11,100	4,560
16	150,000	22,600	15,600	11,300	
17	141,000	27,300	21,700	15,700	
18	92,200	58,100	21,900	21,900	
19	83,200	41,100	18,600	12,700	
20	99,400	85,200	26,400	15,100	
21	93,400	104,000	27,000	19,400	
22	64,500	91,300	25,900	17,100	
23	63,300	119,000	14,800	12,100	
24	45,500	107,000	27,400	15,200	
25	46,700	75,400	26,200	15,200	
26	42,300	60,100	26,900	12,200	
27	40,600	51,900	24,300	15,100	
28	48,200	38,000	24,200	9,150	
29	52,500	37,200	22,100	10,400	
30	46,300	30,300	14,600	13,400	
31	86,100		14,900	10,100	

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, 2019 EST (*1.0 equals full moon*)

Day	May	June	July	August	September
1	0.14	0.06	0.03	0.00	0.05
2	0.08	0.02	0.00	0.02	0.11
3	0.03	0.00	0.00	0.07	0.20
4	0.01	0.01	0.03	0.14	0.30
5	0.00	0.04	0.08	0.23	0.40
6	0.02	0.10	0.16	0.33	0.51
7	0.06	0.18	0.25	0.44	0.61
8	0.12	0.27	0.36	0.55	0.71
9	0.20	0.38	0.47	0.66	0.79
10	0.30	0.50	0.59	0.75	0.86
11	0.41	0.61	0.69	0.83	0.92
12	0.52	0.72	0.79	0.90	0.96
13	0.63	0.81	0.87	0.95	0.99
14	0.74	0.89	0.93	0.98	1.00
15	0.83	0.95	0.97	1.00	0.99
16	0.91	0.98	1.00	0.99	
17	0.96	1.00	1.00	0.97	
18	0.99	0.99	0.98	0.93	
19	1.00	0.97	0.95	0.88	
20	0.98	0.92	0.90	0.81	
21	0.94	0.86	0.84	0.73	
22	0.88	0.79	0.76	0.64	
23	0.81	0.70	0.68	0.54	
24	0.73	0.61	0.58	0.44	
25	0.64	0.52	0.49	0.34	
26	0.55	0.42	0.39	0.24	
27	0.45	0.33	0.29	0.15	
28	0.36	0.24	0.20	0.07	
29	0.27	0.16	0.12	0.02	
30	0.19	0.09	0.05	0.00	
31	0.12		0.01	0.01	

Table 4.5-3: Water Temperature (°C) Taken in Collection Tank, Conowingo Eel Collection Facility, 2019

Day	May	June	July	August	September
1	14.80	23.50	26.00	29.80	27.50
2	14.70	22.70	26.30	29.80	27.70
3	15.80	21.90	26.70	29.60	27.60
4	15.80	21.50	27.50	30.50	27.80
5	16.50	21.30	27.40	30.80	27.30
6	16.60	21.30	27.90	30.70	27.50
7	17.10	22.10	28.50	30.60	27.10
8	18.00	22.20	28.40	30.10	26.90
9	18.00	22.80	29.10	30.20	26.60
10	18.10	23.20	28.70	30.20	26.80
11	18.40	23.20	28.70	29.90	26.20
12	17.80	23.20	28.80	29.60	26.50
13	17.00	23.00	28.30	29.10	26.80
14	15.80	22.90	28.10	28.90	26.70
15	14.10	22.60	28.70	29.00	26.30
16	13.80	22.40	28.60	28.90	
17	14.30	23.70	28.60	28.90	
18	14.80	24.10	28.80	28.90	
19	15.70	22.80	29.40	29.10	
20	17.40	23.90	29.90	29.10	
21	18.30	23.90	30.80	29.40	
22	19.10	22.30	30.90	29.30	
23	19.70	21.60	30.80	29.30	
24	20.00	21.50	30.00	29.00	
25	20.30	22.10	29.90	28.60	
26	20.50	22.90	30.00	28.40	
27	21.40	23.20	29.50	28.00	
28	22.40	23.80	29.30	27.70	
29	23.00	24.20	29.20	27.80	
30	23.00	25.30	29.30	27.50	
31	24.30		29.20	27.70	

Table 4.5-4: Dissolved Oxygen (mg/L) Reading Taken in Collection Tank, Conowingo Eel Collection Facility, 2019

Day	May	June	July	August	September
1	10.18	8.44	6.54	6.98	10.31
2	10.20	7.79	10.10	7.75	9.78
3	10.00	8.07	6.50	9.05	8.06
4	12.80	8.22	6.85	9.03	8.47
5	9.92	8.18	6.10	10.42	9.27
6	9.77	8.34	13.70	9.43	9.45
7	9.70	8.36	7.86	8.23	8.16
8	9.52	8.24	7.35	7.90	7.65
9	9.40	7.99	7.80	7.49	8.60
10	9.24	8.60	7.80	9.50	7.97
11	9.05	7.66	7.10	6.81	7.72
12	9.10	8.90	7.79	7.40	6.74
13	9.44	9.50	7.80	7.76	6.51
14	10.10	14.00	12.50	5.01	7.60
15	10.75	8.00	13.28	7.83	8.09
16	10.82	7.09	6.67	7.33	
17	10.66	7.77	5.76	9.10	
18	10.42	12.76	10.33	7.67	
19	10.10	8.97	13.32	9.73	
20	9.62	8.10	10.05	6.90	
21	9.43	7.93	9.89	7.81	
22	9.08	9.26	7.12	10.67	
23	9.12	8.80	10.19	8.48	
24	9.07	9.20	7.20	8.17	
25	8.73	8.83	9.38	9.43	
26	8.90	8.18	7.92	7.98	
27	8.57	8.12	10.77	7.41	
28	10.52	7.55	6.44	8.04	
29	7.73	7.29	8.97	7.29	
30	7.73	5.70	9.84	9.32	
31	8.50		10.16	8.79	

Table 4.6-1: Eel Transport/Stocking Data, 2019

Location of stocking	Number of eels	Died (Mortality)			Removed for Analysis	Removed for SRBC	Removed by SUNY	Number Stocked
		Collection Tank	Holding Tank	Transported				
Octoraro Creek Collection tanks	14,170	0 (0.00%)						
Transported to Conowingo Eel Collection Facility	14,170			0 (0.00%)				14,170
Conowingo Collection tank	126,181	26 (0.02%)	**193 *(0.15%)***		91	105	16,677	109,089
Total Transported from Conowingo Eel Collection Facility	123,259			61 (0.05%)				123,198
Stocked at West Fairview (Site 5)	40,959			9 (0.02%)				40,950
Stocked at Fort Hunter (Site 6)**	41,120			4 (0.01%)				41,116
Stocked at City Island (Site 12)***	41,180			48 (0.12%)				41,132
TOTAL Transported #	123,259			61 (0.05%)				123,198

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

* Transported to West Fairview (Site 5), (May 11, June 3, July 3, 5, 16, 21, 24, 26, 28, and 31, August 2, 5, 6, 10, 15, 16, 21, and 27-31, September 3, 6, 12, and 15)

** Transported to Fort Hunter (Site 6), (May 6, 14, and 31, June 7, 14, 21, and 28, July 2, 10, 15, 17-19, 22, 25, 27, and 29, August 1, 3, 7, 9, 14, 18-20, 22, 24, and 26)

*** Transported to City Island (Site 12), (May 8, 21, and 28, June 18 and 25, July 1, 8, 12, 14, 20, 23, and 30, August 4, 8, 12, 17, 23, and 25)

Table 4.7-1: Detailed Individual Eel Transport Data, 2019

Transport to West Fairview (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)
5/10	3,520	842	18.5	9.4	930	18.5	3.8	1130	18.9	13.9	17.6	9.2
6/3	5,140	941	22.0	7.6	1100	22.1	8.7	1325	22.3	10.3	20.3	8.0
7/3	2,404	1045	26.7	6.5	1115	27.5	5.4	1340	27.6	20.8	27.5	6.2
7/5	13,682	810	27.5	5.3	918	27.5	8.5	1125	27.5	12.6	26.2	7.1
7/16	2,481	845	28.6	6.7	910	24.2	15.6	1102	25.0	16.5	24.5	8.9
7/21	704	937	30.8	9.8	937	26.4	7.3	1120	29.7	14.3	29.9	6.4
7/24	1,577	1000	30.0	10.5	1028	26.0	11.5	1249	26.1	8.1	26.1	9.1
7/26	397	830	30.0	7.9	857	23.0	11.0	1043	23.7	17.9	24.4	8.7
7/28	438	836	29.3	6.4	900	24.0	9.5	1054	25.1	16.6	25.9	8.2
7/31	647	1000	29.2	10.2	1045	26.1	8.2	1253	27.2	12.2	27.5	9.0
8/2	329	800	25.7	7.0	920	24.7	10.3	1057	25.1	13.6	26.6	8.7
8/5	67	846	30.8	10.4	915	24.5	7.6	1106	25.4	8.9	26.5	9.4
8/6	168	812	30.7	9.4	840	30.0	6.8	1044	27.0	6.7	26.3	7.9
8/10	191	748	30.2	9.5	916	29.6	6.7	1015	28.5	5.9	23.6	8.8
8/15	4,465	923	29.0	7.8	1023	29.1	5.6	1248	29.0	10.8	26.3	9.8
8/16	2,882	855	28.9	7.3	1000	28.9	17.1	1245	28.8	18.1	25.6	9.3
8/21	768	1000	29.4	7.8	1100	29.7	9.5	1315	29.7	18.2	28.2	10.1
8/27	533	856	28.0	7.4	927	27.0	6.6	1123	26.2	16.9	21.9	8.7
8/28	138	815	27.7	8.0	840	27.2	7.2	1030	26.8	13.2	22.3	8.2
8/29	110	1030	27.8	7.3	1041	27.1	6.7	1235	26.8	6.9	22.7	10.4
8/30	29	815	27.5	9.3	915	26.1	6.8	1050	26.0	6.4	22.5	9.3
8/31	35	809	27.7	8.8	823	25.4	7.7	1006	25.2	7.6	22.6	8.1
9/3	113	900	27.6	8.1	1015	26.2	7.7	1157	27.3	6.9	24.5	9.4
9/6	72	915	27.5	9.5	1000	26.0	6.2	1155	24.3	6.6	23.2	8.8
9/12	23	952	26.6	8.1	1039	27.2	6.8	1040	28.6	7.2	26.6	9.5
9/15	37	915	9.3	26.3	945	26.0	7.4	1135	26.1	7.5	21.8	10.1
Total	**40,950**											

Transport to Fort Hunter (Site 6)

Date	Number of eels stocked	Holding Facility			Loaded for Transport			Prior to Unloading			Stocking site	
		Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Time	Temp (°C)	DO (mg/L)	Temp (°C)	DO (mg/L)
5/6	88	1100	16.9	10.3	1245	18.0	10.5	1545	16.0	10.0		
5/14	1,815	908	15.8	10.6	953	15.9	9.4	1200	15.7	10.0	12.0	11.1
5/31	3,171	1115	24.3	7.8	1145	25.9	16.3	1405	26.1	15.9	19.3	9.0
6/7	145	1050	22.3	9.3	1055	22.5	10.3	1320	24.7	5.3	21.7	8.3
6/14	1,751	1110	23.0	8.7	1115	21.6	6.4	1340	21.7	6.2	20.0	8.8
6/21	1,034	940	23.9	7.9	1000	23.7	13.8	1235	23.4	10.6	19.8	7.0
6/28	520	910	18.4	7.4	920	24.5	6.5	1115	25.0	5.5	24.5	9.3
7/2	13,340	945	26.1	6.5	1039	26.4	12.0	1315	26.4	12.3	25.9	8.3
7/10	1,268	1115	28.6	5.8	1130	29.0	16.1	1345	29.6	19.7	26.7	8.1
7/15	2,079	1035	28.7	13.3	1115	24.7	16.0	1315	24.2	14.5	27.8	7.8
7/17	532	1024	28.6	5.8	1040	25.2	7.5	1350	26.4	13.8	29.4	7.0
7/18	893	843	28.8	10.3	920	27.3	9.6	1108	27.1	12.3	28.1	6.3
7/19	939	825	29.4	13.3	900	29.0	10.8	1115	29.9	15.8	28.5	9.0
7/22	1,091	906	30.9	7.1	950	26.2	12.6	1157	26.9	13.1	29.8	7.4
7/25	845	933	29.9	9.4	1015	22.6	17.4	1220	23.2	17.7	25.5	8.0
7/27	751	821	29.5	10.8	844	23.9	16.2	1100	24.7	18.6	25.7	7.8
7/29	653	945	29.2	9.0	1030	26.7	13.8	1240	26.0	13.0	28.4	7.7
8/1	250	847	29.8	7.0	917	25.4	12.1	1117	25.5	13.1	27.4	7.0
8/3	305	756	29.6	9.1	815	24.9	7.5	1009	24.2	14.0	26.5	7.5
8/7	78	900	30.6	8.2	925	24.8	7.2	1155	28.2	7.3	28.5	7.6
8/9	251	935	30.2	7.5	958	30.1	6.4	1205	29.6	9.6	26.4	7.3
8/14	6,232	930	28.7	6.2	1226	28.7	11.5	1432	28.7	17.5	27.8	8.0
8/18	567	821	28.9	7.7	845	28.5	6.2	1031	27.6	19.5	27.4	7.2
8/19	245	855	29.1	9.7	936	29.1	11.1	1144	29.1	15.3	27.7	6.3
8/20	437	815	29.1	6.9	900	28.9	5.7	1050	28.7	24.8	27.3	6.7
8/22	361	846	29.3	10.7	930	28.9	11.3	1141	28.4	18.7	27.6	7.6
8/24	375	820	29.0	8.2	840	28.1	12.4	1045	28.4	6.9	23.9	6.9
8/26	1,100	819	28.4	8.0	915	26.2	7.0	1120	26.4	11.6	23.2	8.0
Total	**41,116**											

Table 4.7-1 (Continued)

Transport to City Island (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)
5/8	944	1150	18.1	10.1	1200	18.2	10.2	1405	18.4	21.0	17.4	9.6
5/21	628	1015	18.5	8.6	1045	18.7	6.9	1300	18.7	5.4	18.8	10.2
5/28	4,510	1055	22.5	8.4	1125	23.0	7.4	1322	23.3	9.7	22.8	8.2
6/18	1,139	1015	24.3	8.6	1115	24.4	60.5	1330	24.5	9.8	21.9	9.9
6/25	845	900	22.0	8.6	955	23.4	12.0	1155	24.1	16.2	20.5	7.7
7/1	6,218	1036	25.9	6.2	1230	26.5	7.9	1428	26.6	8.7	25.8	8.1
7/8	6,319	934	28.3	12.9	1130	28.4	20.4	1358	27.5	14.3	26.7	7.3
7/12	361	907	28.7	6.7	945	27.9	7.1	1141	28.4	16.5	26.5	8.2
7/14	5,209	835	27.9	9.6	915	24.0	5.4	1055	25.1	16.5	27.4	7.4
7/20	1,443	900	29.9	10.1	930	25.8	5.5	1110	27.0	17.0	30.0	9.3
7/23	2,707	902	30.8	10.2	930	25.3	10.5	1125	25.8	16.4	26.6	8.0
7/30	970	852	29.3	9.8	914	29.0	10.6	1104	29.2	12.4	28.6	7.6
8/4	204	830	30.5	9.1	841	25.0	12.4	1020	25.3	9.6	27.0	8.0
8/8	234	945	30.1	7.9	1010	29.8	5.1	1205	28.3	11.3	27.3	7.4
8/12	6,036	800	29.6	5.3	1000	29.4	5.4	1252	30.2	9.7	26.8	8.0
8/17	1,756	822	28.9	9.1	900	29.0	14.7	1104	29.7	16.5	27.5	7.6
8/23	416	900	29.3	8.5	930	27.5	12.8	1142	27.4	11.4	25.8	7.4
8/25	1,193	846	28.6	9.4	928	27.6	10.8	1115	27.2	19.6	24.0	7.3
Total	**41,132**											

Table 4.7-2: Exelon's Eel Stocking Locations by Year, 2015 - 2019

Location	2015	2016	2017	2018	2019
Conowingo Creek boat ramp (USFWS request)	847	-	-	-	-
North Branch Muddy Creek	-	22,004	-	-	-
Conewago Creek	-	378	16,502	-	-
Beaver Creek	-	-	9,738	-	-
Etter's boat ramp	-	-	103,662	-	-
West Fairview Access	-	-	-	22,586	40,950
Fort Hunter Access	-	-	-	22,348	41,116
City Island boat ramp	-	-	-	24,869	41,132

Table 5.0-1: Specified operating range of Conowingo Eel Collection Facility, 2019

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

Table 5.0-2: Calibration of Flows (Gallons per Minute), Conowingo Eel Collection Facility, 2019

	DATE									
	5/8	**5/15**	**5/22**	**5/29**	**6/5**	**6/12**	**6/19**	**6/26**	**7/3**	**7/10**
Collection Tank Fill	15.0	15.9	12.6	15.9	12.6	13.5	12.0	12.3	12.6	12.0
Collection Tank Drain	16.0	16.5	12.6	16.5	13.5	13.5	11.4	12.6	13.2	13.2
Holding Tank #1 Drain	22.0	22.0	22.0	22.0	18.6	21.0	20.0	-	22.0	-
Holding Tank #2 Drain	-	-	-	-	-	-	-	21.0	-	32.0
Holding Tank #3 Drain	43.5	33.8	39.0	37.5	33.8	30.0	37.5	37.5	31.5	30.0
Spray Bar	8.4	8.7	8.6	8.4	8.4	8.4	8.0	8.8	8.4	8.4
Scent line	1.0	1.2	1.2	1.1	1.2	1.2	1.1	1.2	1.2	1.2
Backside of Ramp	2.0	1.8	1.2	1.7	2.1	1.2	0.5	1.5	1.8	2.4
Top Attraction	6.5	6.9	7.4	6.7	6.3	7.2	7.5	7.4	6.6	6.0
Bottom of Ramp Attraction	81.5	72.3	73.6	76.0	65.9	64.5	68.9	71.1	66.7	75.2
Total Attraction	**88.9**	**80.4**	**82.2**	**83.8**	**73.4**	**72.9**	**77.5**	**79.6**	**74.5**	**82.4**

	DATE								
	7/17	**7/24**	**7/31**	**8/7**	**8/14**	**8/21**	**8/29**	**9/4**	**9/11**
Collection Tank Fill	15.0	13.5	13.5	11.4	13.8	11.7	15.0	15.6	17.4
Collection Tank Drain	14.7	13.5	13.2	12.0	13.8	12.3	15.0	16.2	17.4
Holding Tank #1 Drain	19.0	-	-	-	-	-	-	16.2	16.8
Holding Tank #2 Drain	-	-	-	-	-	-	-	-	-
Holding Tank #3 Drain	37.5	58.0	51.0	52.5	39.0	48.8	48.8	35.5	34.0
Spray Bar	8.4	8.3	8.3	8.4	8.4	8.4	8.0	8.3	9.0
Scent line	1.6	1.5	1.9	1.5	1.6	1.5	1.5	1.7	1.9
Backside of Ramp	1.3	1.5	1.6	2.1	1.6	2.1	1.5	2.3	1.9
Top Attraction	7.2	6.8	6.7	6.4	6.9	6.3	6.6	6.0	7.1
Bottom of Ramp Attraction	71.2	71.5	64.2	64.5	52.8	61.1	63.8	67.9	68.2
Total Attraction	**79.9**	**79.8**	**72.8**	**72.3**	**61.2**	**68.9**	**71.8**	**75.6**	**77.2**

Table 5.0-3: Quality Control Checks on Counts, Conowingo Eel Collection Facility, 2019

Date	Number of eels in:		Displacement	Volumetric	Actual	Difference
	200 mL	1 L	of Water	Estimate	Counts	
5/25/2019	90	450	1.5	772	863	91
7/20/2019	137	685	0.54	552	495	-57
8/26/2019	123	615	1.6	1167	1106	-61
Total				**2491**	**2464**	**-27**
						-1.1%

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

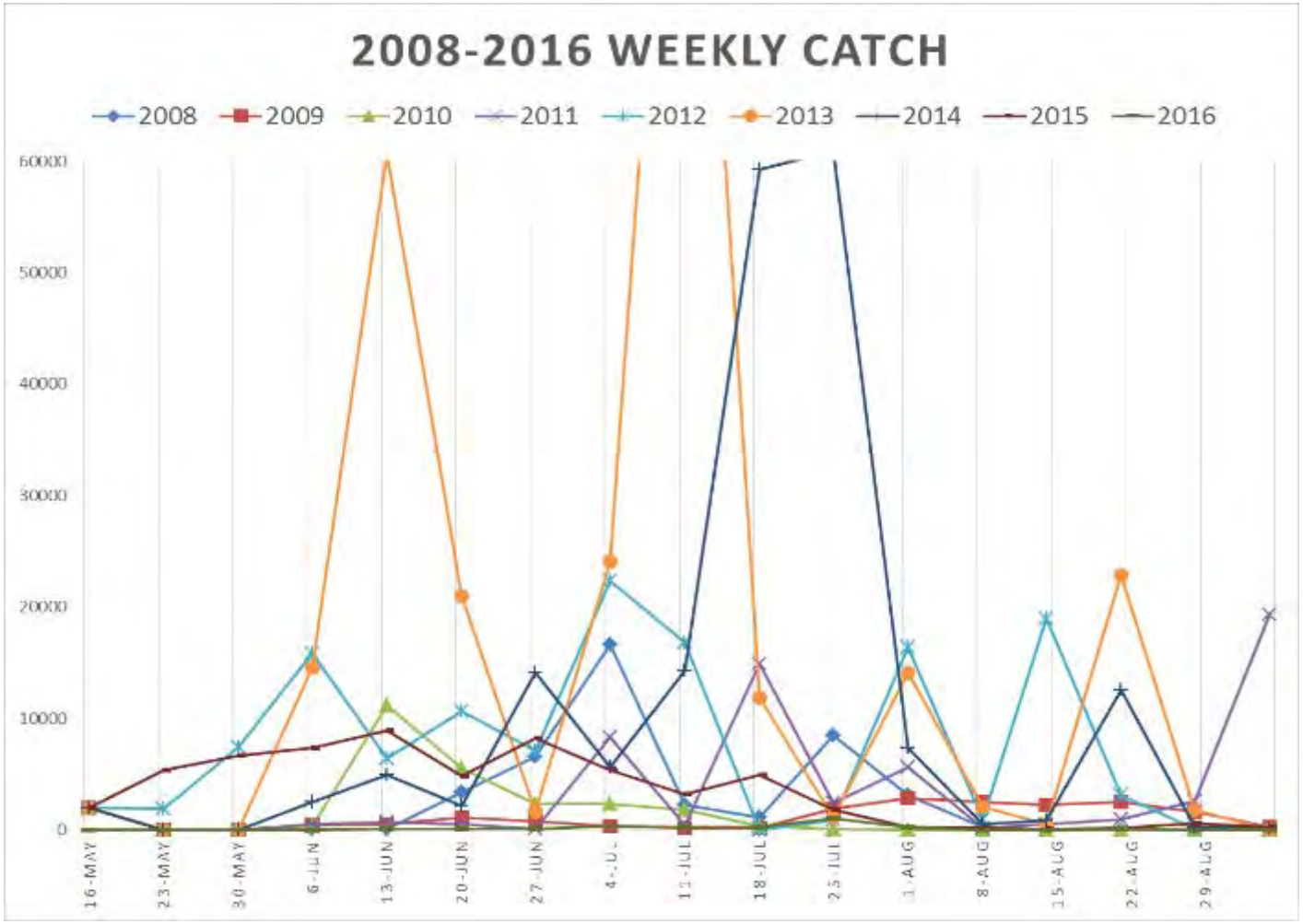
Table 6.0-1: Summary of Eel Collections and Biological Data, Conowingo Eel Collection Facility, 2017-2019

		2017	2018	2019	Average	Total
Eels Collected		122,300	67,949	126,181	105,476	316,430
Peak	Number	7,280	5,572	10,166		
	Day	July 30	July 30	July 5		
Days of Operation		138	138	138	138	
Average eels per day		886.2	492.4	914.4	764.3	
Days over 1,000 eels		31	22	26	26.3	79
Volumetric Estimate Days		40	25	31	32	96
Accuracy of Volumetric days (±)		-1.0%	+1.6%	-1.1%		-0.5%
Sample Size		926	857	909	897	
Length (mm)	Average	122.3	121.6	114.4	119.4	
	Range	78 - 192	84 – 173	64 – 165		64 - 192
	Median	122.0	120.0	115.0		
Weight (grams)	Average	2.1	2.0	1.8	2.0	
	Range	0.5 – 6.0	0.5 – 4.8	0.2 – 4.7		0.2 – 6.0
	Median	2.0	2.0	1.7		
Sacrificed	Number	193	93	91		377
	Contained Parasites	53.9%	48.4%	52.7%		52.3%
	Age	2.2	2.3			
	Age range	1 - 4	1 - 4			
River Flows (cfs, daily average flows at Conowingo)	Average	37,053	62,036	40,214	46,434	
	Min	6,000	11,100	4,560		
	Max	178,000	329,000	157,000		

Figure 2.0-1: Location of the Conowingo Eel Collection Facility at Conowingo Dam, 2019

Figure 2.0-2: Location of the Conowingo Eel Collection Facility Just Downstream of the West Fish Lift, Conowingo, MD, 2019

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 3.2-1: Measuring Juvenile Eel to Nearest Millimeter While Sedated, Conowingo Eel Collection Facility, 2019

Figure 3.2-2: Weighing Juvenile Eel in Grams While Sedated, Conowingo Eel Collection Facility, 2019

Figure 3.3-1: Sample Location (Herring Run) of American Eel Collected for Wild Health Screening, Conowingo Eel Collection Facility, 2019

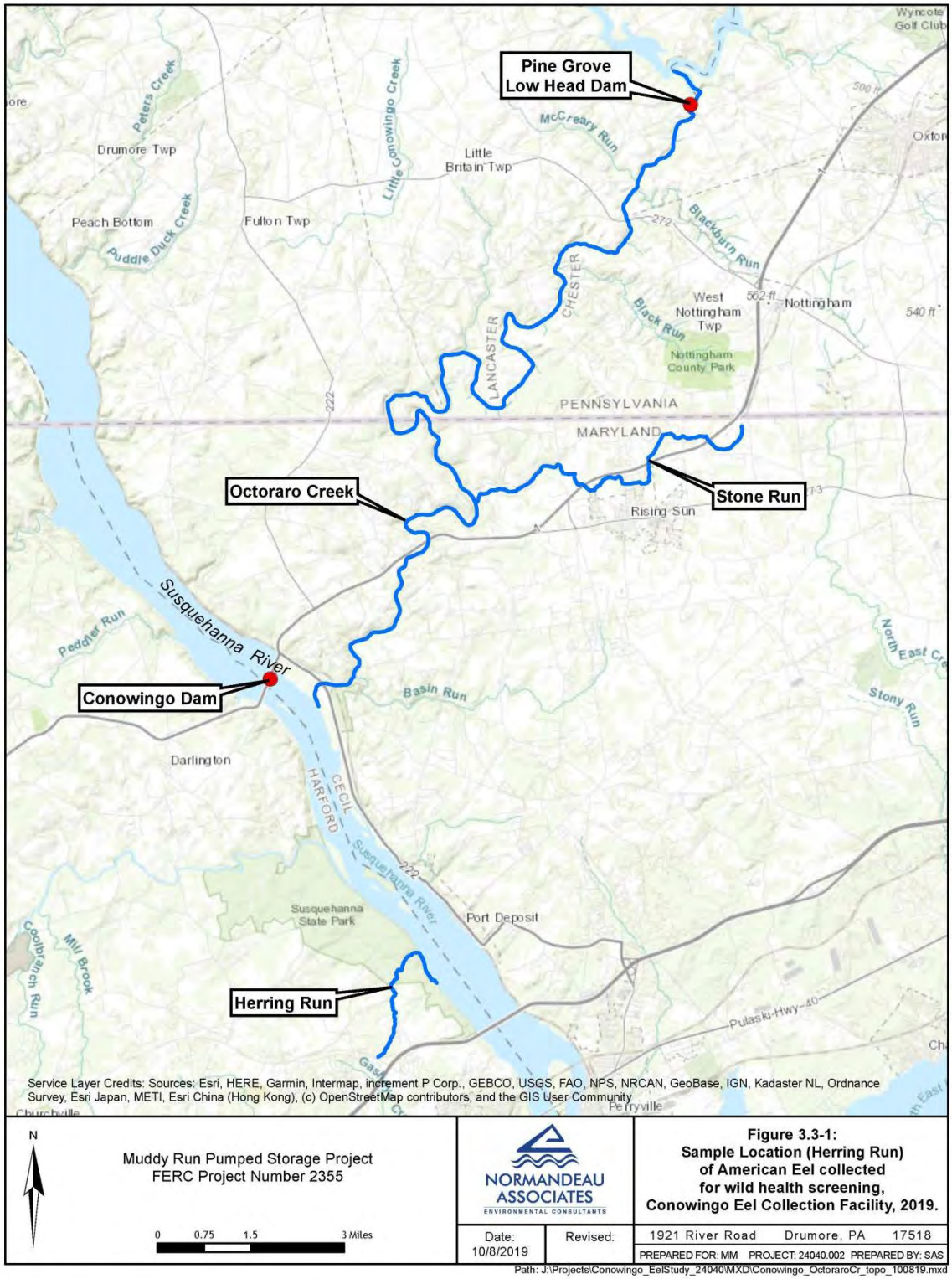
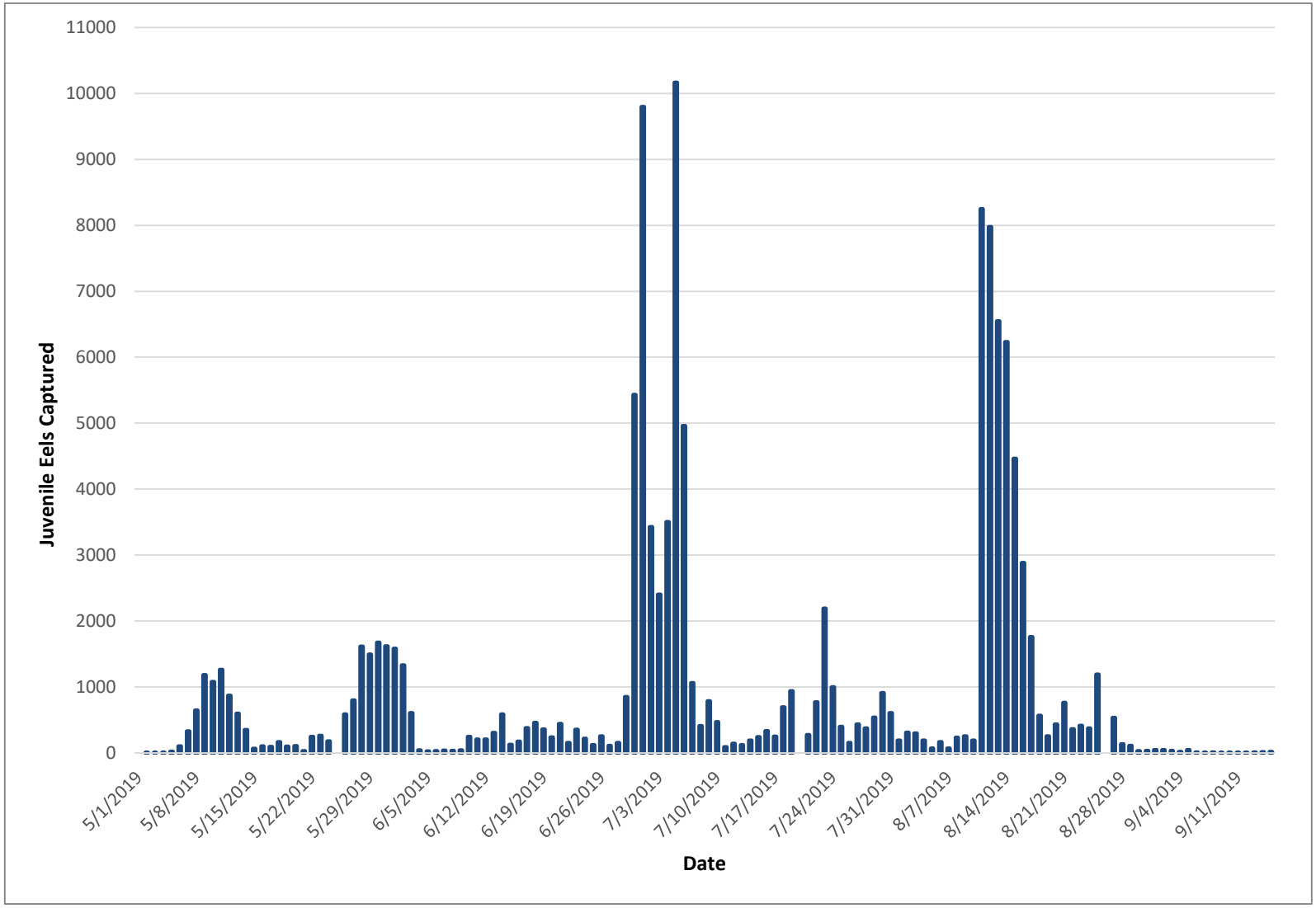


Figure 3.3-2: Herring Run, a Tributary of Susquehanna River used for the Wild Health Screening, Conowingo Dam, 2019

Figure 3.3-3: Small Eel Transport Tank, Conowingo Eel Collection Facility, 2019

Figure 3.3-4: Large Eel Transport Tank, Conowingo Eel Collection Facility, 2019

Figure 4.1-1: Daily Eel Catch, Conowingo Eel Collection Facility, 2019



45 Normandeau Associates, Inc.

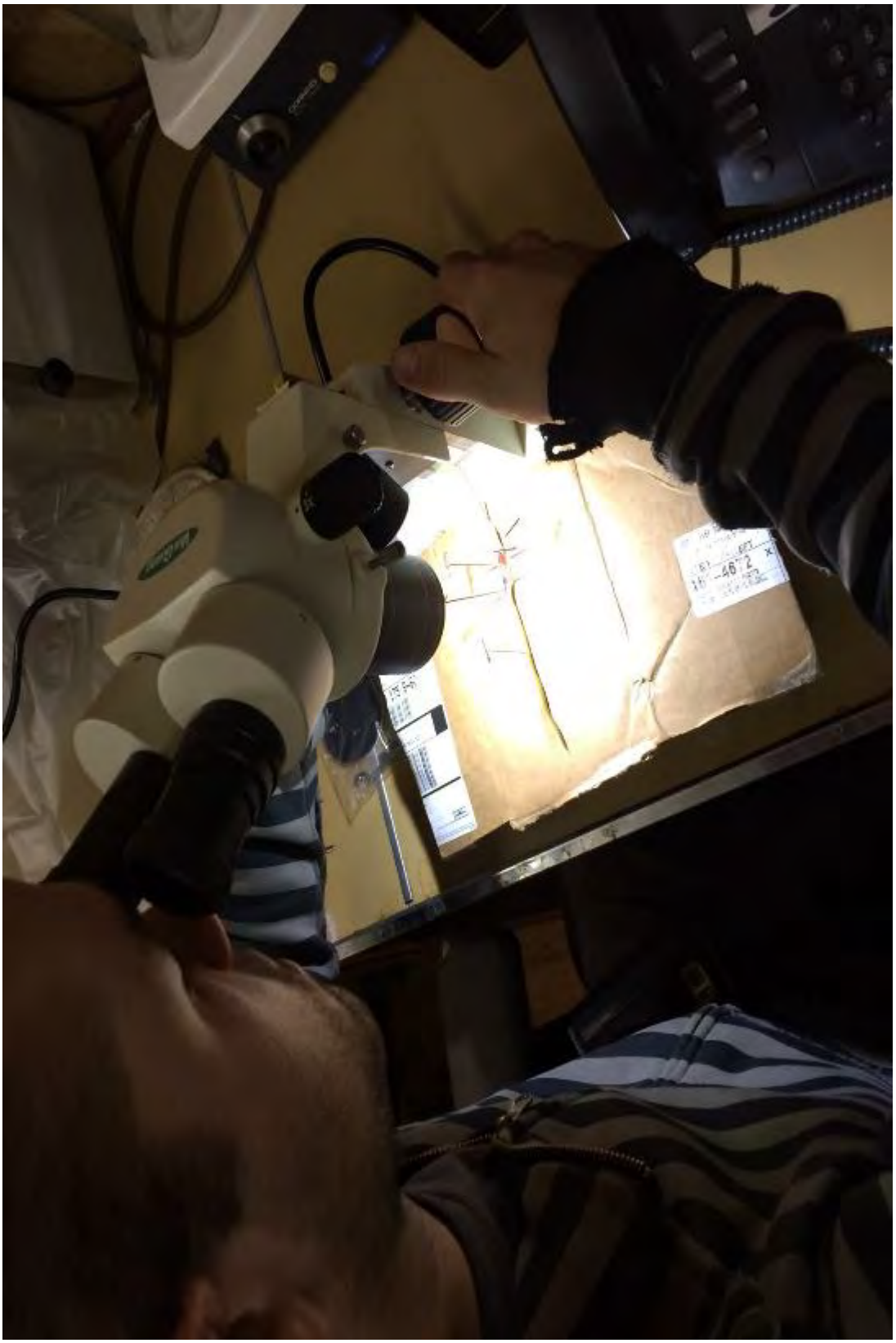


Figure 4.3-1: Examining Sacrificed Juvenile Eels for Swim Bladder Parasite, 2019

Figure 4.3-2: Swim Bladder Parasite Dissection, Conowingo Eel Collection Facility, 2019

Figure 4.4-1: Percentage of Eels Collected per Week, Conowingo Eel Collection Facility, 2019

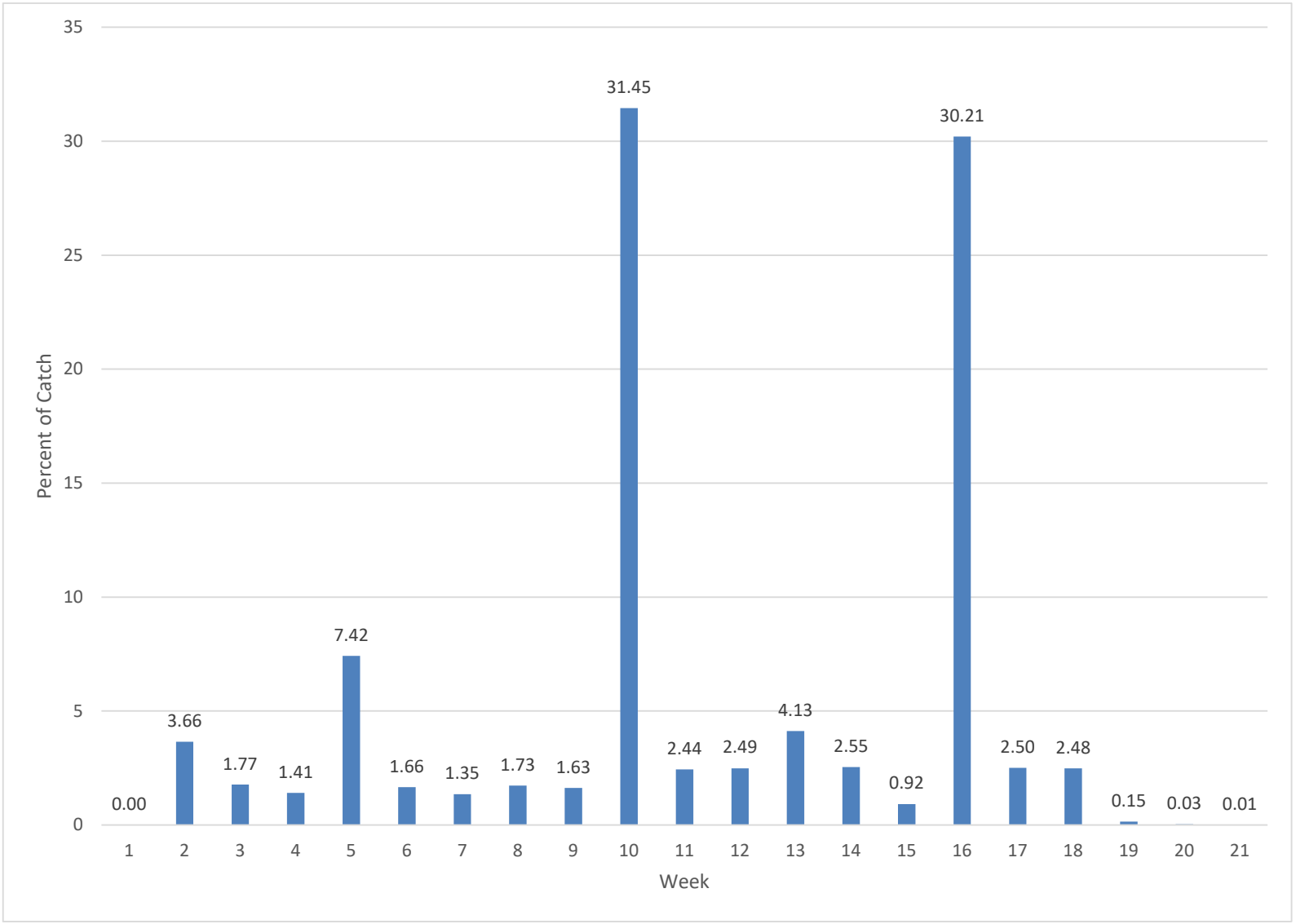
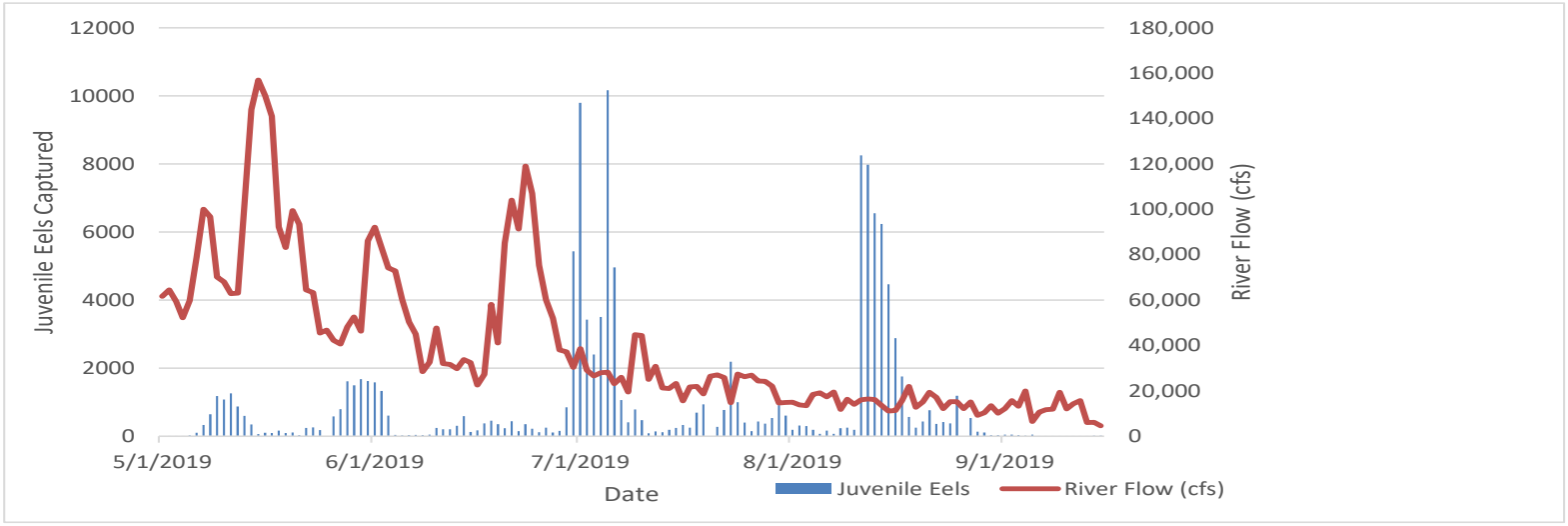


Figure 4.5-1: Daily Eel Catch and Daily Average River Flow (cfs, top graph) and Weekly Eel Catch and Weekly Average River Flow (cfs, bottom graph), Conowingo Eel Collection Facility, 2019



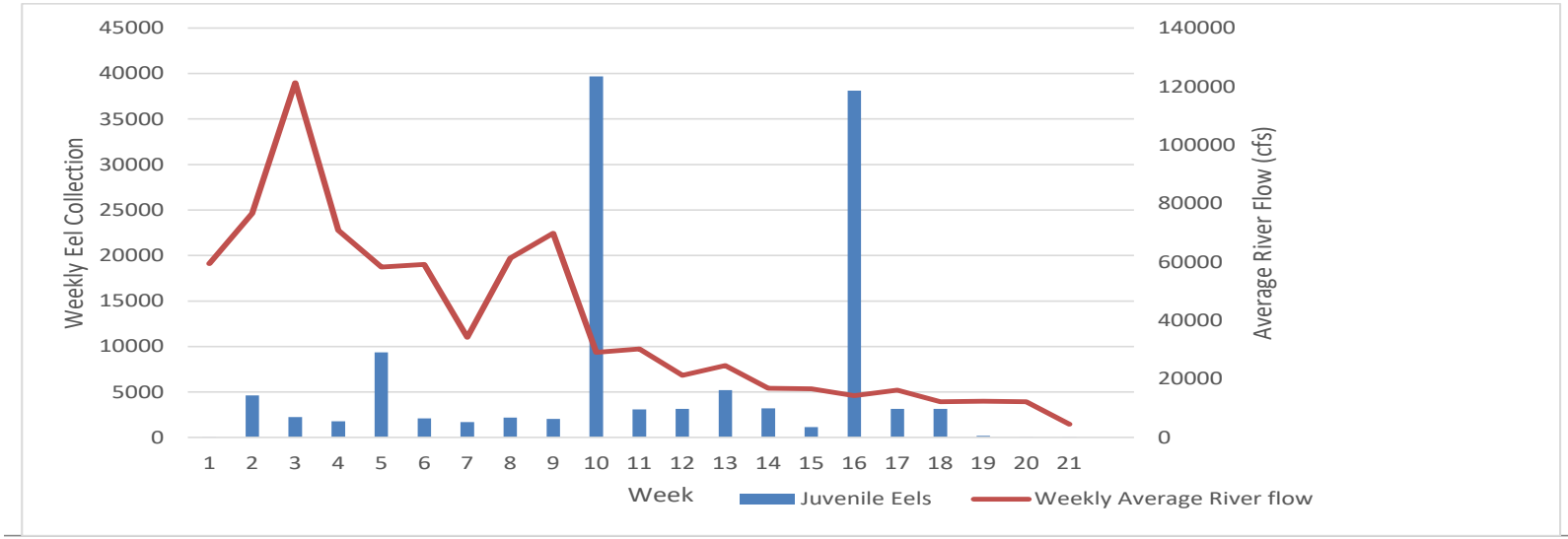


Figure 4.5-2: Eel Catch to Lunar Fraction (Daily above, Weekly Average below), Conowingo Eel Collection Facility, 2019 (*1.0 Equals Full Moon*)

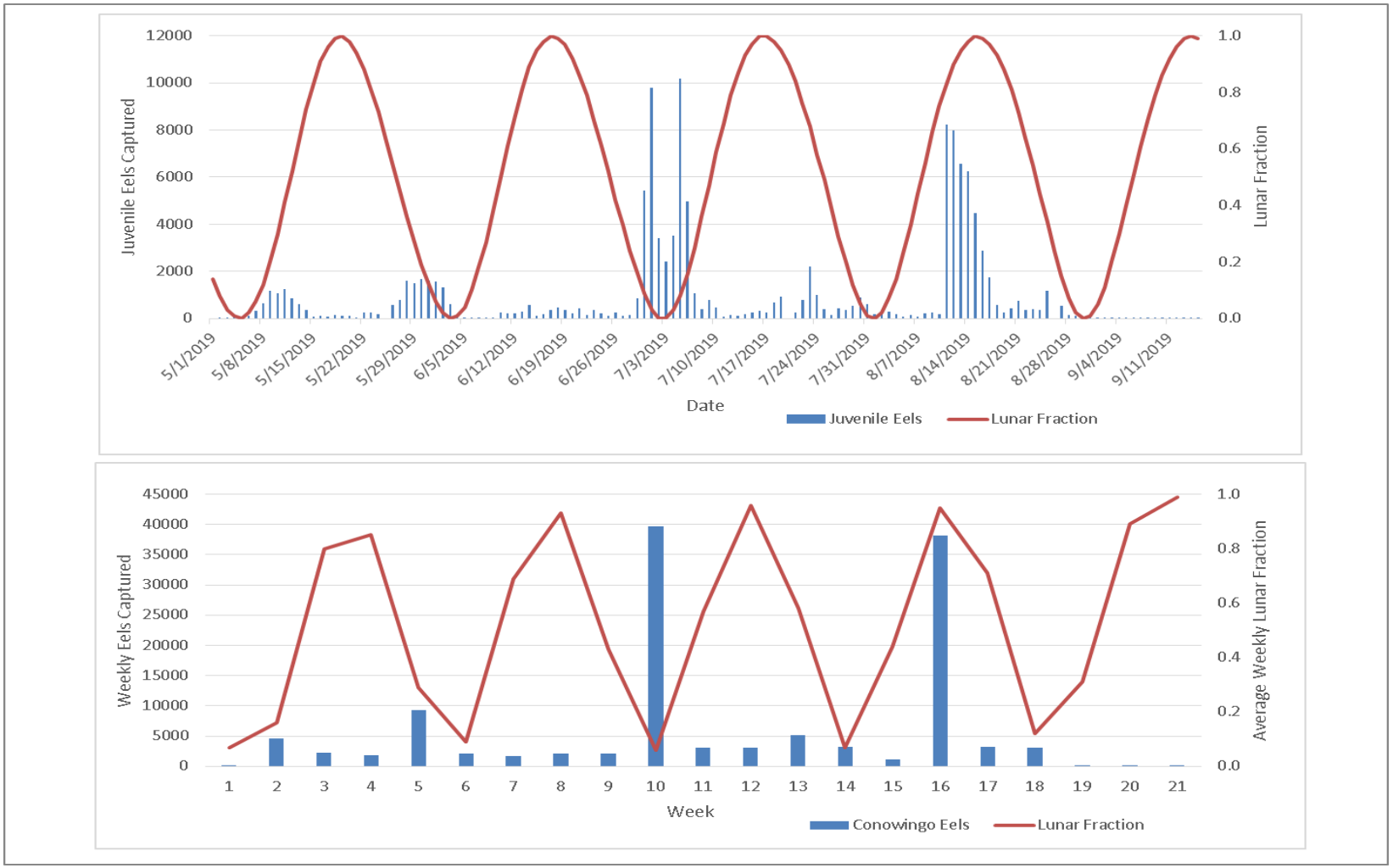


Figure 4.5-3: Eel Catch to Water Temperature, Conowingo Eel Collection Facility, 2019

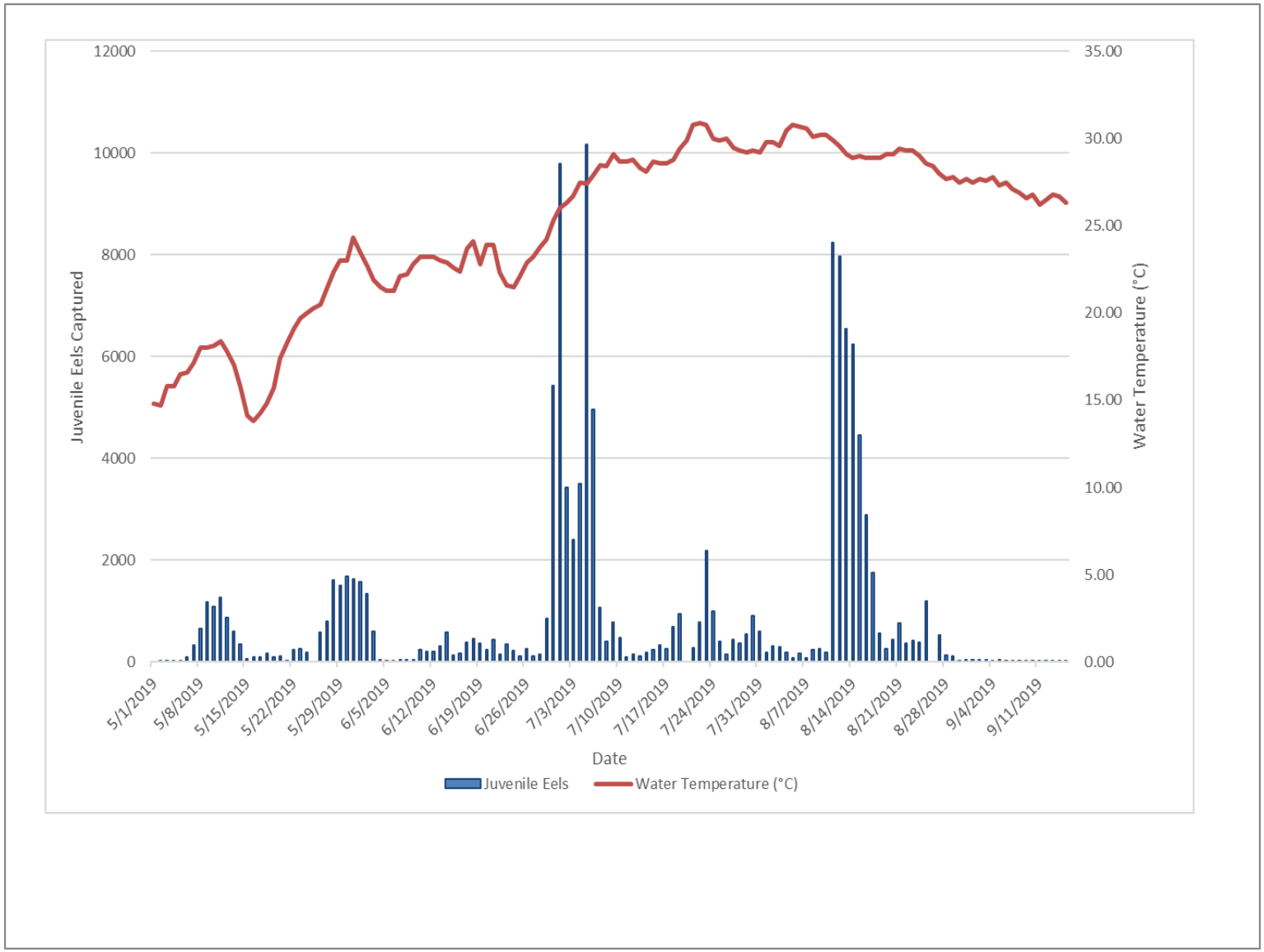


Figure 4.5-4: Eel Catch to Dissolved Oxygen, Conowingo Eel Collection Facility, 2019

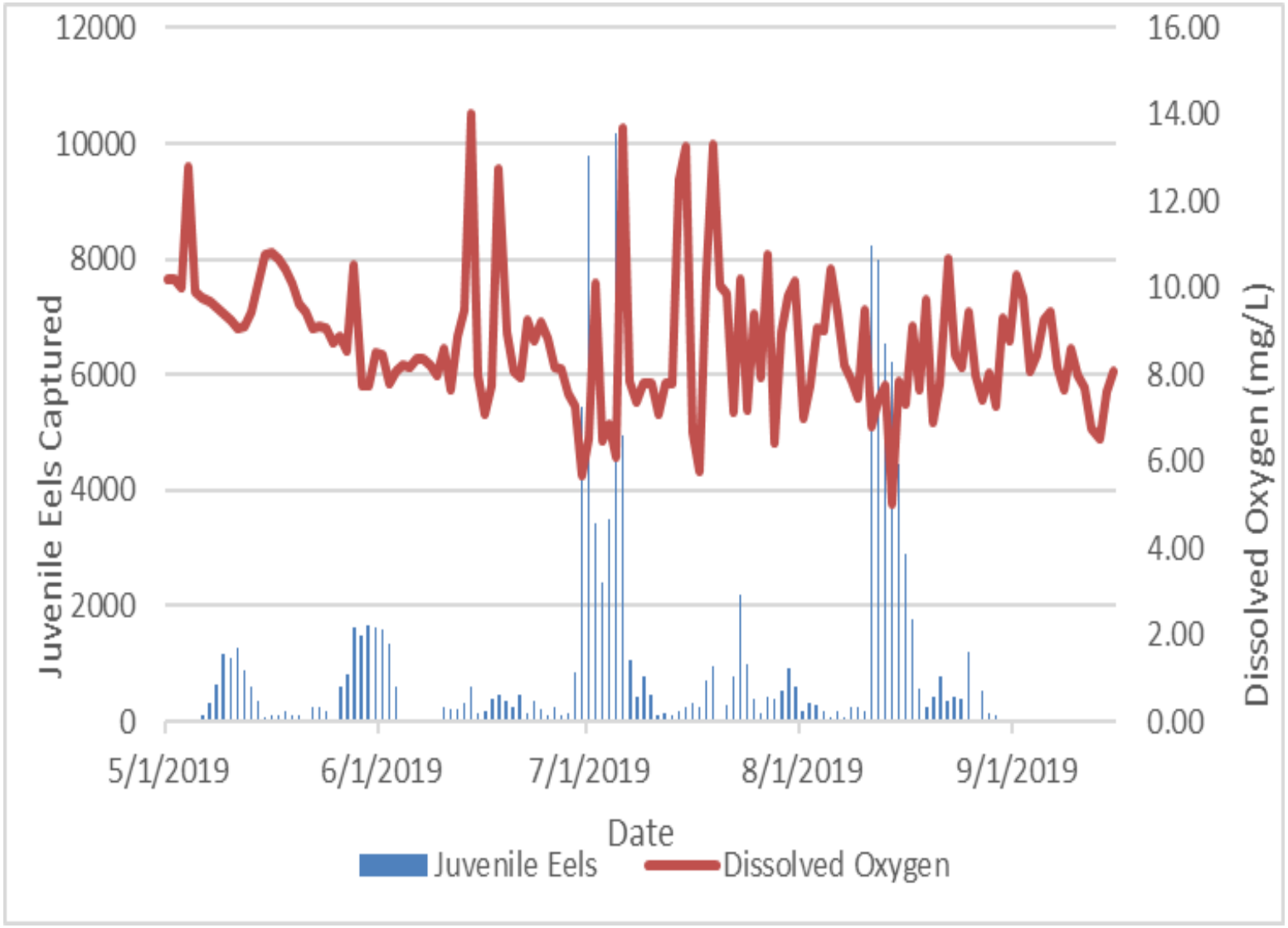


Figure 4.7-1: Normandeau Eel Stocking Sites, 2016-2019

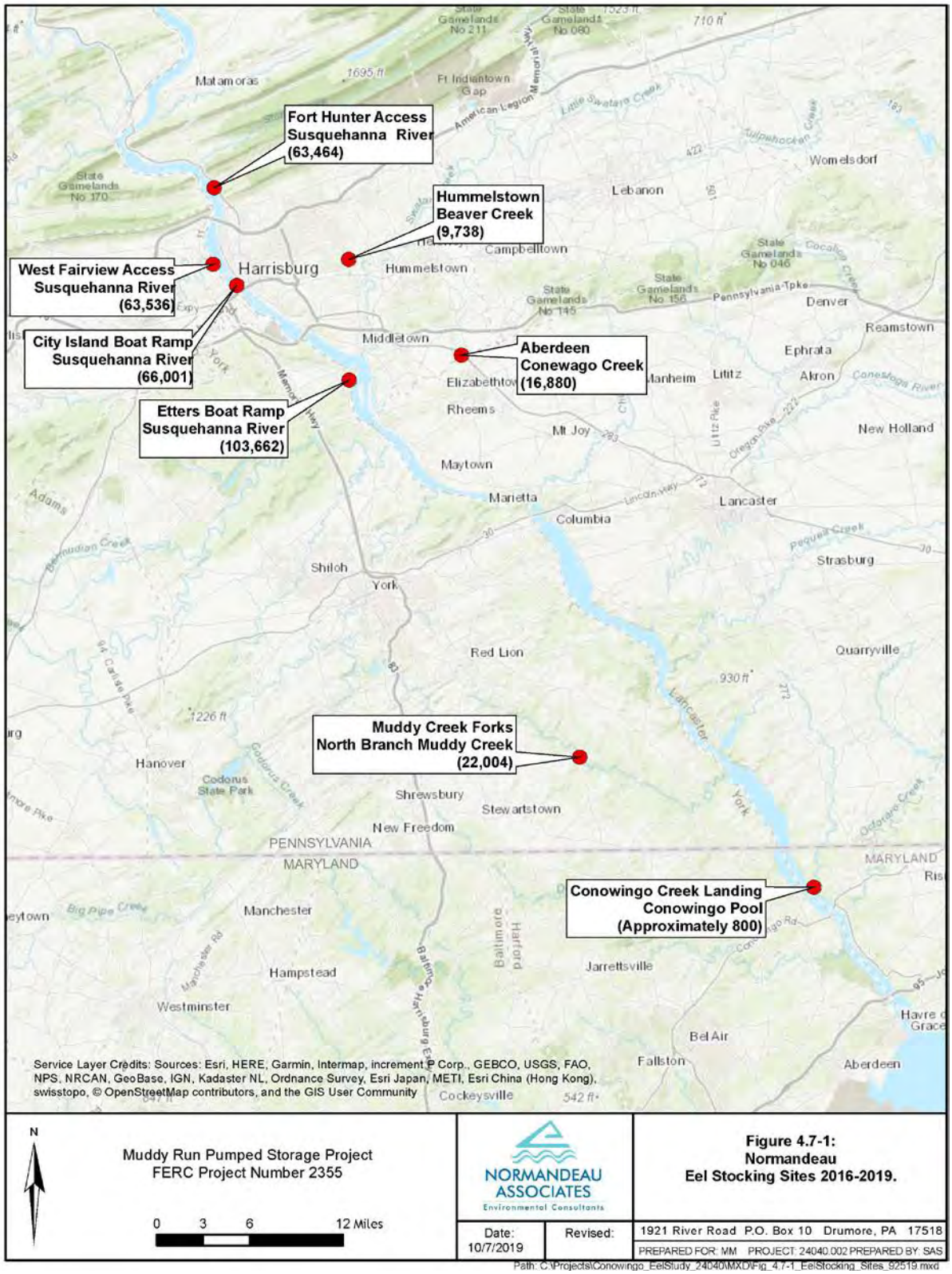


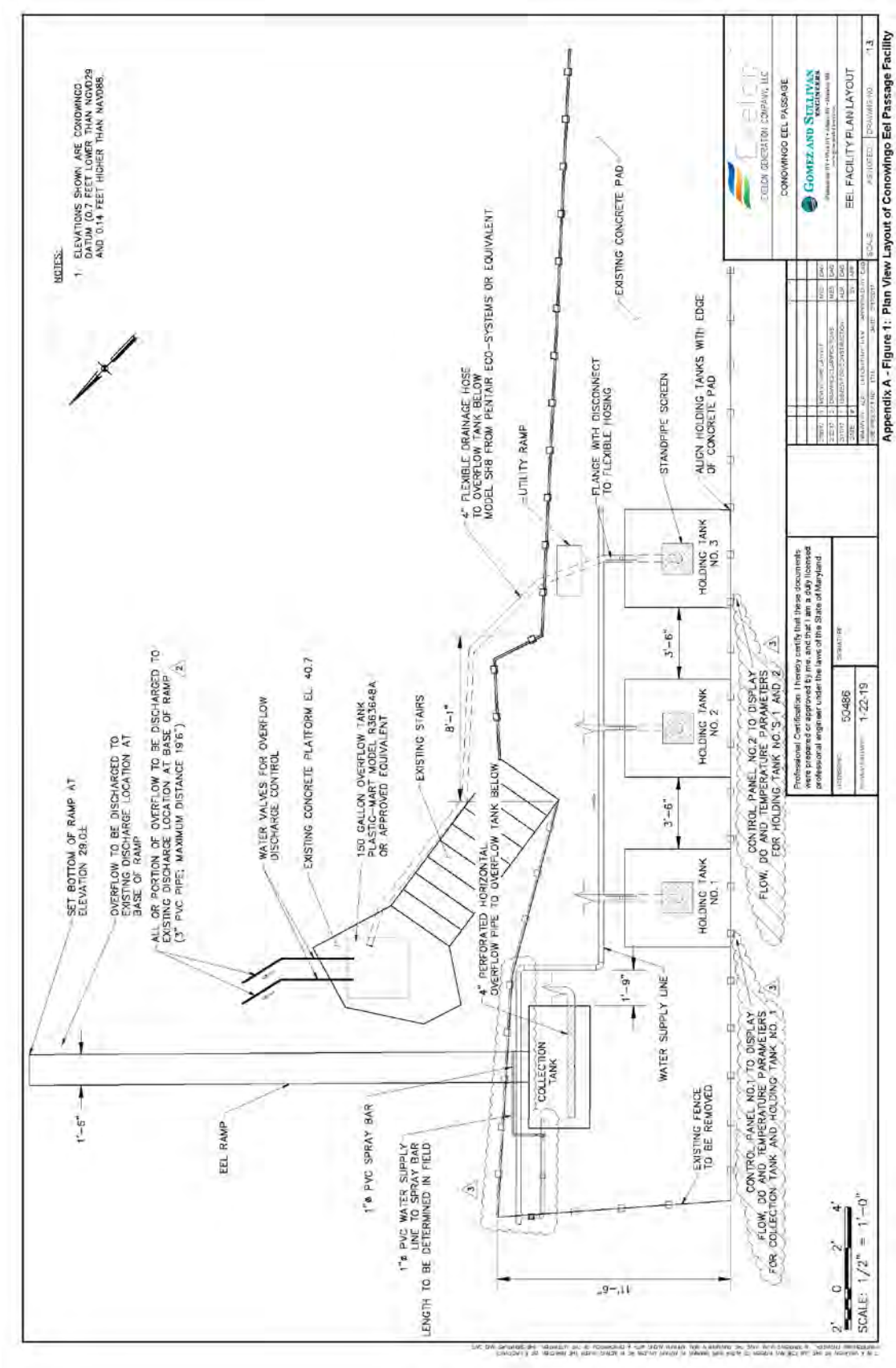
Figure 4.7-2: West Fairview Access (Site 5) Stocking Site, 2019

Figure 4.7-3: Fort Hunter Access (Site 6) Stocking Site, 2019

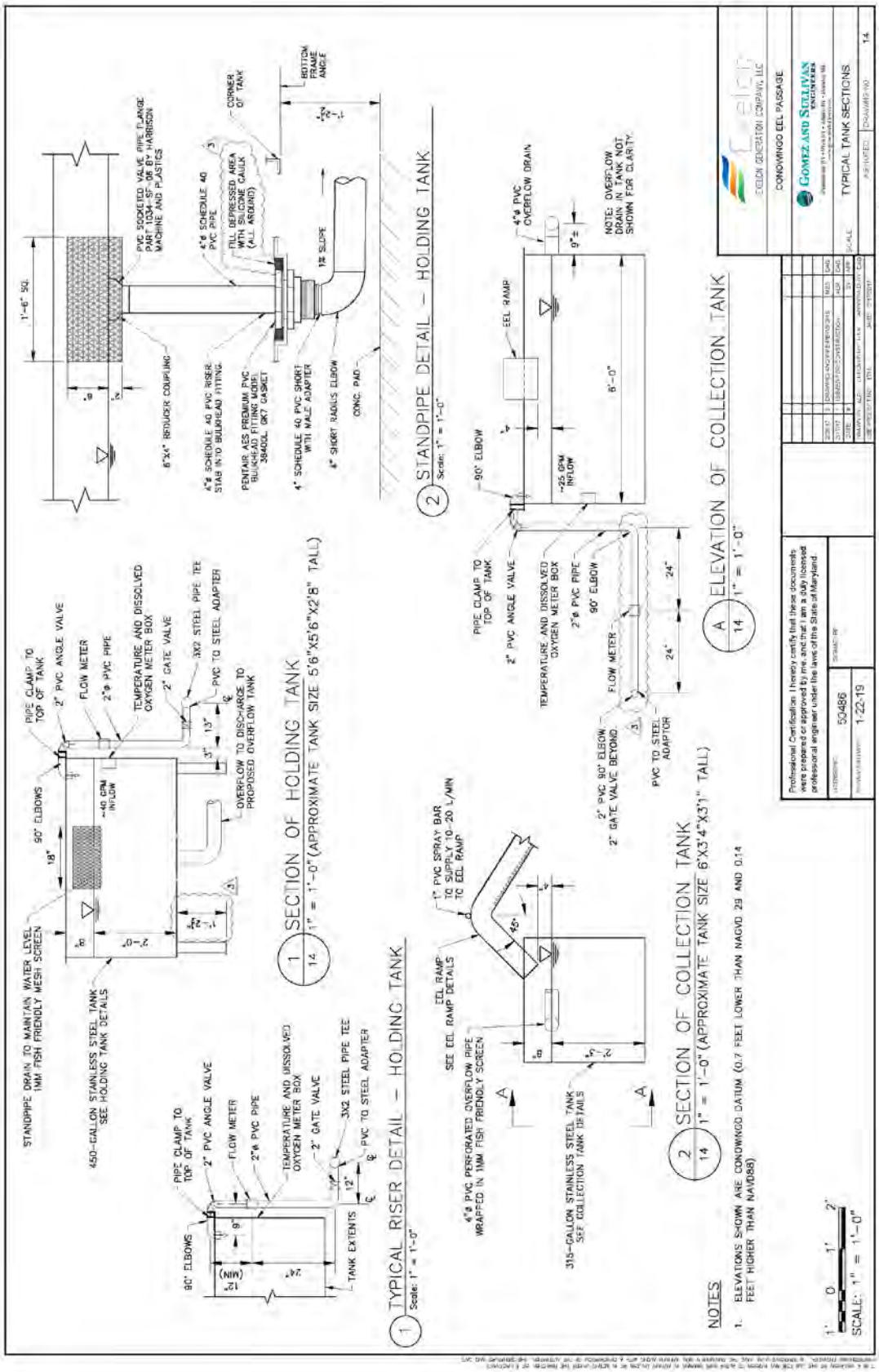
Figure 4.7-4: City Island Boat Ramp (Site 12) Stocking Site, 2019

Figure 5.0-1: Transition from rip-rap shoreline to ramp entrance, (upper) beginning of season, (lower) end of season, CECF, 2019

Appendix A:
Plan View Layout of Conowingo Eel Collection Facility, 2019



Appendix A - Figure 1: Plan View Layout of Conowingo Eel Passage Facility



Appendix A - Figure 2: Side View of Conowingo Eel Passage Facility

Appendix B:
Method of Aging Eel Otolith, Conowingo Eel Collection Facility, 2019

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.

Individual Sacrificed Eel Data, 2019

Date	Collection #	Batch #	Total Length (mm)	Age 1 - CAF*	Age 2- ERS*	Age consensus
5/7/2019	MDM19307	2	116	1.0	1	1
	MDM19307	2	128	2.0	2	2
	MDM19307	2	104	1.0	1	1
	MDM19307	2	142	2.0	2	2
	MDM19307	2	136	3.0	3	3
5/9/2019	MDM19309	3	131	1	1	1
	MDM19309	3	118	1	1	1
	MDM19309	3	133	3	3	3
5/13/2019	MDM19313	4	146	3	3	3
	MDM19313	4	115	1	1	1
	MDM19313	4	108	1	1	1
	MDM19313	4	127	2	2	2
	MDM19313	4	115	1	1	1
5/16/2019	MDM19316	5	128	NR	NR	NR
	MDM19316	5	133	2	2	2
	MDM19316	5	129	2	2	2
	MDM19316	5	136	NR	NR	NR
	MDM19316	5	124	1	2	2
5/20/2019	MDM19320	6	138	2	2	2
	MDM19320	6	139	3	3	3
5/23/2019	MDM19323	7	131	2	2	2
	MDM19323	7	123	2	2	2
	MDM19323	7	140	2	2	2
	MDM19323	7	134	3	3	3
	MDM19323	7	136	2	2	2
5/30/2019	MDM19330	9	133	2	2	2
	MDM19330	9	131	2	2	2
	MDM19330	9	121	2	2	2
	MDM19330	9	122	2	2	2
	MDM19330	9	140	2	2	2
6/6/2019	MDM19337	11	110	2	2	2
	MDM19337	11	145	3	3	3
	MDM19337	11	137	3	3	3
	MDM19337	11	128	2	2	2
	MDM19337	11	118	1	1	1

Date	Collection #	Batch #	Total Length (mm)	Age 1 - CAF*	Age 2- ERS*	Age consensus
7/8/2019	MDM19369	20	120	2	2	2
	MDM19369	20	151	3	3	3
	MDM19369	20	110	1	1	1
	MDM19369	20	88	1	1	1
	MDM19369	20	142	4	4	4
7/15/2019	MDM19376	22	93	NR	NR	NR
	MDM19376	22	96	1	1	1
	MDM19376	22	95	1	1	1
	MDM19376	22	93	1	1	1
	MDM19376	22	86	1	1	1
7/22/2019	MDM19383	24	104	1	1	1
	MDM19383	24	119	2	2	2
	MDM19383	24	105	NR	NR	NR
	MDM19383	24	86	1	1	1
	MDM19383	24	90	1	1	1
	MDM19383	24	104	1	1	1
7/29/2019	MDM19390	26	81	1	1	1
	MDM19390	26	112	NR	NR	NR
	MDM19390	26	94	NR	NR	NR
	MDM19390	26	107	1	1	1
	MDM19390	26	106	1	1	1
	MDM19390	26	92	1	1	1
	MDM19390	26	106	1	1	1
8/5/2019	MDM19397	28	96	1	1	1
	MDM19397	28	121	2	2	2
	MDM19397	28	83	1	1	1
	MDM19397	28	116	2	1	2
	MDM19397	28	104	1	1	1
	MDM19397	28	104	1	1	1
8/12/2019	MDM19404	30	108	1	1	1
	MDM19404	30	95	1	1	1
	MDM19404	30	124	2	2	2
	MDM19404	30	98	1	1	1
	MDM19404	30	113	2	1	2

Date	Collection #	Batch #	Total Length (mm)	Age 1 - CAF*	Age 2- ERS*	Age consensus
8/19/2019	MDM19411	32	146	2	2	2
	MDM19411	32	143	2	3	3
	MDM19411	32	136	2	2	2
	MDM19411	32	138	2	2	2
	MDM19411	32	154	3	3	3
	MDM19411	32	135	2	2	2
8/26/2019	MDM19418	34	117	1	1	1
	MDM19418	34	108	1	1	1
	MDM19418	34	103	1	1	1
	MDM19418	34	123	2	2	2
	MDM19418	34	108	1	1	1
	MDM19418	34	93	1	1	1
	MDM19418	34	94	NR	NR	NR
	MDM19418	34	111	NR	NR	NR
	MDM19418	34	114	1	1	1
9/2/2019	MDM19425	36	77	1	1	1
	MDM19425	36	126	2	2	2
	MDM19425	36	115	1	1	1
	MDM19425	36	141	2	3	2
	MDM19425	36	110	1	1	1
9/9/2019	MDM19432	38	76	1	1	1
	MDM19432	38	87	1	1	1
NR – age could not be determined						

Appendix C:
Weekly Biological Data and Environmental Conditions for Conowingo Eel Collection Facility, 2017-2019

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

Appendix D:
Fish Health Inspection Report, Conowingo Eel Collection Facility 2019

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
Herring Run, Harford county, MD (trib of Susquehanna, below Connowingo Dam) same watershed as Octoro Creek, sampled 2015 -2018 Michael Martinek, collector, Normandeau Ray Bleistine, Project Mgr, Normandeau	☐ Hatchery ☑ Wild	☑ Unsecured: Open Spring, Stream ☐ Secured: Well, sterilized	Last sample date / Classification 1 03/19/2019 2 03/26/2018 3 03/21/2017 4 04/20/2016 5 04/07/2015

					Pathogens inspected[3] & results'[5]												
Species[3]	Lot Identity	Age[4]	# in lot	Eggs (E) or fish (F) Obtained From	EI	AS	YR	RS	MC	IH	IP	IS	LM	OM	SV	VH	A	B
AME	2019 collection	y		(F) Herring Creek, MD	26	26	26			60	60			60		60	60	
					--	--	--	NT	NT	--	--	NT	NT	--	NT	--	+	

Remarks[6]: Lab Case 19-101; AME = American eel; A = swimbladder nematode (Anguillicola crassus)

Inspecting Biologist Signature	Concurred (signature & title)	
Print: Gavin Glenney Date: 04/22/2019	Print: John Coll Date: 04/22/2019	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[3] 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:

19-101 received March 20, 2019. Collection of 60 American eels occurred on 3/19/19 by Michael Martinek.

Bacterial cultures - primary inoculum from kidney onto BHIA, negative for AS, YR, EI. Fish were smaller this year, only the 26 largest specimens could provide an adequate bacterial sample.

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

General gross observation for the swimbladder nematode was conducted with an incidence of 53% (32/60), typical level as reported in previous years.

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

Appendix E:
Chain of Custody Sheets, Conowingo Eel Collection Facility 2019

NORMANDEAU
environmental consultants

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

Date: 5/6/19 **Time:** 12:22

Total – 133

No. of eels provided from CECF Collection Tank: 45 classroom 88 - Ft. Hunter

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: 133

SIGNATURES:

Normandeau/Exelon Representative: Michael D. Mostuck

Agency Representative: Aaron Henning

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

500
30
80
56
646

NORMANDEAU
environmental consultants

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

Date: 5/8/19 **Time:** 1050

No. of eels provided from CECF Collection Tank: 30 Eels in the classroom

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: 30

SIGNATURES:

Normandeau/Exelon Representative: _____ Michael Mathis

Agency Representative: _____ "Duncan Hennigy"

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

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

Date: 5/28/19 **Time:** 10:30

No. of eels provided from CECF Collection Tank: 30

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: 30

SIGNATURES:

Normandeau/Exelon Representative: [signature]

Agency Representative: Aaron Henning

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

NORMANDEAU
environmental consultants

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

Date: 8/12/19 **Time:** 0815 hrs

No. of eels provided from CECF Collection Tank: 1,935

No. of eels provided from Holding Tank # 1: 8,249

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: 10,184

SIGNATURES:

Normandeau/Exelon Representative: Scott Copenhaver

Agency Representative: Sarah Coney

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

NORMANDEAU
environmental consultants

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

Date: 8/14/19 **Time:** 830

No. of eels provided from CECF Collection Tank: —

No. of eels provided from Holding Tank # 1: 6,493

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

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

Total number of eels provided for Transport: 6,493

SIGNATURES:

Normandeau/Exelon Representative: [signature] michael a matlock

Agency Representative: [signature]

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

Appendix F:

Agency Comments on Draft 2019 Conowingo Eel Collection Report

From: Henning, Aaron <ahenning@srbc.net>
Sent: Friday, December 13, 2019 11:30 AM
To: Danucalov, Andrea <Andrea.Danucalov@exeloncorp.com>; Erin Redding <eredding@gomezandsullivan.com>
Cc: Sheila Eyler (sheila_eyler@fws.gov) <sheila_eyler@fws.gov>; Richard McCorkle (richard_mccorkle@fws.gov) <richard_mccorkle@fws.gov>; Shawn Seaman -DNR- (shawn.seaman@maryland.gov) <shawn.seaman@maryland.gov>; Miller, Jeremy (jeremmille@pa.gov) <jeremmille@pa.gov>; 'Ron Eberts' (reberts@pa.gov) <reberts@pa.gov>; Tryninewski, Joshua (jtryninews@pa.gov) <jtryninews@pa.gov>; Jesus Morales <Jesus_Morales@fws.gov>; Minkkinen, Steve (steve_minkkinen@fws.gov) <steve_minkkinen@fws.gov>; Rob Bourdon (robert.bourdon@maryland.gov) <robert.bourdon@maryland.gov>
Subject: SRBC comments on Exelon studies

Andrea & Erin,

Attached are SRBC's comments on the flowing reports: Muddy Run Pumped Storage Project Conowingo Eel Collection Facility (2019), Muddy Run Pumped Storage Project American Eel Collection Facility in Octoraro Creek, 2019 and Muddy Run Pumped Storage Project – Periodic Evaluation of Upstream Segments 2018-2019.

Aaron

Aaron Henning
Fisheries Biologist
Susquehanna River Basin Commission
4423 North Front St.
Harrisburg, PA 17110
Office: (717) 238-0423 ext.1184
Mobile: (717) 884-5937

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Muddy Run Pumped Storage Project Conowingo Collection Facility

- multiple references should be corrected to read 'eels in the classroom'
- pg 5, section 4.5, while the Conowingo gage is the closest geographically, please consider and compare using the Marietta gage which is more indicative of river conditions
- pg 6. Misleading/inappropriate to infer any relationship (or lack thereof) would exist between an oxygen infused collection tank and eels being captured from the river. Collection tank dissolved oxygen isn't an environmental variable. In-river readings are more appropriate.
- Appreciate the very low mortality of American eels at this facility
- in future reports please include photos of injuries noted on eels for reference

Muddy Run Pumped Storage Project American Eel Collection Facility in Octoraro Creek

- Figure 2.0-3 needs axis labels
- Figure 5.0-2 too difficult to read with those many colors & lines
- Figure 4.5-4 shows dissolved oxygen levels in the head pond and collection tank dropped below PA water quality criteria of 5.0 mg/L for a significant portion of the season even after the installation of aerators. Table 4.5-4 and Figures 4.5-4 and 4.5-5 give two vastly different views of dissolved oxygen at this facility. Figures appear to be derived from the continuous DO sensor. Please plot continuous data at a finer scale (one month per figure max) to better show daily DO swings. Please report interval of continuous DO readings and any calibration procedures/records
- Please provide documentation of which days the CWA hydroelectric facility was in operation

Muddy Run Pumped Storage Project – Periodic Evaluations of Upstream stream segments

- Section 3.3.1 pulse width of 4-6 seconds is erroneous. Microseconds is more realistic
- eel densities per m^2 do not need to be reported if eel catch is zero

From: Eyler, Sheila <sheila_eyler@fws.gov>
Sent: Friday, December 6, 2019 10:34:15 AM
To: Danucalov, Andrea H:(Exelon Power) <Andrea.Danucalov@exeloncorp.com>
Cc: Ray Bleistine <rbleistine@normandeau.com>; Richard McCorkle <richard_mccorkle@fws.gov>; Jesus Morales <Jesus_Morales@fws.gov>; Miller, Jeremy <jeremmille@pa.gov>; Ron Eberts <reberts@pa.gov>
Subject: [EXTERNAL] 2019 Conowingo Eel Ramp Collection Report FWS Comments

Andrea,

FWS has reviewed the 2019 Conowingo Eel Ramp Collection Report received on 10/25/19. We offer the following comments:

- Table 4.0-1 is missing data for 6/16
- Please add a table that summarizes collection from past years (2017-2019), similar to table 5.0-1 from the Octoraro Report
- Please add a table that includes total number of eels stocked by location by year (2016-2019)
- Please provide a copy of the updated final report when the aging data becomes available

Thank you for the opportunity to review.

Sheila

Sheila Eyler
U.S. Fish & Wildlife Service
Mid-Atlantic Fish and Wildlife Conservation Office
177 Admiral Cochrane Dr., Annapolis, MD 21401
410-573-4554 (O)
717-387-2117 (C)
Sheila_Eyler@fws.gov

1

Mike Martinek

From: Miller, Jeremy <jeremmille@pa.gov>
Sent: Thursday, December 5, 2019 10:41 AM
To: Danucalov, Andrea H:(GenCo-Pwr); Ray Bleistine; Mike Martinek
Cc: Williamson, Scott; Eberts, Ron; Sheila Eyler
Subject: Exelon's 2019 Muddy Run Conowingo Eel Collection Facility Draft Report DEP Comments

Andrea,

DEP has reviewed the 2019 Muddy Run Conowingo Eel Collection Facility Draft Report received on 10/25/19 and offer the following comments for your review.

1. Page VI, List of Abbreviations, Agencies/Groups: Revise Southern University of New York to State University of New York.

2. Table 4.7-1. Detailed Individual Eel Transport Data, 2019: Provide measurement units (i.e. C, mg/L, etc.) for Transport to West Fairview (Site 5), Transport to Fort Hunter (Site 6), Transport to City Island (Site 12).

Thank you for the opportunity to comment on the draft report. Let me know if you have any questions.

Jeremy Miller | Aquatic Biologist II
Department of Environmental Protection | Clean Water Program
Southcentral Regional Office
909 Elmerton Ave. | Hbg PA 17110
Phone: 717.705.4777 | Fax: 717.705.4760
www.dep.pa.gov

24-hour toll free Emergency Response number for SCRO: 1-800-541-2050.

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From: Tryninewski, Joshua <jtryninews@pa.gov>
Sent: Tuesday, December 17, 2019 3:27 PM
To: Danucalov, Andrea H:(Exelon Power) <Andrea.Danucalov@exeloncorp.com>
Subject: [EXTERNAL] Muddy Run Pumped Storage Project Conowingo Eel Collection Facility 2019 Draft Report - PFBC Comments

Andrea,

The PFBC has reviewed the *Muddy Run Pumped Storage Project Conowingo Eel Collection Facility 2019 Draft Report* and offers the following comments:

- Executive Summary: three (3) highlighted question marks, presumably place holders for age data, should be filled in with age data when available.
- List of Abbreviations: SUNY should stand for "State University of New York"
- Section 3.2 Data Collection: PFBC recommends adding sources for environmental date (i.e. gage station, lunar data site).
- Table 4.0-1" Catch data for 6/16/2019 missing
- Figure 4.5-1: The caption should be clarified regarding flow. Presumably, the flow data for the top graph is daily mean river flow. Recommend rewriting caption – suggested rewrite: "Conowingo Eel Collection Facility daily eel catch and daily mean river flow (top graph) and weekly eel catch and weekly mean river flow (bottom graph), 2019."
- In future summary reports, the PFBC recommends the addition of photographs that characterize typical (and unique) injury types observed on collected elvers.
- Table 4.5-1: Indicate flow units in the caption.
- Table 4.7-1: Units of measure should be included in column headings.

Thank you for the opportunity to review and provide comments on the summary report.

-Josh

Joshua D. Tryninewski
Anadromous Fish Restoration Unit
Pennsylvania Fish & Boat Commission
1735 Shiloh Rd.
State College, PA 16801
Office: 814-353-2239
Cell: 814-424-0985
Fax: 814-355-8264
Email: jtryninews@pa.gov

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NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

2019 Conowingo Eel Collection Facility Report Comments Received by Resource Agency and Date	
Resource Agency	**Date of Receipt by Exelon**
Pennsylvania Department of Environmental Protection	Thursday, December 5, 2019
United States Fish and Wildlife Service	Friday, December 6, 2019
Susquehanna River Basic Commission	Friday, December 13, 2019
Pennsylvania Fish and Boat Commission	Tuesday, December 17, 2019

Responses to Resource Agency Comments for the Muddy Run Pumped Storage Project Conowingo Eel Collection Report, 2019

SRBC

- multiple references should be corrected to read 'eels in the classroom'
  Exelon response: Corrected the references.
- pg 5, section 4.5, while the Conowingo gage is the closest geographically, please consider and compare using the Marietta gage which is more indicative of river conditions
  Exelon response: We agree that Marietta is more indicative of natural river conditions but river conditions can be affected by three dams and a pump storage facility upstream of this facility along with a few rivers between the two gauges that could affect the river flows. We will continue to use the daily mean discharge (cfs) from the USGS Susquehanna River at Conowingo, MD gage in future reports.
- pg 6. Misleading/inappropriate to infer any relationship (or lack thereof) would exist between an oxygen infused collection tank and eels being captured from the river. Collection tank dissolved oxygen isn't an environmental variable. In-river readings are more appropriate.
  Exelon response: We agree that in-river dissolved oxygen readings are more appropriate and we will use DO values from the current state approved monitoring site (Station 643 located 0.6 miles downstream of Conowingo Dam) in future reports to compare daily eel catch and daily DO values. Please note that during warm weather months, the station discharge water is augmented by turbine venting systems to maintain the Maryland DO standard of 5 mg/l.
- Appreciate the very low mortality of American eels at this facility
  Exelon response: Exelon and Normandeau intend to keep the transport protocol the same in future years to help maintain low mortality rates.
- In future reports please include photos of injuries noted on eels for reference
  Exelon response: Images of the injuries will be included in future reports.

USFWS

- Table 4.0-1 is missing data for 6/16
  Exelon response: Catch data from 6/16 were added to the table
- Please add a table that summarizes from past years (2017-2019), similar to Table 5.0-1 from the Octoraro Report
  Exelon response: Table 6.0-1 was added to the report and summarizes data from past years (2017-2019).
- Please add a table that includes total number of eels stocked by location by year (2016-2019)
  Exelon response: Table 4.7-2 was added to the report and states the number of eels stocked by Exelon per year at each location.
- Please provide a copy of the updated final report when the aging data becomes available
  Exelon response: Eel aging data were updated in this report and are included in the final report.

NORMANDEAU ASSOCIATES
ENVIRONMENTAL CONSULTANTS

PA DEP

- Page VI, list of Abbreviations, Agencies/Groups: Revise Southern University of New York to State University of New York.
  Exelon response: Southern was replaced with State.
- Table 4.7-1. Detailed Individual Eel Transport Data, 2019: Provide measurement units (i.e. C, mg/L, etc.) for Transport to West Fairview (Site 5), Transport to Fort Hunter (Site 6), Transport to City Island (Site 12).
  Exelon response: Measurement units were added to Table 4.7-1

PFBC

- Executive Summary: three (3) highlighted question marks, presumably place holders for age data, should be filled in with age data when available.
  Exelon response: Age data were added to the Executive Summary for the highlighted areas.
- List of Abbreviations: SUNY should stand for "State University of New York"
  Exelon response: Southern was replaced with State.
- Section 3.2 Data Collection: PFBC recommends added sources for environmental data (i.e. gage station, lunar data site)
  Exelon Response: References for sources are included in Section 4.5 for environmental factors.
- Table 4.0-1: Catch data for 6/16/19 is missing
  Exelon response: Catch data from 6/16 were added to the table
- Figure 4.5-1: The caption should be clarified regarding flow. Presumably, the flow data for the top graph is daily mean river flow. Recommend rewriting caption – suggested rewrite: "Conowingo Eel Collection Facility daily eel catch and daily mean river flow (top graph) and weekly eel catch and weekly mean river flow (bottom graph), 2019."
  Exelon response: Exelon response: Changed caption to read: Daily Eel Catch and Daily Average River Flow (cfs, top graph) and Weekly Eel Catch and Weekly Average River Flow (cfs, bottom graph), Conowingo Eel Collection Facility, 2019.
- In Future summary reports, the PFBC recommends the addition of photographs that characterize typical (and unique) injury types observed on collected elvers.
  Exelon response: Images of the injuries will be included in future reports.
- Table 4.5-1: Indicate flow units in the caption
  Exelon response: Units of measurement have been added to the caption.
- Table 4.7-1: Units of measure should be included in column headings.
  Exelon response: Measurement units were added to Table 4.7-1.

United States Department of the Interior

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

November 27, 2019

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

RE: 2019 Inspection of Conowingo Fish Passage Facilities

Ms. Danucalov,

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

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

Sincerely,

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

United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 Westgate Center Drive
Hadley, MA 01035-9589

November 25, 2019

MEMORANDUM

To: Susquehanna River Coordinator, Mid-Atlantic Fish & Wildlife Conservation Office

From: Jesus Morales, Hydraulic Engineer, Fish Passage Engineering

Subject: Inspection of Fishways at Conowingo Hydroelectric Project (FERC #405) on May 23, 2019

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

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

East Fish Lift (EFL) Crowding Operation:

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

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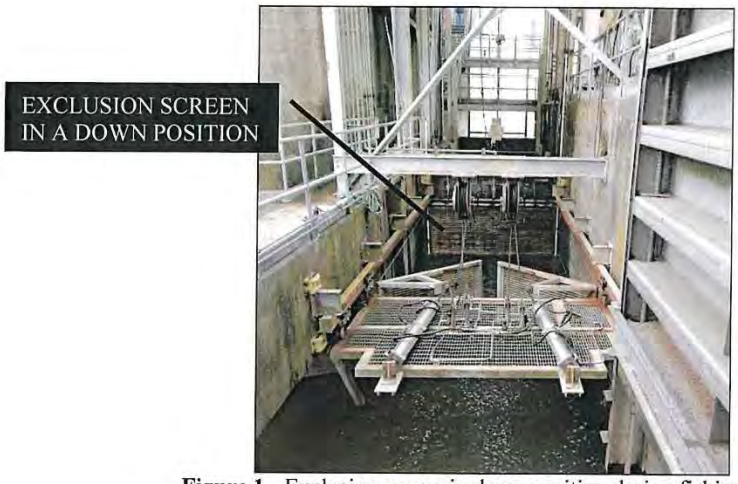

Figure 1 - Exclusion screen in down position during fishing mode

Eel Pass Attraction Flow:

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

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

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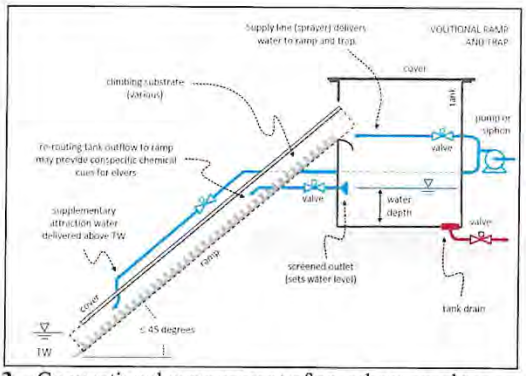

Figure 3 – Conventional arrangement of an eel pass and trap assembly

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

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

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