American Eel Upstream Siting Study

Lawrence Project (FERC No. 2800)

Prepared For
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A subsidiary of Patriot Hydro, LLC

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April 2025

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1 Introduction

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (Project or Lawrence Project), which is Federal Energy Regulatory Commission (FERC or Commission) Project No. 2800. The Project was licensed by the Commission on December 4, 1978 (with an effective date of December 1, 1978), and the license expires on November 30, 2028. The Lawrence Project is located on the Merrimack River in the City of Lawrence in Essex County, Massachusetts.

In accordance with 18 C.F.R. § 5.15, Essex has initiated studies and information gathering activities as provided in the study plan and schedule approved by the Commission. Among the studies completed during 2024 was the American Eel Upstream Passage Siting Study (Eel Siting Study), the methodologies of which were outlined in the Revised Study Plan (RSP) filed by Essex with the Commission on April 10, 2024, and approved with modifications by FERC in their May 10, 2024, Study Plan Determination (SPD). This report describes the Licensee's implementation of the study plan and schedule, the data collected, and any variances from the study plan and schedule.

2 Goals and Objectives

The goal of this study was to evaluate the potential need for additional permanent upstream American eel (*Anguilla rostrata*) passage facilities at the Project. Specifically, this study was intended to inform on the spatial distribution and relative abundance of juvenile eels downstream of the Project and to identify the potential need for any new locations appropriate for a future upstream eel passage structure(s).

3 Project Description and Study Area

3.1 Project Description

The Lawrence Project works consist of: (1) the 35-foot-high by 900-foot-long gravity Essex Dam of stone masonry construction (also known as the Great Stone Dam), with a five-foot-high pneumatic crest gate system mounted on the spillway crest; (2) a 9.8-mile-long impoundment having a surface area of 655 acres at a normal water elevation of 44.17 feet National Geodetic Vertical Datum of 1929 at the top of the crest gates, and gross storage capacity of approximately 19,900 acre-feet; (3) a powerhouse located at the end of a small forebay adjacent to the south abutment of the Essex Dam containing two 8.4 megawatt generating units and a tailrace channel extending into the Merrimack River channel; (4) fish passage facilities integral with the powerhouse, including a fish lift, downstream fish bypass, an eel lift at the left abutment of the dam, and an eel ladder at the right abutment of the dam; (5) the North Canal, approximately 5,300 feet long by 95 feet wide by 15 feet deep, originating at the north abutment of the dam and paralleling the Merrimack River downstream of the Essex Dam; (6) the South Canal, approximately 2,750 feet long by 35 feet wide by 10 feet deep, originating at the south abutment

of the Essex Dam and generally paralleling the Merrimack River downstream of the Essex Dam; (7) a single-circuit, underground/underwater 23.0-kilovolt transmission line to the Massachusetts Electric Company's Lawrence No. 1 substation; and (8) appurtenant facilities.

3.2 Existing Upstream Eel Passage Facilities

Essex operated two permanent upstream eel passage facilities during the 2024 evaluation: the south side eel trap and the north side eel lift.

The south side eel trap, located on the powerhouse side, consists of four switch-backed concrete ramp sections and three resting pools, totaling approximately 40 feet in length (Figure 3-1). Each of the unequal-length switchback sections has a slope of 40 degrees. The climbing substrate consists of 18-inch-wide Milieu elver climbing ramp (3 channels) fitted with 1-inch studs spaced at 0.5 inches. The sides are constructed of lumber and the ramps and pools are fitted with removable plywood cover sections. A 33-gallon collection tank serves as a temporary holding area and the entire system (collection tank water supply, ladder water supply, attraction water supply) is supplied by an 82 gallon per minute (gpm) submersible pump installed in the adjacent impoundment, with flow distributed through an adjustable manifold.

The north side eel lift is located on the river side opposite the powerhouse and consists of an aluminum hopper (70-gallon capacity) that is raised about 35 feet and emptied into a sorting tank at the top of the dam (Figure 3-2). The inside of the hopper consists of a section of cast aluminum climbing substrate manufactured by Lakeside Engineering, Inc., and is angled at an incline of approximately 40 degrees. A single 0.5-inch supply line feeds water to both the ramp and hopper. Two water lines, roughly 1.25 inches each, are located behind the hopper and provide additional attraction flow. Conveyance and attraction water is supplied from the impoundment by an 82-gpm submersible pump. Outside the hopper, affixed to the poured concrete pad to which the hopper sits, is a 30-inch long by 12-inch-wide section of studded substrate, installed with the intention to help facilitate eel movement towards the hopper entrance. Once lifted and emptied into the sorting tank, eels are counted and then sluiced into the impoundment.

3.3 Upstream Eel Passage Study Area

The study area included the section of the Merrimack River located immediately downstream of the Essex Dam as well as the North and South Canals and associated Project structures.

4 Study Methods

Activities conducted during 2024 represented the initial year of study described in the RSP for the Eel Siting Study and consisted of three components: visual nighttime surveys, electrofish sample collection, and deployment of eel pots. Sampling during 2024 took place over a period of ten weeks starting in early June and ending in early August.

The RSP called for Essex to review findings with the MRTC and determine if the installation of temporary eel traps during a second study year is warranted.

4.1 Nighttime Visual Surveys

A series of visual nighttime surveys to evaluate the spatial distribution and relative abundance of juvenile eels downstream of the Essex Dam and other Project structures was conducted once per week for a period of ten consecutive weeks starting on June 20, 2024. Nighttime visual surveys were conducted by a team of two biologists, within the time frame of approximately two hours after sunset and two hours before sunrise. These visual surveys were conducted at locations within the Project area that were deemed safely accessible to Project personnel and field staff, and were characterized by downstream conveyance of river water that may serve as an attraction flow to migrant eels. Survey areas included the downstream face of the dam, the powerhouse tailrace, the downstream areas around the North and South Canal gatehouses, and the North Canal discharge area (Figures 4-1 through 4-9).

During each weekly survey event, observers were equipped with spotlights with available red filters to facilitate eel observations at each safely accessible area. Efforts were made to time each weekly survey to occur on nights when conditions would be optimal (e.g., nights with high cloud cover or low lunar illumination, warmer or rainy nights with minimal wind, or after a rain event). The following items were recorded as part of the record for each survey:

- Date and time of search event,
- List of safely accessible survey areas included in each survey (varied slightly from week to week based upon site conditions),
- Estimate of numerical abundance and size classes by survey area (where size classes are defined as 0-6”, 6-12”, and 12+”),
- Weather conditions,
- Air and water temperatures,
- Moon phase, and
- Project discharge (turbines, fish passage facilities).

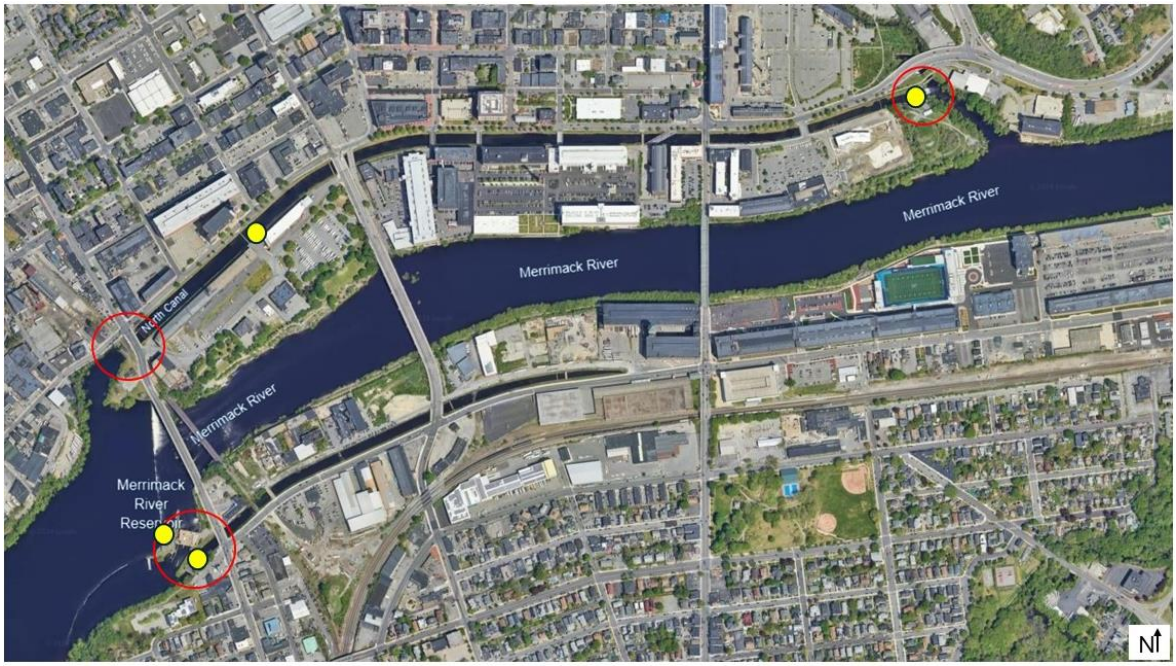

Figure 4-1. General locations of vantage points where nighttime visual eel surveys were conducted (red circles) and where eel pots were deployed (yellow dots) at Lawrence during the 2024 passage season.

Figure 4-2. Visual nighttime survey area for juvenile American eels in the Lawrence powerhouse tailrace.

Figure 4-3. Visual nighttime survey area for juvenile American eels within the lower entrance flume of the Lawrence fish lift.

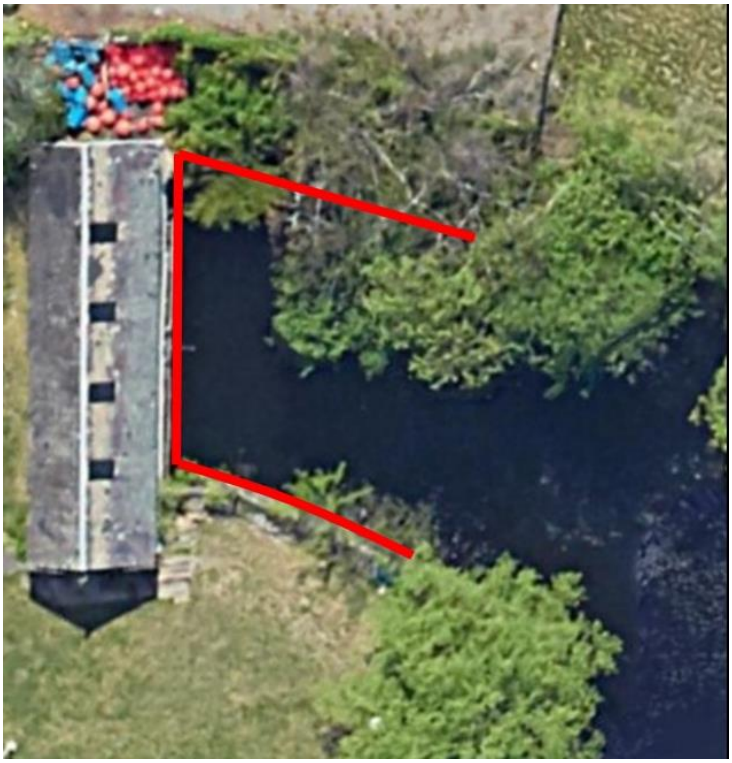

Figure 4-4. Visual nighttime survey area for juvenile American eels upstream of the South Canal Gatehouse.

Figure 4-5. Visual nighttime survey area for juvenile American eels downstream of the South Canal Gatehouse.

Figure 4-6. Visual nighttime survey area for juvenile American eels downstream of the upper gatehouse of the North Canal and downstream of Route 28.

Figure 4-7. Visual nighttime survey area for juvenile American eels downstream of the upper gatehouse on the North Canal and upstream of Route 28.

Figure 4-8. Visual nighttime survey area for juvenile American eels upstream of the North Canal upper gatehouse.

Figure 4-9 Visual nighttime survey area for juvenile American eels in the vicinity of the North Canal lower gatehouse.

4.2 Eel Pot Collections

Essex currently operates the south side eel trap and north side eel lift and evaluation of the nearfield and internal effectiveness of those two permanent structures was evaluated during 2024 and reported as part of the Upstream American Eel Passage Assessment. As a result, sampling for the presence of juvenile eels using eel pots focused on safely accessible locations associated with the North and South Canal structures (with a control location established at the base of the south side eel ramp to provide validation that the eel pots would retain juvenile eels of the size range present downstream of Essex Dam) (Figure 4-1). Following consultation during a June 6, 2024 site visit with representatives from the Merrimack River Technical Committee (MRTC) Essex deployed modified minnow trap style eel pots during 2024. The pots were modified by using a reduced size mesh material (~0.05-inch mesh) custom-wrapped onto all surfaces of the trap to reduce the likelihood that captured eels would be able to escape once they had moved through one of two entrance funnels (Figure 4-10). Over the course of the ten-week sampling period, eel pots were deployed in four locations and checked three times weekly (see example deployment in Figure 4-11). Eel pots were baited periodically during the ten-week deployment using a mix of dead fish or cat food. Deployment locations included:

- The nearfield ledges at the base of the south side eel trap;
- The upper end of the South Canal, immediately downstream of the gatehouse;
- The upper end of the North Canal, below the walking bridge; and
- The lower end of the North Canal, immediately upstream of the lower gates.

Data recorded during each eel pot check included the following:

- Date and time,
- Count of live eels by size class,
- Count of any observed eel mortalities,
- Air and water temperature,
- Project operations , and
- Condition of eel pots (e.g., fishing/not fishing, debris issues, vandalism, etc.).

Figure 4-10. Modified minnow pot lined with reduced size mesh and baited for the collection of juvenile eels in the vicinity of the Lawrence Project.

Figure 4-11. Baited eel trap deployed at the lower gatehouse on the north canal.

4.3 Electrofish Surveys

To supplement the visual nighttime surveys and to provide a more robust estimate of the relative abundance and body size distribution of juvenile American eels downstream of the Essex Dam, electrofishing was conducted twice in the tailrace and once in the north canal during the ten-week survey period. Similar to data recorded during the visual nighttime surveys, data collection during electrofish sampling included the presence/absence of juvenile eels, count of individuals, total length (nearest mm), weight (nearest gram), duration of sampling (i.e., seconds of sample time to allow for calculation of a catch per unit of effort), and the water conductivity/backpack settings (frequency (Hz), voltage (vDC), etc.). Global Positioning System (GPS) coordinates were recorded for each safely accessible search location where individuals were collected.

Electrofish equipment (i.e., backpack, barge, or boat-based) was determined based on the conditions of the intended sampling location. Sampling locations visited included (1) the North Canal, (2) the Merrimack River from below the dam to the point of confluence with the Spicket River, and (3) the lower Spicket River from the terminus of the North Canal to its confluence with the Merrimack River. The mainstem of the Merrimack River downstream of the Project was sampled via boat electrofishing whereas the Spicket River and North Canal were sampled via backpack electrofishing.

Electrofish sampling was conducted during daylight hours and on a date not scheduled for a nighttime survey. Juvenile eels collected during electrofish sampling were returned to the habitat where they were collected. Essex Hydro conducted electrofish surveys during July and August.

To provide additional information on the general fish assemblage downstream of Lawrence Dam, all non-anguillid fish species were also netted during eel electrofish events. For non-target fish species collected from the mainstem of the Merrimack River and lower Spicket River, fish were identified to species, counted, and total length to the nearest mm was recorded. Non-anguillid species collected during sampling within the North Canal were identified to species and counted.

5 Results

5.1 Merrimack River Conditions

Figure 5-1 presents the Merrimack River flow (cubic feet per second; cfs) as prorated for Lawrence Dam from USGS gage no. 01100000 and the allocation of the total inflow passing via the powerhouse tailrace or the spillway. Tailrace flow represents the sum of water conveyed through the two Project turbines, downstream bypass, or upstream fishway. Included for reference are the dates for each nighttime visual eel survey during the ten-week study period. The median inflow during the study period was 2,902 cfs (Interquartile Range [IQR] = 1,729 to 4014 cfs). The Project operated normally for the duration of the study.

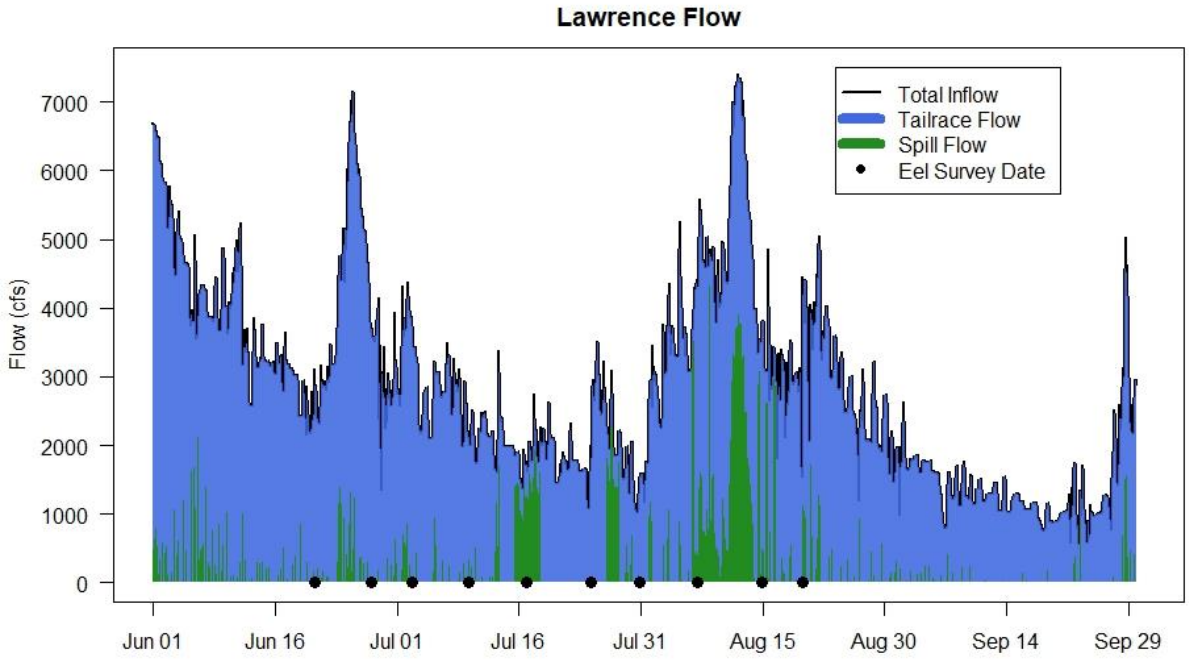

Figure 5-1. Total inflow, tailrace flow, and spill flow at Lawrence for the duration of the Eel Siting Study (June 1 to September 30, 2024).

5.2 Nighttime Visual Surveys

A total of ten visual nighttime surveys for juvenile eels were initiated at the Lawrence Project on June 20 and were continued on a weekly basis with the final survey occurring on August 19. Table 5-1 summarizes survey timing, environmental conditions, and eel counts by size class for each of the ten survey events. Visual searches were initiated between the hours of 20:35-22:38 and lasted for approximately ninety minutes. Air temperatures from each survey ranged from a low of 64 °F to a high of 80 °F (Figure 5-2). Water temperatures tended to be fairly consistent between survey locations on individual survey dates and ranged from 20 °C to 29.3 °C across the entire season (Figure 5-3). Of the ten surveys, five were conducted during or immediately following rain. Conditions on survey nights met the description provided in the 2023 USGS protocol for observational surveys for upstream migrant eels which states "Nights should be selected that have high probability of inducing eels to congregate or climb: warmer nights, cloudy nights, light rain, minimal wind".

When all nighttime surveys are considered, greater than 5,000 eels were observed across all survey locations (Figure 5-4). The highest number of eels observed on a single night occurred on July 16, 2024 when the survey crew observed an estimated total of 3,300 eels (primarily in the fish lift entrance canal and Project tailrace). Other than the entrance to the fish lift and in the vicinity of the tailrace, the most productive survey location was the area immediately downstream of the upper gatehouse of the North Canal (shown in Figure 4.7). Eels observed downstream of the upper North Canal gatehouse and in the entrance flume of the fish lift are likely undercounted due to relatively deep water conditions in these locations, limiting the viewing area to the surface of the water column. Eels observed in the tailrace tended to be swimming in open water in the immediate vicinity of the dam face or climbing on wetted rock surfaces near the discharge of the downstream bypass (Figure 5-5).

Nearly all eels observed during the nighttime visual surveys fell into the 0-6 inch length class (Figure 5-6). All eels observed in the North Canal, and greater than 95% of eels in both the lift entrance canal and tailrace fell into the 0-6 inch length class. No eels above 12 inches were observed at any site during the nighttime visual surveys. Similarly, there were no juvenile eels among any of the size class categories observed during nighttime survey events at the South Canal.

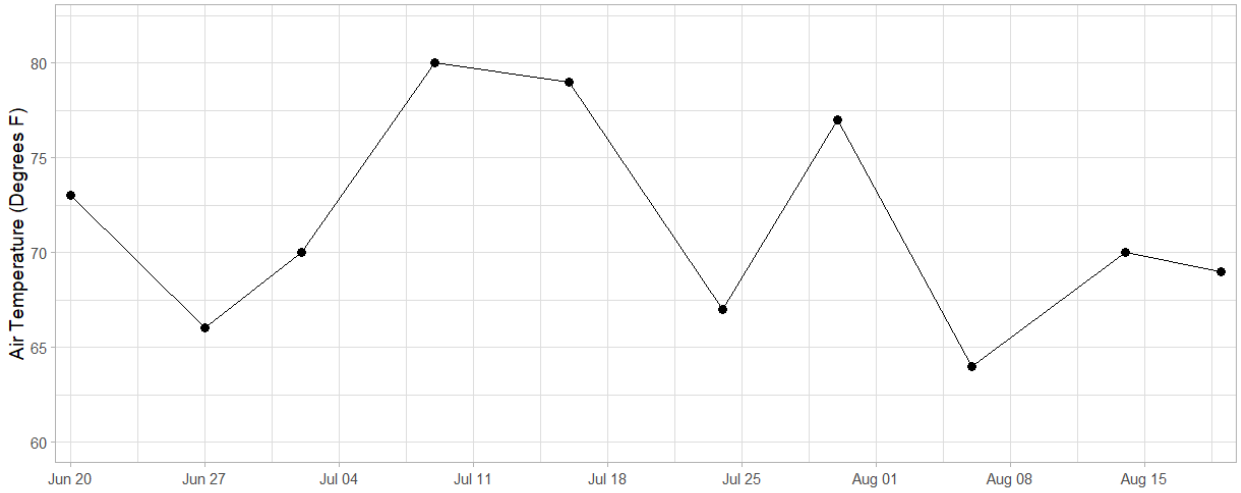

Figure 5-2. Air temperatures recorded during each of the ten nighttime eel surveys conducted at Lawrence during the 2024 passage season.

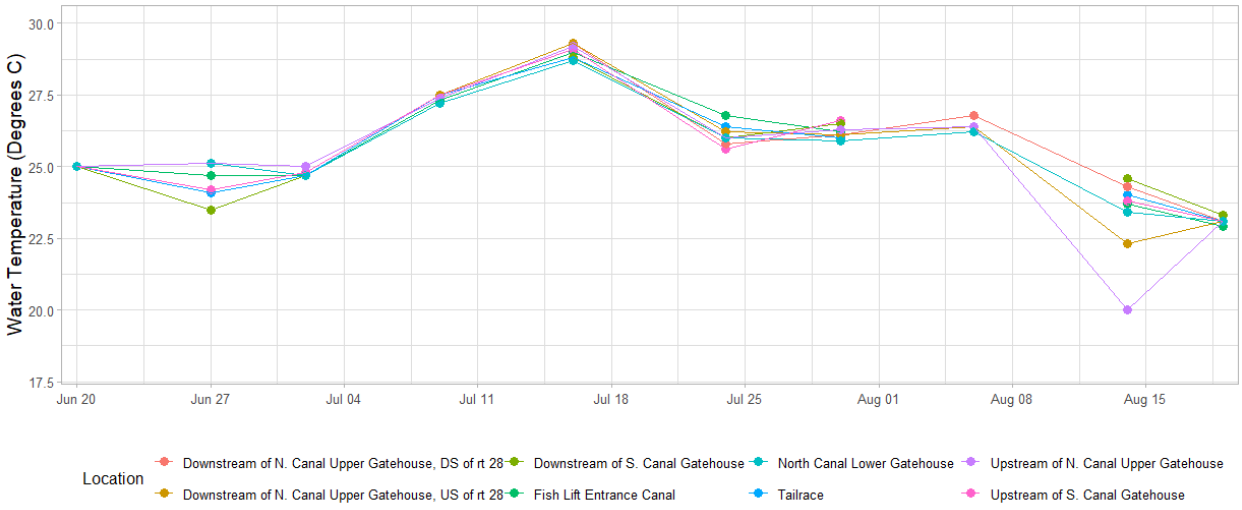

Figure 5-3. Water temperatures recorded at each survey site during each of the ten nighttime eel surveys conducted at Lawrence during the 2024 passage season).

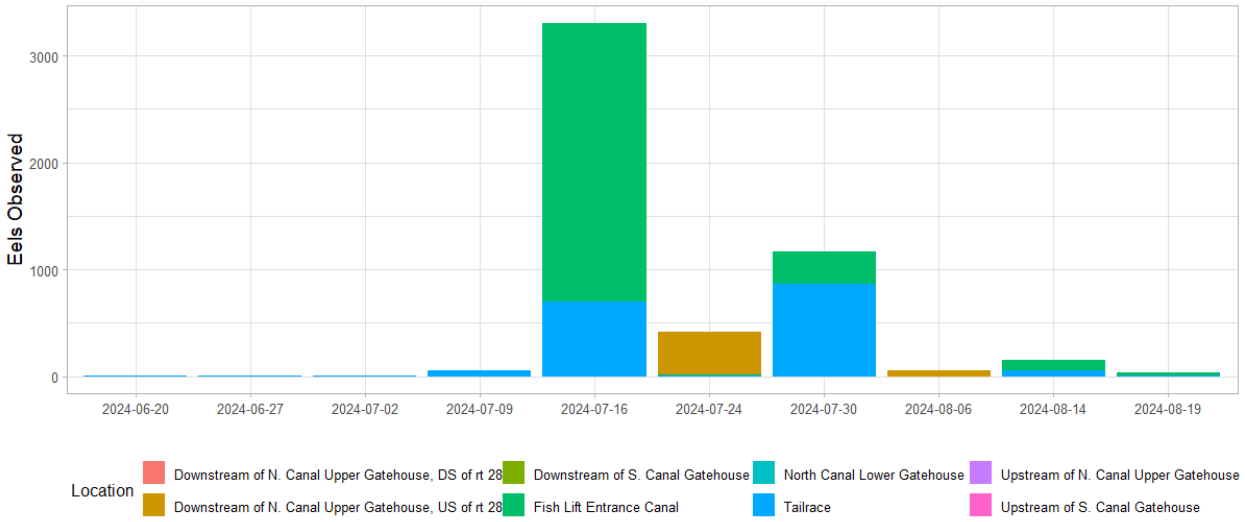

Figure 5-4. Visual nighttime survey counts of juvenile eels as observed on each survey date, separated by observation location.

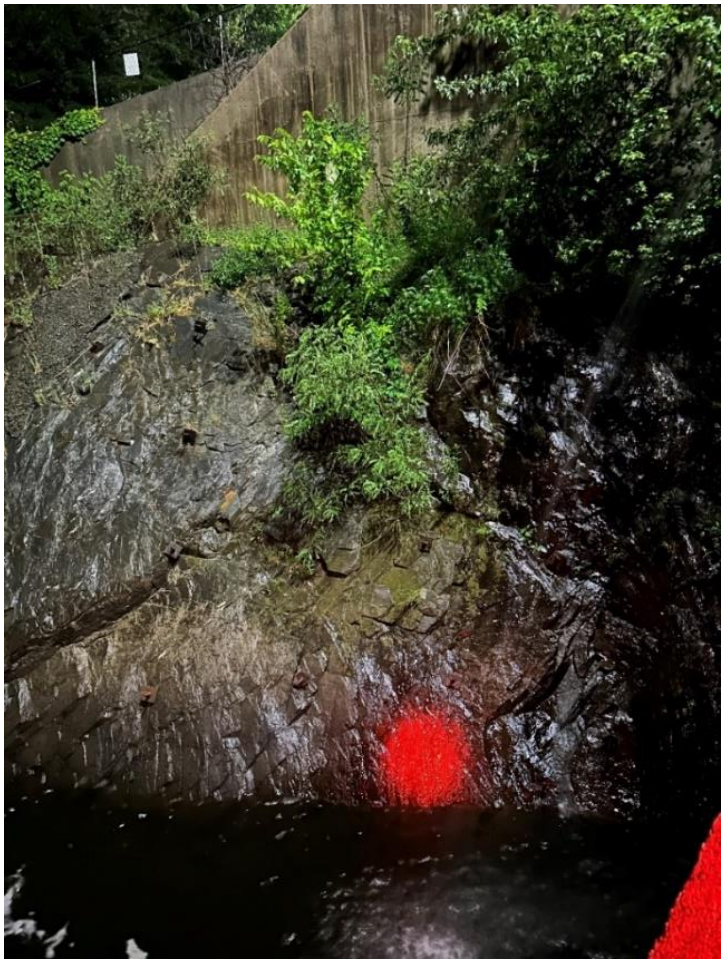

Figure 5-5. Red spotlight on actively climbing juvenile eels along the rocky wall of the Project tailrace. Note: juvenile eels are too small to see in the photo and were confirmed using binoculars.

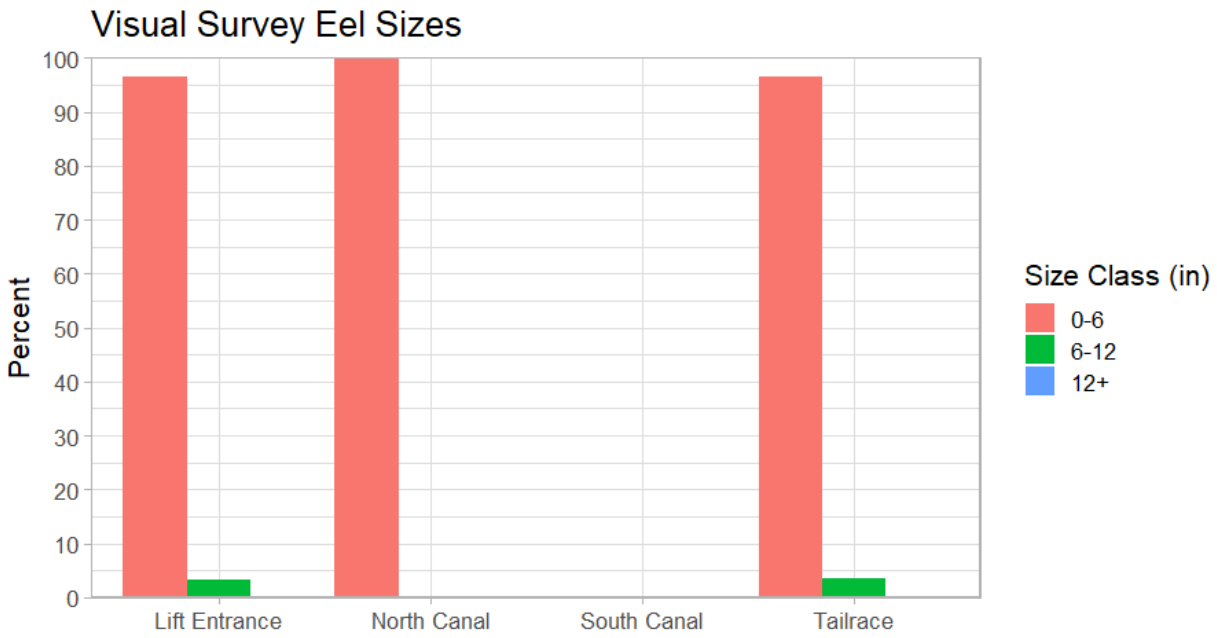

Figure 5-6. Distribution of length class by survey area for all juvenile eels observed during nighttime visual survey efforts in 2024 at Lawrence.

Table 5-1. Summary of data from each of the ten nighttime visual eel surveys conducted in Lawrence during the 2024 upstream passage season.

Date	Location	Start	End	Air Temp F	Water Temp C	0-6"	6-12"	12"+	Moon Phase	Weather
6/20/2024	Fish Lift Entrance Canal	22:27	22:29	73	25	0	0	0	Waxing Gibbous, Nearly Full	Rain, Thunderstorms Earlier
	Tailrace	22:29	22:39		25	3	0	0		
	Upstream of S. Canal Gatehouse	22:45	22:47		25	0	0	0		
	Downstream of S. Canal Gatehouse	22:48	22:54		25	0	0	0		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	23:00	23:02		25	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	23:06	23:15		25	0	0	0		
	Upstream of N. Canal Upper Gatehouse	23:13	23:15		25	0	0	0		
	North Canal Lower Gatehouse	23:30	23:38		25	0	0	0		
6/27/2024	Fish Lift Entrance Canal	20:35	20:37	66	24.7	0	0	0	Waning Gibbous	Clear, Low Wind
	Tailrace	20:40	20:56		24.1	2	0	0		
	Upstream of S. Canal Gatehouse	21:04	21:06		24.2	0	0	0		
	Downstream of S. Canal Gatehouse	21:09	21:17		23.5	0	0	0		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	21:31	21:34		NA	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	21:43	21:44		NA	0	0	0		
	Upstream of N. Canal Upper Gatehouse	21:37	21:40		25.1	0	0	0		
	North Canal Lower Gatehouse	21:56	0:03		25.1	0	0	0		
7/2/2024	Fish Lift Entrance Canal	22:38	22:40	70	24.7	0	0	0	Waning Crescent	Clear, Calm
	Tailrace	22:40	22:54		24.7	3	0	0		
	Upstream of S. Canal Gatehouse	23:00	23:04		24.8	0	0	0		
	Downstream of S. Canal Gatehouse	23:05	23:13		24.7	0	0	0		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	23:20	23:24		24.7	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	23:25	23:27		24.7	0	0	0		
	Upstream of N. Canal Upper Gatehouse	23:29	23:32		25	0	0	0		
	North Canal Lower Gatehouse	23:45	23:53		24.7	0	0	0		
7/9/2024	Fish Lift Entrance Canal	22:35	22:42	80	27.3	0	0	0	Waxing Crescent	Light Rain
	Tailrace	22:42	22:54		27.5	50	0	0		
	Upstream of S. Canal Gatehouse	23:02	23:08		27.5	0	0	0		
	Downstream of S. Canal Gatehouse	23:10	23:16		27.5	0	0	0		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	23:30	23:35		27.5	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	23:36	23:40		27.5	0	0	0		
	Upstream of N. Canal Upper Gatehouse	23:42	23:45		27.4	0	0	0		

Date	Location	Start	End	Air Temp F	Water Temp C	0-6"	6-12"	12"+	Moon Phase	Weather
	North Canal Lower Gatehouse	23:55	0:05		27.2	0	0	0		
7/16/2024	Fish Lift Entrance Canal	22:35	22:45	79	29	2500	100	0	Waxing Gibbous	Cloudy, Rain Immediately before
	Tailrace	22:45	23:05		28.8	700	0	0		
	Upstream of S. Canal Gatehouse	23:10	23:15		29.1	0	0	0		
	Downstream of S. Canal Gatehouse	23:15	23:25		28.8	0	0	0		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	23:35	23:40		29.3	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	23:45	23:48		29.3	0	0	0		
	Upstream of N. Canal Upper Gatehouse	23:52	23:58		29.2	0	0	0		
	North Canal Lower Gatehouse	0:12	0:30		28.7	0	0	0		
7/24/2024	Fish Lift Entrance Canal	22:20	22:30	67	26.8	10	0	1	Waning Gibbous	Cloudy, Rain earlier
	Tailrace	22:30	22:45		26.4	4	0	0		
	Upstream of S. Canal Gatehouse	22:50	22:53		25.6	0	0	0		
	Downstream of S. Canal Gatehouse	22:55	23:02		26	0	0	0		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	23:10	23:14		25.8	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	23:16	23:22		26.2	400	0	0		
	Upstream of N. Canal Upper Gatehouse	23:24	23:28		26	0	0	0		
	North Canal Lower Gatehouse	23:45	23:55		26	0	0	0		
7/30/2024	Fish Lift Entrance Canal	22:10	22:15	77	26.2	300	2	0	Waning crescent	Cloudy
	Tailrace	2:16	22:23		26	800	60	0		
	Upstream of S. Canal Gatehouse	22:26	22:36		26.6	0	0	0		
	Downstream of S. Canal Gatehouse	22:36	22:46		26.5	0	0	0		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	22:53	22:57		26.1	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	22:59	23:05		26.1	0	0	0		
	Upstream of N. Canal Upper Gatehouse	23:07	23:12		26.3	0	0	0		
	North Canal Lower Gatehouse	23:23	23:35		25.9	0	0	0		
8/6/2024	Fish Lift Entrance Canal	Unable To Access		64	NA	NA	NA	NA	Waxing Crescent	Rain
	Tailrace	Unable To Access			NA	NA	NA	NA		
	Upstream of S. Canal Gatehouse	Unable To Access			NA	NA	NA	NA		
	Downstream of S. Canal Gatehouse	Unable To Access			NA	NA	NA	NA		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	21:57	22:03		26.8	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	22:07	22:15		26.4	50	0	0		
	Upstream of N. Canal Upper Gatehouse	22:16	22:20		26.4	0	0	0		

Date	Location	Start	End	Air Temp F	Water Temp C	0-6"	6-12"	12"+	Moon Phase	Weather
	North Canal Lower Gatehouse	22:28	22:40		26.2	0	0	0		
8/14/2024	Fish Lift Entrance Canal	21:47	21:52	70	23.7	100	1	0	Waxing Gibbous	Clear
	Tailrace	21:52	22:02		24	50	0	0		
	Upstream of S. Canal Gatehouse	22:05	22:10		23.8	0	0	0		
	Downstream of S. Canal Gatehouse	22:10	22:15		24.6	0	0	0		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	22:20	22:25		24.3	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	22:25	22:30		22.3	0	0	0		
	Upstream of N. Canal Upper Gatehouse	22:31	22:35		20	0	0	0		
	North Canal Lower Gatehouse	22:45	23:00		23.4	0	0	0		
8/19/2024	Fish Lift Entrance Canal	21:49	21:56	69	22.9	30	0	0	Full (Super Moon)	Cloudy - Immediately Following Thunderstorm
	Tailrace	21:56	22:07		23.1	5	0	0		
	Upstream of S. Canal Gatehouse	22:14	22:17		23.1	0	0	0		
	Downstream of S. Canal Gatehouse	22:18	22:27		23.3	0	0	0		
	Downstream of N. Canal Upper Gatehouse, DS of rt 28	22:40	22:44		23.1	0	0	0		
	Downstream of N. Canal Upper Gatehouse, US of rt 28	22:33	22:37		23.1	0	0	0		
	Upstream of N. Canal Upper Gatehouse	23:01	23:07		23.1	0	0	0		
	North Canal Lower Gatehouse	22:45	22:47		23.1	0	0	0		

5.3 Eel Pot Collections

Eel pots were deployed in four locations. This included three 'test' sites (the upstream of the South Canal, the upstream of the North Canal [near the walking bridge], and the downstream end of the North Canal immediately upstream of the discharge gates) and a single 'control' site to validate that the mesh-lined pot design was suitable to capture juvenile eels when eels were present. The control site was established in a location of known eel presence at the base of the south side eel trap.

Eel pots deployed at the control site were extremely successful in capturing juvenile eels from a location of known presence. The mean number of juvenile eels per pot reached in excess of 1,000 eels per pot during the July 17 check (Figure 5-7). The mean number of eels per pot check was highest at the control location near to the south side eel ramp from early July through early August. Demonstration of successful catch of juvenile eels at the south side eel trap entrance area supported the use of the mesh-lined eel pots at other Project locations and indicated they were capable of capturing juvenile eels when they are in fact present.

Juvenile eels were collected at the sampling locations established within the North and South Canals, although at a much lower rate when compared to the control site (Figure 5-8). Collection numbers were highest in eel pots deployed at the lower end of the North Canal with the highest abundance noted July 15 and July 24 when an average of 0.75 eels per pot was observed. Juvenile eels were observed in eel pot collections at the upstream end of the North Canal (at the walking bridge) on a single date, July 17, when an average of 0.5 eels per pot was observed. Juvenile eel presence in the South Canal was extremely limited as evidenced by the collection of only a single juvenile eel during the 10-week eel pot sampling effort (one 6–12-inch individual observed on August 14).

Figure 5-9 provides the proportional distribution of length classes for juvenile eels collected among the four eel pot sampling locations. At the control site, greater than 95% of eels captured represented the 0-6 inch length class with only a small portion falling into the 6-12 inch category. The length distribution of eels collected in pots at the North Canal sites were more evenly split among the three length classes, but the 6-12 inch length class represented greater than 50% of the total catch. The single eel captured in the South Canal fell into the 6-12 inch length class.

Detailed data collected using deployed eel traps is provided in Appendix A.

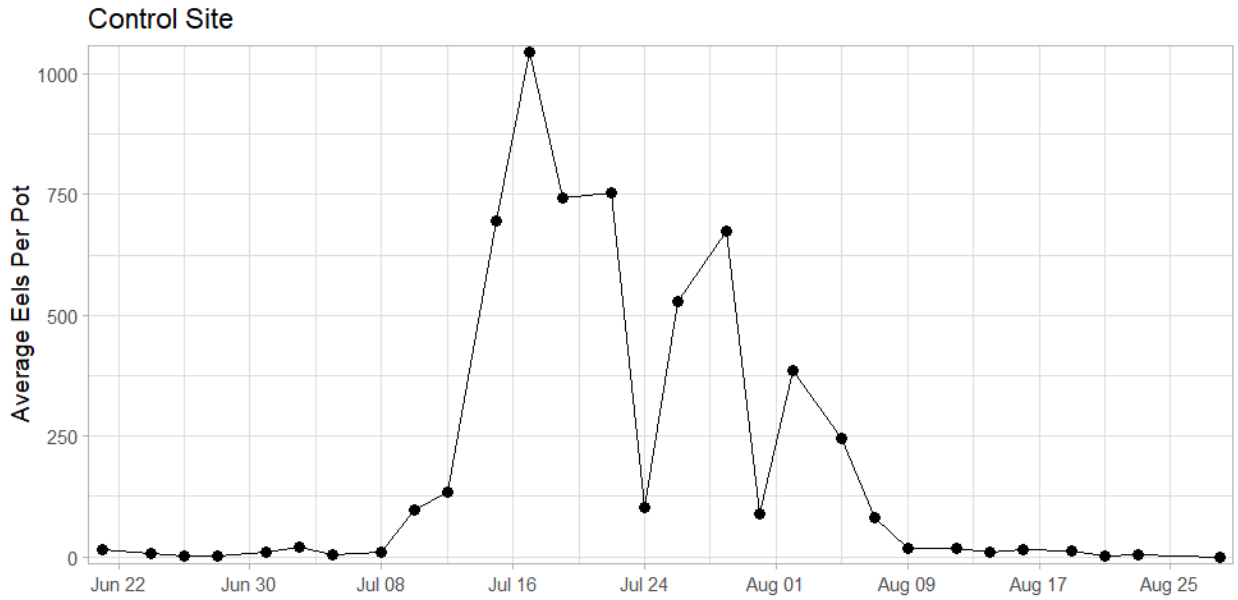

Figure 5-7. Average number of juvenile eels per pot on each check date for eel pots deployed at the entrance area to the south side eel trap.

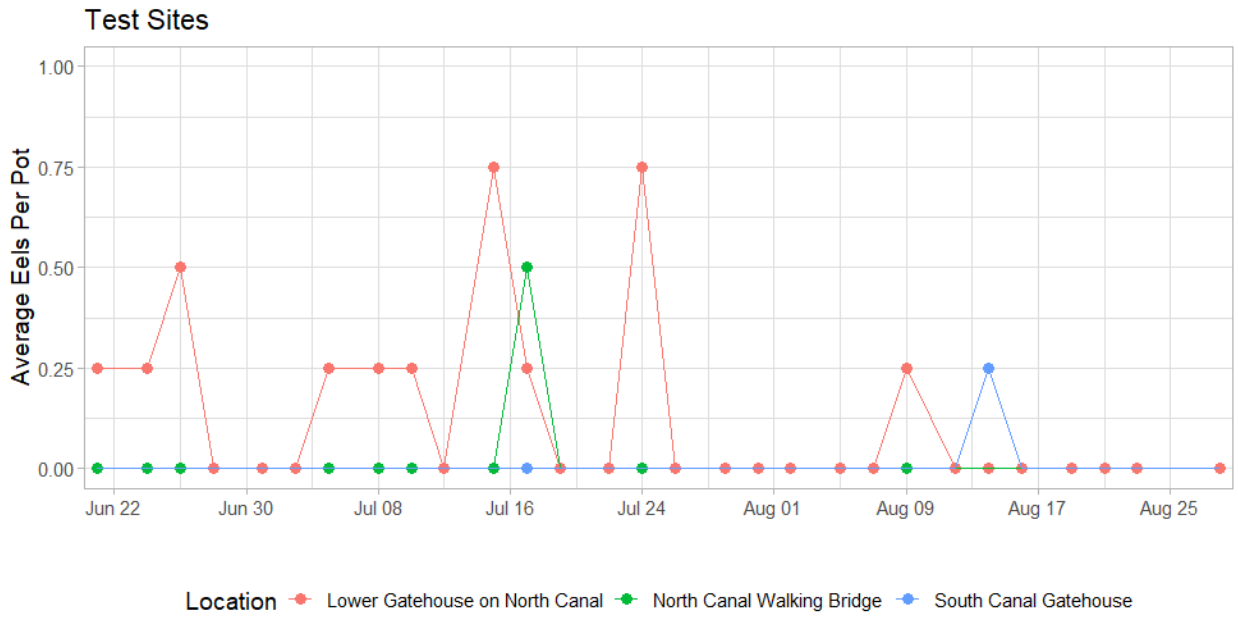

Figure 5-8. Average number of juvenile eels per pot on each check date for eel pots deployed within the North and South Canals.

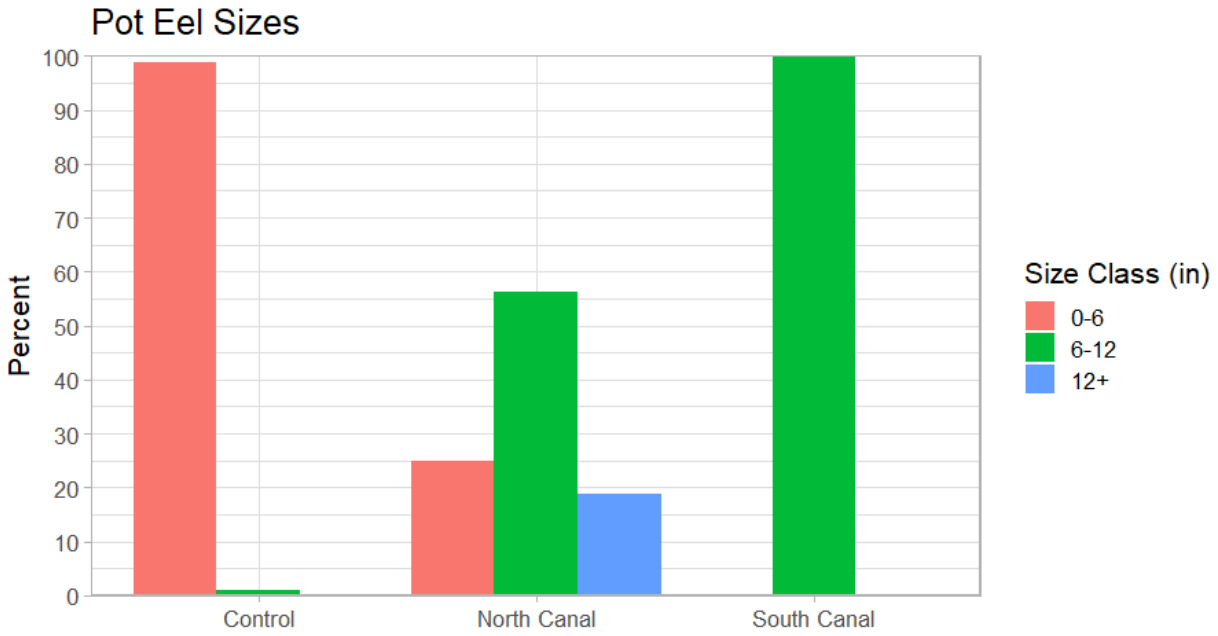

Figure 5-9. Distribution of length class by sampling location for all juvenile eels captured during eel pot sampling in 2024 at Lawrence.

5.4 Electrofishing Surveys

To inform on the distribution and abundance of juvenile eels in the vicinity of the Lawrence Project, electrofishing surveys were conducted in three distinct areas: 1) the Merrimack River from just downstream of the Essex Dam downstream to the confluence with the Spicket River (main stem), 2) the Spicket River from its confluence with the Merrimack River upstream to the confluence with the discharge from the North Canal (Spicket River), and 3) within the North Canal (North Canal).

The main stem was sampled via boat electrofishing whereas water depths within the Spicket River and North Canal required the use of backpack electrofishing. Sampling occurred within the mainstem and Spicket River twice—once on July 26 and again on August 21. The North Canal was sampled a single time, on August 8. Boat electrofish sampling conducted in the mainstem consisted of a series of six shoreline transects to systematically cover the full reach and provide information on juvenile eel distribution and relative abundance (Figures 5-10 and 5-11). Backpack electrofish sampling within the Spicket River consisted of a single transect through representative and accessible habitat (Figures 5-10 and 5-11). Sampling effort within the North Canal was divided into three unique transects (Figure 5-12).

When both sampling dates are considered, a total of 69 juvenile American eels were captured in the main stem, 45 juvenile eels were collected from the Spicket River, and 75 juvenile eels were collected within the North Canal. The majority of juvenile eels captured during electrofishing fell

into the 6-12 inch length class (Figure 5-13). The Spicket River sampling showed the most even size distribution with no single length class falling below 25% of the overall catch. Nearly 40% of eels captured in the main stem fell into the 12+ inch category while the North Canal sampling showed the dominant size class to be 6-12 inch with the other categories representing only a small portion of the overall catch.

A total of 16 additional fish species were collected during the electrofish efforts to target juvenile eels (Table 5-2). A total of 12 non-anguillid species were observed from the main stem, 13 from the Spicket River, 5 from the North Canal. The top three most common species in the main stem were American Eel (52%), Smallmouth Bass (17%) and Common Carp (10%). Catch within the Spicket River consisted primarily of American Eel (42%) and Spottail Shiner (17%). Catch from the North Canal was limited to six total species with American Eel (74%) comprising the majority of individuals.

Full electrofishing results including all other species which were opportunistically sampled are provided in Appendix B.

5.4.1 Catch Per Unit Effort (CPUE)

To evaluate relative abundance of juvenile eels among the various areas sampled using electrofishing techniques, a catch per unit effort (CPUE; eels per minute of sampling) was calculated for each individual transect (Table 5-3). When examined for the main stem sampling transects, the highest CPUE values occurred at Transect 1 (located adjacent to the confluence with the Spicket River) and Transect 6 (located on the powerhouse shoreline closest to Essex Dam). This trend was observed during both the July 26 and August 21 sampling events. CPUE values for juvenile eels in the Spicket River were similar to those observed at main stem Transect 1 during both the July and August sampling events. Among all sampling transects, the highest CPUE value for juvenile eels was observed within the North Canal with a value of 1.26 eels per minute at one of the transect locations.

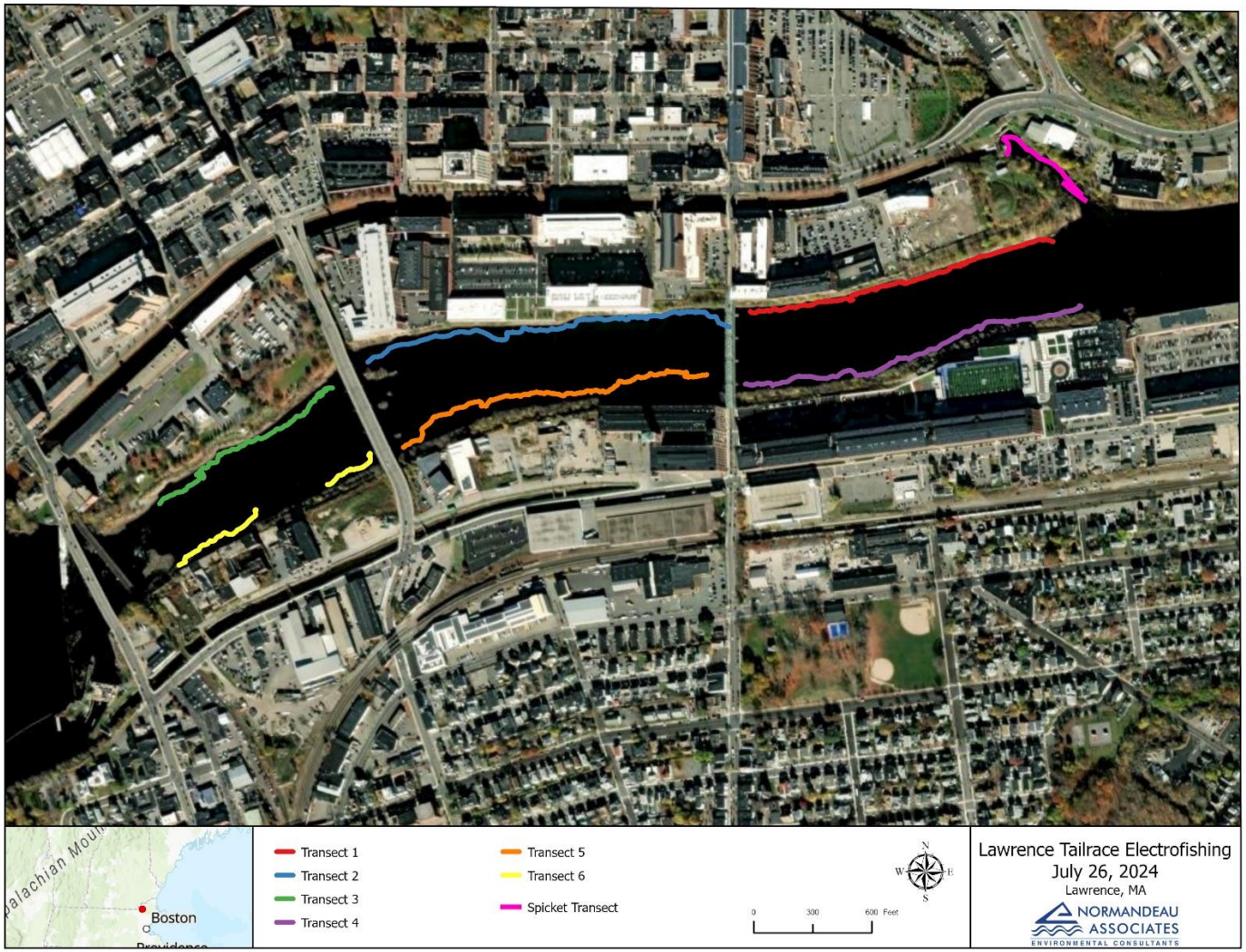

Figure 5-10. Main stem and Spicket River electrofishing transects sampled on July 26, 2024.

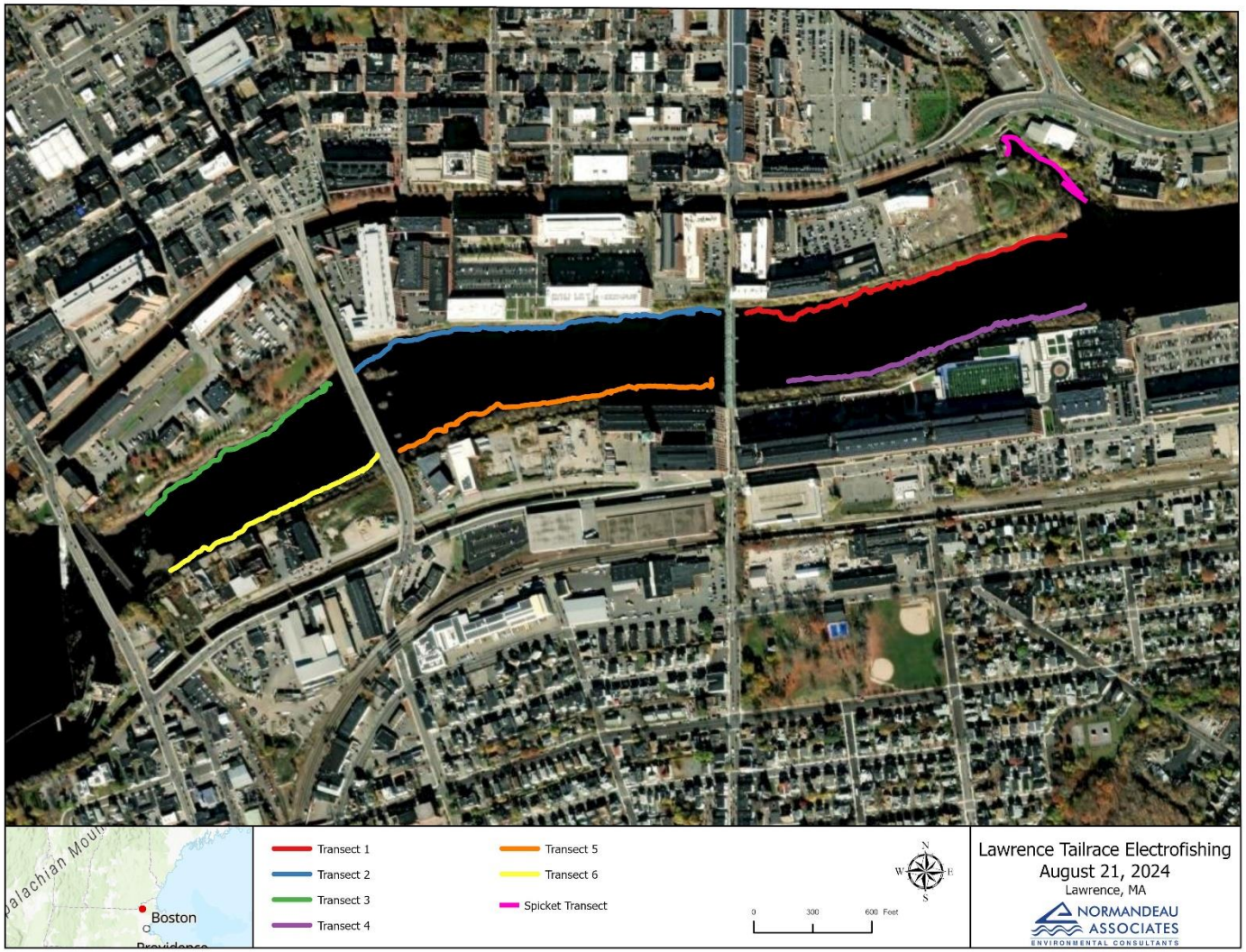

Figure 5-11. Main stem and Spicket River electrofishing transects sampled on August 21, 2024.

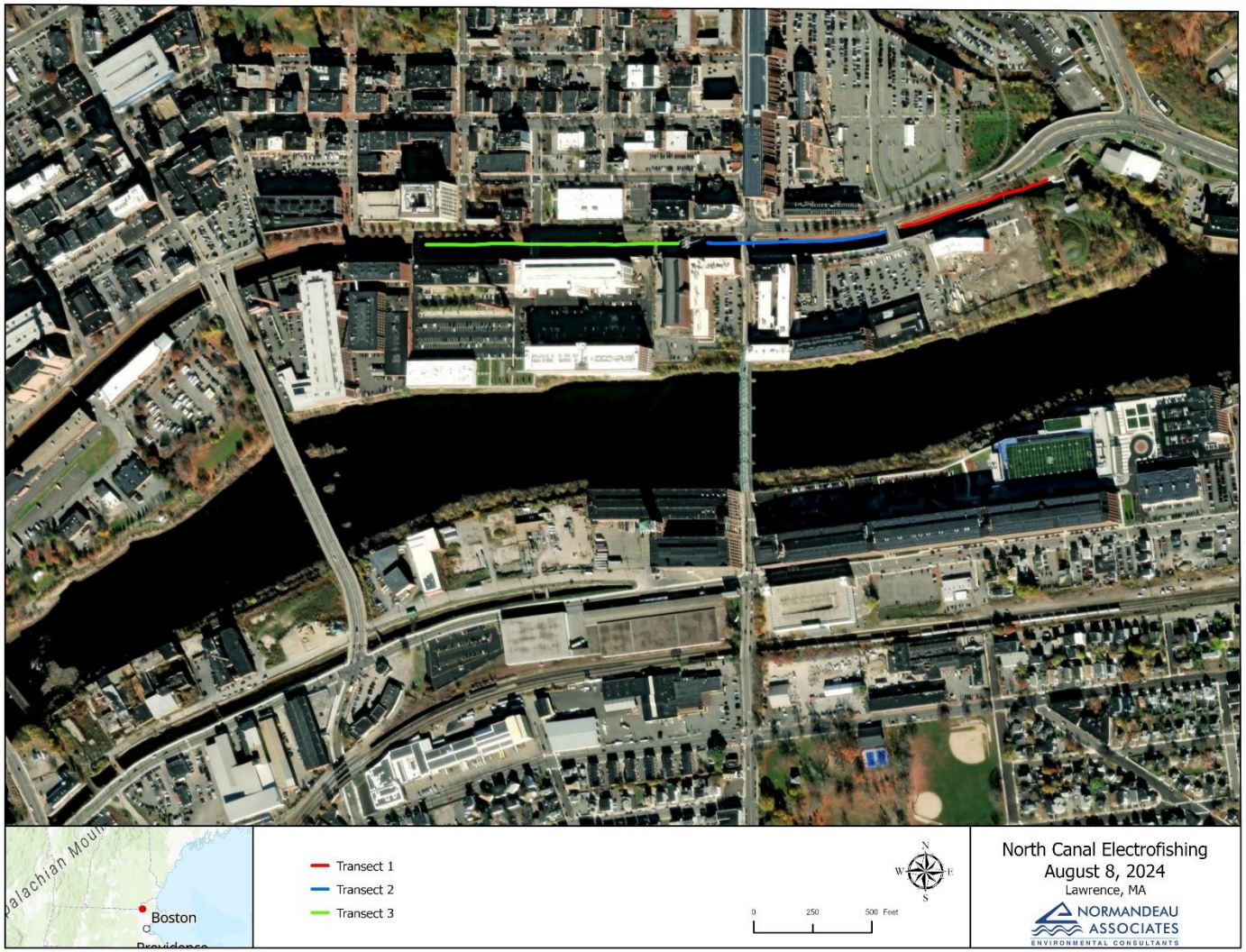

Figure 5-12. North Canal electrofishing transects sampled on August 8, 2024.

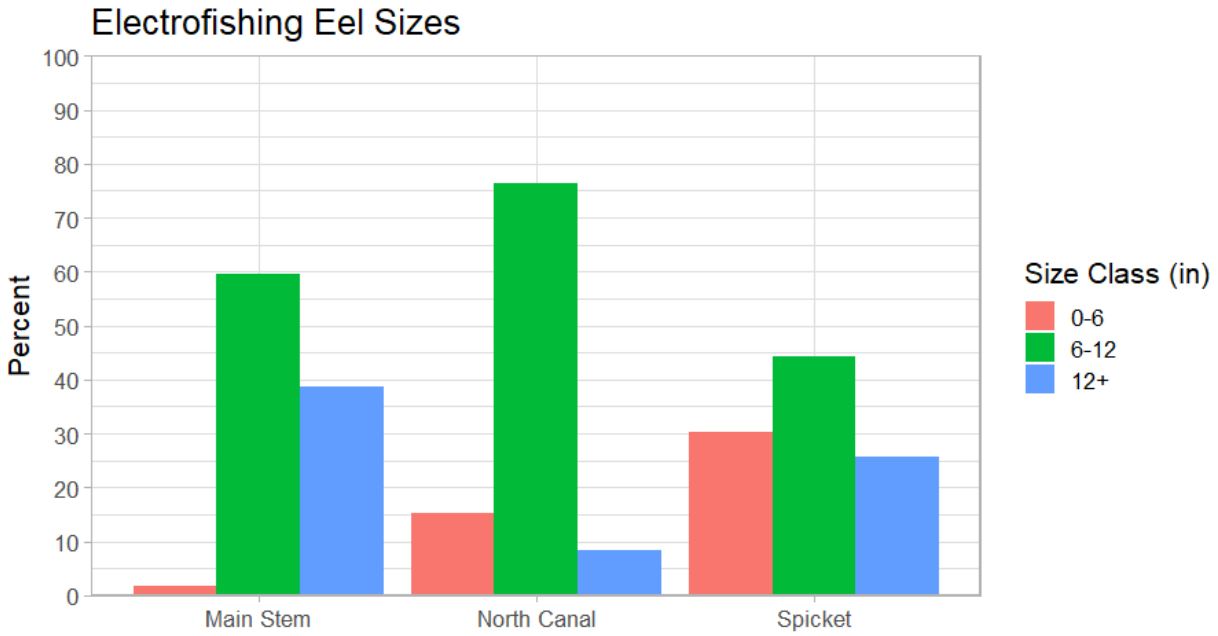

Figure 5-13. Distribution of length class by sampling location for all juvenile eels captured during electrofishing efforts in 2024 at Lawrence.

Table 5-2. Summary of species captured during electrofishing surveys in the main stem Merrimack downstream of Essex Dam, lower Spicket River, and North Canal targeting juvenile eels.

Species	Main Stem	Spicket River	North Canal
Alewife	5	0	0
American Eel	57	43	72
Bluegill	2	4	8
Common Carp	11	0	0
Fallfish	1	5	0
Golden Shiner	0	2	0
Green Sunfish	0	3	3
Largemouth Bass	1	2	5
Margined Madtom	1	4	0
Pumpkinseed	1	3	7
Redbreast Sunfish	1	8	0
Sea Lamprey	0	2	0
Smallmouth Bass	19	1	2
Spottail Shiner	1	17	0
Tessellated Darter	0	3	0
White Sucker	9	5	0
Yellow Bullhead	1	0	0

Table 5-3. Sampling characteristics and juvenile eel catch summary for electrofish sampling conducted during 2024 within the main stem, Spicket River and North Canal sites at Lawrence.

Date	Location	Transect	Water Conductivity mS/cm	Frequency (Hz)	Voltage (vDC)	Duration (Seconds)	No. Eels Captured	CPUE (eels/min)
7/26/2024	Main stem	1	600	60	250	1037	15	0.87
7/26/2024	Main stem	2	609	60	250	931	3	0.19
7/26/2024	Main stem	3	605	60	250	789	3	0.23
7/26/2024	Main stem	4	607	60	250	919	4	0.26
7/26/2024	Main stem	5	595	60	250	948	5	0.32
7/26/2024	Main stem	6	597	60	250	636	5	0.47
7/26/2024	Spicket	1	614	60	350	1483	23	0.93
8/8/2024	North Canal	1	n/a	60	350	1762	11	0.37
8/8/2024	North Canal	2	n/a	60	350	1471	31	1.26
8/8/2024	North Canal	3	n/a	60	350	1849	30	0.97
8/21/2024	Main stem	1	199	70	275	911	4	0.26
8/21/2024	Main stem	2	199	60	275	978	3	0.18
8/21/2024	Main stem	3	201	60	275	679	2	0.18
8/21/2024	Main stem	4	195	60	275	845	2	0.14
8/21/2024	Main stem	5	197	60	300	848	5	0.35
8/21/2024	Main stem	6	196	60	300	762	6	0.47
8/21/2024	Spicket	1	214	60	350	1875	20	0.64

6 Summary

A total of ten nighttime visual surveys targeting juvenile American eels were conducted between June 20 and August 19, 2024 at the Lawrence Project. As defined in the RSP, surveys were conducted from a series of shoreline positions on-site at the Project as well as several vantage points positioned along the North and South Canals. Each survey was conducted by a pair of biologists equipped with red spotlights and binoculars to facilitate the viewing of juvenile eels attempting upstream passage. Over the course of the ten surveys, juvenile eels were observed most frequently in the Project tailrace, within the entrance of the lower entrance flume associated with the existing fish lift, and at the upstream end of the North Canal. No juvenile eels were observed from vantage points surveying the areas upstream or downstream of the South Canal gatehouse during any of the ten weekly survey events. Greater than 5,000 juvenile eels were observed across all surveys, with over 3,000 observed during a single survey on the night of July 16, 2024.

The eel pots deployed during the ten-week sampling period were successful in collecting information on juvenile eel presence and relative abundance. The control site, located on the nearfield ledge areas associated with the existing south side eel trap had a total catch of greater than 20,000 juvenile eels across the full ten-week period. Relative abundance of juvenile eels at that location peaked between early July and early August. The deployment of mesh-lined eel pots in the North Canal resulted in regular observations of small numbers of juvenile eels at the downstream end and near to the discharge gates (n = 15 over the 10-week period). Juvenile eel collections in eel pots fished at the downstream end of the North Canal occurred from late June through early August. A single juvenile eel was observed in the ten weeks of eel pot sampling conducted at the upstream end of the North Canal. Similarly, the ten weeks of eel pot sampling within the South Canal produced only a single juvenile eel. Eel pot collections suggest some presence of juvenile American eels within the North Canal.

Electrofishing was conducted twice (once in July and once in August) in the main stem Merrimack River from the point just downstream from Essex Dam to the confluence with the Spicket River and in the Spicket River from its confluence with the Merrimack to the discharge from the North Canal. Additionally, backpack electrofish sampling was conducted in the North Canal during a single event in August. Electrofish effort (all sites and dates) yielded a total of 309 fish with 172 of those being American eels. A total of 57 juvenile eels were collected within the main stem Merrimack River, 43 within the lower Spicket River, and 72 within the North Canal. The highest CPUE (eels/minute of sampling) occurred in the North Canal with a high of 1.26 eels per minute. The highest CPUE values for juvenile eels within the main stem Merrimack River were noted from the sample areas located adjacent to the confluence with the Spicket River and the region located on the powerhouse shoreline closest to Essex Dam. This trend was observed during both the July 26 and August 21 sampling events. CPUE values for juvenile eels in the Spicket River were similar to those observed at main stem Transect 1 during both the July and August sampling events.

Sampling methodologies employed during this study provided valuable information on the presence and relative abundance of juvenile eels in the Project area. Nighttime surveys conducted during the ten-week period revealed a high relative abundance of juvenile eels within the powerhouse tailrace and lower entrance flume associated with the existing fish lift. These areas are adjacent to the existing south side eel trap which was evaluated during several nighttime surveys associated with the Upstream American Passage Assessment Study and produced observations of large numbers of juvenile eels on the nearfield ledges of the existing eel trap. Similarly, boat electrofish sampling conducted in the main stem Merrimack River from downstream of Essex Dam to its confluence with the Spicket River demonstrated relatively high catch rates from the sample transect located closest to the Essex Dam and on the powerhouse side of the river.

Main stem boat electrofish sampling also produced relatively high catch rates of juvenile eels from the sample transect located adjacent to the confluence with the Spicket River. These same relatively high catch rates were also observed during electrofish sampling conducted within the lower Spicket River during both the July and August sampling events. As demonstrated by eel surveys conducted at the first dam on the Spicket River (Methuen Falls Dam; Normandeau 2024) large numbers of juvenile American eels entering the Spicket River continue upstream in that system. However, nighttime surveys, eel pot collections and backpack electrofish sampling conducted within the North Canal do suggest that juvenile eels are accessing that waterway. Over 400 juvenile eels were observed at the upstream end of the North Canal over survey events conducted during late July and early August. Captures of juvenile eels in pots set at the downstream end of the North Canal occurred between late June and early August and CPUE rates for juvenile eels in the North Canal were the highest observed for areas sampled by electrofishing.

Due to safety issues associated with egress of project staff from the South Canal in the event of an emergency during sampling, electrofish sampling was not performed in that reach. However, both nighttime visual surveys and use of fine-mesh eel pots were conducted over the 10-week sampling period. Despite this considerable effort, observations of juvenile eels in the South Canal were limited to a single individual suggesting minimal use of this reach.

7 Variances from the FERC Approved Study Plan

The Upstream American Eel Upstream Passage Siting Study was conducted following the methodology described in the April 10, 2024, RSP and approved by FERC with modifications in their May 10, 2024, SPD with several exceptions:

- The RSP identified the installation of temporary ramp-style eel traps at locations in the vicinity of the downstream side of the North and South Canal gatehouses and the downstream side of the North Canal outlet gate. These sites were visited with representatives from the MRTC on June 6, 2024 and based on limited safe and feasibly accessible locations to place ramp-style traps, the decision was made to rely on fine-screen eel pots to evaluate eels at these locations. (see Appendix C for correspondence following the June 6, 2024 site visit).
- Essex and the MRTC discussed the potential for electrofish sampling targeting juvenile eels within the South Canal during the June 6, 2024 site visit. Due to safety concerns with the ability for staff to access and exit the South Canal in the event of loss of control at the upstream gatehouse, no electrofish sampling was conducted in that reach.

8 Literature Cited

Normandeau (Normandeau Associates, Inc). 2024. Methuen Falls Juvenile Eel Survey – Methuen Falls Hydroelectric Project (FERC No. 8093). Report Prepared for Methuen Falls Hydroelectric Project.

Appendix A: Eel Pot Collection Data

		Time		Temperature		Eels Captured					
Date	Location	Time Pulled	Time Deployed	Water (°C)	Air (°F)	0-6" Eels	6-12" Eels	12+" Eels	Total Eels	# Mortalities	Condition of Pots
6/21/2024	South Side Ledges	10:07	10:30	23.9	83	62	2	0	64	0	
6/21/2024	South Canal Gatehouse	10:41	10:49	26.1		0	0	0	0	0	
6/21/2024	North Canal Walking Bridge	11:12	11:15	25.8		0	0	0	0	0	
6/21/2024	Lower Gatehouse on North Canal	11:34	11:48	26.5		0	1	0	1	0	
6/24/2024	South Side Ledges	12:08	12:43	22.2	80	24	1	0	25	1	
6/24/2024	South Canal Gatehouse	12:45	13:07	25.1		0	0	0	0	0	
6/24/2024	North Canal Walking Bridge	13:26	13:30	25.1		0	0	0	0	0	
6/24/2024	Lower Gatehouse on North Canal	13:50	14:08	25.9		0	0	1	1	0	
6/26/2024	South Side Ledges	9:21	9:33	20.2	85	10	0	0	10	0	
6/26/2024	South Canal Gatehouse	9:40	9:56	25.3		0	0	0	0	0	
6/26/2024	North Canal Walking Bridge	10:10	10:15	25.2		0	0	0	0	0	Muck on screen
6/26/2024	Lower Gatehouse on North Canal	10:25	10:40	26		0	1	1	2	0	
6/28/2024	South Side Ledges	10:16	10:29	15.5	66	8	2	0	10	1	
6/28/2024	South Canal Gatehouse	10:35	10:40	23.6		0	0	0	0	0	
6/28/2024	North Canal Walking Bridge	11:01	11:04	23.8		0	0	0	0	0	
6/28/2024	Lower Gatehouse on North Canal	No Access to Check				0	0	0	0	0	
7/1/2024	South Side Ledges	11:30	12:10	21.9	77	37	0	0	37	0	
7/1/2024	South Canal Gatehouse	12:12	12:25	24.5		0	0	0	0	0	Eel pot open
7/1/2024	North Canal Walking Bridge	12:40	12:42	25.1		0	0	0	0	0	

		Time		Temperature		Eels Captured					
Date	Location	Time Pulled	Time Deployed	Water (°C)	Air (°F)	0-6" Eels	6-12" Eels	12+" Eels	Total Eels	# Mortalities	Condition of Pots
7/1/2024	Lower Gatehouse on North Canal	12:55	13:10	25.2		0	0	0	0	0	Eel pot open
7/3/2024	South Side Ledges	12:30	12:50	22.9	83	76	0	0	76	0	
7/3/2024	South Canal Gatehouse	13:00	13:14	25.6		0	0	0	0	0	
7/3/2024	North Canal Walking Bridge	13:30	13:40	26.1		0	0	0	0	0	
7/3/2024	Lower Gatehouse on North Canal	13:55	14:15	26.5		0	0	0	0	0	
7/5/2024	South Side Ledges	10:15	10:30	23.5	78	14	0	0	14	0	
7/5/2024	South Canal Gatehouse	10:33	10:42	25.2		0	0	0	0	0	
7/5/2024	North Canal Walking Bridge	10:48	10:54	25.4		0	0	0	0	0	
7/5/2024	Lower Gatehouse on North Canal	11:05	11:18	15.3		0	1	0	1	0	
7/8/2024	South Side Ledges	10:06	10:24	23.1	87	38	0	0	38	2	
7/8/2024	South Canal Gatehouse	10:26	10:35	27.7		0	0	0	0	0	Eel pot open
7/8/2024	North Canal Walking Bridge	10:48	10:52	27.1		0	0	0	0	0	
7/8/2024	Lower Gatehouse on North Canal	9:43	9:54	27.3		0	1	0	1	0	
7/10/2024	South Side Ledges	14:06	14:30	31.4	97	384	0	0	384	3	
7/10/2024	South Canal Gatehouse	No Access to Check - Crane Work				0	0	0	0	0	
7/10/2024	North Canal Walking Bridge	14:50	14:55	29.5		0	0	0	0	0	
7/10/2024	Lower Gatehouse on North Canal	15:07	15:20	29.9		1	0	0	1	0	
7/12/2024	South Side Ledges	17:05	18:05	28.5	89	479	60	0	539	5	
7/12/2024	South Canal Gatehouse	18:35	18:55	29.8		0	0	0	0	0	
7/12/2024	North Canal Walking Bridge	19:10	19:20	26.1		0	0	0	0	0	

		Time		Temperature		Eels Captured					
Date	Location	Time Pulled	Time Deployed	Water (°C)	Air (°F)	0-6" Eels	6-12" Eels	12+" Eels	Total Eels	# Mortalities	Condition of Pots
7/12/2024	Lower Gatehouse on North Canal	19:35	19:55	26.3		0	0	0	0	0	
7/15/2024	South Side Ledges	9:52	10:33	25	100	2777	0	0	2777	2	
7/15/2024	South Canal Gatehouse	10:35	10:57	29.6		0	0	0	0	0	
7/15/2024	North Canal Walking Bridge	11:30	11:35	29.5		0	0	0	0	0	
7/15/2024	Lower Gatehouse on North Canal	11:50	12:10	30.1		2	0	1	3	0	
7/17/2024	South Side Ledges	14:18	14:45	28.6	95	4013	150	15	4178	2	
7/17/2024	South Canal Gatehouse	13:55	14:12	29.6		0	0	0	0	0	
7/17/2024	North Canal Walking Bridge	15:15	15:20	29.7		0	1	0	1	0	
7/17/2024	Lower Gatehouse on North Canal	15:33	15:50	30.3		0	1	0	1	0	
7/19/2024	South Side Ledges	13:10	13:15	28.6	86	2960	15	1	2976	9	
7/19/2024	South Canal Gatehouse	12:29	12:40	29.7		0	0	0	0	0	
7/19/2024	North Canal Walking Bridge	14:35	14:40	29.5		0	0	0	0	0	
7/19/2024	Lower Gatehouse on North Canal	14:52	15:10	29.7		0	0	0	0	0	
7/22/2024	South Side Ledges	9:45	10:12	20.8	86	3006	5	0	3011	0	
7/22/2024	South Canal Gatehouse	9:26	9:35	28.7		0	0	0	0	0	
7/22/2024	North Canal Walking Bridge	10:56	11:02	28.3		0	0	0	0	0	
7/22/2024	Lower Gatehouse on North Canal	11:10	11:21	28.8		0	0	0	0	0	1 Eel pot missing.
7/24/2024	South Side Ledges	14:16	14:37	24	75	413	0	0	413	6	
7/24/2024	South Canal Gatehouse	14:05	14:13	27.3		0	0	0	0	0	
7/24/2024	North Canal Walking Bridge	14:52	14:56	27.1		0	0	0	0	0	

		Time		Temperature		Eels Captured					
Date	Location	Time Pulled	Time Deployed	Water (°C)	Air (°F)	0-6" Eels	6-12" Eels	12+" Eels	Total Eels	# Mortalities	Condition of Pots
7/24/2024	Lower Gatehouse on North Canal	15:06	15:17	28.1		1	2	0	3	0	
7/26/2024	South Side Ledges	13:12	13:35	22.8	82	2109	0	0	2109	5	
7/26/2024	South Canal Gatehouse	14:00	14:12	27.1		0	0	0	0	0	
7/26/2024	North Canal Walking Bridge	14:36	14:40	27		0	0	0	0	0	
7/26/2024	Lower Gatehouse on North Canal	15:00	15:11	27.3		0	0	0	0	0	
7/29/2024	South Side Ledges	10:42	10:56	20.3	70	2701	0	1	2702	4	
7/29/2024	South Canal Gatehouse	10:17	10:33	25.2		0	0	0	0	0	
7/29/2024	North Canal Walking Bridge	11:26	11:30	24.9		0	0	0	0	0	
7/29/2024	Lower Gatehouse on North Canal	11:42	11:52	25.2		0	0	0	0	0	
7/31/2024	South Side Ledges	14:00	14:20	25.3	83	325	0	31	356	8	
7/31/2024	South Canal Gatehouse	No Access to Check - Crane Work				0	0	0	0	0	
7/31/2024	North Canal Walking Bridge	14:35	14:42	27.2		0	0	0	0	0	
7/31/2024	Lower Gatehouse on North Canal	14:57	15:08	27.5		0	0	0	0	0	
8/2/2024	South Side Ledges	9:52	10:08	25.8	83	1540	2	0	1542	13	
8/2/2024	South Canal Gatehouse	9:36	9:45	28.8		0	0	0	0	0	
8/2/2024	North Canal Walking Bridge	10:32	10:35	27.2		0	0	0	0	0	
8/2/2024	Lower Gatehouse on North Canal	10:46	10:50	28.4		0	0	0	0	0	
8/5/2024	South Side Ledges	10:52	11:12	24	81	981	4	0	985	6	
8/5/2024	South Canal Gatehouse	10:36	10:46	27.2		0	0	0	0	0	
8/5/2024	North Canal Walking Bridge	11:36	11:39	26.8		0	0	0	0	0	

		Time		Temperature		Eels Captured					
Date	Location	Time Pulled	Time Deployed	Water (°C)	Air (°F)	0-6" Eels	6-12" Eels	12+" Eels	Total Eels	# Mortalities	Condition of Pots
8/5/2024	Lower Gatehouse on North Canal	12:10	12:15	28.2		0	0	0	0	0	
8/7/2024	South Side Ledges	10:08	11:05	19.8	65	321	1	2	324	7	
8/7/2024	South Canal Gatehouse	11:36	11:48	24.1		0	0	0	0	0	
8/7/2024	North Canal Walking Bridge	12:36	12:38	25.2		0	0	0	0	0	
8/7/2024	Lower Gatehouse on North Canal	12:48	12:57	23.6		0	0	0	0	0	
8/9/2024	South Side Ledges	11:40	12:00	22.1	71	70	0	0	70	3	
8/9/2024	South Canal Gatehouse	11:25	11:35	24.8		0	0	0	0	0	
8/9/2024	North Canal Walking Bridge	12:15	12:18	24.8		0	0	0	0	0	
8/9/2024	Lower Gatehouse on North Canal	12:30	12:40	25.1		0	1	0	1	0	
8/12/2024	South Side Ledges	10:24	10:48	18.2	70	68	1	0	69	3	
8/12/2024	South Canal Gatehouse	10:08	10:20	22.6		0	0	0	0	0	
8/12/2024	North Canal Walking Bridge	10:58	11:00	21.6		0	0	0	0	0	
8/12/2024	Lower Gatehouse on North Canal	11:12	11:16	22		0	0	0	0	0	
8/14/2024	South Side Ledges	20:05	20:22	20.9	73	41	0	0	41	3	
8/14/2024	South Canal Gatehouse	19:50	20:00	25.4		0	1	0	1	0	
8/14/2024	North Canal Walking Bridge	20:35	20:40	24.9		0	0	0	0	0	
8/14/2024	Lower Gatehouse on North Canal	20:52	21:03	24.3		0	0	0	0	0	
8/16/2024	South Side Ledges	12:15	12:18	21.5	77	62	0	0	62	1	
8/16/2024	South Canal Gatehouse	12:00	12:11	23.8		0	0	0	0	0	
8/16/2024	North Canal Walking Bridge	12:40	12:43	24.1		0	0	0	0	0	

		Time		Temperature		Eels Captured					
Date	Location	Time Pulled	Time Deployed	Water (°C)	Air (°F)	0-6" Eels	6-12" Eels	12+" Eels	Total Eels	# Mortalities	Condition of Pots
8/16/2024	Lower Gatehouse on North Canal	12:53	13:04	24.7		0	0	0	0	0	
8/19/2024	South Side Ledges	9:08	9:21	20.7	70	52	0	0	52	4	
8/19/2024	South Canal Gatehouse	8:53	9:03	23.1		0	0	0	0	0	
8/19/2024	North Canal Walking Bridge	9:41	9:44	23.4		0	0	0	0	0	
8/19/2024	Lower Gatehouse on North Canal	9:57	10:04	23.5		0	0	0	0	0	
8/21/2024	South Side Ledges	11:38	11:48	17.3	67	6	0	0	6	1	
8/21/2024	South Canal Gatehouse	11:21	11:32	21.5		0	0	0	0	0	
8/21/2024	North Canal Walking Bridge	11:58	11:02	19.5		0	0	0	0	0	
8/21/2024	Lower Gatehouse on North Canal	12:10	12:15	20.5		0	0	0	0	0	
8/23/2024	South Side Ledges	9:20	9:33	14.1	66	13	0	0	13	0	
8/23/2024	South Canal Gatehouse	9:06	9:16	20		0	0	0	0	0	
8/23/2024	North Canal Walking Bridge	9:50	9:53	21.3		0	0	0	0	0	
8/23/2024	Lower Gatehouse on North Canal	10:03	10:10	21.2		0	0	0	0	0	
8/28/2024	South Side Ledges	11:35		24.4	88	0	0	0	0	0	Eel pot pulled
8/28/2024	South Canal Gatehouse	11:50		24.2		0	0	0	0	0	Eel pot pulled
8/28/2024	North Canal Walking Bridge	12:20		24.2		0	0	0	0	0	Eel pot pulled
8/28/2024	Lower Gatehouse on North Canal	12:30		24.6		0	0	0	0	0	Eel pot pulled

Appendix B: Electrofish Collection Data

Date	Location	Transect	Fish ID	Species	Length (mm)	Weight (g)
7/26/2024	Spicket	1	1	Smallmouth Bass	83	
7/26/2024	Spicket	1	2	Fallfish	55	
7/26/2024	Spicket	1	3	Fallfish	56	
7/26/2024	Spicket	1	4	Fallfish	58	
7/26/2024	Spicket	1	5	Pumpkinseed	115	
7/26/2024	Spicket	1	6	Redbreast Sunfish	112	
7/26/2024	Spicket	1	7	Largemouth Bass	120	
7/26/2024	Spicket	1	8	Bluegill	155	
7/26/2024	Spicket	1	9	Redbreast Sunfish	116	
7/26/2024	Spicket	1	10	Fallfish	55	
7/26/2024	Spicket	1	11	White Sucker	81	
7/26/2024	Spicket	1	12	Fallfish	65	
7/26/2024	Spicket	1	13	Redbreast Sunfish	115	
7/26/2024	Spicket	1	14	Spottail Shiner	54	
7/26/2024	Spicket	1	15	Redbreast Sunfish	115	
7/26/2024	Spicket	1	16	Largemouth Bass	360	
7/26/2024	Spicket	1	17	Bluegill	115	
7/26/2024	Spicket	1	18	Green Sunfish	89	
7/26/2024	Spicket	1	19	Pumpkinseed	83	
7/26/2024	Spicket	1	20	Margined Madtom	90	
7/26/2024	Spicket	1	21	Pumpkinseed	81	
7/26/2024	Spicket	1	22	American Eel	270	45
7/26/2024	Spicket	1	23	American Eel	310	60
7/26/2024	Spicket	1	24	American Eel	360	100
7/26/2024	Spicket	1	25	American Eel	280	45
7/26/2024	Spicket	1	26	American Eel	260	55
7/26/2024	Spicket	1	27	American Eel	60	2
7/26/2024	Spicket	1	28	White Sucker	70	
7/26/2024	Spicket	1	29	American Eel	255	65
7/26/2024	Spicket	1	30	American Eel	285	80
7/26/2024	Spicket	1	31	American Eel	220	45
7/26/2024	Spicket	1	32	American Eel	300	110
7/26/2024	Spicket	1	33	American Eel	230	45
7/26/2024	Spicket	1	34	American Eel	268	85
7/26/2024	Spicket	1	35	American Eel	135	5
7/26/2024	Spicket	1	36	American Eel	275	75
7/26/2024	Spicket	1	37	American Eel	400	135
7/26/2024	Spicket	1	38	American Eel	150	40

Date	Location	Transect	Fish ID	Species	Length (mm)	Weight (g)
7/26/2024	Spicket	1	39	American Eel	240	35
7/26/2024	Spicket	1	40	American Eel	212	50
7/26/2024	Spicket	1	41	American Eel	80	2
7/26/2024	Spicket	1	42	American Eel	410	115
7/26/2024	Spicket	1	43	American Eel	613	1550
7/26/2024	Spicket	1	44	American Eel	545	375
7/26/2024	Spicket	1	45	American Eel	505	325
7/26/2024	Main stem	1	1	Common Carp	660	
7/26/2024	Main stem	1	2	Smallmouth Bass	67	
7/26/2024	Main stem	1	3	Margined Madtom	58	
7/26/2024	Main stem	1	4	American Eel	210	45
7/26/2024	Main stem	1	5	American Eel	280	95
7/26/2024	Main stem	1	6	American Eel	410	105
7/26/2024	Main stem	1	7	American Eel	270	95
7/26/2024	Main stem	1	8	American Eel	160	35
7/26/2024	Main stem	1	9	American Eel	270	70
7/26/2024	Main stem	1	10	American Eel	390	120
7/26/2024	Main stem	1	11	American Eel	260	35
7/26/2024	Main stem	1	12	American Eel	390	150
7/26/2024	Main stem	1	13	American Eel	370	105
7/26/2024	Main stem	1	14	American Eel	620	650
7/26/2024	Main stem	1	15	American Eel	480	280
7/26/2024	Main stem	1	16	American Eel	410	115
7/26/2024	Main stem	1	17	American Eel	542	405
7/26/2024	Main stem	1	18	American Eel	540	275
7/26/2024	Main stem	2	1	Common Carp	620	
7/26/2024	Main stem	2	2	Common Carp	535	
7/26/2024	Main stem	2	3	White Sucker	425	
7/26/2024	Main stem	2	4	American Eel	330	95
7/26/2024	Main stem	2	5	American Eel	390	95
7/26/2024	Main stem	2	6	American Eel	500	155
7/26/2024	Main stem	3	1	American Eel	220	60
7/26/2024	Main stem	3	2	Alewife	75	
7/26/2024	Main stem	3	3	Smallmouth Bass	302	
7/26/2024	Main stem	3	4	White Sucker	475	
7/26/2024	Main stem	3	5	American Eel	270	70
7/26/2024	Main stem	3	6	American Eel	275	100
7/26/2024	Main stem	4	1	White Sucker	470	
7/26/2024	Main stem	4	2	White Sucker	470	
7/26/2024	Main stem	4	3	White Sucker	475	

Date	Location	Transect	Fish ID	Species	Length (mm)	Weight (g)
7/26/2024	Main stem	4	4	American Eel	275	100
7/26/2024	Main stem	4	5	American Eel	288	100
7/26/2024	Main stem	4	6	American Eel	210	55
7/26/2024	Main stem	4	7	American Eel	270	110
7/26/2024	Main stem	5	1	Common Carp	820	
7/26/2024	Main stem	5	2	White Sucker	473	
7/26/2024	Main stem	5	3	American Eel	160	45
7/26/2024	Main stem	5	4	American Eel	300	110
7/26/2024	Main stem	5	5	American Eel	290	105
7/26/2024	Main stem	5	6	American Eel	210	50
7/26/2024	Main stem	5	7	American Eel	185	10
7/26/2024	Main stem	6	1	White Sucker	420	
7/26/2024	Main stem	6	2	Smallmouth Bass	77	
7/26/2024	Main stem	6	3	Smallmouth Bass	95	
7/26/2024	Main stem	6	4	Smallmouth Bass	235	
7/26/2024	Main stem	6	5	American Eel	160	20
7/26/2024	Main stem	6	6	American Eel	260	60
7/26/2024	Main stem	6	7	American Eel	284	100
7/26/2024	Main stem	6	8	American Eel	290	115
7/26/2024	Main stem	6	9	American Eel	285	100
8/8/2024	North Canal	1	1	American Eel	172	
8/8/2024	North Canal	1	2	American Eel	180	
8/8/2024	North Canal	1	3	American Eel	83	
8/8/2024	North Canal	1	4	American Eel	192	
8/8/2024	North Canal	1	5	American Eel	190	
8/8/2024	North Canal	1	6	American Eel	200	
8/8/2024	North Canal	1	7	American Eel	240	
8/8/2024	North Canal	1	8	American Eel	260	
8/8/2024	North Canal	1	9	American Eel	380	
8/8/2024	North Canal	1	10	American Eel	270	
8/8/2024	North Canal	1	11	American Eel	150	
8/8/2024	North Canal	1	13	Bluegill		
8/8/2024	North Canal	1	14	Bluegill		
8/8/2024	North Canal	1	15	Bluegill		
8/8/2024	North Canal	1	16	Pumpkinseed		
8/8/2024	North Canal	1	17	Pumpkinseed		
8/8/2024	North Canal	1	18	Pumpkinseed		
8/8/2024	North Canal	1	19	Pumpkinseed		
8/8/2024	North Canal	1	20	Pumpkinseed		
8/8/2024	North Canal	1	21	Pumpkinseed		

Date	Location	Transect	Fish ID	Species	Length (mm)	Weight (g)
8/8/2024	North Canal	1	22	Green Sunfish		
8/8/2024	North Canal	2	1	American Eel	185	
8/8/2024	North Canal	2	2	American Eel	113	
8/8/2024	North Canal	2	3	American Eel	150	
8/8/2024	North Canal	2	4	American Eel	240	
8/8/2024	North Canal	2	5	American Eel	110	
8/8/2024	North Canal	2	6	American Eel	360	
8/8/2024	North Canal	2	7	American Eel	173	
8/8/2024	North Canal	2	8	American Eel	310	
8/8/2024	North Canal	2	9	American Eel	115	
8/8/2024	North Canal	2	10	American Eel	300	
8/8/2024	North Canal	2	11	American Eel	320	
8/8/2024	North Canal	2	12	American Eel	262	
8/8/2024	North Canal	2	13	American Eel	112	
8/8/2024	North Canal	2	14	American Eel	160	
8/8/2024	North Canal	2	15	American Eel	225	
8/8/2024	North Canal	2	16	American Eel	290	
8/8/2024	North Canal	2	17	American Eel	320	
8/8/2024	North Canal	2	18	American Eel	280	
8/8/2024	North Canal	2	19	American Eel	300	
8/8/2024	North Canal	2	20	American Eel	160	
8/8/2024	North Canal	2	21	American Eel	258	
8/8/2024	North Canal	2	22	American Eel	76	
8/8/2024	North Canal	2	23	American Eel	320	
8/8/2024	North Canal	2	24	American Eel	293	
8/8/2024	North Canal	2	25	American Eel	270	
8/8/2024	North Canal	2	26	American Eel	70	
8/8/2024	North Canal	2	27	American Eel	225	
8/8/2024	North Canal	2	28	American Eel	287	
8/8/2024	North Canal	2	29	American Eel	300	
8/8/2024	North Canal	2	30	American Eel	295	
8/8/2024	North Canal	2	31	American Eel	280	
8/8/2024	North Canal	2	33	Bluegill		
8/8/2024	North Canal	2	34	Largemouth Bass		
8/8/2024	North Canal	2	35	Largemouth Bass		
8/8/2024	North Canal	2	36	Smallmouth Bass		
8/8/2024	North Canal	2	37	Smallmouth Bass		
8/8/2024	North Canal	2	38	Pumpkinseed		
8/8/2024	North Canal	3	1	American Eel	175	
8/8/2024	North Canal	3	2	American Eel	230	

Date	Location	Transect	Fish ID	Species	Length (mm)	Weight (g)
8/8/2024	North Canal	3	3	American Eel	225	
8/8/2024	North Canal	3	4	American Eel	215	
8/8/2024	North Canal	3	5	American Eel	130	
8/8/2024	North Canal	3	6	American Eel	165	
8/8/2024	North Canal	3	7	American Eel	300	
8/8/2024	North Canal	3	8	American Eel	295	
8/8/2024	North Canal	3	9	American Eel	175	
8/8/2024	North Canal	3	10	American Eel	230	
8/8/2024	North Canal	3	11	American Eel	110	
8/8/2024	North Canal	3	12	American Eel	290	
8/8/2024	North Canal	3	13	American Eel	290	
8/8/2024	North Canal	3	14	American Eel	230	
8/8/2024	North Canal	3	15	American Eel	160	
8/8/2024	North Canal	3	16	American Eel	235	
8/8/2024	North Canal	3	17	American Eel	282	
8/8/2024	North Canal	3	18	American Eel	265	
8/8/2024	North Canal	3	19	American Eel	280	
8/8/2024	North Canal	3	20	American Eel	275	
8/8/2024	North Canal	3	21	American Eel	240	
8/8/2024	North Canal	3	22	American Eel	255	
8/8/2024	North Canal	3	23	American Eel	185	
8/8/2024	North Canal	3	24	American Eel	237	
8/8/2024	North Canal	3	25	American Eel	240	
8/8/2024	North Canal	3	26	American Eel	235	
8/8/2024	North Canal	3	27	American Eel	190	
8/8/2024	North Canal	3	28	American Eel	275	
8/8/2024	North Canal	3	29	American Eel	255	
8/8/2024	North Canal	3	30	American Eel	215	
8/8/2024	North Canal	3	32	Bluegill		
8/8/2024	North Canal	3	33	Bluegill		
8/8/2024	North Canal	3	34	Bluegill		
8/8/2024	North Canal	3	35	Bluegill		
8/8/2024	North Canal	3	36	Largemouth Bass		
8/8/2024	North Canal	3	37	Largemouth Bass		
8/8/2024	North Canal	3	38	Largemouth Bass		
8/8/2024	North Canal	3	39	Green Sunfish		
8/8/2024	North Canal	3	40	Green Sunfish		
8/21/2024	Spicket	1	1	Bluegill	159	
8/21/2024	Spicket	1	2	Bluegill	160	
8/21/2024	Spicket	1	3	Spottail Shiner	77	

Date	Location	Transect	Fish ID	Species	Length (mm)	Weight (g)
8/21/2024	Spicket	1	4	Redbreast Sunfish	53	
8/21/2024	Spicket	1	5	Spottail Shiner	63	
8/21/2024	Spicket	1	6	Spottail Shiner	68	
8/21/2024	Spicket	1	7	Spottail Shiner	66	
8/21/2024	Spicket	1	8	Spottail Shiner	67	
8/21/2024	Spicket	1	9	Spottail Shiner	58	
8/21/2024	Spicket	1	10	Spottail Shiner	72	
8/21/2024	Spicket	1	11	Golden Shiner	73	
8/21/2024	Spicket	1	12	Spottail Shiner	55	
8/21/2024	Spicket	1	13	Tessellated Darter	66	
8/21/2024	Spicket	1	14	Spottail Shiner	59	
8/21/2024	Spicket	1	15	Golden Shiner	83	
8/21/2024	Spicket	1	16	Spottail Shiner	69	
8/21/2024	Spicket	1	17	Spottail Shiner	66	
8/21/2024	Spicket	1	18	Spottail Shiner	60	
8/21/2024	Spicket	1	19	Green Sunfish	108	
8/21/2024	Spicket	1	20	Spottail Shiner	63	
8/21/2024	Spicket	1	21	Green Sunfish	147	
8/21/2024	Spicket	1	22	Spottail Shiner	74	
8/21/2024	Spicket	1	23	Spottail Shiner	65	
8/21/2024	Spicket	1	24	White Sucker	93	
8/21/2024	Spicket	1	25	Margined Madtom	95	
8/21/2024	Spicket	1	26	Redbreast Sunfish	111	
8/21/2024	Spicket	1	27	Spottail Shiner	65	
8/21/2024	Spicket	1	28	Tessellated Darter	50	
8/21/2024	Spicket	1	29	White Sucker	87	
8/21/2024	Spicket	1	30	Margined Madtom	56	
8/21/2024	Spicket	1	31	Redbreast Sunfish	54	
8/21/2024	Spicket	1	32	Margined Madtom	107	
8/21/2024	Spicket	1	33	White Sucker	92	
8/21/2024	Spicket	1	34	Redbreast Sunfish	56	
8/21/2024	Spicket	1	35	Tessellated Darter	56	
8/21/2024	Spicket	1	36	American Eel	325	
8/21/2024	Spicket	1	37	American Eel	98	
8/21/2024	Spicket	1	38	American Eel	88	
8/21/2024	Spicket	1	39	Sea Lamprey	128	
8/21/2024	Spicket	1	40	American Eel	310	
8/21/2024	Spicket	1	41	American Eel	331	
8/21/2024	Spicket	1	42	American Eel	310	
8/21/2024	Spicket	1	43	American Eel	104	

Date	Location	Transect	Fish ID	Species	Length (mm)	Weight (g)
8/21/2024	Spicket	1	44	American Eel	273	
8/21/2024	Spicket	1	45	American Eel	71	
8/21/2024	Spicket	1	46	American Eel	87	
8/21/2024	Spicket	1	47	American Eel	89	
8/21/2024	Spicket	1	48	Sea Lamprey	131	
8/21/2024	Spicket	1	49	American Eel	156	
8/21/2024	Spicket	1	50	American Eel	225	
8/21/2024	Spicket	1	51	American Eel	182	22
8/21/2024	Spicket	1	52	American Eel	179	21
8/21/2024	Spicket	1	53	American Eel	180	18
8/21/2024	Spicket	1	54	American Eel	229	23
8/21/2024	Spicket	1	55	American Eel	139	11
8/21/2024	Spicket	1	56	American Eel	73	1
8/21/2024	Spicket	1	57	American Eel	105	1
8/21/2024	Main stem	1	1	Smallmouth Bass	99	
8/21/2024	Main stem	1	2	Smallmouth Bass	124	
8/21/2024	Main stem	1	3	Smallmouth Bass	111	
8/21/2024	Main stem	1	4	Smallmouth Bass	124	
8/21/2024	Main stem	1	5	White Sucker	467	
8/21/2024	Main stem	1	6	American Eel	324	63
8/21/2024	Main stem	1	7	American Eel	232	40
8/21/2024	Main stem	1	8	American Eel	224	32
8/21/2024	Main stem	1	9	American Eel	520	414
8/21/2024	Main stem	2	1	Common Carp	747	
8/21/2024	Main stem	2	2	Common Carp	661	
8/21/2024	Main stem	2	3	White Sucker	432	
8/21/2024	Main stem	2	4	Fallfish	89	
8/21/2024	Main stem	2	5	Spottail Shiner	70	
8/21/2024	Main stem	2	6	American Eel	219	
8/21/2024	Main stem	2	7	American Eel	240	
8/21/2024	Main stem	2	8	American Eel	302	
8/21/2024	Main stem	3	1	Smallmouth Bass	428	
8/21/2024	Main stem	3	2	Common Carp	750	
8/21/2024	Main stem	3	3	Common Carp	627	
8/21/2024	Main stem	3	4	Smallmouth Bass	208	
8/21/2024	Main stem	3	5	Alewife	88	
8/21/2024	Main stem	3	6	Alewife	86	
8/21/2024	Main stem	3	7	American Eel	505	266
8/21/2024	Main stem	3	8	American Eel	361	122
8/21/2024	Main stem	4	1	Common Carp	509	

Date	Location	Transect	Fish ID	Species	Length (mm)	Weight (g)
8/21/2024	Main stem	4	2	American Eel	308	86
8/21/2024	Main stem	4	3	American Eel	101	2
8/21/2024	Main stem	5	1	Common Carp	660	
8/21/2024	Main stem	5	2	Common Carp	599	
8/21/2024	Main stem	5	3	Smallmouth Bass	115	
8/21/2024	Main stem	5	4	Alewife	93	
8/21/2024	Main stem	5	5	Alewife	85	
8/21/2024	Main stem	5	6	Smallmouth Bass	109	
8/21/2024	Main stem	5	7	Smallmouth Bass	110	
8/21/2024	Main stem	5	8	Largemouth Bass	84	
8/21/2024	Main stem	5	9	Smallmouth Bass	90	
8/21/2024	Main stem	5	10	Smallmouth Bass	131	
8/21/2024	Main stem	5	11	Smallmouth Bass	169	
8/21/2024	Main stem	5	12	Smallmouth Bass	119	
8/21/2024	Main stem	5	13	Bluegill	128	
8/21/2024	Main stem	5	14	Pumpkinseed	134	
8/21/2024	Main stem	5	15	Bluegill	121	
8/21/2024	Main stem	5	16	Redbreast Sunfish	151	
8/21/2024	Main stem	5	17	American Eel	292	75
8/21/2024	Main stem	5	18	American Eel	294	80
8/21/2024	Main stem	5	19	American Eel	282	40
8/21/2024	Main stem	5	20	American Eel	295	71
8/21/2024	Main stem	5	21	American Eel	278	60
8/21/2024	Main stem	6	1	Smallmouth Bass	89	
8/21/2024	Main stem	6	2	Yellow Bullhead	207	
8/21/2024	Main stem	6	3	American Eel	267	65
8/21/2024	Main stem	6	4	American Eel	395	150
8/21/2024	Main stem	6	5	American Eel	343	89
8/21/2024	Main stem	6	6	American Eel	420	160
8/21/2024	Main stem	6	7	American Eel	311	75
8/21/2024	Main stem	6	8	American Eel	625	780

Appendix C: Correspondence Following the June 6, 2024 MRTC Site Visit

From: Drew Trested <dtrested@normandeau.com>
Sent: Wednesday, June 12, 2024 3:22 PM
To: Hogan, Kenneth J <kenneth_hogan@fws.gov>; Carpenter, Matthew <matthew.carpenter@wildlife.nh.gov>; Smithwood, Doug <doug_smithwood@fws.gov>
Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>; Gibson, Jim <jim.gibson@hdrinc.com>; Sean Stimmell <sstimmell@normandeau.com>; Curtis Mooney <cmooney@patriothydro.com>
Subject: Lawrence - American Eel Upstream Passage Siting Study - site visit follow up

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Good afternoon –

We are following up on our discussion during the June 6 site visit at Lawrence to review sampling proposed as part of the *American Eel Upstream Passage Siting Study*. The RSP for this effort included descriptions for (1) nighttime visual surveys, (2) electrofish surveys, and (3) temporary ramp traps. Based on site logistics, our group discussion on the overall goal of this study (i.e., identify the potential need for additional upstream passage in locations currently without [e.g. North and South canal]), and follow up discussions on safety and access with the Project operations group we are proposing the following approach to collect this data:

Nighttime visual surveys:

- Will conduct as described in RSP once weekly for ten weeks (starting week of June 17)
- Will focus on areas not currently covered by existing upstream eel passes
    - South canal gatehouse (*Project ops to evaluate whether floor hatch can be safely accessed to allow for camera observations, Project ops will not allow access on ladder or lower gatehouse platform),
    - South canal walls on area immediately downstream of gatehouse,
    - North canal outlet (from wood bridge to look at the three outlet channels on DS side and along structures on the US side),
    - North canal gatehouse downstream side as best we can see,
    - North canal gatehouse US side on canal walls immediately upstream of structure,
    - Tailrace (as viewed from overhead walkways).

Temporary Ramp Traps:

- Not proposing to install temporary ramps at any of the three locations described in RSP due to poor siting conditions, etc.
- Instead of temporary eel ramps, the project will substitute baited eel traps
    - Will conduct over the 10-week period as described in RSP – with trap checks occurring 3x per week
    - Traps will be baited and lined with 1/8” screening to facilitate retention of smaller bodied eels
    - Will deploy:
        - Immediately downstream of south canal gatehouse
        - Immediately upstream of north canal outlet gates
        - In nearfield area downstream of north canal gatehouse

- In pool habitat adjacent to the entrance to south side eel ramp (will serve as a control site to confirm trap success in area of known eels)

Electrofishing:

- Will conduct electrofish sampling as described in RSP to cover Merrimack River from dam down to Spicket River and Spicket River up to north canal discharge
- Will supplement with backpack efish events to cover:
  - Walkable lower section of North Canal
  - South canal (as deployed from an inflatable raft)
  - These two areas will be sampled on a single date each during summer 2024 during the 10-week period of eel traps.

We are looking for feedback on the proposed, modified approach to collection of this data. Ideally Normandeau staff would like to kick off the ten week sampling period next week (i.e., June 17) to meet the RSP stated study timing of "early June".

Please let us know if you have any questions.

Thanks,
Drew

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From: Carpenter, Matthew <mathew.a.carpenter@wildlife.nh.gov>
Sent: Monday, June 17, 2024 12:07 PM
To: Drew Trested <dtrested@normandeau.com>; Hogan, Kenneth J <kenneth_hogan@fws.gov>; Smithwood, Doug <doug_smithwood@fws.gov>
Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>; Gibson, Jim <jim.gibson@hdrinc.com>; Sean Stimmell <sstimmell@normandeau.com>; Curtis Mooney <cmooney@patriothydro.com>
Subject: RE: Lawrence - American Eel Upstream Passage Siting Study - site visit follow up

Hi Drew,

Thanks for this summary. I think this captures most of what we discussed on site. I just have a few comments/suggestions.

We discussed safety and logistical concerns around setting up temporary eel ramps at the gatehouses. If eels are found to be in the canals, these are the areas where we would likely be looking at eel passage, so it would be good to try to think about how we would access these areas in the future. We were not able to get into the gatehouses during our site visit. I think it will be important to figure out how to safely get some good visual survey data from the gatehouses. I think the camera idea has potential, but if there is no way to regularly access the ladders or lower walkways in the gatehouses then we should confirm whether surveys can be effectively done from the upper walkways or whether some other approach would be feasible.

We were on site while the south canal had been drained last Thursday (see pics below). Although more silty than the substrate in the north canal, it did look possible to electrofish (first pic). It also looked like the flashboards under the gatehouse could be approached for a nighttime visual survey. A visual survey below the gatehouse that takes place a few nights after the canal is drained may be an effective method for confirming the presence of elvers in the canal as they will likely be attempting to climb the flashboards. I would recommend doing this during the drawdown for the one day of electrofishing, but I think that it could potentially be such an effective method that it would probably be worth doing multiple times. Maybe once in early July and again in early August. This would be in addition to visual surveys at the gatehouse under normal conditions, since we would still want to know if eels are able to access the area below the gatehouse when the canal is under typical operating conditions. I am not sure whether this approach of visual surveys a few nights after dewatering would be feasible below the gatehouse of the north canal, but I think it would be worth looking in to.

I think the combination of electrofishing and screened, baited eel pots will do a good job of confirming the presence of eels in the canals along with some idea of the size distribution. We discussed trying to reduce the flow in the north canal using bark mulch or other methods do reduce leakage. I would recommend trying to reduce the flow for a day before you plan the electrofishing survey. That way you could see if it works and then choose appropriate locations for electrofishing based on the flow conditions that you will expect to see during the survey. You also mentioned a raft in the south canal. Is this an electrofishing raft or do you plan to use the raft to access areas for backpack electrofishing?

Thanks,

Matt

From: Drew Trested <dtrested@normandeau.com>
Sent: Tuesday, June 18, 2024 12:51 PM
To: Carpenter, Matthew <mathew.a.carpenter@wildlife.nh.gov>; Hogan, Kenneth J <kenneth_hogan@fws.gov>; Smithwood, Doug <doug_smithwood@fws.gov>
Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>; Gibson, Jim <jim.gibson@hdrinc.com>; Sean Stimmell <sstimmell@normandeau.com>; Curtis Mooney <cmooney@patriothydro.com>
Subject: RE: Lawrence - American Eel Upstream Passage Siting Study - site visit follow up

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Hi Matt –

Thanks for the responses. We have reviewed the thoughts you provided on the upstream eel siting study.

It seems that we agree with the use of the use of baited eel pots to confirm the potential presence of eels within either of the two canals. Normandeau intends to install a total of four baited pots at each of the four sample locations the second half of this week (16 total traps). As described in our site visit notes, these will be set (1) immediately downstream of south canal gatehouse, (2) immediately upstream of north canal outlet gates, (3) in nearfield area downstream of north canal gatehouse, and (4) in pool habitat adjacent to the entrance to south side eel ramp (will serve as a control site to confirm trap success in area of known eels). We will run these for the ten-week period, checking them up to three times per week. Concurrent with the traps will be the once weekly nighttime surveys. Those will focus on the list of sites below (as discussed during and summarized following our site visit). Normandeau staff will document weekly the areas that were visually surveyed as well as site conditions as described in the RSP.

With regards to access into the gatehouses. It is Essex's intent at this time to first conduct the eel pots, visual surveys, and backpack electrofish efforts in the canals during 2024. In the event that eels are present in either or both canal structures then effort can be put into evaluating safe access for future efforts there.

Specific to the south canal, your photographs capture the major safety consideration with access into this reach and that is the lack of egress for any foot-based staff in that reach in the event of an opening or breach of a gate at the south gatehouse. The steep walls lining this canal do not allow for the rapid movement of staff out in the event of an emergency and due to this, access by foot into the south canal is a definite no from a safety perspective. To your question below, our efish effort proposed for the south canal will utilize backpack electrofisher(s) deployed by staff in a raft (not a true efish raft). There is less safety concern with egress in the North Canal (particularly the lower section) where the bank angle is much gentler and crews on foot will be able to easily enter and exit.

As summarized in the site visit notes, Essex is proposing to collect backpack efish data from the walkable lower section of North Canal and South canal (as deployed from an inflatable raft). The final extent of the reach surveyed in each canal will be marked by GPS and site conditions

photographed for the study report. During the site visit Essex noted that each canal would be sampled once during the ten-week monitoring period.

Drew

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From: Hogan, Kenneth J <kenneth_hogan@fws.gov>
Sent: Tuesday, June 18, 2024 2:08 PM
To: Drew Trested <dtrested@normandeau.com>; Carpenter, Matthew <mathew.a.carpenter@wildlife.nh.gov>; Smithwood, Doug <doug_smithwood@fws.gov>
Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>; Gibson, Jim <jim.gibson@hdrinc.com>; Sean Stimmell <sstimmell@normandeau.com>; Curtis Mooney <cmooney@patriothydro.com>
Subject: RE: [EXTERNAL] RE: Lawrence - American Eel Upstream Passage Siting Study - site visit follow up

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Hi Drew,

Thanks for the follow-up and details of Essex Company's proposed variance for the *American Eel Upstream Passage Siting Study*. At this time, the U.S. Fish and Wildlife Service does not have a concern with the proposed variance. We simply ask that implementation of the study and any variance, consider and meet the goals and objectives of the study. We look forward to the Initial Study Report.

Sincerely,

Ken

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From: Carpenter, Matthew <mathew.a.carpenter@wildlife.nh.gov>
Sent: Thursday, June 20, 2024 9:52 AM
To: Drew Trested <dtrested@normandeau.com>; Hogan, Kenneth J <kenneth_hogan@fws.gov>; Smithwood, Doug <doug_smithwood@fws.gov>
Cc: Kevin Webb <kwebb@patriothydro.com>; Richard Malloy <RMalloy@patriothydro.com>; Iffert, Kelsey <Kelsey.Iffert@hdrinc.com>; Gibson, Jim <jim.gibson@hdrinc.com>; Sean Stimmell <sstimmell@normandeau.com>; Curtis Mooney <cmooney@patriothydro.com>
Subject: RE: Lawrence - American Eel Upstream Passage Siting Study - site visit follow up

Hi Drew,
I understand the safety concern in the south canal. That makes sense. Here are my final comments on the study plan based on our last conversation:

Given the challenges of accessing and observing eels at the gatehouses under normal operating conditions, timing one of the weekly night time visual surveys to coincide with the canal drawdowns for electrofishing will probably offer one of the best opportunities for seeing eels under a reduced flow/leakage condition. Hopefully the upper platforms can be safely accessed for viewing the wetted surfaces at the head end of each canal.

I like the idea of using a raft in the south canal. The bottom substrate looks hard, but a layer of silt on top would likely get kicked up while electrofishing on foot. Shocking from a raft will definitely help with visibility.

I think the eel pots will work well within the confined area of the canals. It may take a little trial and error in terms of bait and other details, but hopefully you will be able to quickly dial that in using the control pots below the dam.

The leakage flow at the north canal gatehouse is much greater than the leakage in the south canal when the canals are drained. Electrofishing in the north canal looked doable, but challenging, under the flow conditions that we observed on our site visit. If eels are present, you will likely see them, but they will be difficult to capture. Any reduction in the leakage flow at the gatehouse will significantly improve electrofishing capture efficiency in the north canal.

That's about it. If there are eels in the canals, I think this combination of methods should find them.

Matt