

Relicensing Study 3.3.2

EVALUATE UPSTREAM AND DOWNSTREAM PASSAGE OF ADULT AMERICAN SHAD

Updated Study Report Summary

Northfield Mountain Pumped Storage Project (No. 2485)
and Turners Falls Hydroelectric Project (No. 1889)

Prepared for:



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SEPTEMBER 2015

1.1 Study Summary

The purpose of this study is to evaluate upstream and downstream adult shad passage through the Turners Falls and Northfield Mountain Project areas during their seasonal spawning migration.

In 2015, FirstLight conducted a telemetry study employing radio and passive integrated transponder (PIT) technologies to assess behavior, approach routes, passage success, survival, and delay by adult American shad as they encounter the Turners Falls and Northfield Mountain Projects during both upstream and downstream migration. The study was designed to identify the effects of the Turners Falls and Northfield Mountain Projects on adult shad migration with the following specific objectives:

- Describe the effectiveness of the Cabot fish ladder;
- Evaluate attraction, entrance efficiency and internal efficiency of the Gatehouse ladder;
- Identify migration delays resulting from operation of the Turners Falls Project;
- Determine route selection and behavior of upstream migrating shad at the Turners Falls Project under various spill flow levels;
- Evaluate attraction, entrance efficiency and internal efficiency of the Spillway ladder for shad reaching the dam spillway, under a range of spill conditions;
- Evaluate migration through the Turners Falls Impoundment (TFI);
- Identify impacts of Northfield Mountain, Cabot Station and Station No. 1 operations on upstream and downstream adult shad migration, including delays, entrainment, behavioral changes and migration direction shifts.
- Determine downstream passage route selection, timing/delay, and survival at Turners Falls Dam; and
- Determine passage rates and routes taken by shad migrating downstream through the canal, and evaluate Cabot Station fish bypass effectiveness.

Consultation: On February 21, 2014, the Federal Energy Regulatory Commission (FERC) issued its second Study Plan Determination Letter (SPDL), which amended the revised study plan (RSP). In the SPDL FERC included the Cabot Canal receiver layout. On November 17, 2014, FirstLight held a stakeholder meeting to discuss study plans that included radio telemetry components. During the meeting several of the stakeholders indicated that they would like to relocate four (4) of the radio telemetry receivers from the Cabot Canal to elsewhere. There was a consensus among the group that there were redundant receivers in the Cabot Canal and relocating these receivers would provide improved detection at the Cabot and Spillway Ladder entrances and in the vicinity of the confluence of the Turners Falls Dam bypass reach and the Cabot Station tailrace area. In a letter to FERC dated December 8, 2014, FirstLight requested concurrence with the proposed alteration to the study design. In FERC's January 22, 2015 Determination on Requests for Study Modifications and New Studies, it approved Study No. 3.3.2 proposed changes to the study plan. On March 24, 2015, FirstLight held a meeting with stakeholders to further discuss Study No. 3.3.2, along with many other studies. The purpose of the meeting was to finalize the flow releases and logistics for the field work. It was agreed that a small group of stakeholders from USFWS, MADFW and NMFS would be available to discuss study flow releases during the study.

1.2 Study Progress Summary

Task 1: Review Existing Information

Data have already been collected at the Turners Falls Project from multiple years of passage assessments conducted for FirstLight by Conte Lab researchers. Data were also collected in 2011 and 2012 during a USFWS shad telemetry study conducted over the full range of their Connecticut River migration season from the mouth of the river to above Vernon Dam. Review of the data has led to a collaborative effort

between Conte Lab and FirstLight to develop more rapid telemetry data reduction techniques. This effort led to the development of new data analysis techniques that will be used to analyze the telemetry data collected during this study.

Task 2: Study Design and Methods

The study was designed to monitor shad migration within the study area using a combination of active and passive telemetry techniques. Adult shad used in the evaluation were collected at the upstream fish passage facilities at the Holyoke Project and within the Cabot Ladder at the Turners Falls Project using the existing fish trapping facilities. Shad tagging at Holyoke consisted of multiple cohorts that were released in the Holyoke fishway exit flume as well as cohorts that were transported upstream and released in the TFI, approximately 1200 ft upstream of the Turners Falls Dam. Shad tagging at Cabot consisted of multiple cohorts that were tagged and released in the Cabot power canal, immediately upstream of the fishway exit, and within the TFI, approximately 1200 ft upstream of the Turners Dam. Tagging occurred over the course of 12 days in the months of May and June, 2015 with approximately half of the shad tagged with radio and PIT tags (double tagged) (n=397) and half tagged with PIT only (n=396). The release of tagged fish coincided well with the passage of shad and about half the tagged fish had been released into the Turners Falls canal around the time half the fish had passed through the Gatehouse. A total of 793 adult shad were collected, tagged and released as summarized in [Table 1](#).

Table 1. Adult shad collection and tagging summary table.

Date of Collection/Release	Collection Location	Release Location	Number of Double Tagged Shad	Number of PIT only Shad	Total Tagged and Released
5/6/15	Holyoke	Holyoke	72	1	73
5/7/15	Holyoke	Holyoke	0	72	72
5/12/15	Holyoke	Holyoke	48	1	49
5/13/15	Holyoke	Holyoke	0	47	47
	Cabot	Canal	25	25	50
5/15/15	Holyoke	TFI	33	29	62
5/16/15	Cabot	TFI	33	33	66
5/18/15	Cabot	Canal	0	25	25
5/19/15	Holyoke	Holyoke	48	48	96
	Cabot	Canal	25	0	25
5/22/15	Holyoke	Impoundment	33	33	66
5/23/15	Cabot	TFI	33	33	66
5/26/15	Holyoke	Holyoke	24	24	48
6/8/15	Holyoke	Holyoke	23	25	48
Totals			397	396	793

Radio tags were inserted into the gut through the throat, and PIT tags were inserted into the peritoneal cavity through a small incision on the ventral side, anterior to the anal vent. Data were recorded in a dedicated field book and included water quality, and general weather conditions as well as shad gender, total length, condition and tag identification numbers for each tagged shad. Only those shad that exhibited vigor were tagged.

Fish Monitoring

Prior to the release of test fish, stationary monitoring locations were established at an adequate resolution to meet the study objectives. [Table 2](#) summarizes the stationary monitoring locations as well as the equipment employed in the study.

Table 2. Stationary Monitoring Stations at the Turners Falls and Northfield Mountain Projects

Location	RM	Receiver Station
Red Cliffe Canoe Club (upstream of Holyoke Dam)	86.5	An Lotek receiver with double three element yagi antennae monitor the full width of the River
Sunderland Route 116 Bridge	111	A Lotek receiver with double three element yagi antennae and signal amplification monitored the full width of the River.
Montague Wastewater	119.5	A Lotek receiver with double 3-element yagi antennae monitored the full width of the River
Deerfield River Confluence	119.5	An Orion receiver with a 3-element yagi antenna monitored the full width of the Deerfield River upstream of its confluence
Cabot Station Tailrace	120	Two radio receivers monitored the tailrace area;
		1) A Lotek receiver with double 3- element yagi antennae monitored the full river width (far field)
		2) An Orion with double 3-element yagi antennae monitored attraction to the Cabot Station tailwater (near field)
Smead Island	120	An Orion receiver with yagi antenna monitored the west channel of Smead Island.
Cabot Station Forebay	120	Two radio receivers and one PIT receiver monitored the Forebay area;
		1) An Orion with double 3-element yagi antennae monitored the full width of the canal immediately upstream of the Cabot station
		2) An Orion with a dipole antenna and PIT reader monitored the entrance to the Cabot downstream fish bypass
Cabot Fish Ladder	120	Radiotelemetry and PIT telemetry was used to monitor the ladder. An Orion receiver employing an underwater dipole antenna monitored attraction to the fishway entrance. A second Orion and dropper antenna was located upstream of the ladder entrance to confirm entrance into the fishway. Two PIT readers monitored the entrance (1) and exit (1) to the ladder.
Conte Intake Area	120.3	An Orion receiver with yagi antenna monitored the full width of the canal at the intake.
Conte Discharge	120.3	An Orion receiver with yagi antenna monitored the full width of the bypass reach approximately 700 ft upstream of the Conte discharge.
Rawson Island	120.5	The North and South channel were monitored independently using an Orion receiver employing antenna switching.
Lower Power Canal	120.6	An Orion receiver employing a yagi antenna monitored the full width of the canal.
Downstream of Station 1 Canal	120.8	An Orion receiver employing a yagi antenna monitored the full width of the canal downstream of the Station 1 canal in the vicinity of 10th Street.
Station 1 Forebay	121	An Orion with yagi antenna monitored the full width of the intake canal

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Location	RM	Receiver Station
Station 1 Tailrace	121	A Lotek with double three element yagi antenna monitored the tailrace area. The detection zone monitor the full width of the bypass reach. A detection power analysis will differentiate those test fish that are attracted to the tailwater from those that continue upstream
Upper End of the Canal	122	An Orion with a yagi antenna monitored the full width of the canal downstream of the Gatehouse
Turners Falls Spillway Ladder	122	An Orion receiver employing a dipole antenna and PIT were used to monitor the entrance. PIT was used at all other ladder locations including: 1) between the ladder entrance and first turn pool, 2-3) at the first and second turning pools, 4) at the counting window, and 5) at the exit where the spillway ladder transitions into the gatehouse ladder.
Below Turners Falls Dam	122	Two Orion receivers with yagi antennas monitored the area below the dam, one on either side of the river bank such that approach to the dam could be differentiated from either the right or left sides of the River
Gatehouse Ladder	122	Four PIT receivers monitored the Gatehouse Ladder;
		1) Entrance
		2) First vertical slot
		3) Viewing window
4) Last vertical slot		
Immediately downstream of Gatehouse	122	An Orion with a yagi and dipole antenna monitored the full width of the canal and the entrance to the gatehouse ladder
Turners Falls Impoundment	122	A Lotek with double 3-element yagi antennae monitored the full width of the impoundment
NMPS Gill Bank	126.5	A Lotek with double 3-element yagi antennae monitored the full width of the impoundment
NMPS Intake	127	An Orion with double 3-element yagi antennae monitored the intake area
NMPS Upper Reservoir	adjacent to 127	An Orion receiver employing a yagi and dropper antennas monitored the intake of the upper reservoir
Shearer Farms	127.5	Two Lotek receivers, one on each side, with double 3-elemnt yagi antenna monitored the full width of the impoundment

Mobile tracking of radio tagged shad was conducted weekly between Holyoke and the Mount Herman School. A second day of weekly tracking concentrated on the area between the Hatfield S curve and the Cabot Station. Mobile tracking was conducted by boat using a Lotek receiver and a 3-element yagi antenna. A total of 21 days of mobile tracking were conducted between May 15 and July 7, 2015.

Task 3: Evaluation of Mortality

Mortality was assessed using mortality tags from Sigma Eight. All shad were tagged with Pisces Transmitter (tags) operating on five frequencies: 149.720, 149.780 149.800, 150.440 and 150.540 Mhz. The tag frequencies and codes used in the evaluation were coordinated with the TransCanada Study team so that both studies could take advantage of all the test fish released into the River. All tags were programmed with a burst rate of 2 seconds. Expected tag life was approximately 90 days. The program included a mortality function which triggered an 11 second burst after a period of motionlessness. The period of motionlessness was initially set for a period of 24 hrs for the first release cohort. This period was

reduced to 6 hrs for all subsequent releases based on discussions with and recommendation by the United States Geological Survey (USGS) Conte Lab. The concern was that a 24 hr period may be too long to expect motionlessness in a riverine study reach. The tag dimensions were 10mm x 28mm. The analysis of mortality is ongoing but mobile tracking revealed that mortality mode appeared to be effective based on the number of mortality records collected.

Task 4: Reporting

A final report will be completed by September 1, 2016.

1.3 Variances from Study Plan and Schedule

The study was generally conducted in accordance with the RSP and FERC's SPDL. However, the study was further modified following the SPDL in consultation with FERC, state and Federal agencies and stakeholders.

Minor variances to the study design occurred as follows:

- An additional radio telemetry monitoring station was established within the Cabot fish ladder approximately 40 ft upstream of the entrance at the request of the USGS and U.S. Fish and Wildlife Service (USFWS). The monitoring location employed an Orion receiver and a dropper antenna. The noise floor was set and tested such that only those fish entering the fishway were detected to differentiate from those fish that were attracted to the attraction jet but did not enter the fishway.
- Per FERC's SPDL a total of 790 shad were to be tagged. However, an additional 3 fish were tagged for a total of 793.
- Per the RSP and the SPDL, a total of 100 shad were to be collected at the Cabot fish ladder and released into the TFI. However, due to a miscommunication within the study team a total of 132 shad were collected at the Cabot ladder and released into the TFI. This deviation to the study resulted in a greater number of shad collected at Cabot and released in the TFI and fewer fish collected and released at Holyoke than was planned. However since a large number of fish were tagged and released at Holyoke this reduction represented only 6% of all the fish released at Holyoke.
- As anticipated, flow releases into the bypass reach could not follow the schedule established prior to the season, but all planned flows (6,300 cfs, 4,400 cfs, 2,500 cfs, 1,500 cfs and 1,000 cfs) were released during the migration season.

1.4 Remaining Activities

- Data analysis and reporting will be conducted. Although FERC's current deadline for filing the final report is March 1, 2016, FirstLight is proposing to file the report by September 1, 2016 in order to allow sufficient time for data analysis consultation as requested by the agencies.