



# United States Department of the Interior



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September 11, 2020

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

**RE: USFWS Comments on the Updated Study Report and Study Requests for the Pejepscot Hydroelectric Project (FERC No. 4784-095)**

Dear Ms. Bose:

On July 10, 2020, Topsham Hydro Partners Limited Partnership (L.P.) (Topsham Hydro or Licensee) submitted its Updated Study Report (USR) and on August 11, 2020, the Summary of Updated Study Report Meeting (Meeting Summary) for the Pejepscot Hydroelectric Project (FERC No. 4784- or Project) was filed with the Federal Energy Regulatory Commission (FERC). The project is located on the Androscoggin River in the village of Pejepscot and the Town of Topsham, Maine.

We are submitting comments on Topsham Hydro's USR and Meeting Summary, as well as additional study requests in accordance with the FERC's Integrated Licensing Process (ILP).

Please contact Antonio Bentivoglio by email at [Antonio\\_Bentivoglio@fws.gov](mailto:Antonio_Bentivoglio@fws.gov) if you have questions regarding this correspondence.

Sincerely,

Anna Harris  
Project Leader  
Ecological Services Maine Field Office  
Maine - New Hampshire  
Fish and Wildlife Service Complex

cc: Bryan Sojkowski, Ken Hogan, USFWS  
Matt Buhyoff, Dan Tierney, NMFS  
Gail Wipplehauser, Casey Clark, MDMR  
John Perry, MDIFW  
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Kelly Maloney, Matt Leblanc, Jay Seyfried, Brookfield

## U.S. Fish and Wildlife Service Comments and Study Requests

### 1. COMMENTS

#### *1.1 Background*

Beginning in February, 2020, Pejepscot Hydro convened a series of collaborative discussions with us, the National Marine Fisheries Service (NMFS), and the Maine Department of Marine Resources (Maine DMR) (collectively, the agencies) to evaluate and discuss preliminary results of fish passage studies required in the Commission's relicensing of the Pejepscot Project. Particularly concerning were the results of the *2019 Spring Anadromous Fish Passage Effectiveness Study* (2019 Upstream Passage Study), which demonstrated that the current upstream fishway was not effective (less than 20 percent of river herring and 0 percent of American shad passed upstream). Collectively, the agencies determined that available information was not suitable to determine, with any confidence, the causal mechanisms responsible for the poor efficacy of the fishway for river herring or the complete inefficacy of the fishway for American shad. On June 2, 2020, the agencies collectively provided the Pejepscot Hydro a document that defined additional information needs and studies necessary to better understand the poor functioning of the fishway (Attachment). That document included: 1) a request for the results of a 2004 study of upstream efficacy at the Project that was previously unreported; 2) requests for information regarding facility operations during the implementation of the 2019 Upstream Passage Study; and 3) a request for three new studies (radio telemetry, CFD modeling, and a facility sound study).

Topsham Hydro did not provide stakeholders any opportunity to review the results of its required LWD Study prior to the filing of its July 10, 2020, USR. Thus, our review of that study (see section 1.4 below) and resulting request for the modification of the existing study are based upon review of both the USR and the August 11, 2020 Meeting Summary and our participation in the July 22, 2020, USR meeting.

#### *1.2 Pejepscot Hydro's Proposed Additional Studies*

Pejepscot Hydro proposes to perform two of the agencies' three requested additional studies: 1) Project Sound Study; and 2) CFD modeling. Pejepscot Hydro anticipates that these studies will build upon the results of the 2019 Upstream Passage Study and "would add to the information base available to inform the development of protection, mitigation, and enhancement (PME) measures relative to upstream passage of migratory fish."

We appreciate the Licensee's effort and collaborative work in determining the necessity for the two additional studies they propose. We support the Licensee's Project Sound Study as proposed. We also support the proposed CFD modeling study however, we include two minor recommendations/modifications to improve the study:

- 1) The CFD model should incorporate a minimum depth of 3 feet over the entrance gate. The Conte Lab (Mulligan et al., 2019) found that American shad passage is greatly facilitated at depths over 3 feet.
- 2) Ensure that the skimmer gate is not incorporated in the CFD model. The gate should not be extended into the water column, its incorporation could create spurious results.

We do not expect that these modifications will result in any increased costs or delay the results of the study.

### References

Mulligan, K. B., Haro, A., Towler, B., Sojkowski, B., Noreika, J. 2019. Fishway entrance gate experiments with adult American shad. *Water Resources Research*, 55.  
<https://doi.org/10.1029/2018WR024400>

### *1.3 New Study Request*

#### **Anadromous Fish Upstream Passage Efficiency Study**

The project area is a migratory corridor for a number of diadromous species, including blueback herring, alewife, and American shad. The Pejepscot Project is also within designated critical habitat for Atlantic salmon. In order to complete their life cycles, and to achieve restoration and recovery targets, diadromous fish require safe, timely, and effective fish passage. New information obtained through the 2019 Upstream Passage Study indicates that the Pejepscot Project is likely to be inefficient or ineffective in passing upstream migrating fish. Since the 2019 study was carried out, Pejepscot Hydro has proposed to increase lift cycles to increase fish passage (this is a new operational proposal included in its August 31, 2020 Final License Application). We are requesting a new upstream fish passage study to determine the effect, if any, on the Licensee's new operational protocol. In conjunction with the Licensee's proposed CFD modeling and Project Sound Study, we anticipate that this new study will provide information vital to determine the causal mechanisms associated with the Project's lack of effective fish passage, and therefore, information essential for the development of license conditions.

### FERC Criteria for New Study

#### ***1. Any material changes in the law or regulations applicable to the information request:***

Not applicable.

**2. *Why the goals and objectives of any approved study could not be met with the study methodology:***

It is our view that Topsham Hydro's 2019 Upstream Passage Study successfully satisfied the stated objectives, which included, but were not limited to: 1) estimate the survival or passage success for adult river herring and American shad passing upstream through defined river reaches as they approach the Project; and 2) describe the spatial and temporal distribution of adult river herring and American shad presence within the tailwater downstream of the Project during the period of residence time prior to successful passage in the upstream fish lift or downstream departure from the study area. The results of that study indicated extremely poor upstream passage effectiveness for river herring (19.8%) and completely ineffective passage for American shad (0 percent). However, the completed study is not sufficient to inform stakeholders about the survival or passage success of these target species under the new operational scenario that the Licensee is now proposing in the FLA, as described below.

**3. *Why the request was not made earlier:***

As described below, the results of Topsham Hydro's 2019 Upstream Passage Study provided significant new information which combined with additional information that has recently come to light and a new project proposal, we believe raises additional questions that require further investigation. Our new study request is predicated on the following new information developed from our 2017 study requests: 1) information from the 2019 passage study; 2) new supporting information, in the form of a 2004 evaluation of the Pejepscot fishway efficacy, which was previously unreported by Topsham Hydro; and 3) a significant change in the project proposal – a new operational protocol for the fishway, defined in the Licensee's August 31, 2020 Final License Application (FLA). None of this information was available to us previously and thus this new study could not have been requested at an earlier date.

**4. *Significant changes in the project proposal or that significant new information material to the study objectives has become available:***

The Service provided our PAD Comments and Study Requests on January 3, 2018. Topsham Hydro conducted the first study season of its 2019 Upstream Passage Study in the spring of 2019. As described above, results of that study indicated extremely poor upstream passage effectiveness for river herring (19.8 percent) and completely ineffective passage for American shad (0 percent). Additionally, during the period following the Commission's July 8, 2018, Study Plan Determination, new information came to light in the form of the results of a 2004 upstream passage study of adult herring at the Pejepscot

Project that indicated similarly poor upstream efficacy (11.5 percent). Both the new studies conducted by Topsham Hydro and the complimentary findings of the 2004 study illuminated new information -- that the Project is likely responsible for a detrimental effect on the upstream passage of diadromous species.

The Licensee's PAD, filed on August 31, 2017, included no specific proposed measures relative to fish and aquatic resources. As such, the Licensee conducted its 2019 Upstream Passage Study, wherein the Project fish lift performed 2-5 lift cycles per day. However, in its recent August 31, 2020, FLA, Topsham Hydro now proposes the following operation of the Pejepscot fish lift:

“Increase the number of lift cycles at the Project fish lift to one lift event per hour (10 lift cycles per day) between the hours of 0800 and 1800, during the peak upstream migration period (May 16 through June 15) for river herring and American Shad.”

Therefore, this new proposal represents a significant change from that which was originally proposed by the Licensee in 2017 and upon which study requests were originally conceived. Without the new *Anadromous Fish Upstream Passage Efficiency Study*, that we propose here, there will be no basis to evaluate the effects of this new project proposal.

### FERC Study Criteria

***1. Describe the goals and objectives of each study proposal and the information to be obtained***

The goal of the study is to evaluate whether the existing upstream fishway provides safe, timely, and effective passage for blueback herring, alewives, and American shad under the new operational protocol defined by the Licensee in its August 31, 2020 FLA:

*One lift event per hour (10 lift cycles per day) between the hours of 0800 and 1800, during the peak upstream migration period (May 16 through June 15).*

The objectives of this study are to replicate the radio-telemetry evaluation of upstream passage effectiveness for blueback herring, alewives, and American shad (under the 2019 Upstream Passage Study) with the operational protocol for the project fish lift as defined

above and facility operation data collected and to: 1) describe the passage effectiveness, and the extent of injury and mortality that occur during passage, and 2) assess the extent of delay migrating fish may experience due to fishway operations to obtain an accurate understanding of the effects of the proposed operational regime on upstream passage of anadromous fish.

**2. *If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied***

The Service is a federal resource agency with a mandate to protect and conserve fisheries resources and associated habitat. Resource management goals and plans are codified in our regulatory statutes including the Endangered Species Act, Fish and Wildlife Coordination Act, and the Federal Power Act. We rely on the best available data to support conservation recommendations and management decisions. Data sought in this study are not otherwise available.

**3. *If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study***

The requestor, the Service, is a federal resource agency.

**4. *Describe existing information concerning the subject of the study proposal, and the need for additional information***

Topsham Hydro conducted the first study season of its 2019 Upstream Passage Study in the spring of 2019. As described above, results of that study indicated entrance into the fishway for river herring was 92 percent and for shad was 0 percent but passage through the fishway was extremely poor for both groups: river herring 19.8 percent and American shad 0 percent. The results of the 2004 upstream passage study of adult herring at the Pejepscot Project also indicated similarly poor upstream efficacy (11.5 percent). Both the 2019 Upstream Passage Study conducted by Topsham Hydro and the complimentary findings of the 2004 study provided new information indicating that the Project is negatively affecting the upstream passage of diadromous species. Lift cycle for the 2004 study and fishway settings for both studies are unknown.

The Licensee's PAD, filed on August 31, 2017, included no specific proposed measures relative to fish and aquatic resources. As such, the Licensee conducted its 2019 Upstream Passage Study wherein the Project fish lift performed 2-5 lift cycles per day. However, in its recent August 31, 2020, FLA, Topsham Hydro now proposes to operate

the Pejepscot fish lift at one cycle per hour (or 10 lifts per day) as a way to increase passage effectiveness.

As described above, we appreciate and agree with the Licensee's proposal to perform two additional studies (CFD modeling and Project Sound). After multiple collaborative meetings with Topsham Hydro, we, the NMFS, and Maine DMR (the agencies) determined that neither the existing study results, nor existing information were suitable to determine with any confidence the mechanism or mechanisms responsible for the poor and ineffective passage. Therefore, the two additional Licensee proposed studies are necessary to help stakeholders evaluate reasonable hypotheses regarding the mechanisms responsible for the poor and ineffective fish passage demonstrated by the 2019 Upstream Passage Study and supported by existing information. However, neither the studies conducted to date nor the two additional proposed studies were intended, nor are they sufficient, to evaluate the hypotheses associated with the new proposal for additional lift cycles. Similarly, increasing lift cycles for shad will have no effect because no shad entered the fishway. However, knowing the fishway settings, and possibly testing different settings could improve entry and passage for shad.

Fishways are designed to be operated within a range for specific parameters that provide the target species with conditions to effectively pass upstream. Therefore, basic fishway operations can significantly influence, positively and negatively, upstream passage. Topsham Hydro did not collect important data regarding the operation of the facility during the conduct of its 2019 Upstream Passage Study that could have negatively influenced upstream passage. This includes: elevation of the entrance gate, headloss at the entrance gate, elevation of water within the entrance channel, and total attraction water supplied via pumps. Absent this information, it is impossible to determine whether these basic operational parameters contributed to the poor and ineffective passage results or not, and therefore, results of the 2019 Upstream Fish Passage Study are not sufficient to reasonably inform license conditions, much less new fishway operations provided in the FLA.

Ostensibly, Topsham Hydro is now hypothesizing that increasing the lift frequency will improve passage efficiency. Without an empirical evaluation of the Licensee's new operational proposal, there will be no way to determine: 1) whether additional lift cycles meaningfully improve the safe, timely, and effective passage of target species; and 2) if so, to what degree. Absent this information, all stakeholders, including the Service and FERC, will lack a critical foundation necessary to inform any license conditions that will be necessary to address the known deleterious effect of the Project on diadromous species.



**5. *Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements***

The results of the Licensee's 2019 Upstream Passage Study demonstrated that the project's direct effects include extremely poor upstream passage efficacy for river herring (19.8 percent) and at times, a barrier to passage for migrating American shad (0 percent). Evaluation of effectiveness, delay, injury, and mortality associated with fishway operations under the proposed operating protocol will inform our decision process and contribute to an administrative record for potential Section 18 fishway or 10(j) recommendations and may also help inform the eventual section 7 consultation and any required terms and conditions.

**6. *Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge***

We request a new radio-telemetry study, consistent with the methodology used by the Licensee in its 2019 Upstream Passage Study plus collection of fishway operations as described below. Radio telemetry studies are a commonly accepted field method for assessing in-stream behavior of migratory fish and passage efficacy. A well-executed radio telemetry study can track the location of fish within the river. Consistent with the 2019 study, arrays should be placed to detect fish that might be attracted to flow from the tailrace, gates, spillway, and downstream of the entire project. All study fish should be tagged and released above the Brunswick dam to allow them to migrate upstream to Pejepscot. The Licensee should ensure that sample sizes are sufficient to produce statistically reliable results. In order to evaluate operational and environmental conditions as they relate to passage performance, the Licensee should provide information on the following parameters during conduct of the study: 1) elevation of the entrance gate; 2) drop, or headloss, at the entrance; 3) elevation of water within the entrance channel; 4) total attraction water supplied via pumps; 5) headpond elevation; 6) river flow; 7) river temperature; 8) flow through units; 9) approximate amount of spill; and 10) v-trap setting.

**7. *Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.***

The telemetry studies and associated desktop analysis could be completed in one migration season. Other monitoring protocols such as PIT tagging are limited in their ability to provide sufficient data and do not provide the scope of behavioral data that radio telemetry provides. We anticipate that this study will cost between \$75,000 and \$100,000. The level of effort and cost is commensurate with a project the size of the Pejepscot facility, the likely license term, and the poor and ineffective passage demonstrated by existing studies. No alternatives have been proposed.

#### *1.4 Request for Modification of Approved Study.*

### **Large Woody Debris (LWD) Sub-Sampling**

#### FERC Criteria for Modification of Approved Study

##### ***1. Approved studies were not conducted as provided for in the approved study plan; or***

The Commission's July 3, 2018, Study Plan Determination (SPD) included the requirement for an LWD study. The SPD stated that "more information is needed to determine the quantity and quality of LWD typically collected at the dam and whether opportunities exist to improve downstream aquatic habitat by altering Topsham Hydro's management of LWD at the project." In the SPD, the Commission specifically required Topsham Hydro to collect and report the following information: "record for one year the number of logs equal or exceeding 4 inches in diameter and 6 feet in length that it collects and removes from the project."

The Licensee's USR instead reported the following information: "from July 2019 to June 2020, the Licensee had five 30-yard containers removed from the site; on average a 30-yard roll off container measures 22 feet long, 7.5 feet wide, and 6 feet high and holds 30 cubic yards of debris. The Licensee considers this volume of debris representative of a typical year." Pejepscot Hydro does not provide any reasonable estimate of the amount of LWD within the size class specified by the Commission, which we understand is particularly relevant to aquatic habitat and geomorphic processes. Furthermore, the USR did not provide any compelling reason or justification for the study variance. When asked for an explanation about the study variance during the July 22, 2020, USR teleconference call, Pejepscot Hydro implied that it did not allocate the staff or resources necessary to conduct the study as required.

Without the information required by FERC in its SPD, it is not possible to determine the magnitude or seasonality of the project's effects on an ecologically-meaningful resource, and an element of critical habitat for Atlantic salmon, and correspondingly, the necessity or scope of any potential license conditions to address that effect. We note that in its

SPD, the Commission similarly defined the “quality of LWD typically collected at the dam and whether opportunities exist to improve downstream aquatic habitat” as objectives of the required study. Information provided by the Licensee does not permit any evaluation of the “quality” of LWD collected.

**2. *The study was conducted under anomalous environmental conditions or that environmental conditions have changed in a material way:***

Not applicable.

FERC Study Criteria

**1. *Describe the goals and objectives of each study proposal and the information to be obtained***

The goal of this study is to evaluate project effects on LWD in the project area. The objective of this study is to produce an estimate of the biologically and geomorphologically relevant material required in the SPD via the implementation of sub-sampling and extrapolation.

**2. *If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied***

The Service is a federal resource agency with a mandate to protect and conserve fisheries resources and associated habitat. Resource management goals and plans are codified in our regulatory statutes including the Endangered Species Act, Fish and Wildlife Coordination Act, and the Federal Power Act. We rely on the best available data to support conservation recommendations and management decisions. Data sought in this study are not otherwise available

**3. *If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study***

The requestor, the Service, is a federal resource agency.

**4. *Describe existing information concerning the subject of the study proposal, and the need for additional information***

A trash rack is located at the entrance to the project intakes and is designed to prevent woody debris and other objects from damaging turbines and other structural components of the facility. The Pejepscot Project does not have a formal woody debris management plan, but wood is periodically removed and disposed throughout the season. In its USR, the Licensee provided information regarding the total volume of LWD (and presumably other debris) disposed of from July 2019 to June 2020. However, the report did not contain any estimate of the number of logs equal or exceeding 4 inches in diameter and 6 feet in length. This size class of LWD is of particular importance, as it represents material that creates habitat structure and promotes channel-forming processes that enhance habitat heterogeneity. Absent this information, it is difficult or impossible to determine the scope of the project effect and thus, the necessity for and scope of any potential license conditions.

**5. *Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements***

Coastal Maine rivers have been shown to be LWD-limited. The Project actively traps and disposes of a potentially limited and significant biological and geomorphological resource – a direct nexus to project-related effects. Results of this study will be essential for a complete understanding of the project’s effects LWD availability and recruitment, and will be used to determine the necessity and scope of potential protection, mitigation, and enhancement measures related to LWD management as well as provide sufficient information that can be used to evaluate the effects of the project on Atlantic salmon and their critical habitat.

**6. *Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge***

We recognize and appreciate that the effort that the Licensee put forward in determining a total volume of material removed from the Project over a year. Specifically, Topsham Hydro provided the following information: “from July 2019 to June 2020, the Licensee had five 30-yard containers removed from the site; on average a 30-yard roll off container measures 22 feet long, 7.5 feet wide, and 6 feet high and holds 30 cubic yards of debris. We believe that in conjunction with this existing information, a relatively simple and low-effort sub-sampling study should be sufficient to extrapolate the amount of biologically-relevant material removed from the project on an annual basis. Specifically,

we request that the licensee sample the contents of a 30-yard container to determine the number of logs equal or exceeding 4 inches in diameter and 6 feet in length. This sampling should occur at least twice; one sample immediately following spring flows and one sample following lower late-summer or early-fall flows. Utilizing the existing information on the removal of 30-yard containers, results of this sub-sampling should be sufficient to extrapolate the total amount of this relevant size class of LWD removed on an annual basis, while also providing some insight as to the seasonality of LWD recruitment.

***7. Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.***

We estimate that it would cost about \$5,000 to implement our proposed study modification. Given that the existing LWD study was not performed as required, nor did it provide information to sufficiently evaluate project effects, we feel that this low cost and effort alternative to repeating the required study represents a reasonable compromise.

**ATTACHMENT**

**PEJEPSCOT ADDITIONAL INFORMATION NEEDS**

## **Pejepscot Additional Information Needs**

**Provided to the Licensee on June 2, 2020**

Following review of the study results from the FERC relicensing of the Pejepscot project, USFWS, NMFS, and Maine DMR have collaboratively determined that the following information and data needs are necessary to adequately evaluate the effects of the project on the passage of diadromous fish and to inform any beneficial recommended or prescribed measures in the context of the relicensing proceeding.

### **Additional Data Needs:**

#### *2004 DTA Study*

Maine DMR has discovered information corresponding with a study of the efficacy of upstream passage at Pejepscot that was conducted by DTA in 2004. We request that you procure this study and file it on the project record.

#### *Facility Data Needs:*

The results of the 2019 upstream fish passage study demonstrated that the current fishway is not effective (less than 20 percent for river herring, and 0 percent for shad) during spill conditions. These results varied significantly from the results of studies conducted in 1991 and 1992 (a stated 90 percent efficiency) that were conducted in conditions in which spill was not present. There are multiple components of a fishway, one of the most critical being the hydraulic conditions (e.g., depth, drop, velocity) maintained at the entrance. Investigating the operational conditions of the fishway (specific to the entrance) that occurred during the 2019 study may clarify the disparity between the current, and past study results. For instance, during the 2019 annual site inspection at Pejepscot in May, USFWS and NOAA staff noted that the entrance gate seemed to be set too high (see photo below). The blocking screen was also submerged into the tailwater in order to skim debris. These conditions are not ideal for upstream fish passage. An entrance gate analysis was conducted by USFWS staff that demonstrated that the lip of the entrance gate, during the conditions witnessed during the 2019 site inspection (e.g., tailwater elevation, assumed 160 cfs attraction water), should have resided an estimated 4 ft below tailwater. This did not seem to be the case during the May, 2019 site inspection. Unfortunately, to our knowledge, some of the critical operational parameters at the Pejepscot station have not been collected in the past or during the 2019 study in order to confirm if potential operational issues (e.g., entrance gate set too high) existed. The following data is necessary in order to verify that the entrance is being operated as designed:

1. Elevation of Entrance Gate – this is the elevation (same datum as displayed on the 1986 design set) of the lip of the gate. This value is typically obtained via a gage on the screw stems or actuator.
2. Drop Head loss at Entrance – this is the measured drop in water surface from within the entrance channel to the tailwater. Typically this value is between 0.5 – 1.0 ft for alosines. This value should not be instantaneous but rather measured over 10 to 20 ft in length. It is recommended that the head loss be measured by either a staff gage or water pressure transducer placed approximately 10 ft upstream of the entrance gate and a staff gage or water pressure transducer placed approximately 10 ft downstream of the entrance gate. The difference in elevation readings between the two is the head loss.
3. Depth Elevation of water in Entrance Channel – this value can be back calculated from the drop, or this depth can be measured via staff gage located within the entrance channel and used to calculate the drop. If the drop from entrance to tailwater is not determined by elevation, all other data should either be referenced from the tailwater elevation or the gate elevation. In other words, all data should be able to be related to one another.
4. Total attraction water – number of pumps running and estimated attraction water. This assumes that the pumps are not variable speed and provide a set amount of flow of 40 cfs each. If pumps are down then the entrance gate needs to be adjusted.

A properly designed and operated entrance is critical to passage success. Maintaining a submergence depth (depth measured from the tailwater to the lip of the gate) of at least 3 ft was found to significantly improve the entrance efficiency for American shad (Mulligan et al, 2019). If it is not being done currently, we recommend that you record the above data parameters during a follow up study in order to verify that the fishway entrance is operating as designed. We also recommend that you collect this data when lifting (i.e., collect the above data each time a lift is conducted). This will provide the resource agencies and the licensee a better understanding of the fishway operations, and potential operational issues.





**Photograph 1** – Blocking screen submerged in tailwater to skim debris (Left), and entrance gate setting potentially too high (Right)

**Additional Study Needs:**

*Radio Telemetry*

Results of the 2019 upstream passage studies demonstrated that the operation of the Pejepscot project can result in poor upstream passage for river herring and American shad. However, the results of the study were not suitable for precisely locating areas where anadromous species could be held or delayed due to false attraction or the determination of other specific project-related variables that could affect poor upstream passage.

The goal of an additional telemetry study is to more precisely evaluate effectiveness for blueback herring, alewives, and American shad. The objectives of this study are to: 1) describe the passage effectiveness, and the extent of injury and mortality that occur during passage, 2) assess the extent of delay migrating fish may experience due to fishway operations; and 3) implement methods, as described in this document, and produced in consultation with the resource agencies, that more precisely define these variables with respect to potential upstream passage routes.

*CFD Modeling*

Results of the 2019 upstream passage studies demonstrated that the operation of the Pejepscot project can result in poor upstream passage for river herring and American shad. However, the available information is not suitable for determining the potential project-related variables that could affect poor passage. Therefore, we recommend that you conduct CFD modelling to determine the flow field conditions that exist downstream of the project. The modelling will provide information on the location and velocity of competing flows that are attracting migrating fish away from the fishway entrance. When coupled with data from our requested studies of upstream passage, this information will help us develop a comprehensive understanding of migratory fish behavior downstream of the project. The objective of this study is to develop a series of layered drawings that show velocity magnitude at discharges determined in consultation with the resource agencies. We expect the results demonstrate velocities and flow orientation in the vicinity of the fishway as well as the spillway.

#### *Passage Facility Sound Study*

Results of the previous study demonstrated that the operation of the project can result in poor upstream passage for river herring and American shad. American shad can detect sounds from 100 Hz to 180 kHz, with two regions of best sensitivity, one from 200 to 800 Hz and the other from 25 to 150 kHz (Mann, et.al., 1998). There are a number of sources that may induce ultrasonic or audible noises in the vicinity of the upstream fish lift that could deter American shad or river herring. These sources include the attraction water pumps that are located underwater within the entrance of the fishway and the turbine/generator units in the powerhouse.

The goal of this study is to determine if audible and ultrasonic sounds created by the turbine generator units and/or the attraction water pumps have an effect on the passage efficiencies of American shad through the lifting mechanism at Pejepscot Hydro. The objective of this study is to monitor sound levels in various locations in and around the project concurrent with the radio telemetry study.

#### *Pejepscot Upstream Eel Survey*

The Licensee conducted a total of 14 surveys from June 17 to August 26, 2019. All surveys were conducted after sunset and used spotlights and binoculars from vantage points to observe eel. Field crews noted leakage conditions on the spillway during 12 of the 14 surveys. However, no juvenile eels were observed during the visual searches during any of the survey.

The known presence of American eel both upstream and downstream of Pejepscot Project, indicate that survey methods implemented were ineffective at detecting upstream migrating eel. As a result, we recommend the Licensee develop a new upstream eel study, in consultation with the resource agencies, that employs new methods to improve eel detections and satisfy the study's goals and objectives.

**References:**

Mann, D., L. Zhongmin, M C. Hastings, and A N. Popper. 1998. Detection of ultrasonic tones and simulated dolphin echolocation clicks by a teleost fish, the American shad (*Alosa sapidissima*). *Journal Acoustical Society America*, Vol. 104, No. 1, July 1998. 0001-4966/98/104(1)/562/7

Mulligan, K. B., A. Haro, B. Towler, B. Sojkowski, and J. Noreika. 2019. Fishway entrance gate experiments with adult American shad. *Water Resources Research*, 55.  
<https://doi.org/10.1029/2018WR024400>