Report:
Upstream River Herring Passage
and
Stage 1 American Shad Presence Study

Freshet Channel Fishway, Cumberland Mills Site
Westbrook, Maine

Submitted By:
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1.0 BACKGROUND

On October 5, 2010 the Commissioner of the Maine Department of Inland Fisheries and Wildlife (MDIFW) signed a Final Order regarding fish passage facilities at the Cumberland Mills site on the Presumpscot River in Westbrook, Maine. The Order approved an Effectiveness Testing Plan (April 8, 2010) that specifies the nature and scope of studies that are required to evaluate the effectiveness of the fish passage facilities after they are placed into operation. The Effectiveness Testing Plan includes testing requirements over a span of several years. The following is a direct quotation from the April 8, 2010 Effectiveness Testing Plan.

“Stage 2 Testing. Stage 2 effectiveness testing for alewife and blueback herring shall be conducted by S.D. Warren, in consultation with DMR, during the second and third upstream migration seasons following completion of the installation of the freshet channel Denil fishway, mechanical flashboard system, and fish barrier dam, and the repair or replacement of the main channel dam stop log bays, gates and flashboards. This testing will consist of observing fish behavior via underwater video cameras at or near the fishway entrance. In addition, regular visual observations will be conducted during the upstream migration season to assess whether alewife and blueback herring are successfully finding and using the Denil fishway. Finally, all fish using the Denil fishway will be counted via recordation by three underwater video cameras, with two installed in the fishway entrance and the third installed in the fishway exit. All video camera output will be digitally recorded for review and analysis. No later than 90 days prior to initiation of the study, S.D. Warren shall prepare and submit the details of a stage 2 upstream alewife and blueback herring effectiveness study plan to DMR for approval. By December 31 of each year, S.D. Warren shall submit a report to DMR detailing the results of the Stage 2 testing for that year. If, based on the results of the Stage 2 testing, DMR determines that changes to the design or operation of the freshet channel Denil fishway, mechanical flashboard system, main channel gates, main channel stop logs bays, main channel dam flashboards, or fish barrier dam are needed to provide safe, timely and effective passage for alewife and blueback herring, these changes shall be implemented by S.D. Warren in accordance with the Findings of Fact and Conclusions of Law on Fishway design issued by the Commissioner of Inland Fisheries and Wildlife for the Cumberland Mills Dam. After the changes (if any) are implemented, Stage 2 effectiveness testing shall be repeated, during one upstream migration season.

Due to the unique characteristics of the Cumberland Mills site, for purposes of this proceeding only, the upstream passage facilities shall be considered to be effective for alewife and blueback herring if (1) there is no evidence of significant numbers of alewife and/or blueback herring bypassing or avoiding the fishway entrance, surmounting the fish barrier dam, engaging in circling or other delaying behavior in or near the fishway entrance, or otherwise not entering the fishway, and (2) at least 80% of the alewife and blueback herring that enter the fishway exit into the impoundment in a safe and timely manner. The percentage figure must be calculated using all of the digitally recorded
data gathered during a single migration season and the test will only be considered valid if more than 300 river herring exit the fishway during the season.”

The Effectiveness Testing Plan includes requirements for S.D. Warren Company (Warren) dba Sappi North America to submit a study plan to the Maine Department of Marine Resources (MDMR) prior to undertaking the studies, and to submit a report for each phase of effectiveness testing by December 31.

The Effectiveness Testing Plan (April 8, 2010) included a requirement that Stage 2 effectiveness testing be done during the second (2014) and third (2015) migration seasons following the installation of the freshet channel Denil fishway. The plan for the 2015 Stage 2B study for alewife and blueback herring (river herring) and the shad presence study was submitted in April 2015. A final version of the work plan was approved by DMR on April 24, 2015. This document constitutes the report for the 2015 Stage 2B study of the effectiveness of the upstream anadromous fish passage facility and the shad presence study, as described in the Effectiveness Testing Plan.

This report is divided into two parts based on the organization of the Effectiveness Testing Plan. This document does not address upstream eel passage since that issue has been addressed separately. The two parts of this report address:

- **Stage 2B Effectiveness Testing**
  - **Upstream Anadromous Fish Passage for Alewife and Blueback Herring**
    This portion of the report describes the results of the monitoring and counting of the target species to evaluate the efficiency and effectiveness of the Cumberland Mills fishway. The following tasks were the three essential elements of this part of the study:
    - Observation of fish behavior at or near the fishway entrance.
    - Regular visual observation to assess whether alewife and blueback herring are successfully finding the entrance and entering the Denil fishway.
    - Observation and counting of fish entering and exiting the fishway using video recording equipment installed at the entrance and exit of the Denil fishway.

- **Stage 1 American Shad Presence Study**
  The following tasks comprise the two essential elements of this portion of the report:
    - Regular visual observations in the vicinity of the fishway entrance to determine the presence and relative abundance of American shad.
    - Review of video recordings from within the fishway to determine the presence and relative abundance of American shad.
Figure 1 below depicts the location of the cameras within the fishway at Cumberland Mills.
2.0 Scope of Study

This section of the report outlines the scope of study that was detailed in the “Effectiveness Testing Study Plan for Upstream Anadromous Fish Passage at Cumberland Mills Site, Westbrook, Maine, Freshet Channel Fishway” (2015 Upstream Anadromous Fish Passage Study), that was submitted by Warren to MDMR in April 2015.

The 2015 Upstream Anadromous Fish Passage Study included two distinct parts that were based on the Effectiveness Testing Plan. These included Stage 2B effectiveness testing for upstream anadromous fish passage for alewives and blueback herring and Stage 1 of shad presence testing. The scope of study for both parts of the 2015 Upstream Anadromous Fish Passage Study is detailed in this section of the report.

2.1 Stage 2B Effectiveness Testing for Upstream Anadromous Fish Passage for Alewife and Blueback Herring

The following tasks describe the essential elements of this portion of the 2015 Upstream Anadromous Fish Passage Study.

2.1.1 Observation of Fish Behavior at or Near the Fishway Entrance

Observations of fish behavior at or near the fishway entrance were made with video cameras mounted inside and outside of the fishway entrance. Warren installed and activated four video cameras and a 4-channel digital video recorder at the Cumberland Mills fishway site on May 1, 2015 (Figure 1). One camera was installed near the exit end of the fishway, directly downstream of the bar rack. This camera pointed upstream toward the fishway exit and enabled Warren to observe and count the fish exiting the fishway. One wide angle camera was installed in the entrance, on the east wall of the fishway, pointing perpendicular toward the west wall. A black line 12-inch by 12-inch grid was installed on the opposing wall of the fishway to assist with observations. This camera was used to observe and count fish entering the fishway. Two additional cameras were installed outside of the entrance to the fishway along the training wall. These two cameras enabled Warren to observe fish congregating near the entrance, as well as to assess whether fish were being delayed outside the entrance.

Due to the physical configuration of the channel, the velocity of the river in the eastern side of the freshet channel is lower than the velocity in the western side of the channel. It was anticipated that fish moving upstream would favor the eastern side due to less turbulence and lower velocities. Observations were made during daylight hours, two to three times per week between May 1 and July 15 at or near the freshet channel dam and in the vicinity of the Obermeyer structure to determine whether fish attempted to pass, or whether they congregated near the barrier dam and Obermeyer structure or were bypassing or avoiding the fishway entrance, surmounting the fish barrier dam, engaging in circling or other delaying behavior in or
near the fishway entrance, or otherwise not entering the fishway. Observation notes that detail a qualitative assessment of fish behavior were maintained for each observation period.

2.1.2 Assessment of the Ability of Target Species to Locate and Enter Denil Fishway

The videos from the cameras outside the fishway entrance were used to assess whether alewife and blueback herring successfully found the entrance and entered the Denil fishway. The fixed cameras were positioned at two locations and various depths to observe the behavior of fish in and near the entrance. Using this technique, the cameras were positioned near the entrance to observe fish swimming up to and toward the entrance of the fishway. The water depth at the entrance varied with the flow rate in the river, so the locations were periodically refined based on flow rates, velocities, and depth. Video observations were recorded during daylight hours.

2.1.3 Fish Counts at the Entrance

The process for identifying and counting fish at the entrance was modified for the 2015 study based on the recommendations outlined in the 2014 Effectiveness Testing for Upstream Anadromous Fish Passage at Freshet Channel Fishway Report, which called for improvements to videography to facilitate fish counts. The south wall of the fishway was painted white to aid in viewing fish that entered the fishway. Grid lines were applied to make it easier to estimate the size of the fish entering the fishway. Supplemental lighting was added to make it easier to view and count fish at the entrance. A special wide angle camera was installed to increase the field of view. The new camera was oriented perpendicular to the flow to provide a better view of fish passing through the entrance area.

The video from the entrance camera was reviewed from May 1 through July 15. The viewing of the entrance camera was used to determine when river herring arrived at the fishway (May 13, 2015) and when river herring were no longer present at the fishway (June 18, 2015). The estimated number of river herring exiting the fishway was derived by counting the number of river herring passing by the exit end camera during the first ten minutes of every daylight hour from May 13 through June 18. The count for each 10-minute interval was multiplied by six to estimate the number fish exiting the fishway each daylight hour. The estimate of the number of river herring for each day from May 13 through June 18 was determined by summing the hourly estimates for each day. The estimated seasonal total was derived by summing the daily total estimates. The counts were terminated on June 18 because there were no river herring observed at the entrance or exit after June 18.

Several factors made counting the number of fish entering the fishway challenging, including turbidity, turbulence and air bubbles, as well as the fact that the fish entered the fishway in schools. The number of fish in the schools or groups varied. These schools of river herring were observed moving back and forth in front of the camera usually several times before exiting the camera area. This behavior made it difficult to count the exact number of fish moving past the entrance camera inside the fishway. To overcome this challenge, video recordings from the
entrance camera were used to estimate the relative size of schools inside the entrance. The relative size of each school was recorded from May 13 through June 18, the period of time when river herring were observed at the fishway). Each group was designated as being small, medium, or large, based on the estimated number of fish it contained. A small group consisted of an estimated 1 to 6 river herring, a medium group consisted of an estimated 7 to 12 river herring, and a large group consisted of an estimated 13 to 18 river herring. The total number of schools and relative size of each school were counted and recorded during the first 10 minutes of every daylight hour. The daily estimate of river herring entering the fishway was calculated by multiplying the daily quantity of each school size by an average quantity of fish per group size. Small schools were assigned an average value of 3 river herring, medium size schools were assigned an average value of 9 river herring, and large schools were assigned an average value of 15 river herring. The estimate for the entire fish passage season was derived by summing the daily totals.

2.2 Stage 1 American Shad Presence Study

The following tasks describe the elements of the second year (2015) of the American shad presence study.

2.2.1 Regular Visual Observations of American Shad

Video recordings were made in the vicinity of the fishway entrance to determine the presence and relative abundance of American shad. These video recordings were made using the same equipment and procedure described in Section 2.1. It was relatively easy to differentiate American shad from river herring, as shad are significantly larger than herring. During a portion of the fish passage season, shad and river herring were observed at the exit on the same day and at the same time.

In addition to the use of video recordings, Warren personnel made visual observations from the bridge that is located approximately 250 feet downstream from the entrance of the fishway. Observations were made 5 days a week, for approximately 15 minutes each viewing day from May 1 through July 15. No fish were observed from the bridge.

The video recording obtained from cameras inside and outside of the fishway entrance were reviewed during the course of the river herring migration and then from June 18 to July 15 for the first 10 minutes of every odd hour during daylight hours to determine the presence and relative abundance of American shad inside the fishway.

The results of these qualitative and quantitative observations are described in Section 4.0.
3.0 Observation Schedule

The video cameras remained in operation from May 1 to July 15. The following sections outline the general observation schedule, as well as specifics pertaining to each species.

3.1 Observation of Fish Behavior at or Near the Fishway Entrance

A subset of the video recording from the camera outside the fishway entrance was reviewed once per day for 20 minutes from May 1 until river herring arrived at the fishway. Following arrival of river herring at the fishway, the video from the outside camera was reviewed for 10 minute intervals, 2 times per week until June 18, the last day river herring were observed at the entrance.

3.2 Assessment of the Ability of Target Species to Locate and Enter Denil Fishway

These visual observations occurred simultaneous to the recorded observations described in Section 3.1. The video cameras remained operational from May 1 through July 15 and were periodically reviewed to assess whether alewife and blueback herring were successfully finding the entrance and entering the Denil fishway.

3.3 Observation of Fish Entering the Fishway

A subset of the total (daylight hours) recording period of the camera inside the entrance was reviewed for 10 minutes of each day from May 13 through June 18 to evaluate fish behavior in the vicinity of the entrance.

3.4 Counting of River Herring Entering the Fishway

Estimates of the number of river herring entering the fishway were made from May 13, the first day that river herring were observed at the entrance, until June 18, the last day river herring were observed at the entrance.

3.5 Counting of River Herring Exiting the Fishway

Estimates of the number of river herring exiting the fishway were made from May 13, the first day river herring were observed at the entrance, until June 18, the last day river herring were observed at the entrance.

3.6 Observations for American Shad Presence

Observations to determine the presence of American shad at the entrance to the fishway were made from May 1 through July 15. The visual observations for American shad were made using the video observations described in Section 3.4 from May 13 through June 18. Following June 18, the first 10 minutes of every odd numbered hour of every odd numbered day through July 15 of video recordings from the camera at the entrance were reviewed. American shad that were observed during the counting period for river herring (Section 3.4, Section 3.5) were counted and recorded. Visual observations from the bridge downstream of the fishway were made from the onset of the migration season through July 15.
3.7 Summary Chart
The following chart, Figure 3-1, depicts the schedule for each of the tasks described above in graphic format.
### Figure 3-1 Schedule for Viewing Fishway Video

<table>
<thead>
<tr>
<th>Task</th>
<th>Task Description</th>
<th>Observation Frequency</th>
<th>weeks Ending Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Observation for Fish Presence at Fishway</td>
<td>Combined with tasks 2 and 7</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Observation of fish behavior at or near the fishway entrance</td>
<td>Once a day for 20 minutes from May 1 to the start of the river herring run. Then twice a week for 10 minutes for the remainder of the run</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Regular visual observations to assess whether river herring are finding the entrance</td>
<td>Once a day for 20 minutes from May 1 to the start of the river herring run. Then twice a week for 10 minutes for the remainder of the run</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Observation of fish entering the fishway (Included river herring and American shad)</td>
<td>10 minutes each day during the actual river herring migration</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Counting of river herring entering the fishway</td>
<td>1st 10 minutes of each daylight hour - 7 days/week</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Counting of river herring exiting the fishway</td>
<td>1st 10 minutes of each daylight hour - 7 days/week</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Observations for American Shad Presence</td>
<td>1st 10 minutes of every odd numbered hour of every odd numbered day</td>
<td></td>
</tr>
</tbody>
</table>
4.0 RESULTS

This section of the report describes the observations and quantitative measurements from the 2015 Cumberland Mills fishway effectiveness study. The results are organized based on the two distinct components of the study, the Stage 2B effectiveness testing for upstream anadromous fish passage for alewife and blueback herring, and the Stage 1 shad presence study.

4.1 River Water Temperature

Upstream migration of anadromous fish is influenced by river water temperature. As water temperatures rise, migration eventually slows and, at a certain point, the upstream migration season ends; studies demonstrate that upstream migration ends when the water temperature reaches 21°C. See, e.g., ASMFC River Herring Management Plan, May 2009, p. 12 (“As water temperatures rise, alewife migration eventually slows. Cooper (1961) noted that upstream migration ceased in a Rhode Island stream when temperatures reached 21°C”); 76 Fed. Reg. 67652, 67654 (Nov. 2, 2011) (“According to ASMFC (2009b), as water temperatures rise, the upstream spawning migration of alewife declines, and will mostly cease once temperatures have risen above 21 degrees Celsius.”); Dr. Karen Wilson, Review of the Biology and Ecology of River Herring from a Climate Change Perspective, Department of Environmental Science, University of Southern Maine, July 2012 lists the spawning migration temperature for alewife in the range of 8°C to 18°C and 13°C to 21°C for blueback herring; in 2014, the migration season on the Presumpscot River at Cumberland Mills ended when the river water temperature reached 20°C (S.D. Warren-2014 Effectiveness Testing Report).

The following figure, Figure 4-1, depicts the temperatures of the Presumpscot River at Cumberland Mills from May 1 to June 18. The temperature data were obtained from Warren’s instruments on the process water intake at Cumberland Mills.
These data demonstrate that, in 2015, the upstream migration season in the Presumpscot River effectively ended on May 31, given that the water temperature had by then reached 21°C. Water temperature in the river did temporarily decrease after May 31 which could have extended the season; however, additional river herring did not appear at the fishway again until June 11, when the water temperature had again reached 21°C. Thus, the relevant period in terms of the upstream migration season was May 1 to May 31.

4.2 River Flow
The following Figure 4-2 is a chart of the staff gauge readings from the USGS Gauge No. 01064118, located immediately downstream of the fishway.
This graph depicts the gauge height at the USGS Gauge No. 01064118 located directly downstream of the Cumberland Mills fishway and depicts fluctuations in the flow rate of the Presumpscot River at Cumberland Mills from May 1 to June 18. Generally, the flow rate was very stable, with the exception of one storm event in early June.

4.3 Stage 2B Effectiveness Testing for Upstream Anadromous Fish Passage for Alewife and Blueback Herring

4.3.1 Observations of Fish Behavior at or Near the Fishway Entrance
Visual observations were made two to three times per week during daylight hours between May 1 and July 15 at the barrier dam and Obermeyer gate. There were no fish observed attempting to pass the barrier dam, or at or near the Obermeyer dam.

4.3.2 Assessment of the Ability of Target Species to Locate and Enter Denil Fishway
The video camera recordings from the video cameras located outside and inside the entrance of the fishway were reviewed to determine whether river herring were successfully finding and entering the fishway. The video recording system was set up to be able to view all four cameras at the same time. In general, schools of river herring were first observed passing by one or both
of the cameras outside the fishway. In almost every instance, river herring were observed passing by the camera mounted inside the entrance within one minute after they disappeared from the view of the cameras mounted outside the fishway. These observations clearly demonstrate that river herring moving upstream were able to successfully and efficiently find and enter the fishway entrance.

4.3.3 Observation of Fish Entering Fishway
Several factors made counting the number of fish entering the fishway challenging. These factors included turbidity, turbulence, and air bubbles, as well as the fact that the fish entered the fishway in schools. The number of fish in the schools varied. Schools of river herring were often observed moving repeatedly back and forth in front of the camera. This behavior made it difficult to count the exact number of fish moving past the entrance camera inside the fishway.

Observations of the entrance camera were used to estimate the relative size of schools of fish inside the entrance. Based on the visual observations, the relative size of each school of fish was recorded from May 13 through June 18. Each group was designated as being small, medium, or large based on the estimated number of fish it contained. A small group consisted of an estimated 1 to 6 river herring, a medium group of an estimated 7 to 12 river herring, and a large group of estimated 13 to 18 river herring. The total number of schools and the relative size of each school were counted and recorded during the first 10 minutes of every daylight hour. The daily estimate of river herring entering the fishway was calculated by summing the product of the daily quantity of each school size with an average quantity of fish per group size. Small schools were assigned an average value of 3 river herring, medium schools were assigned an average value of 9 river herring, and large schools were assigned an average value of 15 river herring. The estimate for the entire time period was derived by summing the daily totals.

The following Figure 4-3 chart depicts the daily estimate of river herring entering the fishway by the procedure described above.
4.3.4 Observation and Counting of Fish Exiting the Fishway using Video Recording Equipment

An estimate of the number of river herring exiting the Cumberland Mills fishway was developed in accordance with the procedures described in Section 2.1. The quality of the video at the fishway exit was sufficient to allow Warren to count fish passing by the exit camera. The fish passing by the exit camera were generally in single file and the water clarity was good enough to allow for an accurate count.

The daily estimate of river herring passing the exit end of the fishway are summarized in Figure 4-4. A total of approximately 2,592 river herring passed by the exit end of the Cumberland Mills fishway between May 1 and June 18, 2015.
4.4 Comparison of Daily Estimate of Fish Passing the Entrance and Exit of the Fishway

The following Figure 4-5 graph depicts the combined results of the estimates of river herring passing through the fishway entrance, the river herring passing through the exit of the fishway, and the temperature of the Presumpscot River at Cumberland Mills for the period from May 1 through June 18, 2015.
Figure 4-5 depicts two distinct stages of river herring migration at the Cumberland Mills fishway. The first stage lasted from May 13 through to May 30. The second stage lasted from approximately June 10 through June 15. Figure 4-5 indicates that during the first stage of the migration, a majority of river herring entering the fishway also exited the fishway, while during the second stage, very few of the river herring entering the fishway made it to the exit end of the fishway. Steve Amaral, principal fisheries biologists from Alden Labs reviewed these data and offered the following comments:

- “Passage decreased at the end of May due to rising temperatures (typically herring and shad slow their upstream migration when water temperature exceeds 20 degrees C)."
Although the temperature dropped when flows increased in the beginning of June, the higher flows may have prevented river herring from moving upstream (shad and herring often will stage in lower velocity habitats until high discharges begin to recede).

When the flows began to drop, temperatures also began to rise again, probably causing any fish downstream to make a last push to reach upstream habitats.

From an energetics standpoint, the higher temperatures likely prevented many of these late run fish from negotiating the full length of the ladder, leading to the lower efficiencies.

Although daily passage counts are collected at many fishways in New England, this information is not readily accessible. However, I would expect similar trends in upstream passage of herring and shad at fishways in other Northeast river systems that had similar temperature and flow regimes."

Based on these data, and as discussed above in Section 4.1, the 2015 Presumpscot River upstream migration season ended on May 31, 2015.

4.5 Fishway Efficiency Calculations
The following table summarizes the fishway passage efficiency at Cumberland Mills. Efficiency calculations are based on the estimates of the number of fish entering and exiting the fishway presented in Figure 4-5.

<table>
<thead>
<tr>
<th>Description</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Total Number of River Herring Entering Fishway between May 1- June 18</td>
<td>4,140</td>
</tr>
<tr>
<td>Estimated Total Number of River Herring Exiting the Fishway between May 1- June 18</td>
<td>2,692</td>
</tr>
<tr>
<td>Estimated Number of River Herring Entering the Fishway between May 1- May 31</td>
<td>2,970</td>
</tr>
<tr>
<td>Estimated Number of River Herring Exiting the Fishway between May 1- May 31</td>
<td>2,538</td>
</tr>
<tr>
<td><strong>Estimated Fishway Efficiency for Upstream Migration Season</strong></td>
<td><strong>85.4%</strong></td>
</tr>
</tbody>
</table>

These data clearly indicate the Cumberland Mills fishway is both effective and efficient. During the upstream migration season, from May 13 through May 31, a total of 2,538 river herring
passed through the fishway. The data demonstrate a fishway efficiency of 85% during the 2015 Presumpscot River upstream migration season. That fact that some fish that arrived later were not able to pass the fishway is due solely to water temperatures and flows, and not in any way related to the configuration or operation of the fishway. The data demonstrate that the design and operation of the fishway is capable of achieving 80% passage efficiency, so changes to the design and operation are not necessary or appropriate.

4.6 Stage 1 American Shad Presence Study

American Shad were observed in very low numbers at the Cumberland Mills fishway during the 2015 study. American shad were observed in videos outside the entrance, inside the entrance and at the exit of the fishway. Shad were observed at the entrance and exit of the fishway from May 13 to June 28.
5.0 CONCLUSIONS

Stage 2B (2015) of the Cumberland Mills Upstream Effectiveness Testing Study for the Cumberland Mills fishway on the Presumpscot River in Westbrook Maine was executed in accordance with the Study Plan approved by MDMR. This section details the conclusions from the study.

1. Between May 1 and July 15, 2015, the estimated number of river herring passing through the Cumberland Mills fishway was 2,692. This number is substantially less than the estimated 9,300 river herring that passed through the Cumberland Mills fishway during the 2014 season. The upstream anadromous fish migration on the Presumpscot River at Cumberland Mills is extremely small compared to other rivers in Maine. The following data published by MDMR is provided for comparison purposes:

   - River herring passing the Brunswick Dam fishway in 2015: 81,000
   - River herring passing Lockwood Dam on the Kennebec River: 88,337
   - River herring passing Cataract Dam on the Saco River: 53,872
   - River herring passing Benton Falls Dam on the Sebasticook River: 2,157,983

2. River herring arrived at the Cumberland Mills fishway in two distinct intervals separated by a period when no river herring were observed. The primary interval was from May 13 until May 31. The second interval was from June 10 until June 15. During the first interval, which constituted the 2015 Presumpscot River upstream migration season for the reasons discussed above, an estimated total of 2,943 river herring entered the fishway and 2,538 of those river herring, or 85.6% successfully ascended the Denil fishway and exited into the headpond above the dam. During the second interval, an additional 1,170 river herring showed up at the entrance, but very few ascended the fishway.

3. The April 10, 2010 Effectiveness Testing Plan, prepared by MDMR reads in part as follows:

   "Stage 3 Testing. If (1) there is evidence of significant numbers of alewife and/or blueback herring bypassing or avoiding the fishway entrance, surmounting the fish barrier dam, engaging in circling or other delaying behavior in or near the fishway entrance, or otherwise not entering the fishway, or (2) less than 80% of the alewife and blueback herring that enter the fishway do not exit into the impoundment in a safe and timely manner, then Stage 3 effectiveness testing for alewife and blueback herring shall
be conducted by S.D. Warren, in consultation with DMR, during one to three upstream migration seasons following the completion of the Stage 2 testing.”

The data from the Stage 2B, 2015 Effectiveness Testing provides clear and convincing evidence that:

- No alewife and/or blueback herring (river herring) are bypassing or avoiding the fishway entrance, surmounting the fish barrier dam, engaging in circling or other delaying behavior, and

- During the period from May 13 through May 31, the 2015 Presumpscot River upstream migration season, more than 85% of the alewife and blueback herring (river herring) that entered the fishway successfully exited the fishway and entered the impoundment in a safe and timely manner. These data demonstrate that the fishway is effective and meets the 80% efficiency threshold set forth in the 2010 Effectiveness Testing Plan.

Therefore, having demonstrated compliance with the requirements and criteria listed above, all of the requirements of the 2010 Effectiveness Testing Plan have been met and there is no need for additional effectiveness testing at the Cumberland Mills fishway.

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