

Summary of efficiency and delay data from adult Atlantic salmon upstream passage studies from reports for the Milford and Lockwood projects

The below summaries were compiled from data that was either filed on the FERC record for Lockwood or Milford or published by the relevant researcher from the University of Maine. All data is represented here as it was in the original documents. This data was compiled in the fall of 2022 by Maine Department of Marine Resources staff as reference material.

Milford Atlantic Salmon Upstream Passage

The performance standard for upstream fish passage requires that 95% of upstream migrating Atlantic salmon pass the dam within 48 hours of approaching within 200 meters of the Project when the river temperature is at or below 23 degrees Celsius. The upstream migrants must not exhibit any trauma, loss of equilibrium, or descaling greater than 20% of the body surface. Trauma is defined as injuries including, but not limited to, hemorrhaging, open wounds without fungus growth, gill damage, bruising greater than 0.5 cm in diameter, etc. Fish displaying these injuries or signs of trauma will be categorized as not having passed safely and will be considered failures.¹

There are no upstream fish passage facilities at the Stillwater Project and, therefore, no upstream performance standard is being proposed.

2014 Penobscot SPP Annual Report Summary

A total of 40 adult Atlantic salmon captured at the Milford fish lift were tagged and released back downriver at the Orono boat launch between May 19 and June 28, 2014. The fish lift was not operational between June 15 and June 26, but the denil was in operation for this time.

Overall, 34 of these 40 salmon were recaptured at the Milford Project. One additional tagged salmon (radio tag ID: 360-34) was detected by a PIT reader at the upstream West Enfield Project, thus suggesting that this salmon passed upstream over Milford Dam without being detected or captured

Effectiveness

- 35 of 40 (87.5 percent) were determined to have passed the Milford project via the fish lift, denil, or some other route

¹ Accension Number: 20120831-5201 (NOAA 2012 Biological Opinion)

- 2 of the 40 were not detected above the Eddington boat launch, suggesting that they moved downstream and therefore were not included in the total salmon that approached the Milford project
- 2 of the 40 were detected at the Milford Project approach receiver, but were never detected passing upstream
- 1 of the 35 was not recaptured at Milford, but was detected at West Enfield (ID: 360-34)
 - o The study report includes this fish in the 35 that passed Milford but did not indicate if the fish retained the radio tag
- 1 of the 40 tagged adult salmon was recaptured in denil while the fish lift was dewatered and under repair (ID: 460-40)
 - o This fish was not include in the study report, but NMFS and other agencies corrected this reporting because the study was meant to asses project effectiveness not fish lift effectiveness
 - o This fish was included in the 35 fish that passed Milford
- 1 of the 40 was originally reported as being recaptured, but was not received by the hatchery
 - o The fate of this fish is unknown and it is not included in the effectiveness summary
- Therefore, 34 of 37 adult salmon that approached Milford were determined to have passed the Milford project via the fish lift, denil, or some other route demonstrating an effectiveness (number of fish that passed regardless of delay) of 89.7 percent in 2014

Delay

- 28 of the 40 fish retained radio tags and migrated upstream to the Milford project in 2014
 - o 8 of the 40 fish did not retain radio tags and therefore the time of approach was not able to be assessed for these fish
 - o 2 of the 40 fish did not approach the Milford Project
 - o 2 of the 40 fish approached, but did not pass, the Milford Project
- 14 of 28 (50 percent) were detected at either one of the Orono Project tailraces or in the Orono spillway before being detected at the Milford Project
 - o The maximum elapsed time spent by 13 of the 14 fish at the Orono Project was 11.8 hours
 - o However 1 of the 14 fish spent an elapsed time of 249.7 hours at Orono over the span of multiple visits back and forth between Milford and Orono when the Milford fish lift was not operational
 - o Delay at Orono was not included in the delay summary for Milford
- 14 of 28 (50% percent) of recaptured salmon passed the Milford Project within 48 hours
- 14 of 28 (50% percent) of recaptured salmon did not pass the Milford Project within 48 hours
- Range from detection on approach receiver to the fish lift exit at Milford of 1.9 to 386.5 hours with a median time of 26.1 hours
- Therefore, 14 of the 28 (50 percent) recaptured salmon did not pass the Milford Project within 48 hours

A total of 49 adult salmon captured at Milford fish lift were captured in the Milford fish lift, tagged, and released approximately 10 kilometers downstream at the Orono public boat launch between May 12 and June 2, 2015.²

Effectiveness

- 47 of 49 (96 percent) were recaptured in the upper flume of the fish lift
- 1 of 49 was not detected above the Eddington boat launch, suggesting that it moved downstream and therefore was not included in the total salmon that approached the Milford project
- 1 of the 49 was detected at the Milford Project approach receiver in May, June, and early July, but it was never detected passing upstream
- 1 of 49 was not recaptured at Milford, but was detected at West Enfield (149.440 code 194)
 - o The study report includes this fish in the 47 that passed Milford
- Therefore, 47 of 48 adult salmon that approached Milford were recaptured at the project demonstrating an effectiveness (number of fish that passed regardless of delay) of 97.9 percent in 2015

Delay

- 8 of the 47 (17.0 percent) recaptured salmon passed the Milford Project within 48 hours
 - o Range from detection on approach receiver to the fish lift exit at Milford of 2.5 to 32 hours
- 39 of the 47 (83 percent) recaptured salmon did not pass the Milford Project within 48 hours
 - o Range from detection on approach receiver to the fish lift exit at Milford of 55 hours to 35 days
- 1 of the 47 was not recaptured at Milford, but was detected at West Enfield
 - o The study report includes a timestamp for detection 4 days and 4 hours after detection on the approach receiver, however it is unclear if this detection was at West Enfield or at Milford
 - o We have removed this fish from the results due to the uncertainty in the reported data
- Therefore, 8 of the 46 (17.4 percent) recaptured salmon did not pass the Milford Project within 48 hours

Overall results

- 47 of 48 (97.9 percent) adult salmon that approached Milford were recaptured at the project
- 8 of 46 (17.4 percent) adult salmon were recaptured at Milford within 48 hours of detection on the approach receiver below the Project
- Therefore, 8 of 47 (17.0 percent) of salmon that approached the Milford Project were recaptured at the project within 48 hours of detection on the approach receiver below the Project

² All results summarized in this section are directly from data reported in the *Atlantic Salmon Species Protection Plan – 2015 Annual Report for Project Nos. 2710, 2712, 2534, 2600, and 2666 (Orono, Stillwater, Milford, West Enfield, and Medway Hydroelectric Projects)* filed on the FERC record on May 31, 2016.

2014 University of Maine Milford Upstream Salmon Report Summary

Effectiveness

- 22 of 22 fish approached the Milford project
- 21 of 22 were determined to have passed the Milford project via the fish lift or some other route demonstrating an effectiveness (number of fish that passed regardless of delay) of 95.5 percent in 2014

Delay

- 10 of 22 fish were able to be included in the delay assessment for the study
- 5 of the 10 (50 percent) fish that approached Milford passed within 48 hours of being detected in the tailrace at the project
 - o Delay times ranged from 1.2 h to 76 d, with 70% of tagged fish passing Milford Dam within 1 week

2015 University of Maine Milford Upstream Salmon Report Summary

Effectiveness

- 50 of 50 fish approached and passed the Milford project via the fish lift demonstrating an effectiveness (number of fish that passed regardless of delay) of 100 percent in 2015
- However, 1 fish was never seen or recaptured at the trap and handling facility, indicating that it may have fell back

Delay

- 49 of 50 fish were able to be included in the delay assessment for the study
- 1 fish was not included in the delay assessment because it was never seen or recaptured at the trap and handling facility
- 17 of 49 (34.7 percent) of fish that approached Milford passed within 48 hours of being detected in the tailrace at the project
 - o Delay times ranged from 7.4 h to 26 d, with 63.2% passing Milford Dam within 1 week

2018 University of Maine Milford Upstream Salmon Summary

Effectiveness

- 48 of 49 fish (86 percent) released at the Orono boat launch subsequently approached the Milford project
- 42 of 48 were determined to have passed the Milford project via the fish lift demonstrating an effectiveness (number of fish that passed regardless of delay) of 87.5 percent in 2018

Delay

- 41 of the 48 fish were able to be included in the delay assessment for the study
- For the 41 fish, delay length was 21.3 days on average (median = 12; range 2-155 days)
- 1 of the 41 fish (2.4 percent) that passed the Milford Project did so within 48 hours

- This data was translated from Figure 1.5 and is not from a data table. Values could be inaccurate.

2019 University of Maine Milford Upstream Salmon Summary

Effectiveness

- 49 of 50 fish (92 percent) released at the Orono boat launch subsequently approached the Milford project
- 46 of 49 were determined to have passed the Milford project via the fish lift demonstrating an effectiveness (number of fish that passed regardless of delay) of 93.9 percent in 2019

Delay

- 45 of the 49 fish were able to be included in the delay assessment for the study
- For the 45 fish, delay length was 11.0 days on average (median = 8; range 0-30 days)
- 1 of the 45 fish (2.2 percent) that passed the Milford Project did so within 48 hours
 - This data was translated from Figure 1.5 and is not from a data table. Values could be inaccurate.

Lockwood Atlantic Salmon Upstream Passage

2016 Diadromous Fish Passage Report

Effectiveness

- 18 of 18 fish released at the Waterville boat launch subsequently approached the Lockwood project in 2016
- 1 of the 18 fish approached Lockwood on June 23 and was detected at wastewater treatment plant on July 5th but the radio tag was recovered on the river bank in Gardiner on August 8th
 - o This fish was removed from the effectiveness assessment in the report due to suspected predation
- 1 of the 18 fish (18.8 percent) was still in the project area at the termination of the study on and therefore identified as not passing the project
- Therefore for 16 of 17 tagged salmon were determined to have passed the Lockwood project via the fish lift demonstrating an effectiveness (number of fish that passed regardless of delay) of 94.1 percent in 2016

Delay

- 17 of the 18 fish were able to be included in the delay assessment for the study
- 12 of the 17 (70.5 percent) of recaptured salmon did not pass the Lockwood Project within 48 hours
- 1 of the 17 fish was still in the project area at the termination of the study on and therefore failed to meet the 48 hour standard
- Detection on approach receiver to capture in the fish lift for the 16 radio-tagged adult salmon, which were eventually recaptured at Lockwood, ranged between 16.8 hours to 164.9 days (mean = 17.0 days).
- Therefore 5 of the 17 (29.4 percent) recaptured salmon passed the Lockwood Project within 48 hours

2017 Diadromous Fish Passage Report

Effectiveness

- 20 of 20 fish released at the Waterville boat launch subsequently approached the Lockwood project
- 1 of the 20 fish regurgitated its radio tag downstream following release, but was identified with a PIT tag in the fish lift and therefore included in the effectiveness assessment
- 3 of the 20 fish (18.8 percent) were still in the project area at the termination of the study on October 31, 2017 and therefore identified as not passing the project
- Therefore for 17 of 20 were determined to have passed the Lockwood project via the fish lift or bypass demonstrating an effectiveness (number of fish that passed regardless of delay) of 85.0 percent in 2017
 - o The efficiency for the fish lift was reported at 70 percent due to two fish that passed via the bypass, which resulted in 14 of 20 fish that were captured in the lift

Delay

- 19 of the 20 fish were able to be included in the delay assessment for the study
- 13 of the 19 (68.4 percent) recaptured salmon did not pass the Lockwood Project within 48 hours
 - o Range from detection on approach receiver to capture in the fish lift at Lockwood of 28 hours to 55.2 days (mean = 19.6 days, median = 10.4 days)
- 3 of the 19 fish (18.8 percent) were still in the project area at the termination of the study on October 31, 2017 and therefore failed to meet the 48 hour standard
- Therefore 3 of the 19 (18.8 percent) recaptured salmon passed the Lockwood Project within 48 hours

2018 University of Maine Lockwood Upstream Salmon Summary

Effectiveness

- 6 of 6 fish released at the Waterville boat launch subsequently approached the Lockwood project
- 4 of 6 were determined to have passed the Lockwood project via the fish lift demonstrating an effectiveness (number of fish that passed regardless of delay) of 66.6 percent in 2018

Delay

- 6 of the 6 fish were able to be included in the delay assessment for the study
- For the 4 fish that passed Lockwood in 2018, delay length was 18.8 days on average (median = 16; range 13-30 days)
- None of the 4 fish (0 percent) that passed the Lockwood Project did so within 48 hours
 - o This data was translated from Figure 1.5 and is not from a data table. Values could be inaccurate.

2019 University of Maine Lockwood Upstream Salmon Summary

Effectiveness

- 19 of 20 fish released at the Waterville boat launch subsequently approached the Lockwood project
- 9 of 19 were determined to have passed the Lockwood project via the fish lift demonstrating an effectiveness (number of fish that passed regardless of delay) of 47.4 percent in 2019

Delay

- 9 of the 19 fish were able to be included in the delay assessment for the study
- For the 9 fish that passed Lockwood in 2019, delay length was 16.1 days on average (median = 18; range 2-31 days)
- 1 of the 9 fish (11.1 percent) that passed the Lockwood Project did so within 48 hours
 - o This data was translated from Figure 1.5 and is not from a data table. Values could be inaccurate.

| Milford | | | | | | | | |
|------------------|--------------|--------------|------------|------------|------------|------------|--------------|------------------|
| Source and Year | 2014 SPP | 2015 SPP | 2014 UM | 2015 UM | 2018 UM | 2019 UM | All Years | All Years (%) |
| Efficiency | | | | | | | | |
| Sample Size | 37 | 48 | 22 | 50 | 48 | 49 | 254 | |
| Pass | 34 | 47 | 21 | 50 | 42 | 46 | 240 | 94.5% |
| Fail to Pass | 3 | 1 | 1 | 0 | 6 | 3 | 14 | 5.5% |
| Delay | | | | | | | | |
| Sample Size | 28 | 47 | 10 | 49 | 41 | 45 | 220 | |
| Pass (<48 hours) | 14 | 8 | 5 | 17 | 1* | 1* | 46 | 20.9% |
| Pass (>48 hours) | 14 | 39 | 5 | 32 | 40 | 44 | 174 | 79.1% |
| Lockwood | | | | | | | | |
| Source and Year | 2016 BREG | 2017 BREG | 2018 UM | 2019 UM | | | All Years | All Years (%) |
| Efficiency | | | | | | | | |
| Sample Size | 17 | 20 | 6 | 19 | | | 62 | |
| Pass | 16 | 17 | 4 | 9 | | | 46 | 74.2% |
| Fail to Pass | 1 | 3 | 2 | 10 | | | 16 | 25.8% |
| Delay | | | | | | | | |
| Sample Size | 17 | 19 | 4 | 9 | | | 49 | |
| Pass (<48 hours) | 5 | 3 | 0* | 1* | | | 9 | 18.4% |
| Pass (>48 hours) | 12 | 16 | 4 | 8 | | | 40 | 81.6% |

Table 1. Summary of efficiency and delay data from adult Atlantic salmon upstream passage studies from reports for the Milford and Lockwood projects.

* This data was translated from Figure 1.5 and is not from a data table. Values could be inaccurate.