

Development of the Bristol Mills Dam 2015 Fishway Design

2003: The Bristol alewife fishery on the Pemaquid River is closed due to low returns of adults. DMR has been stocking the river with alewives since 1987 to spark recovery of the population or at least prevent total collapse of the run.

October 2005: United States Fish and Wildlife Service (USFWS) Chief Fish Passage Engineer, Curtis Orvis, and Maine Department of Marine Resources (DMR) staff assess the Denil-style Bristol Mills Dam fishway on the Pemaquid River. The Bristol Mills dam is the last remaining major barrier to fish passage on the Pemaquid and reported problems with the fishway have prompted the assessment. In his report, Orvis stated that “the population of adult alewives returning to the fishway has diminished to alarming numbers.” Key conclusions are that the fishway design lacked adequate water flow control at the entry, turning pool, and exit. Another major problem was that up-migrating adult alewives were much more attracted to flows at the base of the dam rather than the entry to the fishway. This last issue required volunteers to annually construct a 100-foot long temporary leader fence made of lobster trap wire and rebar and angled across the stream to guide alewives, with moderate success, to the fishway entry.

Orvis suggested several relatively low-cost options for improving performance of the fishway, including the addition of 1) concrete extensions to both the entry and exit into which stoplogs and baffles could be installed to dissipate and control flow as needed, 2) a baffle midway in the turning pool to dissipate high velocities, and 3) a low, concrete “sill” across the stream onto which stoplogs could be rapidly installed and removed and which might do a better job of guiding alewives to the fishway entrance than the leader fence and require far less maintenance.

August 2012: After contacting the Town of Bristol to gather information on the fishway, who operates and maintains it, and its performance, the Gulf of Maine Council on the Marine Environment (GOMC) and DMR staff coordinate to investigate and seek avenues for reversing reported declines in the Pemaquid alewife run. In hopes that a solution will be implemented in the next 2-3 years, DMR’s 25-year long program of alewife stocking in the Pemaquid River is suspended.

March – April 2013: GOMC and DMR work with local citizens and the Pemaquid Watershed Association to create a Volunteer Alewife Monitoring Program for the Pemaquid River, with the intent of obtaining a credible assessment of the run size. Upstream of the dam, there is sufficient lake habitat acreage to accommodate at least 600,000 adult fish each year. Results of the first volunteer count conducted May-June 2013 estimate that between 9,425 and 19,031 adult alewives passed upstream of the fishway and dam. In other words, the run upstream of the dam is only 2-3% of the minimum estimated population size. With such an extremely low run size, the threat of total population collapse prompted immediate interest in finding solutions to the problem.

September 2013: A fish passage improvement team is assembled, including Curtis Orvis (USFWS, Chief Fish Passage Engineer); Matthew Bernier (NOAA, Fish Passage Engineer); Claire Enterline (DMR, Diadromous Fish Biologist); Rick Poland (sole Bristol Fish Committee member); Slade Moore (GOMC, Habitat Restoration Coordinator), and Kristine Poland (Town of Bristol, Town Administrator). Information is provided to the Town to submit a Maine Coastal Program (MCP) Coastal Communities Grant application for engineering in October.

December 2013: An MCP Coastal Communities Grant is awarded to Bristol for fishway engineering.

March 2014: The Town and project partners develop and release a competitive engineering RFP for the fishway improvements.

April 2014: Wright-Pierce is selected as the engineering firm to design fishway improvements.

June-August 2014: Data collection and coordination meetings are conducted with Wright-Pierce to inform the development of Initial Fishway Design Improvements.

September 2014: Two primary concepts are provided by Wright-Pierce to address the Town's request for the most economical fish passage improvement solutions. Both re-use major portions of the existing fishway. The first concept mirrors USFWS's 2005 suggestions, which were to extend to the current fishway at both ends for better flow control, integrate a turning pool baffle, and construct a permanent concrete foundation on which to secure a seasonal leader for directing alewives to the fishway entrance. The second concept would extend the exit, retain the upper half of the fishway, and build a new lower fishway that situates the exit at the foot of the dam. This second concept is recommended by the project team and chosen by the Selectmen at their September 24th meeting because placing the fishway entry at the foot of the dam takes advantage of the alewife's natural attraction to higher flows. Also, constructing a permanent structure across the stream to accommodate the season leader fence is deemed less feasible from a regulatory perspective. The Alaskan Steeppass design was not considered for alewives at Bristol Mills because with a design limitation of about 50,000 fish, it is not a viable option for a run with this size potential (at least 600,000 adults), nor is it a preferred design for alewives.

December 2014: W-P delivers 90% design drawings for the fish passage improvement team to review. The comments focus on minor modifications, with the exception of one: the 3-foot wide Denil's inability to adequately accommodate anything close to full recovery potential of the Pemaquid alewife population (>600,000 returning adults) is questioned. A 3-foot wide Denil could adequately pass a run on the order of 200,000 returning adults without overcrowding or delays in passage. How much crowding and backing-up of fish is acceptable was discussed. Recovery to 600,000 adults would require a different design to avoid overcrowding. The group agreed that capacity of the fishway required further investigation, because it would be far less expensive to retrofit or rebuild the fishway once, than having to do it a second time in the next

few years to accommodate a growing population. This item was considered to be the highest priority because it would require a major shift in the design.

January 2015: The fish passage improvement team agreed that improvements to the Bristol 3-foot wide Denil would increase the run size from its presently suppressed levels, but would be highly unlikely to support Pemaquid’s full recovery potential of >600,000 adult fish. As a result, the team asked for a new 90% engineering design that would be more likely to meet the goal of promoting growth of the population toward its full potential. Wright-Pierce agreed to undertake this major change in the contract scope and budget without compensation for the increased cost of work.

The discussion of how best to support substantial recovery of the run put the following fishway options under consideration:

- Four foot-wide Denil with two entrances and a large resting pool
- Two side by side 4’-wide Denils with resting pool
- Nequasset style “linear” pool and weir that is larger than 5’-wide
- Damariscotta style “round” pool and weir

The following qualitative matrix summarizes results of the discussion:

| Alternatives | Potential for passing >600k fish | Factors potentially complicating performance | Tolerance to flow fluctuations | Cost Ranking | Additional time and cost to design | Time to obtain construction funds |
|----------------------|----------------------------------|--|--------------------------------|--------------|------------------------------------|-----------------------------------|
| 4’ Denil | Low-mod | Less | More | Least | Less | Least |
| Twin 4’Denil | Mod-high | Less | More | More | Less | More |
| Linear pool and weir | Mod-high | More | Less | More | More | More |
| Round pool and weir | High | More | Less | Most | Most | Most |

Fishway Maintenance and Operation: Evaluation of the existing options for full alewife run recovery determined that a Denil design would provide a greater certainty of effectiveness than the pool and weir because there would likely be fewer complicating factors with a well-designed Denil. For instance, the Denil design is generally more tolerant of flow fluctuations and requires less attention/adjustment during the run than does the pool and weir design. That was an important distinction because apart from the efforts of one or two volunteers, Bristol had demonstrated limited capacity to consistently perform adequate stewarding of the fishway and run each year. Damariscotta Mills is a

different situation, owing at least in part to that run having a commercial harvest and hydropower generation that provides income for annual maintenance of the run and other activities.

Fishway Effectiveness: A major benefit of the twin, 4-foot Denil design was its ability to provide a fish loading capacity sufficient to promote at least a moderate potential for recovery (at least 400,000 returning adults alewives). Only the round, Damariscotta style pool and weir fishway could exceed capacity of the twin Denil.

Fishway Cost and Conclusions: The Pemaquid alewife run, which monitoring showed was at critically low levels and persisting only because of a few volunteers, needed prompt and far-reaching improvements. Under funding programs administered by NOAA and other organizations at the time, money for the first phase of a twin Denil could probably be rapidly acquired, whereas funds for the round pool and weir design used in Damariscotta Mills would take far longer, which risked survival of the run. That was another critical factor in the Denil outcompeting the pool and weir fishway. Building the first Denil would allow the run to start experiencing growth almost immediately. By the time the population size was experiencing a major surge in growth (three years), fundraising for the second Denil could be acquired to encourage further population growth.

May 2015: Engineering drawings and construction documents were completed for the first phase of the twin Denil. Phase two would be integrated as soon as possible after the first. Fishway regulatory permitting was postponed until planning for necessary dam repairs and modifications were completed so that phase bundling of the first fishway and dam work would be more cost efficient.

April 2016: A proposal to fund the first of two Denil fishways at Bristol Mills is submitted to NOAA.

July 2016: The NOAA fishway funding proposal is not funded. Feedback from NOAA reveals that they have largely shifted away from funding fishways, which are recognized as having far less sustainable fish passage outcomes than dam removals. Installation of nature-like fish passage structures are also favored; these are used to maintain water levels at the desired elevation using natural stone in configurations like weirs and roughened ramps that require little maintenance, less costly maintenance, and pass all fish species.

Other dates and data:

1974 – 1978: About \$100 spent on fishway annually.

1978 – 1982: Town ran fish harvest at trap at head of tide

1981: Replace old wooden fence with twine for new leader at fish ladder that is installed annually.

1985: Added bottom step to fish ladder and many more fish went up ladder.

1974 – present: Fish Committee meets every year and works on improvements to fish migration.