Flanders Stream Restoration
2015 Volunteer Count Report

Prepared by Maine Dept. of Marine Resources, July 2015
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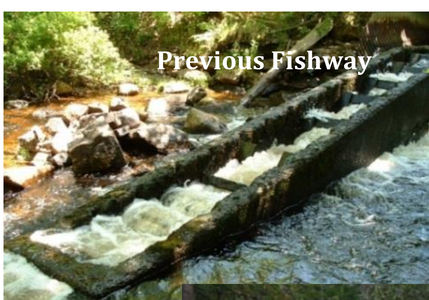
Background:

In 2012, the aging Thorne Road culvert crossing over Flanders Stream was successfully replaced. The project used Stream-Smart principles that made the crossing more resilient to storm flows, and less maintenance-prone. Just downstream, the project team also replaced a crumbling fish ladder with a series of rock weirs that act like a natural cascade that gradually helps migrating fish reach the elevation of the new culvert. The new design is capable of boosting the productivity of a commercially harvested alewife run on the stream. With the help of dedicated community volunteers, the Maine Coastal Program, DMR, and the town of Sullivan conducted pre- and post-construction alewife monitoring that confirmed the project's alewife restoration value.

The town of Sullivan partnered with a variety of organizations to implement the Thorne Road project over several years of planning and fundraising. The Gulf of Maine Council, Maine Coastal Program, National Oceanographic and Atmospheric Administration, U.S. Fish and Wildlife Service, Maine Department of Marine Resources, Maine Natural Resources Conservation Program, and Corporate Wetlands Restoration Partnership provided funding and technical assistance.

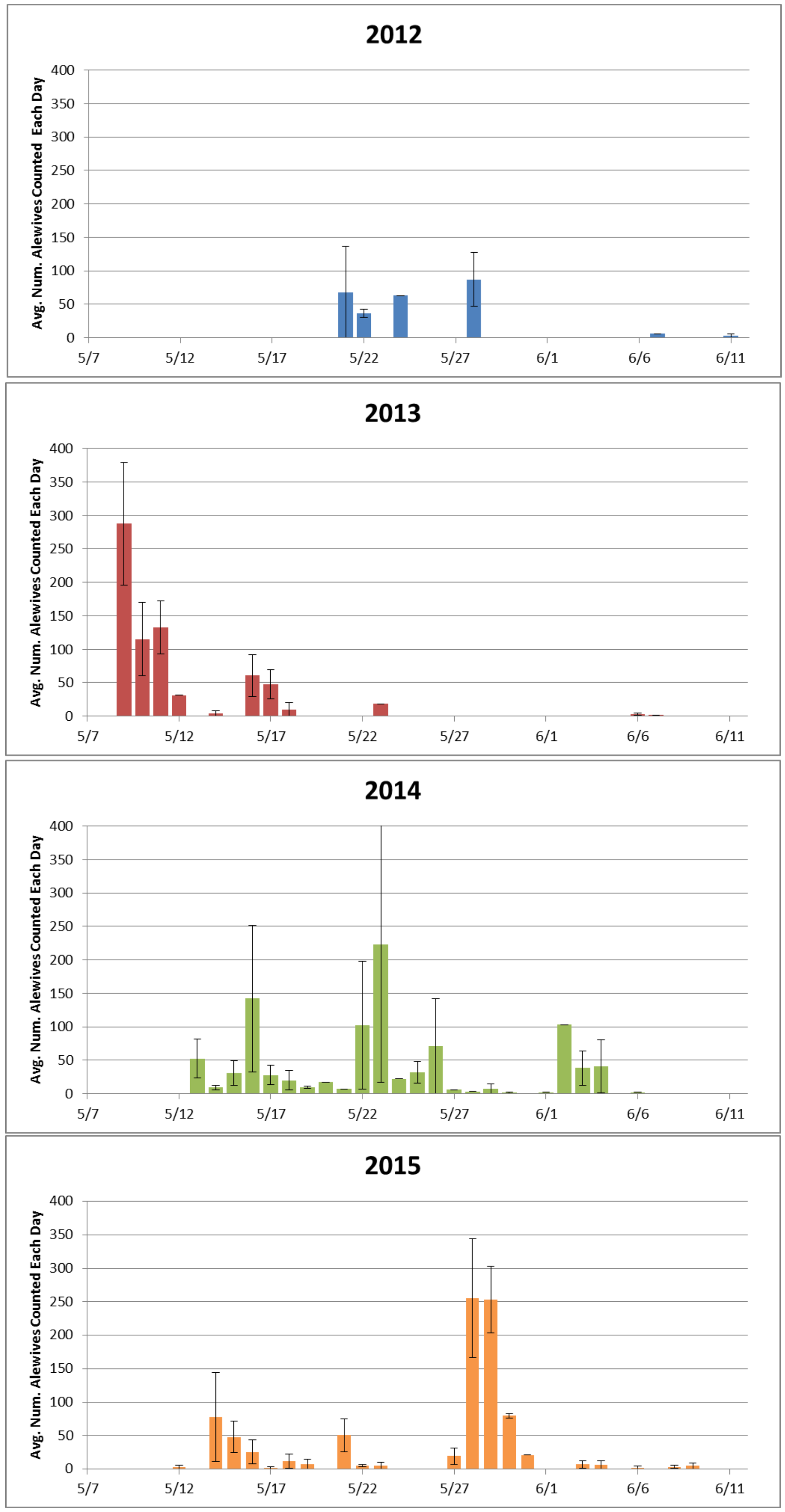
Alewife Run Monitoring:

In an effort to show how the new culvert improved fish passage, we established a monitoring program to count the number of alewives passing through a weir installed roughly 200 feet upstream of the culvert. Counts lasted 30 minutes during different "blocks" of time, where each day was divided into a certain number of counting blocks. In 2012, 30-minute counts were performed during two 6-hour blocks, three days a week. In 2013, 30-minute counts were performed during three 4-hour blocks, three days a week. Counts were not performed during the four days a week when the run was commercially harvested and a fish trap blocked upstream migration. In 2014 and 2015, the count was performed every day (30-minute counts, four times a day) because the harvest allowed for continuous upstream passage.



Results

Comparing the number of alewives counted before the culvert was replaced (the 2012 count) to the counts performed after the culvert was replaced (the 2013 and 2014) helps us understand if the new culvert improved fish passage. The 2012 pre-construction average number of alewives counted in each monitoring session was 35.1 (±1SE = 13.3) alewives. After the new culvert was in place, the average counts were higher, in 2013 the average number of alewives counted during 30-minutes was 66.7 (±1SE = 15.8), in 2014 it was 37.4 (±1SE = 10.8), and in 2015 it was 46.9 (±1SE = 12.1).



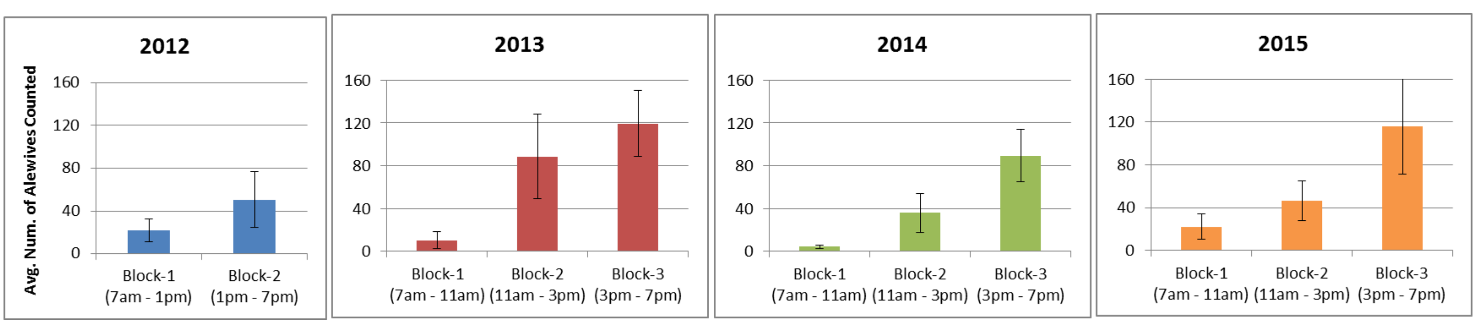
It is difficult to compare these averages among the years because the sampling effort was expanded in each year. In 2012, only 13 counts were performed, and these counts were performed primarily at the height of the spawning run, so the data are skewed higher compared to if the entire run was documented (figure on the right). In 2012, very few of the volunteers reported seeing no fish pass during their 30-minute count. In 2013, 26 counts were performed, encompassing more of the spawning season. Later in the season, however, fewer counts were performed because heavy rains made it impossible to see fish or unsafe to perform the count. In 2014, 50 counts were performed, fully encompassing the spawning season.

In 2014 and 2015, volunteers were able to perform most of the scheduled counting periods. The result of having more counts performed was that more people recorded seeing zero fish pass. This does not mean that fewer fish passed in 2014 and 2015, it simply means that because counts were performed more frequently, the likelihood of capturing the entire *range* of the run was more likely. In 2015, 64 counts were performed, and we saw a wider range in the number of alewives counted during each time block, from 0 to 427 counted in a 30-min period. The number of alewives counted in 2014 during a 30-min period ranged from zero to a high count of 429 alewives. In 2013, the range was zero to 379. In 2012, the range was zero to 136.

It is also informative to look at the number of times the average daily count exceed a certain threshold. In 2012, the average daily count never exceeded 100 alewives. Comparatively, the average daily count exceeded 100 seven times in 2013, six times in 2014, and two times in 2015.

The volunteer counts also showed that the number of alewives passing increased from morning to evening (figures below). Because fewer counts were performed during the evening counts in 2013, 2014, and 2015, when more alewives likely passed, the higher range of counts may be under-represented. The table below shows the number of counts that were performed in each block for each sampling year, with the average number per block and the standard deviation and standard error.

Year and Counting Period	Avg. Num. Alewives Counted During Time Period	Standard Deviation	Counts Performed During Time Block	Standard Error
2012				
Block-1 (7am - 1pm)	21.7	27.8	7	10.5
Block-2 (1pm - 7pm)	50.7	63.5	6	25.9
2013				
Block-1 (7am - 11am)	10.1	25.2	10	8.0
Block-2 (11am - 3pm)	88.6	118.8	9	39.6
Block-3 (3pm - 7pm)	119.4	81.7	7	30.9
2014				
Block-1 (7am - 11am)	4.1	5.5	16	1.4
Block-2 (11am - 3pm)	35.8	88.6	23	18.5
Block-3 (3pm - 7pm)	89.3	81.0	11	24.4
2015	46.9	96.7	64	
Block-1 (7am - 11am)	21.9	64.9	30	11.8
Block-2 (11am - 3pm)	46.3	88.9	23	18.5
Block-3 (3pm - 7pm)	116.2	149.0	11	44.9



Estimating the Run Size

Since 1984, Maine Department of Marine Resources (DMR) has used the figure of 235 alewives for each lake/pond acre to estimate alewife production. The Department established this value from the commercial harvest in six Maine watersheds for the years 1971-1983, using metrics like the average pounds harvested, the upstream lake acreage of each location, and estimated escapement from the harvest, to determine this figure. The term escapement is used to describe the alewives that are not harvested, but make it to the lake or pond to spawn because they “escape” the harvest either during the days of the week when the harvest is closed or “escape” the harvest by going around the harvest area, like moving past a weir net when there is a gap between the net and the side of the river.

The surface area of Flanders Pond is ~535 acres, so we estimate the Pond could support a run of 125,655 alewives. Commercial harvests in Maine must maintain an average escapement of 35 alewives per acre. For Flanders Pond, this minimum escapement is 18,715 alewives. When no other count is performed, we estimate the escapement from harvest records, with the assumption that the total run would be made up of the harvest (4-days a week) and the calculated escapement estimate (the other 3-days a week). This method, however, can drastically underestimate the total run size (and the escapement) if runs are minimally harvested by choice. This has been the case the past three years at Flanders Stream, when there has been lower harvesting effort.

Using the harvest data, we calculate that the escapement in 2013 was 5,130 alewives, and in 2014 was 5,400. The volunteer count data show that the escapement was in fact much larger. The volunteer count data were extrapolated to estimate a total run size for the year using methods described by G. Nelson in *A Guide to Statistical Sampling for the Estimation of River Herring Run Size Using Visual Counts* (MADMF TR-25, 2006). ***Please note that the 2013 and 2014 run estimates have been revised based on a change in statistical methods to more accurately extrapolate the volunteer counts.*** The estimated counts for 2013 and 2014 are higher than previously estimated, but there is a wider margin of error. The estimates below were determined using a one-way stratified sampling design.

Using the volunteer counts, we estimate that the escapement (or number of alewives able to reach the pond to spawn) in 2013 was ~15,300 (95%CI = 8,073 to 22,527), in 2014 was ~23,240 (95%CI = 3,506 to 42,974), and in 2015 was ~21,290 (95%CI = 14,809 to 27,771). The run count is not estimated using the 2012 data because not enough data were collected to perform a confident analysis. These run size estimates calculated from the volunteer count show that the harvest data may underestimate the true run size for Flanders Stream. The minimum escapement is likely being met.

There is error associated with these estimates because not every fish was counted. The error is a factor of the variability of daily counts (i.e. whether the counts during the same day were about equal, or very different from each other), the variability among all the daily counts (i.e. whether the average counts highly vary from day to day, or are similar), and the amount of volunteer coverage (i.e. whether three counts were performed each day). In 2013, fewer counts were performed by design (only performing counts 3 days a week), and because there was less volunteer coverage. This led to a large range of error, where we are 95% confident that the estimated run size (15,300) lies between 8,073 and 22,527. In 2014, more counts were performed, but there was more variability in counts on each day, and among the days. In 2014, we are 95% confident that the estimated run size (23,240) is between 3,506 and 42,974. In 2015, we had more volunteer coverage and there was less variability among the counts. In 2015, we are 95% confident that the estimated run size (21,290) is between 14,809 and 27,771.

Many thanks to the volunteers who make the count possible!

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