# The Positive Impact of Fishways on Our Local Fish Populations


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## ABSTRACT


1) Human-made barriers in waterways have serious implications on a number of aquatic species, specifically fish, due to the sudden halt of their migrations.
2) The use of fishways has been drastically increasing in order to reduce the negative impacts of dams by allowing fish to bypass these obstacles during migration, yet few people are aware of the issues associated with dams and these solutions.
3) The objectives of this project were to inform my community about the importance of fishways, with a specific focus on where and why different types of fishways are installed, as well as survey a newly installed fishway.
4) In the spring and summer of 2015, I monitored the number of alewives (Fig. 1) that migrated through the Tiley-Pratt Fishway, located on the Falls River in Essex, Connecticut.
5) I also created a pamphlet with information about the different types of fishways and their importance to the environment. The pamphlet is displayed at the Connecticut River Museum, as well as various Essex Land Trust locations.
6) An observation that stemmed from my monitoring was that no alewives migrated through the Tiley-Pratt Fishway in 2015 because that section of the river experienced a very dry season.
7) An implication of this observation is that the fish had to migrate to and spawn in new locations. This relocation of the alewives, though, was not influenced by the installment of the fishway, considering that other species of fish, that would not have been affected by the structure, were also absent from this segment of the Falls River.


## INTRODUCTION

In the U.S. Army Corps of Engineers National Inventory of Dams, there are over 79,000 man-made dams recorded in the U.S., 66,000 of those dams located on rivers (Irvin, 2014). Dams were created to store water for when energy or water levels are low, as well as raise the level of water to increase “hydraulic head,” or the difference in height between the reservoir and the river downstream (McCully, 2001).

While dams prove to be beneficial to humans and even some land animals, these barriers in the waterways have serious implications on a number of aquatic species, specifically fish, due to the sudden halt of their migrations. It is in a fish’s nature to want to lay their eggs relatively close to the location where they were hatched, however, if fish are unable to complete their migrations to this specific location, they are forced to lay their eggs in less suitable locations with detrimental factors such as predators and lack of food. In addition, other detrimental risk factors to fish include increased predation while swimming in the slow waters of the reservoir above the dam and the downfall from the dam to the river. Fish eggs are also not guaranteed to have a safe trip back downstream (Haya, 2013).

A **fishway** (Fig. 2), another term for a **fish ladder**, is a ladder-like structure that makes it more accessible for fish to continue migration upstream over an obstacle such as a dam, and is more cost effective than removing an unnecessary dam (Zimmer, 2014). However, some factors to consider before installing a fishway include the depth of water below the obstacle, the height of the barrier, the water velocity over and through the barrier, the quantity and quality of fish habitat upstream in relation to the barrier, and fish movement patterns. Different species of fish also require specialized ladders because of certain physical characteristics (Garrity, 2014).

Yet, 4,000 dams still obstruct sections of various rivers in Connecticut alone (Skahill, 2015), and few property owners understand the importance of fishways. The purpose of this research and educational project is to demonstrate how fishways help fish bypass these barriers in the waterways; therefore, allowing them to complete their migrations and further increase the fish population. This project will also help people better understand the importance of maintaining fishways and how they make a positive impact on the environment.

***Fig 1.*** *Alewives using a newly installed fishway.*

**Question: What impact do fishways have on fish populations, specifically in Connecticut?**

**Objectives: To communicate the importance of fishways in our environment in order to help encourage the migration and spawning of fish, and therefore, ensure the increase and protection of future fish populations.**

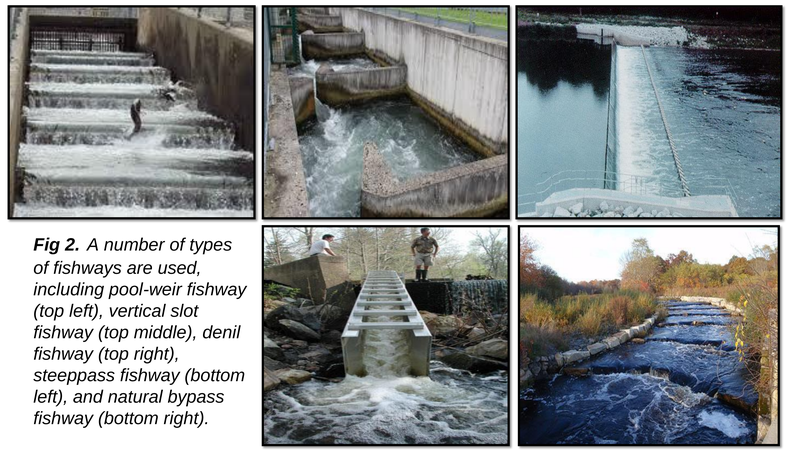


***Fig 2.*** *A number of types of fishways are used, including pool-weir fishway (top left), vertical slot fishway (top middle), denil fishway (top right), steeppass fishway (bottom left), and natural bypass fishway (bottom right).*

## MATERIAL AND METHODS

This project consisted of a research component that involved monitoring a newly installed fishway and comparing the data with the collected data from other fishways around Connecticut. This project also incorporated an education component where I created a pamphlet that describes what a fishway is and its importance to the environment, and includes the data I had collected. This pamphlet is currently displayed at the Connecticut River Museum in Essex, Connecticut.

### *Monitoring Fishway*

- The Nature Conservancy, the Connecticut Department of Energy and Environmental Protection (DEEP), and the Essex Land Trust installed a fishway at Tiley-Pratt River in Essex, CT (Fig. 3).
- I monitored the fishway two days a week from May to June 2015.
- During monitoring periods, the number of fish using the fishway were counted and recorded to later be compared to last year’s data.

### *Research on CT Fishway Success*

- The total number of fish spotted throughout these waterways was collected to assess the efficiency of the fishway via ability of fish to travel and migrate upstream to spawning locations.
- Information on seven CT rivers and streams that incorporate fishways into their flowing systems were recorded (Table 1A).
- I collected this data from the Connecticut Weekly Diadromous Fish Report (Sprankle, 2015) and contributed to this database through my field observations over the summer.
- I also recorded data and information collected at various points throughout the year in order to track seasonal use by fish populations.

### *Creating Educational Material*

- I summarized data and information compiled in the above section and created a pamphlet (Fig 4).
- I worked with the Connecticut River Museum and the Essex Land Trust to distribute the pamphlet to the public.

***Fig 3.*** *Tiley-Pratt Fishway, located in Essex, Connecticut, where I monitored alewives that migrated upstream using the fishway (above). Learning the monitoring procedure with Bob Nussbaum (Essex Land Trust) and Stephen Gephard (CT DEEP) (right) .*

## RESULTS

### *Monitoring Fishway*

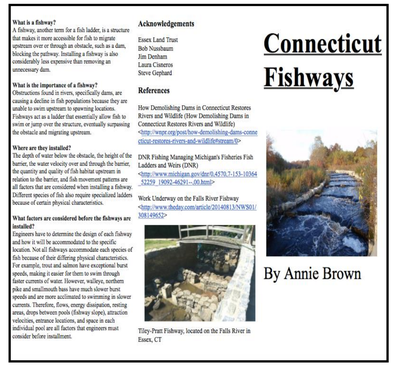
- The new Tiley-Pratt Fishway is very useful and beneficial to multiple species of fish.
- There was a major decrease in migration upstream at the location of Tiley-Pratt Fishway because 2015 had a particularly dry season, forcing fish to migrate to new spawning locations.

### *CT Fishways*

- There are five different types of fishways that can be installed (Fig. 2), some more beneficial to specific types of fish than others (Table 1B).
- Fish populations migrating upstream increase with the presence of a fishway (Table 1).

### *Information in Pamphlet*

***Fig 4.*** *Excerpts from the fishway pamphlet that I created, which is currently displayed at the Connecticut River Museum located in Essex, Connecticut.*



What is a fishway?
A fishway, another term for a fish ladder, is a structure that makes it more accessible for fish to migrate upstream over or through an obstacle, such as a dam, blocking the pathway. Installing a fishway is also considerably less expensive than removing an unnecessary dam.

What is the importance of a fishway?
Obstructions found in rivers, specifically dams, are causing a decline in fish populations because they are unable to swim upstream to spawning locations. Fishways act as a ladder that essentially allow fish to swim or jump over the structure, eventually surpassing the obstacle and migrating upstream.

Where are they installed?
The depth of water below the obstacle, the height of the barrier, the water velocity over and through the barrier, the quantity and quality of fish habitat upstream in relation to the barrier, and fish movement patterns are all factors that are considered when installing a fishway. Different species of fish also require specialized ladders because of certain physical characteristics.

What factors are considered before the fishways are installed?
Engineers have to determine the design of each fishway and how it will be accommodated to the specific location. Not all fishways accommodate each species of fish because of their differing physical characteristics. For example, trout and salmon have exceptional burst speeds, making it easier for them to swim through faster currents of water. However, walleye, northern pike and smallmouth bass have much slower burst speeds and are more acclimated to swimming in slower currents. Therefore, flows, energy dissipation, resting areas, drops between pools (fishway slope), attraction velocities, entrance locations, and space in each individual pool are all factors that engineers must consider before installment.

Acknowledgements
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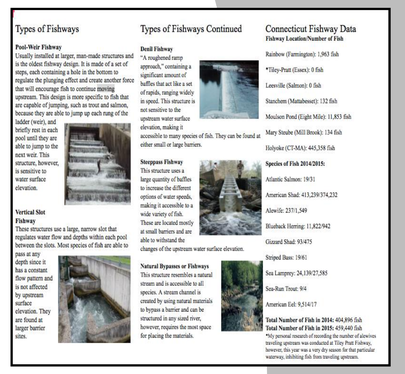
Connecticut Fishways



By Annie Brown



Tiley-Pratt Fishway, located on the Falls River in Essex, CT



Types of Fishways

Pool-Weir Fishway
Usually installed at larger, man-made structures and is the oldest fishway design. It is made of a set of steps, each containing a hole in the bottom to regulate the plunging effect and create another force that will encourage fish to continue moving upstream. This design is more specific to fish that are capable of jumping, such as trout and salmon, because they are able to jump up each rung of the ladder (weir), and briefly rest in each pool until they are able to jump to the next weir. This structure, however, is sensitive to water surface elevation.

Vertical Slot Fishway
These structures use a large, narrow slot that regulates water flow and depths within each pool between the slots. Most species of fish are able to pass at any depth since it has a constant flow pattern and is not effected by upstream surface elevation. They are found at larger barrier sites.

Types of Fishways Continued

Denil Fishway
"A roughened ramp approach," containing a significant amount of baffles that act like a set of rapids, ranging widely in speed. This structure is not sensitive to the upstream water surface elevation, making it accessible to many species of fish. They can be found at either small or large barriers.

Steeppass Fishway
This structure uses a large quantity of baffles to increase the different options of water speeds, making it accessible to a wide variety of fish. These are located mostly at small barriers and are able to withstand the changes of the upstream water surface elevation.

Natural Bypasses or Fishways
This structure resembles a natural stream and is accessible to all species. A stream channel is created by using natural materials to bypass a barrier and can be structured in any sized river, however, requires the most space for placing the materials.

Connecticut Fishway Data
Fishway Location/Number of Fish

Rainbow (Farmington): 1,963 fish
*Tiley-Pratt (Essex): 0 fish
Leesville (Salmon): 0 fish
Stanchem (Mattabesset): 132 fish
Moulson Pond (Eight Mile): 11,853 fish
Mary Steube (Mill Brook): 134 fish
Holyoke (CT-MA): 445,358 fish

Species of Fish 2014/2015:
Atlantic Salmon: 19/31
American Shad: 413,239/374,232
Alewife: 237/1,549
Blueback Herring: 11,822/942
Gizzard Shad: 93/475
Striped Bass: 19/61
Sea Lamprey: 24,139/27,585
Sea-Run Trout: 9/4
American Eel: 9,514/17

Total Number of Fish in 2014: 404,896 fish
Total Number of Fish in 2015: 419,440 fish
*My personal research of recording the number of alewives traveling upstream was conducted at Tiley Pratt Fishway, however, this year was a very dry season for that particular waterway, inhibiting fish from traveling upstream.

***Table 1.*** *1A and 1B. Number of migrating fish in different species utilizing fishways located throughout Connecticut between 2014 and 2015.*

| Fishway Location | Number Migrating Fish |
|---|---|
| Rainbow (Farmington) | 1,963 |
| Tiley-Pratt (Essex) | 0 |
| Leesville (Salmon) | 0 |
| Stanchem (Mattabesset) | 132 |
| Moulson Pond (Eight Mile) | 11,853 |
| Mary Steube (Mill Brook) | 134 |
| Holyoke (CT-MA) | 445,358 |

| Species of Fish | Number Migrating Fish 2014 | Number Migrating Fish 2015 |
|---|---|---|
| Atlantic Salmon | 19 | 31 |
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| Alewife | 237 | 1,549 |
| Blueback Herring | 11,822 | 942 |
| Gizzard Shad | 93 | 475 |
| Striped Bass | 19 | 61 |
| Sea Lamprey | 24,139 | 27,585 |
| Sea-Run Trout | 9 | 4 |
| American Eel | 9,514 | 17 |

## CONCLUSIONS

The informational pamphlet, including the photos from Fig. 2 and the Tables 1A and 1B, will help to better educate the public about the importance of fishways and how they impact the environment. Hopefully this project will inspire people to make positive contributions to the environment by helping fish migrate upstream, which will eventually result in an increase of the fish population as a whole.

## ACKNOWLEDGEMENTS


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