USA: Ten Mile River Aquatic Habitat Restoration of Anadromous Fish Run in East Providence, Rhode Island

Credit: Brian Murphy, U.S. Army Corps of Engineers. Fish ladderat Hunt's Mill Dam.

Overview

The Ten Mile River restoration project restores diadromous fish migration to the lower part of the Ten Mile River in East Providence, RI. This project's main goal is to provide fish passage over the first three downstream dams on the river: Omega Pond Dam, Hunts Mill Dam and Turner Reservoir Dam. A feasibility study was first conducted between 2001 and 2002 by the U.S. Army Corps of Engineers. Fish passage facilities were constructed at these dams to provide upstream migration of adult blueback herring, alewife, and American shad to historic spawning areas. The project restored these anadromous fish populations, providing alewife access to about 340 acres of spawning habitat and 3 miles of riparian spawning habitat for blueback herring and American shad. Dam construction along this river nearly extirpated these fish populations by obstructing migration routes. The city of East Providence joined in partnership with the Department of Environmental Protection (DEM), the U.S. Army Corps of Engineers and several others to pursue this project. It has improved the river environment of the watershed, surrounding communities, and Narragansett Bay. DEM projects that these areas will have the potential to support a fish run of over 200,000 river herring and 25,000 shad.

Project Details

Lead Entity:

Rhode Island Department of Environmental Management

Lead entity types:

- Governmental Body

Partner Organizations:

City of East Providence Environmental Protection Agency National Oceanic and Atmospheric Administration Rhode Island Coastal Resources Management Council Save the Bay Ten Mile River Watershed Council U.S. Army Corps of Engineers USDA Natural Resources Conservation Service

Adaptive management

Describe adaptive management processes and mid-course corrections taken to address unforeseen challenges and improve outcomes in each of the following categories:

Other:

This project is still being evaluated for its success, but has shown promising results since its completion. The Director of the Department of Environmental Management, Janet Coit, has said that thousands of fish have already begun to use the fishways, which indicates progression toward a more self-sustaining ecosystem. The project has improved the river environment for the surrounding community, the watershed and Narragansett Bay. Work on the project did not finish without presenting challenges. The contractor for the construction of the Turner Reservoir and Hunts Mill Dams, The John Ricchio Corporation of Smithfield, R.I., initially began work at the Turner Reservoir when seepage issues

occurred during dewatering stages of the cofferdam. A new approach was required to prepare the area for fish passage construction, and a modification to the contract was made to allow the contractor to install additional sheeting around the cofferdam and along the concrete spillway to maintain integrity of the dam and ensure work can continue with dry conditions. The Omega Pond Dam fishway was constructed last by the Steven & Roger Contracting Corporation. A surprise at this dam introduced a gas line discovered at an unexpected location. Contract terms also had to be renegotiated here with a new design relocating the gas line. Other projects should consider the surprises that can come in an environment like dam construction and consider all safety precautions to ensure a proper construction environment for the people and natural organisms involved. The Ten Mile River in East Providence was dammed at its mouth near Narragansett Bay in the early 20th century. With the efforts of local fisherman and volunteers who have caught and hauled fish over the dam to spawn, remnants of the original fish runs have remained intact. These efforts ensured that the project's target fish species were not completely eradicated from the watershed. Small community efforts are just as important, if not more, as large state and federal endeavors. It is critical that we continue to combine our efforts in pursuit of environmental conservation and protection for the sake of our future and that of the natural world. This project brought together a diverse community of organizations and individuals from the private, public, local, state, and federal levels to work toward a common goal of restoring a vital ecosystem. Further management will indicate the exact measurable success this restoration project has had on anadromous fish populations and the extensive community, but current status shows that the work each partner of the project has contributed has made a largely positive impact on the state of the Ten Mile River watershed. This points to the truth that restoration projects like this are a critically collaborative effort.

State of Progress:

- Monitoring & Evaluation

Project Start:

2001-01-01

Project End:

2015-04-01

Total budgeted expenses:

- USD 5-10 million

Global Regions:

- Americas
- Northern America
- World

Countries:

- United States of America

Ecosystem Functional Groups / Biomes:

- Rivers and streams biome

Extent of project:

- Other

Extent of restoration:

- Other

Degradations:

- Contamination (biological, chemical, physical or radiological)
- Drainage and hydrologic changes
- Fisheries & Aquaculture
- Fragmentation
- Urbanization, Transportation & Industry
- Demographic changes

Description:

Many New England coastal rivers like the Ten Mile River provided habitat for various species of anadromous fish. During the last 200 years, dams were built along these rivers to provide water power for industrial purposes. Manufacturing in the Ten Mile River watershed began in the late 1700's, which initiated the construction of dams to power the new industries. The Boston and Providence Railroad was completed in the mid-1800's, creating a transportation link between industries along the river, allowing for increased production. Primary industries were jewelry and textiles, along with paper, primary metals and machinery. The river was also used as a conduit for wastewater disposal. All this combined, the

river began seeing fragmentation from dam construction as well as poor water quality from human development by the mid-1900's, which has greatly reduced the populations of fish runs that utilize the habitat in this river. The three dams in this project were built soon after the city of East Providence was established in 1636. Hunts Mill Dam was constructed by John Hunt in approximately 1770 to provide power to his gristmill. In the early 1800's, the Omega Pond and the Turner Reservoir Dams were built. The Omega Pond was used for process water for industries like steel product manufacturing. The Turner Reservoir was used as a water supply to East Providence. As a result, these dams not only obstructed fish passage, but also accentuated the discharge these industries put into the river as waste, which severely impacted water quality. The water remained poor in quality up through the 1970's until the Clean Water Act and Amendments of 1972 were implemented to provide funding for wastewater treatment plants, which led to improvement in water quality of the river. In 1984, the Rumford River Laboratories surveyed the Ten Mile River and prepared a report in 1985 that found the overall condition of the river to have improved significantly in the previous decade with better treatment of municipal and industrial wastewaters. Two major problems that remained were metal contamination by copper, lead, and nickel and over-fertilization of aquatic vegetation by phosphate nutrients. These impacts were seen at all levels in the aquatic organisms and fish. In 1999, the U.S. Army Corps of Engineers conducted an investigation of Turner Reservoir and found elevated levels of nitrogen and phosphorus that exceeded the water quality criteria of the Environmental Protection Agency for the prevention of algal blooms and eutrophication. This same year, the U.S. Army Corps of Engineers completed its study, known as the Rhode Island Ecosystem Restoration Reconnaissance Report/Analysis, under Section 905(b) of the Water Resources Development Act of 1986. In the study, the Ten Mile River was identified as a river where anadromous fish could be restored by providing fish passage over the obstructing dams. Remnants of original fish runs remain due to efforts of local fisherman. Every spring, herring have returned to the base of the dams, and local fisherman have caught and hauled the fish over the dam to spawn. Within the last 30 years, water quality has improved to support large biological communities of native and stocked fish species, largely due to the Clean Water Act and resulting reduction of discharge by nearby industries. However, restoration of anadromous species that previously inhabited the Ten Mile River could not be accomplished, nor could self-sustaining populations of the species in focus be established without fish passage at the identified dams.

Planning and Review

Goals and Objectives

Was a baseline assessment conducted:

unsure

Was a reference model used:

OTHER

Other reference models used::

The reference ecosystem is primarily based on <u>historical information</u> about ecological attributes at the site prior to degradation.

were_goals_identified:

YES

Goals and objectives:

- Other

Goals Description::

The construction of dams along the Ten Mile River has caused reduction of fish populations by decreasing their ability to reach spawning habitat and thereby limiting their ability to spawn upstream. In 1999, the U.S. Army Corps of Engineers conducted a study, known as the Rhode Island Ecosystem Restoration Reconnaissance Report/Analysis, under Section 905(b) of the Water Resources Development Act of 1986. In it, the Ten Mile River was identified as a key site where anadromous fish could be restored if provided fish passage over the dams. In 2001, the organization conducted a feasibility study to survey the sites and develop plans for fish ladder construction at the three dams. The goal of the project is to bring self-sustaining runs of American shad and two species of river herring (blueback and alewife) to the Ten Mile River watershed. Rhode Island's Department of Environmental Protection has taken responsibility to sponsor the project, and has partnered with several other agencies to organize their goals and see this restoration through. The project not only upholds environmental responsibility of the public-private partnership amongst local, state and federal agencies working with environmental advocacy groups. This endeavor supports cultural and economic resources of the City of East Providence by improving fish populations to enhance commercial fishery productivity and recreational activities at the dams as well for stakeholders in Rhode Island.

Stakeholder Engagement

Were Stakeholders engaged?:

unsure

Description of Stakeholder Involvement:

Major stakeholders include those organizations that have largely participated in research of the watershed area and have contributed funding to the project. The RI DEM and the Army Corps of Engineers provided a large amount of help in this project, leading the study which created the action plan for project implementation. Other large contributors were the USDA Natural Resources Conservation Service and the Environmental Protection Agency. The project was also supported by the Narragansett Bay Watershed Restoration Bond Fund, the National Oceanic and Atmospheric Administration, the Rhode Island Coastal Resources Management Council's Habitat Restoration Trust Fund and the Fish America Foundation. Other large contributors to the project include Save the Bay, the City of East Providence, and the Ten Mile River Watershed Council. Residents of East Providence and any participants in the fisheries impacted by the project are significant stakeholders as well. Local fishermen and residents bordering the watershed are a large part of the project at hand. Information containing project descriptions and updates were released by the DEM and the U.S. Army Corps of Engineers. News articles were also written as the project progressed, all of which maintained inclusion of stakeholders to keep them informed of project activities.

Ecosystem Activities and Approaches

General Activities: The Ten Mile River has been studied under several comprehensive habitat and water quality investigations through the restoration efforts of various private, state, local and federal agencies. Between 1996 and 1997, the Turner Reservoir was stocked with alewives and blueback herring by the Rhode Island Department of Environmental Management. This action was deemed a success, indicated by subsequent netting of juvenile river herring in the fall of those years. Habitat studies conducted during that time indicated that the Ten Mile River could also support American shad. These studies evaluated appropriate alternatives to provide fish passage at the three lowermost dams on the Ten-Mile River to restore anadromous fish to their historic upstream habitat. In 1999, the U.S. Army Corps of Engineers completed the Rhode Island Ecosystem Restoration Reconnaissance Report/Analysis, under Section 905(b) of the Water Resources Development Act of 1986 (WRDA 86). This study identified the three dams that became the three main sites of this project as requiring fish passage to restore anadromous fish to the lower portion of the Ten Mile River. A feasibility study was then conducting in 2001 and 2002 to determine how to accomplish this restoration. Site inspections were conducted on foot, from a canoe, or by boat. Observations were made of the types of spawning and juvenile habitat for targeted anadromous fish species. Measurements of the width of the stream were taken to aid in habitat area size calculations. Obstructions to fish passage were located, measured for height and width, judged for the most effective type of fish passage methods and the proximity to anadromous habitat. Other characteristics were noted during site inspections including water levels, water characteristics, surrounding land use, presence or absence of anadromous species, wildlife species, substrate types, vegetation types, point sources of pollution or runoff and any of significant characteristics. At Omega Pond, a 4-foot wide concrete Denil fishway was installed on the left-side of the dam, facing downstream, adjacent to the northern abutment of the concrete spillway. The fishway is made of reinforced concrete supported by drilled shafts and extends from the base of the dam to the top of the spillway with a 13-foot height. Upstream and downstream cofferdams were required to clear the construction area temporarily. Its downstream entrance is on the left bank of the river at the base of the spillway. It runs along the existing retaining wall, and notches into the left side of the existing spillway to form the exit channel. The entrance channel is 30 inches wide and sits at a 45-degree angle to the direction of river flow. The fishway widens to 4 feet by 135 degrees relative to river flow. After a 10-foot section, the fishway ascends parallel to the spillway for 42.5 feet. At the top of this leg of the ladder, the fishway turns 180 degrees at a 10-foot long turning pool. The fishway then ascends 57.5 feet to an 8.5-foot long exit channel cut into the existing stone spillway and into Omega Pond. To provide downstream passage, a 3-foot wide and 1-foot deep downstream migrant slot was cut into the spillway 20 feet from the left abutment. It is operational during upstream fish migration periods and has mechanisms of stop log control structures at each end that allow for adequate flow during these periods. A smooth surface flume and plunge pool are included for safe passage of juvenile fish. Similar structures were built at both Hunts Mill and Turner Reservoir Dams. At Hunts Mill Dam, the Denil fishway is located on the right side of the spillway, with its downstream entrance and upstream exit channels located on the right side of the dam and its abutments. After the entrance channel widens from 30-inches to 4 feet and turns 135 degrees, the fishway ascends 35 feet parallel to the riverbank. The fishway then turns 180 degrees at a 10-foor turning pool and ascends 32.5 feet before entering the 10-foot level section. A different feature implemented at Hunts Mill Dam is a fish trap at the fishway exit, which follows this section. It is 8-feet wide and 10-feet long with lifting brails to allow fish transfer. This allows the Rhode Island Division of Fish and Wildlife to relocate excess fish exceeding available spawning grounds to other coastal watersheds. The exit channel from the fish trap is 3 feet wide. At Turner Reservoir Dam, a Denil fishway was constructed on the left side of the spillway abutment. Its downstream entrance is at the base of the spillway along the left embankment at a 45-degree angle to river flow. It makes a 135-degree turn and ascends 47.5 feet along the left embankment to a 180-degree 10-foot turning pool, where it proceeds to the exit channel at the left end of the spillway. The upper portion of the fishway is 60-feet long and ends at an exit channel that is 11-feet long. The exit channel is cut into the spillway by 1.1 feet. Both the Hunts Mill and Turner Reservoir Dams required portable dams or coffer dams to clear construction areas of water and allow for construction of the fishways, as did the Omega Dam. Less than 100 cubic yards of bank and riverbed material were excavated at each site and were either replaced or disposed of at an approved upland site. 1) eliminate existing threats to the ecosystem: Regarding removal of existing threats to the ecosystem (the three dams under manipulation and their obstruction to fish migration routes), the project focused on the construction of fishways. This occurred during the low flow season outside of the seasonal time that existing anadromous fish populations migrate downstream. A Clean Water Act, Section 401 Water Quality Certificate and all other permits needed were obtained prior to construction. These fishways acted to remove the existing threat by allowing access to fish migration routes, but

also contributed to reinstating appropriate physical conditions to achieve the desirable species composition of various fish species historically important to the river. Restoring these fish populations will provide forage for existing resident fish populations, like the commercially important striped bass, cod and bluefish. Thus, the activities of this project will support the structural diversity of this area by strengthening the food webs these anadromous fish populations were a part of. 5) recover ecosystem functionality (e.g. nutrient cycling, plant-animal interactions, normal stressors): To address ecosystem functionality, RI DEM is working with the Massachusetts Department of Environmental Protection and the United States Environmental Protection Agency to carry out plans for a pollution reduction strategy known as Total Maximum Daily Load (TMDL) which will establish improved pollutant loads in the river to achieve better water quality standards in a river heavily affected by the surrounding city pollutant discharge.

Project Outcomes

Reinstate appropriate physical conditions: Fishway implementation has been successful at the three dams along the Ten Mile River in East Providence. Project officials and local stakeholders have seen the return of many adult fish, indicating the potential for future sustainable fish populations. Fishways have reduced the fragmentation brought by the dams to increase connectivity along the river. Appropriate physical conditions in terms of migration routes have been achieved. Appropriate water quality standards remain under manipulation. With monitoring still underway, species composition and structural diversity can be seen with significant positive growth since the implementation of the fishways. Recover ecosystem functionality: The Division of Fish and Wildlife for Rhode Island Department of Environmental Management continues to monitor fish populations, as well as the fish trap at Hunts Mill Dam to measure population health and overall health of the river ecosystem. Adult fish runs are increasing, and the fishery industry has benefited from the completion of the project. Ecosystem functionality is a future focus of the river to better the health of the waterways and reduce the amount of pollution entering the river system. The fishways have contributed to external exchanges to allow for fish migration to northern portions of the river through reinstatement of connectivity between dams and upriver spawning grounds. Migration routes have been restored to allow access to greater areas of the river and therefore greater gene flow of fish populations. Factors limiting recovery of the ecosystem: Overall, the river has experienced fluctuations in its water chemistry that challenges the resiliency of its fish populations and other aquatic organisms, which detracts from the recovery of the entire system. The Rhode Island Department of Environmental Management is working with the Massachusetts Department of Environmental Protection and the United States Environmental Protection Agency to carry out their plans of a Total Maximum Daily Load (TMDL). The Clean Water Act of 1972 and its following effects leading up to this project have greatly helped the water quality of the Ten Mile River, which is cleaner today than it has been in decades. However, the effects of the industrial revolution remain in the watershed to hinder the recovery of the ecosystem. In 2010, a toxic algal bloom occurred on the Turner Reservoir, which caused a ban on recreational activities between August and September and slowed the re-establishment of fish species by reducing the healthy function of their habitat along the river. In January of 2013, the Department of Environmental Management held a meeting on a water quality restoration plan for the Ten Mile River in response to improper water quality standards of the river. Testing found that the Ten Mile River and its impoundments (Central Pond, Turner Reservoir, and Omega Pond) do not meet state water quality standards for total phosphorus, dissolved oxygen, pathogens and metal content for aluminum, cadmium, lead, and iron. The disproportionate levels in each of these categories negatively impacts aquatic life and recreational use. Elevated phosphorus levels cause excessive growth of aquatic plants and algae, resulting in lower oxygen levels and cyanobacteria blooms. Two of the most significant sources of pollution are wastewater and storm water discharges to the river. Most of the river's flow during periods of no precipitation consists of treated wastewater discharged from two publicly-owned treatment facilities in Massachusetts. Being highly urbanized, any rain or snowmelt events cause runoff containing pathogens, metals, and phosphorus to flow into the river and further degrade it, limiting the river's recovery. Other sources of pollutants include contaminated sediments re-introduced to the water column during high river flows, contaminated groundwater, phosphorus released from sediments in impounded portions of the river, and other natural sources such as atmospheric deposition. Pollution reduction strategies have since been adopted through the water quality restoration plan, consistent with the Clean Water Act requirements, formally called the Total Maximum Daily Load (TMDL) to establish allowable pollutant loads in the river and achieve acceptable water quality standards. Economic vitality and local livelihoods: The implemented fishways are helping river herring reach upstream spawning grounds that had been blocked by dams since the late 1600s. Allowing passage will help balance the ecosystem and enable Rhode Islanders to fish healthy schools of herring. These fish populations will increase, which will provide a food source for striped bass, cod, bluefish and other commercially and recreationally important fish. They are integral parts of Rhode Island's fishing industry, worth over $200 million annually. The U.S. Army Corps of Engineers notes that the project supports an influx of additional forage for existing resident fish populations. All life stages of anadromous herrings are important forage for many freshwater and marine fishes that occur in the Ten Mile River estuary. Having shad and blueback herring established in this river would provide out-migrating juveniles as forage not only for resident warm water species, but also marine and estuarine fish in the Seekonk and Providence Rivers as well, downstream from Omega Pond. Adults would also provide forage to larger fish in Narragansett Bay. As a result, this project supports Rhode Island's vital fishing industry and economy. Cultural dimensions including recreational, aesthetic and/or spiritual values: The Ten Mile River itself is a significant recreational resource. The impoundments behind each of the three dams are used for fishing, non-power boating, and other recreational activities like hiking or bird-watching. Fish ladders would positively affect cultural and economic resources of the city of East Providence and its vicinity by providing additional recreational opportunity to view migrating fish and enhancing existing fisheries, especially in Hunts Mill Dam where it is located in a small park already used for hiking and picnicking, having a positive effect on overall productivity. Together with other anadromous fish restoration projects throughout the watershed and other coastal areas of New England, anadromous fish populations will experience substantial increases in population numbers that contribute to restoration of important marine, estuarine, and freshwater fish stocks. This project also aligns with the Coastal America cooperative effort aimed at restoring anadromous fish to the Northeast. Has the project had any negative consequences for surrounding communities or given rise to new socio-economic or political challenges?: This project has not had any negative consequences for surrounding communities or given rise to new socio-economic or political challenges.

Monitoring and Data Sharing

Does the project have a defined monitoring plan?:

YES

Monitoring Details:

Monitoring includes recording adult returns, measuring upstream and downstream passage efficiency, checking of Hunts Mill fish trap, testing water quality, and re-stocking the area if needed. Duration Start: Monitoring began with the completion of construction of the fish passage facilities in 2015. Duration End: There is no projected end date, currently. Monitoring will continue until fish populations are sustainable.

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Long Term Management

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