NATURAL RESOURCES CONSERVATION SERVICE
Rhode Island Anadromous Fish Habitat Restoration
Special Project Proposal
Fiscal Year 2005

Pawtuxet River Falls Dam, Warwick & Cranston RI

NRCS Natural Resources Conservation Service

Statement of Need:

Rhode Island once supported lucrative fisheries for anadromous Atlantic salmon *(Salmo salar),* American shad (Alosa sapidissima), and river herring - alewife *(Alosa pseudoharengus)*and blueback herring (Alosa aestavalis). These "anadromous" species spawn in fresh water, and mature and spend most of their adult lives in salt water. Because most of Rhode Island's rivers are blocked or obstructed by dams, weirs, tide gates, or other water-control structures; anadromous fish populations in Rhode Island have been severely impacted. Although commercial fisheries for these species are not currently viable, some fish runs still persist today (*e.g.*, Gilbert Stuart –North Kingstown and Nonquit in Tiverton). USDA NRCS Farm bill programs, working together with an established and effective state, local, and federal partnership, are now uniquely positioned to positively impact these valuable fish runs. Significant opportunities now exist to increase the scale of fish passage restoration in RI. Hundreds of restoration opportunities have been evaluated and identified by the Rhode Island Department of Environmental Management (RIDEM) Division of Fish and Wildlife's *Strategic Plan for the Restoration of Anadromous Fishes to RI Coastal Streams*. Based upon a number of State Watershed Restoration Planning Meetings conducted in 2004, the highest priority river basin projects have been selected as part of this NRCS Special Project request. NRCS is requesting $4,313,750 in financial assistance to restore over 3559 acres of anadromous fish habitat to RI coastal and inland communities. This will result in far reaching ecological, social, and economic benefits to the state of Rhode Island.

Fish Run Restoration Overview

Anadromous fish runs in Rhode Island occur in rivers, streams, and adjacent areas that drain into coastal ponds, Narragansett Bay, and Block Island Sound. These systems are used by migratory fish to reproduce and provide nursery habitat for juveniles. River herring, Atlantic salmon, rainbow smelt, sturgeon, and American shad depend on passage upstream for survival. American eels are a catadromous species, living in lakes and ponds as adults. They migrate downstream and eventually far out into the Atlantic, where they are believed to spawn and die in the Sargasso Sea. Their newly born young, less than an inch long, travel on ocean currents back to Rhode Island's rivers and streams. Proposed fish passage restoration efforts include provisions for passing both catadromous and anadromous species. In addition to unobstructed passage through the water, anadromous fish need healthy riparian areas whose vegetation provides cover, bank stabilization, and temperature regulation. Riparian vegetation also provides detritus (leaf litter, wood, etc.), which forms the base of the riverine food chain. Recreational and commercial fisheries benefit when riparian corridors remain intact and passable to migratory fish.

Fish Run Habitat Degradation and Impacts

Prior to European colonization, Native Americans depended on the spawning runs of herring and salmon as staples. Accounts by Roger Williams, Verrazano, and other explorers and colonists describe the astounding productivity of the Bay's tributaries. During colonial times, dams were constructed throughout Rhode Island to harness water power. The advent of the Industrial Revolution in the late 18th century resulted in an increased number of larger dams. By the early 20th century, over 500 dams had been constructed in Rhode Island streams and rivers, with disastrous effects on anadromous fish runs. The Atlantic salmon fishery was lost by 1870. The river herring harvest was significantly depleted by 1930.

Dams change stream flow patterns, encourage upstream siltation and physically prevent fish from reaching upstream spawning habitat. Many rivers and streams that flow through urban, residential, and farmed areas are subject to industrial and agricultural pollution, both from point and non-point runoff. Additional impediments to spawning success may include blockage of migratory pathways by debris (*e.g.*, construction materials, trash, brush piles, logs, etc.), blockage of smaller waterways by vegetation, culverts which may drain waterways or divert flow into rivers and ponds, and poor water quality. Water quality parameters critical to the successful

movement of anadromous fish upstream include temperature, salinity, pH and dissolved oxygen (Durkas, 1992).

In an unaltered riverine system, fish migrate upstream to lay their eggs, and the eggs remain there until they develop into juveniles. In the fall, triggered by a decrease in water temperature and change in daylight, most of the juveniles begin their downstream run into more brackish water. Naturally functioning, stable stream systems promote the diversity and availability of habitats necessary to support anadromous fish habitat requirements. Sinuous streams with intact streamside vegetation, undercut banks, fallen logs, boulders and riffle/pool sequences provide some of the most diverse habitats for aquatic organisms.

When a river or stream is blocked or altered, it will change the flow levels of the river or stream, sometimes allowing more sedimentation to build up in the channel upstream of the dam, covering previously used habitat for these fish species. Pollutants can accumulate in these sediments to levels of concern for humans and the ecosystem. Obstructions can alter the water flow significantly, and in effect, they can change the bottom contours of the water body both upstream and downstream of the obstruction.

Fish runs often run through urban and agricultural areas, and are often degraded by point and nonpoint source runoff when excess sediments, nutrients, and other pollutants clog streams and poison fish and wildlife. Stream banks that have been channelized and whose banks have been stripped of stream-side vegetative cover cannot provide the habitat necessary for the living resources of the water body.

Unimpacted Anadromous Fish Habitat	Degraded Anadromous Fish Habitat
• Forested or thickly vegetated riparian zone bordering river or stream • Presence of fallen logs or boulders that provide habitat structure • Indicators of good water quality, such as diverse benthic community • Valuable in-stream species such as native brook trout • Vegetated banks • Gravelly or sandy sediments	• Presence of an obstruction to fish passage • Channelized streambank • Unvegetated or undercut banks • Paved banks or riparian areas • Presence of floodwalls • Trash in the river or along the banks • Erosional areas along banks • Poor water quality • Presence of fish species representative of degraded habitats, such as carp • Contaminated sediments • Mucky sediments

Anadromous Fish Restoration Techniques:
The most common fish passage facilities are fish ladders. Fish ladders can be built of concrete, timber, or aluminum. Some of the most common types are Alaskan steep-pass. Denil, rock-ramp, bypass channels, and pool-and-weir. Each is suitable for a particular species, stream size, project cost, or specific site condition. If a fish run restoration project is aimed at several target species, the ladders should generally be designed for the weakest swimmer.

Where practicable, dam removal is a better option than ladder construction because it restores the natural hydrology of the river, has the potential for many habitat and water-quality benefits, and because some anadromous fish such as rainbow smelt and sturgeon do not climb fish ladders. Federal, state, and non-profit agencies have begun promoting this approach to river restoration over the past several years, and several dams have been removed or breached in New England. In Rhode Island, the legacies of industrialization and urbanization present special problems for dam removal. For example, on the Woonasquatucket River in Providence, the discovery of dioxin-

contaminated sediments has spurred the reconstruction of an obsolete dam to prevent the release of contaminants into the river. Nevertheless, among the hundreds of dams in Rhode Island, most of which no longer serve their original purpose, there are many dams that it would be beneficial to remove. Dam removal increases fish spawning habitat upstream of the obstruction. Where dam removal is not an option, fish ladders can be used. These structures are designed to enable anadromous fish to bypass these blockages and return upstream to spawn. Blockages can also be removed, notched, or breached, particularly if the dam is small or in disrepair.

Proposed Restoration Goals

It has been determined by RIDEM that there are at least 41 streams with potential for fish run restoration in Rhode Island and Massachusetts. Currently 18 streams support herring runs in Rhode Island but most are impaired to some degree and in need of restoration. Historically, at least 45 runs existed in the Narragansett Bay watershed. RIDEM's Anadromous Fish Restoration Plan along with priority projects identified by the Rhode Island Habitat Restoration Team (RIHRT) have been used to determine funding priorities and identification of potential projects. RIHRT has been responsible for coordinating statewide restoration planning since its inception in 1998. RIHRT consists of a local, state, and federal partnership whose mission is to promote the restoration of damaged coastal habitats by coordinating restoration planning, projects, and information at the state level. RIHRT is responsible for developing a state coastal habitat restoration plan as mandated by the RI "Coastal and Estuary Habitat Restoration Program and Trust Fund which was established into law in Spring 2002. NRCS is an active partner on the RIHRT

<u>The following River Basin Projects have been identified and prioritized by the RIHRT and RIDEM Anadromous Restoration Plan as part of this NRCS special project proposal:</u>

Almy Creek Watershed

Almy Creek has an existing river herring run into Nonquit Pond. A significant amount of habitat is currently inaccessible upstream of Watson Reservoir. Funding for engineering, design, permitting, and construction will be required to restore over 380 acres of anadromous fish habitat. Anticipated restoration action will be the installation of a denil type fishway.

Kickemuit River

The Kickemuit Reservoir Dam, located at the head of tide, currently prevents the passage of migrating river herring and other fish species. The proposed project includes the installation of a Denil fish ladder and plunge pool to allow both upstream fish access to the reservoir during the spring adult migration, as well as out-migration by adults and juveniles in the summer and early fall. This fish ladder will allow river herring access to spawning and nursery habitat in the Kickemuit Reservoir and is an excellent opportunity to restore a historic river herring run to Narragansett Bay. Engineering and Permitting for this project is already completed. Restoration will result in the restoration of over 40 acres of habitat in Rhode Island and Massachusetts.

Pawcatuck River Watershed

The Pawcatuck river, one of the three largest and most pristine rivers in Rhode Island, is located in the southwestern portion of RI and southeastern Connecticut (Erkin, 2002). The 308 sq. mile watershed includes the Rhode Island towns of Westerly, Charlestown, South Kingstown, Richmond, Hopkinton, Exeter, and West Greenwich; and in Connecticut-Stonington, North Stonington, Voluntown, and Sterling. Aquatic habitats range from warm-water impoundments and flowing water to freestone streams in the Wood River and Usquapaug River watersheds. Warm water areas are predominated by

submerged aquatic vegetation, and have a habitat suitable for American shad, alewives, and blueback herring. Coldwater sections are suitable for Atlantic salmon and trout species. This is the only watershed identified by RIDEM with significant salmon habitat. A total of fourteen major restrictions to fish passage will be addressed by this proposal, resulting in the restoration of over 1750 acres of fish habitat. Conceptual restoration designs have already been completed for four of these projects.

Lower Pawtuxet River

The Pawtuxet River is Narragansett Bay's third largest tributary. Anadromous fish have been prevented from spawning in the Pawtuxet River due to a dam at the mouth of the river where it confluences with Narragansett Bay. Today, river herring can be found at the base of the dam where the freshwater discharge of the river provides sufficient attraction for fish migrating through Narragansett Bay. Providing fish passage to the Pawtuxet River would enhance the marine fishery in Pawtuxet Cove and Narragansett Bay and the freshwater fishery in the river. Restoration design and planning is currently underway for this critical project which has the potential to not only restore 54 acres of anadromous fish habitat but also freshwater tidal and brackish wetland habitats, the rarest wetland types in Rhode Island.

Woonasquatucket River

The Woonasquatucket River extends from its headwaters in North Smithfield, Rhode Island to the City of Providence. In Providence, the River creates "Waterplace Park" a centerpiece for Providence's downtown revival, then merges with the Moshassuck River and flows into Narragansett Bay. The watershed is approximately 52 square miles in area and drops more than 200 feet in elevation along its 19-mile length. Due to the River's significant industrial heritage, dams are prevalent. Fish passage in the lower Woonasquatucket River is currently obstructed by five abandoned mill dams. Preliminary surveys by staff of the RI Department of Environmental Management Division of Fish and Wildlife, NOAA Restoration Center, and Narragansett Bay Estuary Program have found suitable habitat and conditions for river blueback herring and alewife species with possible habitat for American shad in the lower river. Restoration of river herring to the Woonasquatucket River will provide ecological benefits to the river and upper Narragansett Bay by restoring historic anadromous fish spawning and rearing areas. This phase of the restoration will restore approximately 4.5 acres of upstream habitat for fish passage. Total area including downstream habitat from the river mouth to the first dam is approximately 37 acres.

The dams initially targeted for this project are within the area of the Woonasquatucket River Watershed Council's Woonasquatucket River Greenway Project (the Greenway Project), a designated Brownfield Showcase Community, and the Woonasquatucket River is a federally designated American Heritage River. Each of these designation efforts received broad community support. The master plan for the Greenway Project was developed after 18 community meetings, focusing on the restoration of abandoned public lands and Brownfields as new passive and active recreational spaces for the residents of Olneyville, a designated Federal Enterprise community neighborhood. Restoration of the river and its habitat is an important element in the plan for the Greenway Project. In addition to meetings for the master plan, neighborhood organizations and school children participated in the design of the public spaces. The Woonasquatucket River is an important natural asset in a neighborhood where 54% of the children live in poverty, the population is 78% minority, and the median family income is the lowest in the city - $19,676 (citywide-$32,058).

NRCS has entered into a cooperative agreement with U.S Fish and Wildlife Service to provide conceptual engineering designs for the lower four restoration projects. This work will be completed Fall 2004. Additionally, Owners of three dams have expressed their willingness and interest in pursuing fish habitat restoration. Struever Brothers, Eccles & Rouse, the owner of the first two dams, has applied for funding from NRCS for assistance in looking at options for fish passage at these two sites. The fourth impoundment, formerly known as Dyerville Dam, has deteriorated to a state where removal would be possible and welcomed by the owner.

Greenwich Bay Watershed-Gorton Pond

Gorton Pond is a 57.89-acre pond located near the City of Warwick's village center, Apponaug. It drains southwesterly through a culvert at Route 116 (Greenwich Avenue) into Little Gorton Pond. Little Gorton Pond drains at its southern end by a stream that follows a meander before becoming channelized under the mill complex located at the corner of Route 116 and Route 117. Somewhere along the stream reach under Little Gorton Pond, the stream joins Hardig Brook and ultimately drains to Apponaug Cove and Greenwich Bay. This is a highly urbanized drainage with intense residential, commercial and industrial land uses on the pond's shorelines and along the streams. In addition to noticeable impacts to the pond and its streams, (i.e. channelization, litter, debris), it suffers from several water quality impairments. According to the State of Rhode Island's 2002 303(d) List of Impaired Waters, Gorton Pond is a 'Group 2' water with excessive algal growth/chlorophyll A, low dissolved oxygen and high levels of phosphorous. Despite these negative conditions and impacts, several sources verify that the system supports a significant annual run of spawning alewives (*Alosa pseudoharengus*). According to RIDEM and local sources, migrating adult alewives have been observed at the outlet of Little Gorton Pond for the past several years in the spring. It has also been witnessed that anglers frequent the Gorton Pond and Little Gorton Pond outlets to catch migrating adults.

Annaquatucket River

The Annaquatucket River runs through the town of North Kingstown, R.I. on the west shore of Narragansett Bay. Four fish ladders on the Annaquatucket (Hamilton, Featherbed, Belleville Pond and Secret Lake) allow river herring to pass upstream to spawn in several large impoundments. Minor modifications and the installation of a slide gate at Hamilton dam (first ladder on system) will restore over 200 acres of spawning habitat for river herring.

Restoration Partners:

RIDEM Division of Fish and Wildlife
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Wakefield, RI 02879**Coastal Resources Management Council**
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Narragansett Bay Estuary Program
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Save The Bay
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US Fish and Wildlife Service
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NOAA Fisheries, Northeast Fisheries Science Center
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Wood-Pawcatuck River Watershed Association
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Hope Valley, RI

RI Rivers Council
Meg Kerr
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Kickemuit River Watershed Council
Ann Morrill
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Pawtuxet River Authority
http://www.pawtuxet.org/
Historic Pontiac Mills
334 Knight St.
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Buckeye Brook Coalition
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Woonasquatucket River Watershed Council
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RI Watershed Partnership

Corporate Programs
The Rhode Island Corporate Wetlands Restoration Program

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Project Budget

Basin/Project	Dam Height	Anticipated Restoration Method	Total Installation Cost	Partner Contributions-Installation	Planning & Design Costs by Partners	75% NRCS Cost share-FA	Total Habitat Acres*
Kickemuit River		denil	**$ 220,000**	**$ 140,000**	**$100,000**	**$ 80,000**	**40**
Woonasquatucket River							
Rising Sun*	5.53	denil	$ 200,000		$ 12,000	$ 150,000	1.5
Paragon*	4	removal	$ 150,000		$ 12,000	$ 112,500	3
Riverside/Atlantic Mills Dam	9.5	denil	$ 332,500		$ 12,000	$ 249,375	13
Dyerville Dam	2	removal	$ 50,000			$ 37,500	5
Manton Dam	6	denil	$ 210,000		$ 12,000	$ 157,500	7
Sub Total Watershed			**$ 942,500**		**$ 48,000**	**$ 706,875**	**31**
Lower Pawtuxet River							
Pawtuxet River Falls Dam*	9	Rock ramp	**$ 400,000**		**$150,000**	**$ 300,000**	**101**
Greenwich Bay Watershed Gorton Pond							
Upper Dam	na	obstruction removal	$ 80,000		$ 10,000	$ 60,000	58
Lower Dam	na	obstruction removal	$ 20,000		$ 10,000	$ 15,000	3
Sub Total Watershed			**$ 100,000**		**$ 20,000**	**$ 75,000**	**70**
Almy Watershed							
Watson Reservoir	34	denil	**$1,190,000**			**$ 892,500**	**606**
Pawcatuck River Basin							
Ashaway Line Pond*	4.2	steepass	$ 105,000			$ 78,750	1
Ashaway Mill Pond *	6.5	steepass	$ 162,500			$ 121,875	3
Bethel Pond*	6	steepass	$ 150,000			$ 112,500	18
Ashaway river-Chapman Pond debris clean up	****	obstruction removal	$ 10,000			$ 7,500	172
Bradford Dam	6	repair				$ -	82
Potter Hill Dam*	8	denil	$ 320,000			$ 240,000	83
Alton Pond Dam*	12	denil	$ 480,000		$ 15,000	$ 360,000	72
Woodville Pond*	7	denil	$ 245,000		$ 15,000	$ 183,750	51
Wood River Junction*	7	steepass	$ 175,000			$ 131,250	34
Route 91 gauging station*	3	slot	$ 20,000		$ 5,000	$ 15,000	22

Project Budget Continued.

Basin/Project	Dam Height	Anticipated Restoration Method	Total Installation Cost	Partner Contributions-Installation	Planning & Design Costs by Partners	75% NRCS Cost share-FA	Total Habitat Acres*
Carolina Pond *	7	removal	$ 200,000			$ 150,000	1
Shannock Mill Pond *	7	removal	$ 245,000			$ 183,750	4
Horseshoe Falls Dam *	16	denil	$ 640,000			$ 480,000	12
Kenyon Mill Pond *	7	denil	$ 245,000			$ 183,750	1200
Sub Total Watershed			**$2,997,500**		**$ 35,000**	**$2,248,125**	**2533**
Annaquatucket River							
Hamilton Dam		Slidegate repair	**$ 15,000**			**$ 11,250**	**193**
PROJECT TOTAL			**$5,865,000**	**$ 140,000**	**$353,000**	**$4,313,750**	**3559**

*** Maximum NRCS contribution, partners will likely provide some portion of installation cost in excess of 25%**

Fish Passage Restoration Types:

Removal: Either full or partial dam removal, restoring in stream aquatic riverine habitat as well as fish passage

Denil: Artificial roughened channel used on larger river systems

Steeppass aka "Alaskan Steeppass" fishway: denil type fishway for lower flow rivers and streams

Rock Ramp: Nature Like Fishway using pool and weir concept usually run of river

Obstruction Removal: removal of in stream obstructions via mechanical methods

* Bold Acreage is the total restoration area affected by restoration actions (upstream and downstream, calculated using NOAA Anadromous Fish Site Selection Model). Unbolded acreage reported for each fish passage project is upstream area affected by each particular restriction, calculated by Erkan (2002). Therefore, unbolded numbers do not sum to subwatershed total reported in bold.

Restoration Outcomes:

Basin/Project	Upstream Habitat Acres	Potential Annual River Herring Returning Adults
Kickemuit River	40	54,480
Woonasquatucket River		
Sub Total Watershed Cost	29.5	40,179
Lower Pawtuxet River		
Pawtuxet River Falls Dam*	54	73,548
Greenwich Bay Watershed Gorton Pond		
Sub Total Watershed Cost	61	83,082
Almy Watershed		
Watson Reservoir	380	517,560
Pawcatuck River Basin		
Sub Total Watershed Cost	1755	2,390,310
Annaquatucket River		
Hamilton Dam	216	294,192
PROJECT TOTAL	2536	3,453,351

* Based upon habitat suitability models adapted by L. Cavallaro, NOAA Restoration Center