Assessing the Efficacy of Remediating Episodic Low pH (and High Aluminum) Concentrations in Headwater Brook Trout Streams With Clam Shell Additions

NFHAP Funding Request: $36,085

Washington County, Maine

U.S. Congressional District: Maine 2nd District

Applicant Organization:
Project SHARE
14 Boyton Street
Eastport, ME 04631

Project Officer:
Steven Koenig
Executive Director
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207 853-0931

Submitted On:
October 1, 2008

Sponsoring U.S. Fish and Wildlife Service Fisheries Office:

U.S. Fish and Wildlife Service
Maine Fishery Resources Office
East Orland, Maine 04431

Project Officer:

Scott Craig
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"Each stream has an individuality as distinctive as that of a living thing. Each presents its own set of life-or death challenges to the creatures that live in it. Forever changing, forever posing new problems of survival, the stream is never an easy place for life. But its community of plants and animals is always rich, varied, and endlessly fascinating."
The Life of Rivers and Streams by Robert L. Usinger

PROJECT DESCRIPTION, SCOPE OF WORK, AND PARTNER INFORMATION

A. Project Description and Scope of Work

Project SHARE, USFWS Maine Fishery Resources Office (MEFRO), and Maine Department of Environmental Protection (MDEP) are currently conducting a pilot study to determine degradation rates of clam shells placed into 1st and 2nd order brook trout streams. The ongoing results suggest that marine based clam shells degrade at approximately 1% every 2 weeks. Our short-term results suggest that discarded marine clam shells could be used as a calcium addition to help remediate low pH and high labial aluminum concentrations in Downeast Maine Brook trout streams.

The clam shell industry in coastal Maine currently pays for discarding shells shucked at processing facilities; so in essence, we would be using a waste product to help remediate low pH and subsequent high labial aluminum issues in brook trout streams.

Biosecurity Issues: USFWS and State of Maine fish pathologists have identified low pH and high labial aluminum as limiting factors for brook trout and sea-run Atlantic salmon in Maine. These pathologists, Russ Danner (Maine) and John Coll (USFWS) have already suggested a simple composting-type protocol to sterilize freshly shucked shells. However, we currently have access to a several metric tons of several year (clean) old shells that do not require sterilization-composting.

• *Need for the project;*
In July 2008, MEFRO staff collected dead brook trout from Honeymoon Brook, a tributary to Old Stream, Maine. The cause of the fish kill was believed to be related to high labial aluminum concentrations that were augmented by a low pH event following a prolonged dry period and subsequent heavy rain event.

Two tributaries included in this study currently do not sustain fish, even though they contain high quality habitat for fish. The likely reason for fish absence is thought to be low pH and subsequently high aluminum.

Our study will determine if clam shell additions could help remediate episodic pH (low) events and therefore decrease the amount of toxic organic aluminum in brook trout tributaries.

• *Purpose, goals, and objectives;*
This proposal will assess if clam shell additions will increase in-stream pH and decrease organic aluminum concentrations in headwater brook trout tributaries.

• *Work to be done and by whom;*
Project SHARE, MEFRO, and MDEP will work together to place clam shells (and if necessary, limestone gravel on approach roads) and monitor water quality within the project study area. We have already collaborated on a project that added limestone gravel upon approach roads in the Crooked River. Data sonde results have indicated that pH levels were higher below the treatment sites in the much larger sized Crooked River. Contact Mark Whiting (MDEP) for more information 207 941-4566.

All project partners will coordinate in regard to the calcium additions via clam shells and/or limestone gravel additions. See Table 1. Some clam shells will be deposited directly to the stream. However, most shells and all limestone gravel additions (if needed) will be deposited to road approaches near the treatment sites.

Mark Whiting of MDEP will coordinate the monthly (May- November) data sonde data calibrations as well as the monthly calcium and organic aluminum grab samples from the study locations. Due to inaccessibility in winter and early spring, data sondes will need to be removed from December to April. Data sondes will be active for 2 years post treatment as per the degradation rates we have estimated from our pilot project.

Table 1. Proposed study sites, clam shell deposition estimates and number of data sondes required at study sites (Coordinates are UTM Zone 19N NAD83).

UTM E	UTM N	Study Site (Road)	Watershed Area (Ha)	pH	Dosing Factor[1]	Clam Shells Required (Metric Tons) [1]	Fish Present	Data Sondes
592,761	4,982,518	55:00:00	236.1	6.4	0.01	1.99	Yes	2
595,854	4,978,949	55:50:0 East	57.0	4.6	0.05	2.87	No	2
595,096	4,978,487	55:50:0 West	207.3	5.1	0.03	5.97	No	2
594,942	4,980,684	58:00:00[2]	Downstream water quality site				Yes	1

[1] Calculated from Clayton et al (1998)
[2] Non-treatment site- only water quality measurements

• *Who owns or will own and manage affected lands;*
American Forestry Management (AFM) of Milford, ME owns the entire Dead Stream watershed. Project SHARE will be the Project Coordinator for AFM.

• *Duration of benefits, including length of any land or management contracts, easements or other agreements;*
We hypothesized that stream pH will be higher for at least one year post treatment, however Clayton et al (1998) suggest that limestone sand additions typically lower after two years.

• *Expected results and how and when they will be monitored; and*
We expect that pH will be higher and organic aluminum concentration will be lower below the treatment sites, especially during the first year of the project.

Mark Whiting (MDEP) will conduct the monthly data sonde calibrations (n=7) and Spring-Summer-Fall water quality sampling grabs for calcium and organic aluminum (2 grabs per 3 treatment and 1 grab sample at the non treatment site= 7 grab samples). Estimated cost is $150 per grab sample (calcium and organic aluminum) at an EPA certified laboratory.

B. Partner Information

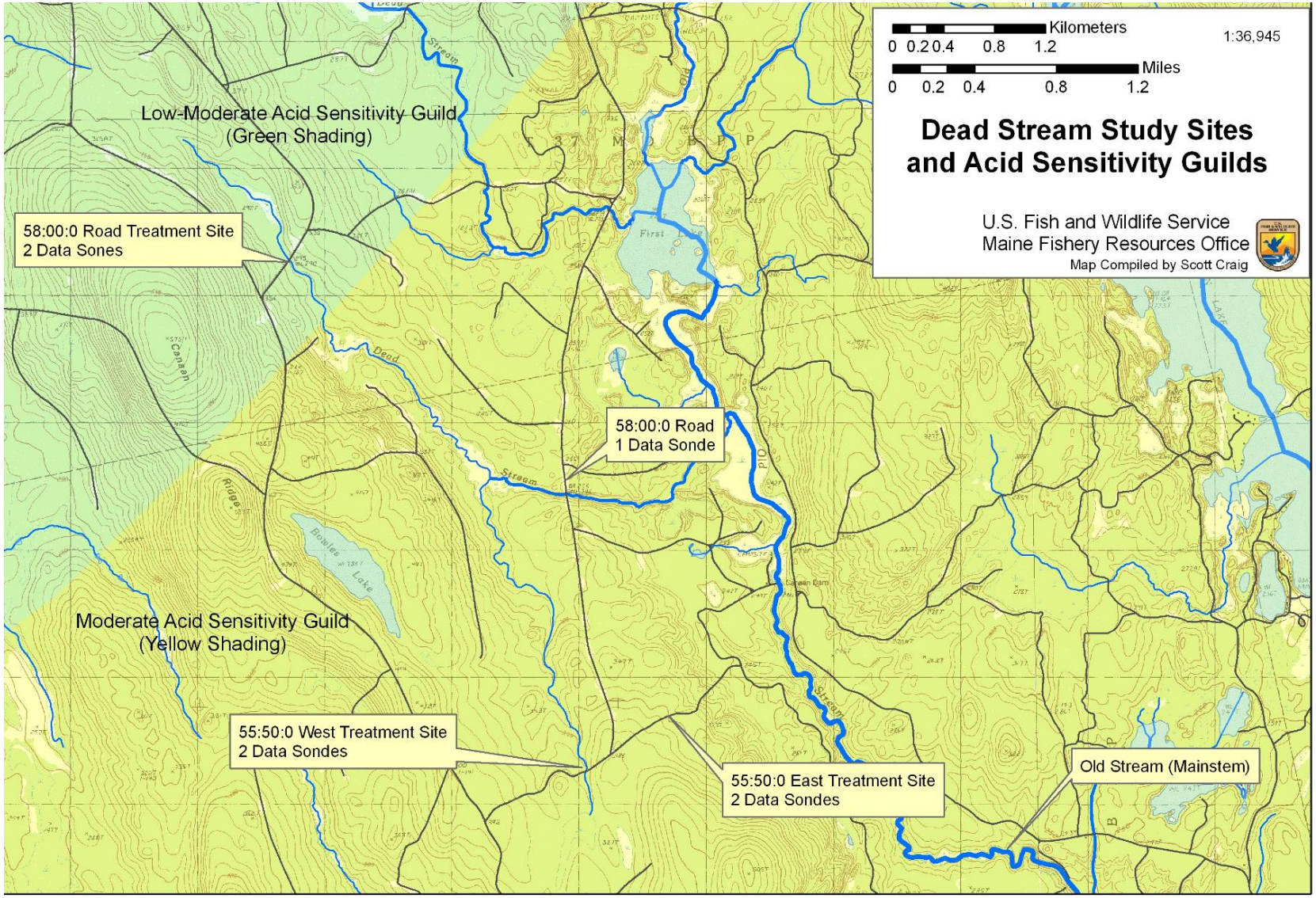
Partner Name	In-Kind	Cash	Federal or Non-Federal	Partner Category	Role of Partner
Project SHARE	$5,000		Non-Federal	Conservation Group	Treatments
MEFRO	$5,000		Federal	Federal	Treatments
MDEP	$5,000		Non-Federal	State Agency	Treatments
Project SHARE	$20,000		Non-Federal	Conservation Group	Limestone gravel- if needed
Project SHARE	$3,000		Non-Federal	Conservation Group	Water Quality Collection
MDEP	$9,000		Non-Federal	State Agency	Water Quality Collection
MDEP		$3,150	Non-Federal	State Agency	Water Quality Chemistry
Total	$53,000	$3,150			

C. Milestones and Timeline

A large, multi-metric ton pile of clean (sterilized) clam shells has been located in Addison, Maine. Project SHARE has a applied for a grant to acquire $20,000 of limestone gravel that is to be used for remediating low pH in Downeast Maine Salmonid Watersheds. Should we need limestone gravel, Project SHARE would contribute this product to this project.

We should have no problems in ordering and receiving the YSI 600 XLM data sondes (with pH and depth Probes) within two weeks of submitting an order. Provided that funds are available by May 1st 2009, and the fact that we would like to have at least two weeks of pre-project data collection, we could conceivably have the three treatment sites completed by June 1st 2009.

III. MAP OF PROJECT AREA. Acid Sensitivity Guilds adopted from Robinson and Kapo (2003)



IV. PHOTOGRAPH(S) OF PROJECT AREA (optional)
Project location photographs are available from MEFRO upon request. 207 469-7300 x226

V. PROJECT BUDGET A. General Requirements B. Budget Table

Partner	Activity	NFHAP Request	Non-Fed. Contribution	Federal Contribution	Total	Acres/ miles Affected
Project SHARE	Clam shell/limestone additions- 5 days		$5,000		$5,000	
MEFRO				$5,000	$5,000	
MDEP			$5,000		$5,000	
Project SHARE	Limestone gravel- if needed		$20,000		$20,000	
Project SHARE	Water Quality Collection		$3,000		$3,000	1,236 Acres
MDEP	Water Quality Collection		$9,000		$9,000	
MDEP	Water Quality Chemistry		$3,150		$3,150	
Project SHARE	Data Analysis-Reporting		$3,000		$3,000	
MDEP	Data Analysis-Reporting		$3,000		$3,000	
7@ YSI 600XLM Data Sondes (with added pH-Depth probes)		$36,085				
	Total	$36,085	$51,150	$5,000	$56,150	

VI. EVALUATION QUESTIONS (3 pages maximum)
A. Conservation of Sustainable Brook Trout Populations:

- Dead Stream contains high quality brook trout habitats that are degraded by episodic low pH events that in turn precipitate high liable aluminum concentrations.
- The project does not protect brook trout habitat through an official easement to an conservation organization.
- The project address' specific objectives in the State of Maine's brook trout conservation strategy by improving habitat quality (Bonney 2001).

B. Threatened and Endangered Species and Species of Conservation or Management Concern:

- The project site is located within proposed critical habitat of Atlantic Salmon (Gulf of Maine) DPS area (National Oceanic and Atmospheric Administration 2008). The lower study site (58:00:0 road) is fry stocked annually with Gulf of Maine listed Atlantic Salmon!
- American eel have also been documented in the project area.

C. Other Species of Economic Importance not Included Above:

Our project will undoubtedly increase the diversity, density and abundance of macro invertebrates below the treatment locations.

D. Special Considerations:

This project will utilize an innovative technique to help remediate low-episodic pH events in headwater streams that have lost the bulk of their acid neutralizing capacity.

Since the commercial clam industry currently pay's to have discarded shells removed from their facilities, our results may provide them an avenue to minimize their operating costs.

The only costs associated with this project are the purchase of the YSI Inc. data sondes which will monitor pH, water depth, water temperature, and conductivity at each sampling location. MDEP staff has experience with the YSI data sondes and they will accrue all costs associated with water quality sampling.

E. EBTJV Targeted Watershed:

Dead Stream-Old Stream corresponds to EBTJV hydrologic unit number 230519. It is an been modeled as being an "Intact" population, but threats associated with low pH and high organic aluminum have not been fully assessed.

F. Habitat Connectivity and Enhancing Population Mobility:

- Project SHARE and MEFRO are currently restoring ecological stream habitat connectivity at all fish bearing stream-road crossing in Old Stream above State Route 9. We have currently restored 11 of 41 crossings above Route 9. In 2009, we will restore unhindered fish passage in the proposed project study area at the following crossings-55:00:0 and 58:00:0. If this proposal allows brook trout to recolonize stream habitats at the two 55:50:0 crossings, we will direct efforts to fix these crossings in the future. We believe that low pH-high aluminum concentrations preclude sustained fish residence in these two tributaries!

G. Management Assets:

- Crucial water quality data collection through the use of data sondes and frequent grab samples will provide federal and state agencies with information to assess the severity of the low pH-high aluminum stream flows in Downeast Maine.
- The project does not have a formal education component. However, planning and design documentation will provide guidance for similar efforts in the future.

H. Supporting Documentation and Management Plans:

Literature Cited:

Bonney, F. R. (2001). Brook Trout Management Plan, Dept. of Inland Fisheries and Wildlife. Division of Fisheries and Hatcheries**:** 34 p.

Clayton, J. L., E. S. Dannaway, et al. (1998). "Application of Limestone to Restore Fish Communities in Acidified Streams." North American Journal of Fisheries Management(18): 347-360.

Hudy, M., T. M. Thieling, et al. (2005). Distribution, Status and Perturbations to Brook trout within the eastern United States. Final Report: Eastern Brook trout Joint Venture.

National Oceanic and Atmospheric Administration (2008). Endangered and Threatened Species; Proposed Critical Habitat for the Gulf of Maine Distinct Population Segment of Atlantic Salmon, Federal Register. **73:** 51747-51781.

Robinson, G. R. and K. E. Kapo (2003). Generalized Lithology and Lithogeochemical Character of Near-Surface Bedrock England Region, United States Geological Survey**:** 60 p.

Thieling, T. M. (2006). Assessment and predictive model for brook trout (Salvelinus fontinalis) population status in the eastern United States Harrisonburg, VA, James Madison University. **Master of Science** 65 p.

Letter of Recommendation:

United States Department of the

FISH AND WILDLIFE SERVICE

Maine Fisheries Program
Complex
Maine Fishery Resources Office
306 Hatchery Road
East Orland, Maine 04431

September 29, 2008

EBTJV Committee

Project SHARE
Steven D. Koenig
Executive Director
14 Boyton Street
Eastport, ME 04631

Subject: U.S. Fish and Wildlife Service; Maine Fishery Resources Office Support to Project SHARE for Conducting Experimental Clam Shell Additions into Dead Stream, Located near Wesley, Maine.

The Maine Fishery Resources Office (MEFRO) of the U.S. Fish and Wildlife Service (Service) greatly supports Project SHARE (Salmon Habitat and River Enhancement) in their endeavor to remediate episodic low pH concentrations within high habitat quality brook trout watersheds in Downeast Maine.

We are currently collaborating with Project SHARE and Maine Department of Environmental Protection on a pilot clam shell project that is assessing degradation rates. I can assure you that any funds issued will be spent wisely and expeditiously.

These projects have also received support from both State resource agencies in Maine (Dept. Fish & Wildlife and Dept. Marine Resources).

Sincerely,

Scott D. Craig

Scott D. Craig
Assistant Project Leader MEFRO
207 469-7300 x226

STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION

JOHN ELIAS BALDACCI
GOVERNOR

DAVID P. LITTELL
COMMISSIONER

August 1, 2008

Mr. Steve Koenig, Executive Director
Project SHARE
14 Boynton Street
Eastport, Maine 04631

RE: Pilot Study of Experimental Calcium Enhancement Project;
Machias River Watershed

Dear Steve,

The Department has received and reviewed Project SHARE's request to conduct a pilot study in the Machias River watershed of a potentially larger experimental calcium enhancement project involving the Narraguagus, Pleasant, Machias, and East Machias Rivers. Per your June 10, 2008 letter, Project SHARE, with the assistance of staff from the Department's Division of Environmental Assessment, seeks to determine degradation rates of small amounts of clean clam shells placed in five streams and rivers, as related to efforts to enhance buffering capacities in waters experiencing significant effects from acid rain. A maximum of 100 pounds of clam shells will be divided into approximately 10 nylon mesh bags and placed in one location in each of Harmon Brook (Crawford), Kerwin Brook (T36MD), Lanpher Brook (T37MD), Dead River – Boles Lake (T31MD), and the Crooked River (T30MD). These waters were selected for their specific water chemistries. The Department understands that baseline water quality monitoring for pH, alkalinity, cations, anions, dissolved organic carbon, and aluminum will be undertaken. The primary focus of the pilot study is to verify assumptions that the shells will dissolve rapidly enough to produce a beneficial boost to stream alkalinity and provide adequate calcium nutrition for fish, that the shells can be added to streams without causing embeddedness of the stream and loss of fish and invertebrate habitat, and that the open bags will allow for colonization of macroinvertebrates. The proposed pilot study may lead to proposals for larger in-stream clamshell applications and riparian material applications designed to affect water chemistry, leading to improved trout and salmon production and survival in downeast waters.

From review of your June 10, 2008 proposal, the Department has determined that the Pilot Study represents a deminimus discharge of pollutants to waters of the State and thus does not require a Maine Pollutant Discharge Elimination System (MEPDES) Permit / Maine Waste Discharge License (WDL) pursuant to state law, 38 MRSA, Section 413, *Waste Discharge License*. However, any subsequent Experimental Calcium Enhancement Project is predicted to involve significantly larger quantities of materials and thus is anticipated to require Department approval pursuant to 38 M.R.S.A., Section 362-A, *Experiments and Scientific Research in the Field of Pollution and Pollution Control*. The Department looks forward to the results of this pilot study.