

Study Plan
For Mussel Injury Investigation
for the Hudson River

Hudson River Natural Resource Damage Assessment

HUDSON RIVER NATURAL RESOURCE TRUSTEES

New York State Department of Environmental Conservation
U.S. Department of Commerce
U.S. Department of the Interior

DRAFT FOR PUBLIC REVIEW AND COMMENT

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Executive Summary

Natural resources of the Hudson River have been contaminated through past and ongoing discharges of polychlorinated biphenyls (PCBs). The Hudson River Natural Resource Trustees – New York State Department of Environmental Conservation, the U.S. Department of Commerce, and the U.S. Department of the Interior – are conducting a natural resource damage assessment (NRDA) to assess and restore those natural resources injured by PCBs.

Mussels are important components of the Hudson River ecosystem; mussels filter the water, cycle nutrients, stabilize sediments, enhance habitat complexity, and are food for wildlife.

Dredging and capping/backfilling activities in the Upper Hudson River are destroying mussel beds and mussel habitat, which are not being replaced as part of the remedy for the Hudson River PCBs Superfund Site. The proposed study will collect information about mussel communities and habitats affected by the dredging and subsequent capping/backfilling of the Upper Hudson River. This information will serve to inform restoration planning relating to mussels adversely impacted by remedial work. Results should inform the determination of impacts of the remedy upon natural resources, spatial/temporal recovery of impacted mussel beds, and establishment of (replacement) mussel beds.

Pursuant to the Hudson River NRDA Plan, the Trustees have developed this Draft Study Plan for a mussel injury determination effort. This Draft Study Plan describes a field study the Trustees propose to undertake meet the following objectives:

1. Trustees seek to quantify freshwater mussels, mussel habitat, and the services provided by these mussels in areas not targeted for remediation.
2. Trustees seek to quantify the loss of freshwater mussels, mussel habitat, and the services provided by these mussels in areas that have been or will be dredged and subsequently capped or backfilled.
3. Trustees seek to confirm absence of freshwater mussels in areas that have been dredged and subsequently capped or backfilled.
4. Trustees seek to characterize mussel habitat and community in a non-PCB contaminated, undredged reference location.

In the future the Trustees may propose additional work to supplement this effort.

In accordance with the Hudson River NRDA Plan, the Trustees are issuing this Draft Study Plan for public review and comment. Comments should be submitted by July 2, 2014 to:

CONTACT FOR PUBLIC COMMENTS

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1.0 Background

Past and continuing discharges of polychlorinated biphenyls (PCBs) have contaminated the natural resources of the Hudson River. The Hudson River Natural Resource Trustees – New York State, the U.S. Department of Commerce, and the U.S. Department of the Interior – are conducting a natural resource damage assessment (NRDA) to assess and restore those natural resources injured by PCBs (Hudson River Natural Resource Trustees 2002).

Freshwater pearly mussels are among the most imperiled groups of animals in North America (Strayer et al. 2004). Almost 300 species of freshwater mussels have been described as endemic to North America, representing the greatest diversity of these mussels in the world. The diversity and abundance of freshwater fauna provide critical functions and services in these ecosystems.

Mussels are important components of the Hudson River ecosystem; mussels filter the water, cycle nutrients, stabilize sediments, enhance habitat complexity, and are food for wildlife. However, the mussel populations of many of the rivers and lakes in the State of NY have never been surveyed and recorded. In the Upper Hudson River (north of Troy, NY) there is knowledge that abundant populations of mussels exist, but documentation of population sizes and species diversity is limited. Strayer (2012) noted that there could be 19 species of mussels present in the Hudson River between Corinth and Troy, NY.

In 2013, a freshwater mussel pilot study was conducted within the Fort Miller and Stillwater pools of the Hudson River in areas targeted for remediation and in areas that would not be dredged. (http://www.dec.ny.gov/docs/fish_marine_pdf/nrdmussel.pdf). Proposed surveys in 2014 will quantitatively survey freshwater mussel populations and characterize the ecosystem services (i.e., biomass, filtration, and production) provided by the existing native mussel community in at least three areas of the river (including unremediated areas within two pools and a reference stretch). This information will be used to estimate background data on species composition, relative abundance, population size, and ecosystem services of mussel communities in the Upper Hudson River prior to remedial actions.

2.0 Introduction

Based on the results of preliminary investigations conducted by the Trustees, including the mussel work conducted in 2013, review of the existing scientific literature, and considering factors such as the life history of mussels and goals of the NRDA, the Trustees have determined that it is appropriate to conduct further investigations focused on freshwater mussels to be initiated in the year 2014.

Pursuant to the Hudson River NRDA Plan, the Trustees have developed this Draft Study Plan for a mussel injury determination effort. This Draft Study Plan describes an effort to estimate the species composition, relative abundance, population, and potential ecosystem services of freshwater mussels in unremediated, remediated (may include areas targeted for remediation but not yet dredged) and references reaches of the Hudson River.

In accordance with the Hudson River NRDA Plan, the Trustees are issuing this Draft Study Plan for public review and comment. The Trustees are interested in receiving feedback on this Draft Study Plan. To facilitate this process, the Trustees are asking the public and the party or parties responsible for the contamination to review this Draft Study Plan and provide feedback on the proposed approach. Comments should be submitted by July 2, 2014. These comments will help the Trustees plan and conduct an assessment that is scientifically valid and cost effective and that incorporates a broad array of perspectives.

To that end, the Trustees request that you carefully consider this Draft Study Plan and provide any comments you may have to:

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3.0 Purpose and Objective

The purpose of this work is to inform the Trustees regarding injury to mussels and guide their future efforts to identify pathways and specific injuries to mussels from PCBs, as defined in regulations written by the U.S. Department of the Interior contained in Title 43 of the Code of Federal Regulations Part 11, Natural Resource Damage Assessment. This work will also be used to help determine whether future studies will be performed, and if so, to help in their design.

The objectives of the field study the Trustees propose to undertake pursuant to this Study Plan are

1. Trustees seek to quantify freshwater mussels, mussel habitat, and the services provided by these mussels in areas not targeted for remediation.
2. Trustees seek to quantify the loss of freshwater mussels, mussel habitat, and the services provided by these mussels in areas that have been or will be dredged and subsequently capped or backfilled.
3. Trustees seek to confirm absence of freshwater mussels in areas that have been dredged and subsequently capped or backfilled.
4. Trustees seek to characterize mussel habitat and community in a non-PCB contaminated, undredged reference location.

4.0 Methods

4.1 Freshwater Mussel Field Study

On behalf of the Trustees, Principal Investigators (PIs) will conduct a study of freshwater mussel populations and ecosystem services in the Upper Hudson River. This work will be conducted pursuant to a work plan entitled “Population Assessment and Potential Functional Roles of Native Mussels in Three Sections of the Upper Hudson River: 2014 Remedial Injury Study.”

The purpose of this investigation is to evaluate the species composition, relative abundance, population estimate, and potential ecosystem services of freshwater mussels in three reaches of the Hudson River to help inform restoration planning of mussels impacted by the remedy. Proposed surveys in 2014 will quantitatively survey and characterize the ecosystem services provided by the existing native mussel community.

Proposed surveys in 2014 will quantitatively survey and characterize the ecosystem services provided by the existing native mussel community in at least three areas of the river that were not sampled in 2013:

1. Upstream Reference Stretch in uncontaminated areas between the South Glens Falls Dam and Corinth, NY. Surveys in the reference stretch will provide information on mussel populations undisturbed by dredging and PCB contamination.
2. River Section 1 (Thompson Island Pool) in unremediated and remediated areas. Surveys in remediated (dredged and subsequently capped/backfilled) areas will determine presence/absence of mussels and surveys in unremediated areas will provide information on mussel populations undisturbed by dredging.
3. River Section 2 (Northumberland Pool) in unremediated and remediated areas. Surveys in remediated (dredged and subsequently capped/backfilled) areas will determine presence/absence of mussels and surveys in unremediated areas will provide information on mussel populations undisturbed by dredging.
4. River Section 3 (Upper Mechanicville Pool) in areas targeted and not targeted for remediation. This pool has not yet been dredged and sampling this location will provide information on mussel populations prior to dredging. Sampling of this pool is dependent upon time and funding constraints.

Mussel sampling and design

Study sites will be selected using a probabilistic sampling design and Geographical Information System (GIS). Investigators will target approximately 650 sites, which will include approximately 350 sites within the reference stretch and 300 sites in the Thompson Island and Northumberland Pools. The extent of sampling within remediated areas will be determined by field results. If time and budget permit, sampling will occur in Mechanicville Pool.

Survey areas will not include the navigation channel, due to safety considerations, consistent with the approach taken during 2013 field season. A probabilistic sampling design using regularly spaced square grids will be implemented by using the aquatic areas coverage provided by NOAA. The sampling frame (i.e., sites to select from) will be a square lattice of points spaced 10 m apart using GIS. A random selection of sites will be drawn within each river reach. Investigators will make efforts to reduce sampling bias over space and through time by assigning sampling locations to blocks that represent a day of sampling (approximately 30 sites per day). The sequence for sampling of these blocks will be random, thus minimizing the potential for bias from sampling point locations in an ordered fashion. Additionally, the design will provide for an unbiased sample if not all sampling locations could be visited in the allotted study period; missing data will be at random (Rogala et al. 2007). Study site selection approach is consistent with the method employed in the 2013 pilot survey. The sampling approach is consistent with the method employed in the 2013 pilot survey, except where noted.

Predetermined sample sites shall be located in the field using a GPS (Geographical Positioning System), a marker buoy labeled with the site identification number set at the site, and coordinates for the sampled site will be recorded on the datasheet. At each location, field crews shall excavate substrate within two 0.0625 m² quadrats (one excavation on each side of the marker anchor) to a depth of about 15 cm into a 6-mm mesh bag attached to the sampling frame. The total area of each sample will be 0.125 m². Excavated material will be rinsed through the mesh bag and the contents transferred into a bucket labeled with the site number. The sample will be sieved and transferred to trays to facilitate removal of all mussels. All live mussels will be identified to species, counted, aged (via external annuli count, if visible), and measured for shell length (to the nearest mm using the posterior/anterior axis). For consistency, the aging of mussels by counting external annuli and other mussel observations will be conducted by the same technician as in the 2013 surveys. The number of fresh dead mussels, with soft tissue and/or clean, shiny nacre, will also be counted as an index of recent mortality and recorded. At each site, investigators will record the water depth in the center of each quadrat to the nearest 0.1m, substrate type, substrate penetration resistance, and the presence and type of aquatic vegetation.

At each location, field crews will excavate substrate from a total area of 0.125m² to a depth of about 15 cm, collecting all mussels. A subsample of live mussels from each river reach (approximately 20 to 40 individuals of each abundant species), representing a range of size classes, will be returned to the laboratory for estimation of wet and dry tissue and shell mass. Representative shell or whole specimens of each species will be retained for species confirmation by colleagues who have expertise in the identification of mussel species in the Northeastern U.S. A subsample (up to 50 from each river section, pool, or unremediated/remediated stratum) of older individuals of each abundant species (*Elliptio complanata* length ca. 85-110 mm) from each river section (including mussels from pools sampled in 2013) will be sent to a contract facility for thin sectioning and aging of shells by counting the internal growth rings (Neves and Moyer 1988; Haag and Commens-Carson 2008) as a separately funded portion of the project. All other mussels will be returned to the approximate location where they were sampled or retained and frozen for future analyses. Retained mussel samples will be placed in ziplock bags labeled with the collection date, site number, and purpose of the sample (i.e., dry weight, aging, or PCB), and packed in coolers with ice for transport. They will be stored initially at -20°C until they can be processed. Investigators will document and track each sample on chain of custody sheets. Frozen mussels will be processed by experienced technicians. Each mussel shell, whole tissue, and DNA tissue sample will be assigned and labeled with a unique identification number and preserved for future studies. Archived tissues will be held at -80 °C. Chain of custody will be maintained. To estimate potential ecosystem services, scientists will estimate biomass, filtration rate, and production provided by the mussel community within each sampled river reach.

Data analysis

Data on population size and relative abundance will be analyzed with survey sampling statistical software (Survey means procedure, SAS 2003).

Investigators will estimate biomass, production and filtering rates of each abundant species and present graphs of age frequency distributions. Results from 2014 will be combined with those from the 2013 pilot study. Predictive estimates of mussel densities and ecosystem services will

be prepared for remediated areas within Thompson Island and Northumberland Pools that were not surveyed prior to remediation and for unsampled pools in River Section 3. Investigators might observe similarities or differences in various descriptive characteristics of the mussel community between pools or between unremediated and remediated areas (includes areas to be remediated) such as: the number of juvenile mussels, the number of species present, the densities of individual species, the age frequency distribution of each species, the age of the oldest mussels, and/or the total number of mussels in an area.

The purpose of this study is to assess the remedial injury to freshwater mussels due to dredging and subsequent capping/backfilling being conducted between Fort Edward and Troy, New York as part of the Hudson River PCB Superfund Site remediation, and to use the results to guide mussel restoration planning efforts following remedial actions at the site. This work may also inform the potential for adverse effects from PCB-contamination from the site on native mussels.

Study results will provide the Hudson River Natural Resource Trustees with a more complete picture of the mussel community across surveyed pools (Thompson Island, Fort Miller, Northumberland, Stillwater, and possibly Upper Mechanicville Pool) in River Sections 1, 2, and 3, including remediated and unremediated areas within the geographic scope of the Hudson River PCB Superfund Site remedy, and in an upstream reference stretch of the Hudson River. Results from surveyed pools will be used to provide estimates for unsampled pools.

Injury Assessment

This study will enable the Trustees to assess injuries to natural resources. This study will enable the Trustees to assess injury to biological resources under the DOI NRDA regulations. These regulations state “an injury to a biological resource has resulted from the discharge of oil or release of a hazardous substance if concentration of the substance is sufficient to cause the biological resource or its offspring to have undergone at least one of the following adverse changes in viability: Death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions, or physical deformations.” The Trustees will measure the death of freshwater mussels (and the accompanying loss of ecological services) attributed to the remedial actions on the Hudson River.

As this investigation entails injury endpoints, the Trustees are engaged in a peer review of the proposed investigation. A draft work plan, prepared by the PIs, will be peer reviewed and changes may be made as a result of the peer review process. We are seeking public review and comment on this work plan as part of the public review of this Draft Study Plan, in accordance with the Hudson River NRDA Plan.

In the future the Trustees may propose additional work to supplement this effort.

5.0 Quality Assurance/Quality Control

This study is being conducted in accordance with the Quality Assurance Management Plan (QA Plan) for the Trustees’ Hudson River NRDA (Hudson River Natural Resources Trustees, 2002).

As noted in the Trustees' Responsiveness Summary for the NRDA Plan (HRNRT, 2003), for each data collection effort that is part of the Hudson River NRDA and is identified in the NRDA Plan, the Trustees will develop a project-specific QA Plan which may be an independent document or may be incorporated into the project Study Plan. Such a QA Plan, in combination with the information on QA management described in the NRDA Plan (HRNRT, 2002), will ensure that the requirements listed in the National Contingency Plan and applicable EPA guidance documents for quality control and quality assurance plans are met.

The work plan for the investigation entitled "Population Assessment and Potential Functional Roles of Native Mussels in Three Sections of the Upper Hudson River: 2014 Remedial Injury Study" incorporates project-specific QA provisions.

No chemical analyses are proposed. If the study plan is revised to include such, any chemical analyses will be conducted in accordance with the requirements of the Hudson River NRDA Analytical QA Plan (HRNRT, 2005).

6.0 Literature Cited

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