

DEPARTMENT OF THE INTERIOR
U.S. FISH AND WILDLIFE SERVICE
REGION 5

**FY09 ENVIRONMENTAL CONTAMINANTS PROGRAM
ON-REFUGE INVESTIGATIONS SUB-ACTIVITY**

MA – Determining Sources of Mercury at Parker River National Wildlife Refuge

Project ID: New

(New-Saltmarshsparrow_followup.doc)

by

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and

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for

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Concord, NH

and

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May 1, 2008

Congressional Districts: MA (6)

II. INTRODUCTION

II.A. Background and Justification

Wildlife exposure to mercury (Hg) can impact behavior, physiology, and reproductive success. Previous Off-Refuge Special Studies have documented reproductive impacts to Common Loons (*Gavia immer*) in the Northeast as a result of mercury exposure (Evers *et al.* 1998, 2005). Freshwater wetlands generally serve as areas of high Hg methylation, thus making obligate wetland and aquatic wildlife especially vulnerable to high levels of Hg contamination. The role of saltmarsh habitats in methylating Hg and enhancing its bioavailability is less well documented. The 2004 USGS DOI Landscape Initiative identified baseline assessment of mercury across the freshwater-marine interface as one of the highest priority areas for future research. One of the best indicators of mercury exposure in estuaries is the Saltmarsh Sharp-tailed Sparrow (*Ammodramus caudacutus*) (Mason *et al.* 2005). Saltmarsh Sparrows are the number one Partners in Flight Priority species for PIF Area 9, the number two priority species for PIF Area 44 and are considered a “Bird of Conservation Concern” by USFWS Region 5. An estimated 98 percent of their global population nests in Region 5.

From 2004-2007, a cooperative study (partially funded by EC On-Refuge Funds) between the Service and the BioDiversity Research Institute examined mercury exposure in Saltmarsh Sharp-tailed Sparrows on four National Wildlife Refuges in New England (Project ID: 5N39/200550006). Adult blood mercury levels were highest at Parker River NWR (1.24 ug/g), followed by Ninigret NWR (0.79 ug/g), Stuart B. McKinney NWR (0.61 ug/g), and Rachel Carson NWR (0.61 ug/g). **Based on one year of limited nest monitoring, productivity parameters such as number of eggs hatching and fledging appear to be significantly lower at Parker River NWR than at Rachel Carson NWR (Lane and Evers 2007).**

Although the previous study documented exposure and potential reproductive effects, it did not directly address the pathway of the mercury. Northeastern Massachusetts has been identified as a mercury “hotspot” (Hutchenson *et al.* 2007) with municipal solid waste combustors and medical waste incinerators contributing much of the atmospheric mercury. Within the past five years, as controls on these facilities have been implemented, mercury levels in yellow perch (*Perca flavescens*) and largemouth bass (*Micropterus salmoides*) from area lakes have decreased an average of 24% (MA DEP 2006). Mercury concentrations in the blood of adult saltmarsh sparrows on Parker River NWR, however, have **increased** during the duration of the previous study (Lane and Evers 2007). **EPA Region 1 has identified at least four potential point sources within the watershed that could be contributing to the mercury load at Parker River NWR.**¹ We are proposing a follow-up study to determine if any of these potential point sources are responsible for the elevated level of mercury found in saltmarsh sparrows at Parker River NWR.

¹ EPA has requested that we NOT release any details concerning these four sites pending internal analysis being conducted by EPA Region 1.

II.B. Scientific Objective

- 1. Determine if any of the four potential mercury point sources within the Parker River watershed are contributing to the mercury load on the refuge.**

II.C. Management Action(s)

Indirect: Determining the pathways, exposure rates, effects, and geographic extent of mercury to wildlife are of significant national interest nationally and of extreme interest regionally. Understanding the mechanisms by which mercury is transported to and through biotic systems is essential in order to scale appropriate decisions at the federal and regional level regarding appropriate regulations for mercury emissions. Regulators need to be able to justify decreases in permitted mercury emissions to the regulated community due to the considerable costs involved.

Direct: This study involves identifying mercury point sources to the watershed that feeds directly onto the refuge. **If we determine that levels of mercury from these potential point sources are impacting Service trust resources on Service lands, ES and Refuge staff will work with USEPA Region 1 and MA DEP to enforce existing water quality regulations to eliminate these point sources.**

III. METHODS

III.A. Data Collection and Analysis

Post and Greenlaw (2006) determined that four prey groups (flies, amphipods, grasshoppers, and moths) composed 80% of the diet of the saltmarsh sharp-tailed sparrow. We propose to collect at least three subsamples of each of these prey groups within the three main habitat types (high marsh, low marsh, and salt panne) for each site sampled (4 prey groups x 3 subsamples x 3 habitat types = 36 samples per site – see Appendix A). Prey items will be collected using a combination of sweep nets, soil cores, and litter bags. For each of the suspected point sources, two sites of collection will be established (one upstream of the source and one downstream). Samples will then be split into two equal fractions. One will be preserved and used for taxonomic identification. The other will be analyzed for total and methyl mercury using Hg-Thiourea Complex Ion Chromatography with On-line Cold Vapor Generation and Atomic Fluorescence Spectrometric Detection (Shade and Hudson 2005).² Quicksilver Scientific (directed by Chris Shade) can run total and methyl mercury for \$100/sample (ACF labs would charge \$255/sample) and the lab has more strict quality control acceptance criteria than those found in EPA method 1630 and 1631 (<http://www.quicksilverscientific.com/services/analytical/mercury-speciation/>). Ten

² One of our cooperators, BioDiversity Research Institute, is currently using Quicksilver Scientific for invertebrate THg and MeHg analysis on a larger Northeastern mercury project.

percent of these samples (15 total) would be split again and these would be shipped to an ACF contracted laboratory to insure that results from Quicksilver Scientific are of the same quality as those from ACF laboratories. Because of anticipated workloads for both ES and Refuge personnel, it is unlikely that all four sites could be sampled during the field season when mercury prey levels are most critical for saltmarsh sparrows (June/July). We therefore scheduled sampling to occur over a two-year period.

III.B. Proposed Schedule of Milestones

Year 1

March 2009: Meeting w/all Cooperators to draft work plans
May 2009: Final work plans complete
June/July 2009: Field sampling for first two sources (4 sites)
January 2010: Results return from lab, begin data assessment

Year 2

March 2009: Meeting w/all Cooperators to draft work plans
May 2010: Final work plans complete
June/July 2010: Field sampling for second two sources (4 sites)
January 2011: Results return from lab, continue data assessment

Year 3

April 2012: Final report submitted to WO and RO

V. REFERENCES

- Evers, D.C., N. M. Burgess, L. Champoux, B. Hoskins, A. Major, W. M. Goodale, R. J. Taylor, R. Poppenga, and T. Daigle. 2005. Patterns and Interpretation of Mercury Exposure in Freshwater Avian Communities in Northeastern North America. *Ecotoxicology*, 14, 193–221.
- Evers, D. C., J. D. Kaplan, M. W. Meyer, P. S. Reaman, A. Major, N. Burgess, and W. E. Braselton. 1998. Bioavailability of Environmental Mercury Measured in Common Loon Feathers and Blood across North America. *Environ. Tox. Chem.* 17:173-183.
- Hutcheson M, Smith C, M., Wallace G, Rose J, Eddy B, Sullivan J, Pancorbo O, West C. 2007. Freshwater Fish Mercury Concentrations in a Regionally High Mercury Deposition Area. *Water Air Soil Pollut DOI* 10.1007/s11270-007-9604-9.
- Massachusetts Department of Environmental Protection. 2006. Massachusetts Fish Tissue Mercury Studies: Long-Term Monitoring Results, 1999-2004. Report by Massachusetts Department of Environmental Protection, Office of Research and Standards and Wall Experiment Station. Boston, MA. (accessible online at: <http://mass.gov/dep/toxics/stypes/hgtrend.doc>).

Lane, O.P. and D.C. Evers. 2007. Methylmercury Availability in New England Estuaries as Indicated by the Saltmarsh Sharp-tailed Sparrow, 2004-2006. Report BRI 2007-14. BioDiversity Research Institute, Gorham, Maine.

Mason, R.P., M.L. Abbott, R.A. Bodaly, O.R. Bullock, C.T. Driscoll, D. Evers, S.E. Lindberg, M. Murray and E.B. Swain. 2005. Monitoring the Environmental Response to Changing Atmospheric Mercury Deposition. Environ. Sci. Technol. 39: 14A-22A.

Post, W. and J. S. Greenlaw. 2006. Nestling Diets of Coexisting Salt Marsh Sparrows: Opportunism in a Food-rich Environment. Estuaries and Coasts Vol. 29, No. 5, p. 765-775.

Shade, C.W. and R.J.M. Hudson. 2005. Determination of MeHg in Environmental Sample Matrices Using Hg-Thiourea Complex Ion Chromatography with On-line Cold Vapor Generation and Atomic Fluorescence Spectrometric Detection. Environ. Sci. Technol., 39, 4974-4982.

VI. ROLES, RESPONSIBILITIES, AND PARTNERSHIPS

VI.A. Roles and Responsibilities

This specific project will be a cooperative effort between Service Ecological Services and Refuges. **The mercury prey analysis is only one part of a much broader analysis of saltmarsh sparrow ecology conducted by the Service, the Biodiversity Research Institute (BRI), and the University of New Hampshire.** The principal investigators for this project are Andrew "Drew" Major, EC Specialist, New England Field Office and Nancy Pau, Refuge Biologist, Parker River National Wildlife Refuge. Drew Major will be responsible for procurement, logistics, reporting requirements, data analysis, and assistance with field work as needed. Nancy Pau will coordinate all field efforts associated with this project.

VI.B. Partnerships

In total, the Service expended \$87,150.00 on Project ID: 5N39/200550006 from 2005-2008. The FWS Regional Biological Team funded \$31,000 (with partners contributing \$35,000 of in-kind services) for a project in 2007 that **examined sparrow genetics and mercury exposure at Parker River and Rachael Carson NWRs. In 2008, NEFO has committed \$10,000 of EC capability funding and the region has committed \$4,000.00 of emergency analytical money to continue collecting data on sparrow mercury exposure and begin radio telemetry work.** Refuges have committed \$30,000.00 in 2008 to the same goals and plan on continued funding in subsequent years. **Total partnership support to date is approximately \$197,000.**

VI. BUDGET

| | | | | | |
|---------------------------------|---------------------|---------------------|--------------------|-------------|---------------------|
| Personnel - Refugees | \$ 7,000.00 | \$ 7,000.00 | \$ - | \$ - | \$ 14,000.00 |
| Personnel - NEFO | \$ 7,000.00 | \$ 7,000.00 | \$ - | \$ - | \$ 14,000.00 |
| Personnel - Data Analysis | \$ - | \$ - | \$ 2,800.00 | \$ - | \$ 2,800.00 |
| Personnel - Report Writing | \$ - | \$ - | \$ 2,800.00 | \$ - | \$ 2,800.00 |
| Travel (including boats) | \$ 500.00 | \$ 500.00 | \$ - | \$ - | \$ 1,000.00 |
| Supplies | \$ 1,000.00 | \$ 1,000.00 | \$ - | \$ - | \$ 2,000.00 |
| Equipment (Nets, funnels, etc.) | \$ 500.00 | \$ 500.00 | \$ - | \$ - | \$ 1,000.00 |
| Non-PACF Analytical | \$ 14,400.00 | \$ 14,400.00 | \$ - | \$ - | \$ 28,800.00 |
| RO Overhead | \$ 3,472.00 | \$ 3,472.00 | \$ 560.00 | \$ - | \$ 7,504.00 |
| Invert ID (144 x \$30/sample) | \$ 4,320.00 | \$ 4,320.00 | \$ - | \$ - | \$ 8,640.00 |
| Other (Specify) | \$ - | \$ - | \$ - | \$ - | \$ - |
| Other (Specify) | \$ - | \$ - | \$ - | \$ - | \$ - |
| Operational Subtotal | \$ 38,192.00 | \$ 38,192.00 | \$ 6,160.00 | \$ - | \$ 82,544.00 |
| PACF Analytical | \$ 3,825.00 | \$ 3,825.00 | \$ - | \$ - | \$ 7,650.00 |
| Total Funding | \$ 42,017.00 | \$ 42,017.00 | \$ 6,160.00 | \$ - | \$ 90,194.00 |

Notes: Personnel calculated at \$700/day x 10 days.

Notes: Non-ACF analytical calculated at 144 samples x \$100/sample

Notes: ACF analytical calculated at 15 samples x \$255/sample

VII. FY 2009 REVIEW AND APPROVAL

Proposal Title: MA: Determining Sources of Mercury at Parker River National Wildlife Refuge

Project ID#: New

Submitted by: _____ Date: _____
Contaminant Specialist, Field Office

Reviewed by: _____ Date: _____
FO Supervisor

Reviewed by: _____ Date: _____
Refuge Manager, (required for On-Refuge Investigations)

Reviewed by: _____ Date: _____
Regional Environmental Contaminants Coordinator

NOTE: All On-Refuge proposals must be signed by the Refuge Manager. In addition to the required signatures, proposal authors are free to add to this signature page to include other Project Leaders and Offices (especially when other Service programs are involved). Authors also may modify this signature page to accommodate the surname process of their respective Regional and Field Offices (e.g., adding additional signature lines for the Assistant Regional Director and other participants in the surname process). The standard Regional surname process along with the Regional Transmittal Memo will serve to demonstrate the review and approval of the proposal by the Regional Director.

FY 2009 National Criteria Score Sheet

TITLE: MA: Determining Sources of Mercury at Parker River National Wildlife Refuge

PROJECT I.D.: New REGION: 5 RO RANK: _____ TARGET STATES: MA

Pass/Fail Criteria

The investigation proposal **DOES** **DOES NOT** pass the minimum required standards of the Environmental Contaminants Program. Note: authors should answer the questions below by keeping either “Yes” or “No” (in accordance with what the response would be) and deleting the remaining part of the “Yes/No” phrase.

Yes/No Proposal clearly identifies (1) an environmental problem related to anthropogenic contaminants and (2) site-specific management actions designed to resolve that problem. If not, explain:

Yes/No The proposal clearly identifies a level of biological impacts that must be investigated. Abiotic only sampling is clearly linked to an established threshold level of concern. If not, explain:

Yes/No At least one substantive peer review has been conducted and is attached. The proposal has been revised as appropriate. The study design is sufficient to meet the objectives of the proposal. If not, explain:

Yes/No The required surnames have been obtained. If not, explain:

Ranking Criteria

For the above referenced proposal, determine a score for each of the following criteria in accordance with the criteria definitions described in Chapter 7 of the investigations manual. Identify the location of the text that supports the score. If you disagree with a score previously provided, explain why.

A. *Threats to resources are **DOCUMENTED** (20 pts) or **SUSPECTED** (15 pts).*

Field Office Supporting Text (**in bold**): Section IIA, ¶ 2 Score: 20

Regional Office Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

Reviewer Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

*B. Management actions are **DIRECT (15 pts)** or **INDIRECT (10 pts)**.*

Field Office Supporting Text (**in bold**): Section IIC, ¶ 2 Score: 15

Regional Office Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

Reviewer Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

*C.1. The study question(s) or hypotheses being addressed by the investigation **ARE (4 pts)** or **ARE NOT (0 pts)** clearly stated.*

Field Office Supporting Text (**in bold**): Section IIB, ¶ 1 Score: 4

Regional Office Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

Reviewer Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

*C.2. The study design as described in the proposal **WILL (4)** or **WILL NOT (0 PTS)** answer the study question(s)/hypotheses.*

Field Office Supporting Text (**in bold**): Section IIIA, ¶ 1 Score: 4

Regional Office Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

Reviewer Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

*C.3. The scope or complexity of impacts being addressed by the investigation **IS (4 pts)** or **IS NOT (0 pts)** appropriate.*

Field Office Supporting Text (**in bold**): Section VIA,B, ¶ 1 Score: 4

Regional Office Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

Reviewer Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

C4. *The most severe type of biological impact addressed by the investigation is an **INDICATOR OF ADVERSE EFFECTS (4 pts) or ACTUAL ADVERSE EFFECTS (7 pts).***

Field Office Supporting Text (**in bold**): Section IIA, ¶ 2 Score: 7
Regional Office Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

Reviewer Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

C.5. *Source of the contaminant **IS (3 pts) or IS NOT (0 pts) sufficiently addressed.***

Field Office Supporting Text (**in bold**): Section IIA, ¶ 3 Score: 3
Regional Office Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

Reviewer Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

C.6. *Pathway of the contaminant **IS (3 pts) or IS NOT (0 pts) sufficiently addressed.***

Field Office Supporting Text (**in bold**): Section IIA, ¶ 3 Score: 3
Regional Office Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

Reviewer Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

D. *Final regional rank order is ___ of ___ proposals submitted.* Score:

E1. *Regional Performance Score* Score:

E2. *Total Partnership Effort*

Field Office Supporting Text: Section VIB, ¶ 1 Score: 5
Regional Office Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

Reviewer Supporting Text: Section _____, ¶ _____ Score:
Explanation (if scores differ):

General Reviewer Comments or Major Concerns:

Appendix A – Sampling Scheme

| | Site #1 | | | | | |
|---------------------|------------|-----------|------------|------------|-----------|------------|
| | Upstream | | | Downstream | | |
| | high marsh | low marsh | salt panne | high marsh | low marsh | salt panne |
| fly samples | 3 | 3 | 3 | 3 | 3 | 3 |
| amphipod samples | 3 | 3 | 3 | 3 | 3 | 3 |
| grasshopper samples | 3 | 3 | 3 | 3 | 3 | 3 |
| moth samples | 3 | 3 | 3 | 3 | 3 | 3 |

Sampling scheme will be repeated for the other three sites