Do Tidal Restrictions Lessen Methylmercury Exposure to Saltmarsh Sparrows?

ABSTRACT

Though it is a natural contaminant in some systems, 95% of the environmental mercury (Hg) contamination in the northeast is from human sources\(^1\). Tidal marsh soils host high levels of Hg compared to other habitats\(^2\). An organic form mercury, methylmercury (MeHg), can be eaten and assimilated by wildlife\(^3\). MeHg causes many harmful effects in wildlife, such as decreased reproductive success and physical deformities\(^4\). Populations of Saltmarsh Sparrows (\textit{Ammodramus caudacutus}, hereafter SALS), a species of conservation concern, are particularly threatened by MeHg exposure\(^3\). SALS have been observed to exhibit high MeHg levels compared to other similar species\(^3\).

Interestingly, the high degree of modification of the tidal marshes of the northeast might lessen MeHg exposure to SALS. MeHg concentration increases with periodic wetting and drying cycles, such as those found in tidal marshes\(^2\). Many tidal marshes in the northeast are highly modified, however\(^5\). For example, tidal restrictions placed under roadways and buildings built over tidal marshes often limit the flow of the tide to the marsh behind them, preventing the marsh from experiencing natural tidal cycles. Therefore, human modification to marshes might decrease SALS MeHg exposure by disrupting the wetting-drying cycle of natural tidal regimes.

To explore this hypothesis that disruption of tidal flow in marshes would lessen MeHg levels in soils and its exposure to birds, I conducted a field study from July-August of 2013. At nine study sites that cover a range of tidal restrictions, we collected blood samples from adult SALS. We also collected soil samples from each site so we can explicitly link SALS blood MeHg levels to soil MeHg and tidal restrictions.
This project will provide important information about SALS, a species that federal agencies are moving toward considering for endangered species listing. Wildlife managers across the northeast can use the results of my study to guide marsh management and help ensure the survival of SALS in the future. Moreover, this is the first study to our knowledge that investigates MeHg exposure in wildlife as a function of tidal wetting-drying cycles, so it is a novel experiment in environmental toxicology.

This project will enable UMaine to contribute to the ongoing conversation about this threatened species and provide essential information for federal and state wildlife managers. I will experience new networking opportunities through the U.S. Geological Survey and expansion of my research into a field that is new to me (biochemistry). These funds would also support undergraduate research. I have been employing and mentoring a UMaine undergraduate on my project for the past two years. This year, she is beginning her Honors Thesis in Biochemistry, for which she would like to work with our research project. Thus, integrating a biochemical component into my project will provide an educational opportunity for my student and groundwork for her Honors Thesis next year.

Thank you for your consideration.

REFERENCES
## ITEMIZED BUDGET

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TOTAL $1,125.00 $850.00

*Note: Most cost effective option in bold.*

## BUDGET EXPLANATION

My former supervisor at the U.S. Geological Survey is generously analyzing the MeHg level of the blood samples for free. To use an outside contractor for these analyses would cost thousands of dollars. Soil samples require analysis by a different type of machine than that of my supervisor, so we must send out the soil samples to another lab. MeHg and Hg analyses can be performed at UMaine, at the in-house cost of about $125 per sample. The exact price depends on the number of samples run (which for me depends on the amount of funding I receive, I have up to 12 soil samples from each of nine study sites). I will use GSG funds to analyze as many soil samples as possible, excluding sites if need be. This month, I am also submitting a proposal to my department for a small research grant to cover the cost of the remaining samples that the GSG award would not.