USING BIOSENTINELS TO ASSESS METHYLMERCURY RISK IN WETLAND RESTORATION PROJECTS

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BACKGROUND

Methylmercury (MeHg) contamination in food webs is one of the primary water quality issues in San Francisco Bay. Wetlands have been shown to be important sites of MeHg production and there is concern that wetland restoration projects may result in increased MeHg bioaccumulation. Biosentinel monitoring can be used to directly evaluate the impacts of marsh projects on marsh wildlife at risk of mercury contamination. Here we present data from the first year of a two-year project that is using a region-wide approach to monitoring wetland restoration in San Pablo Bay. Risk varies by site and species but many fish in the North Bay are at levels of concern.

> Mississippi Silverside
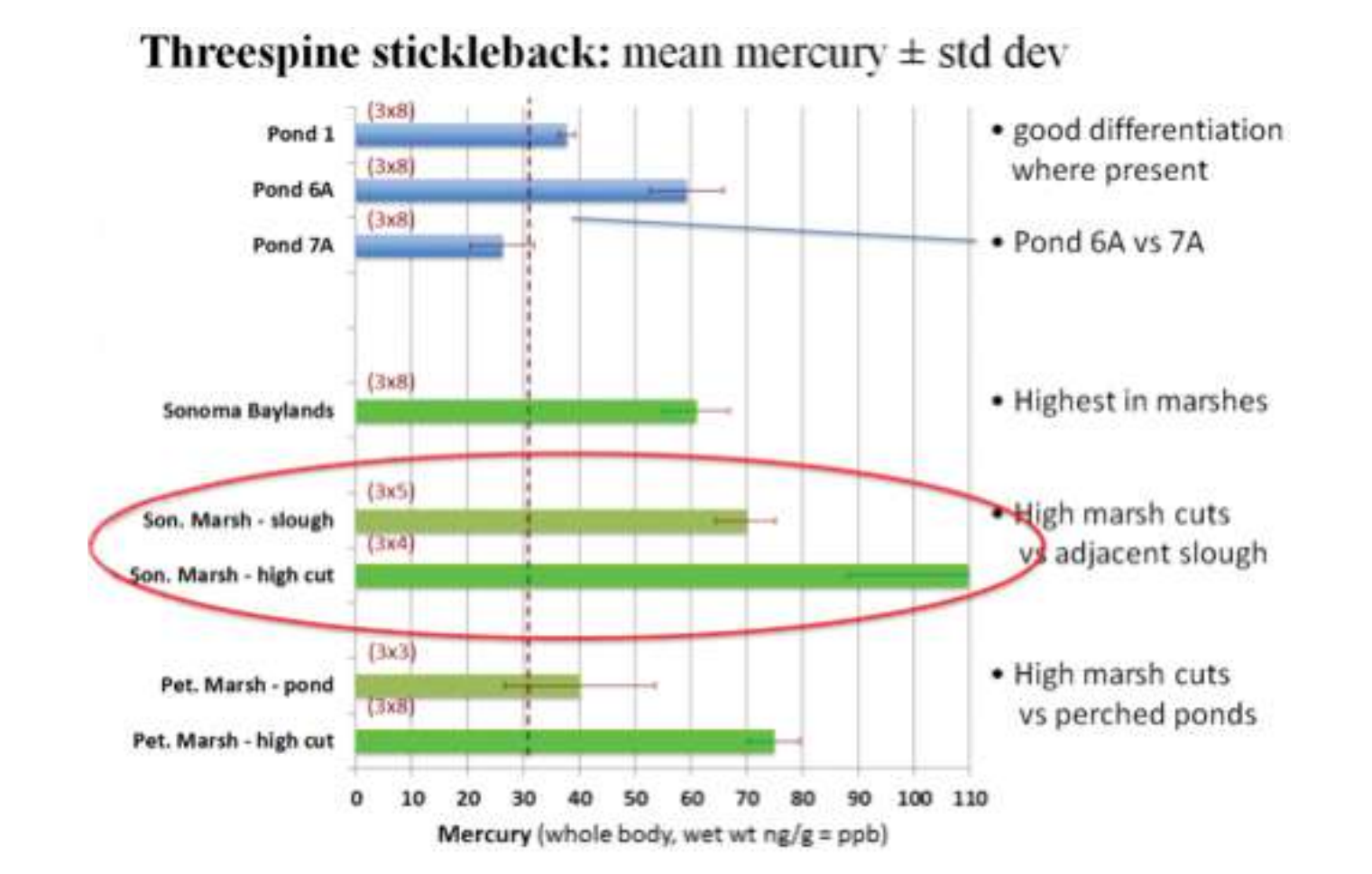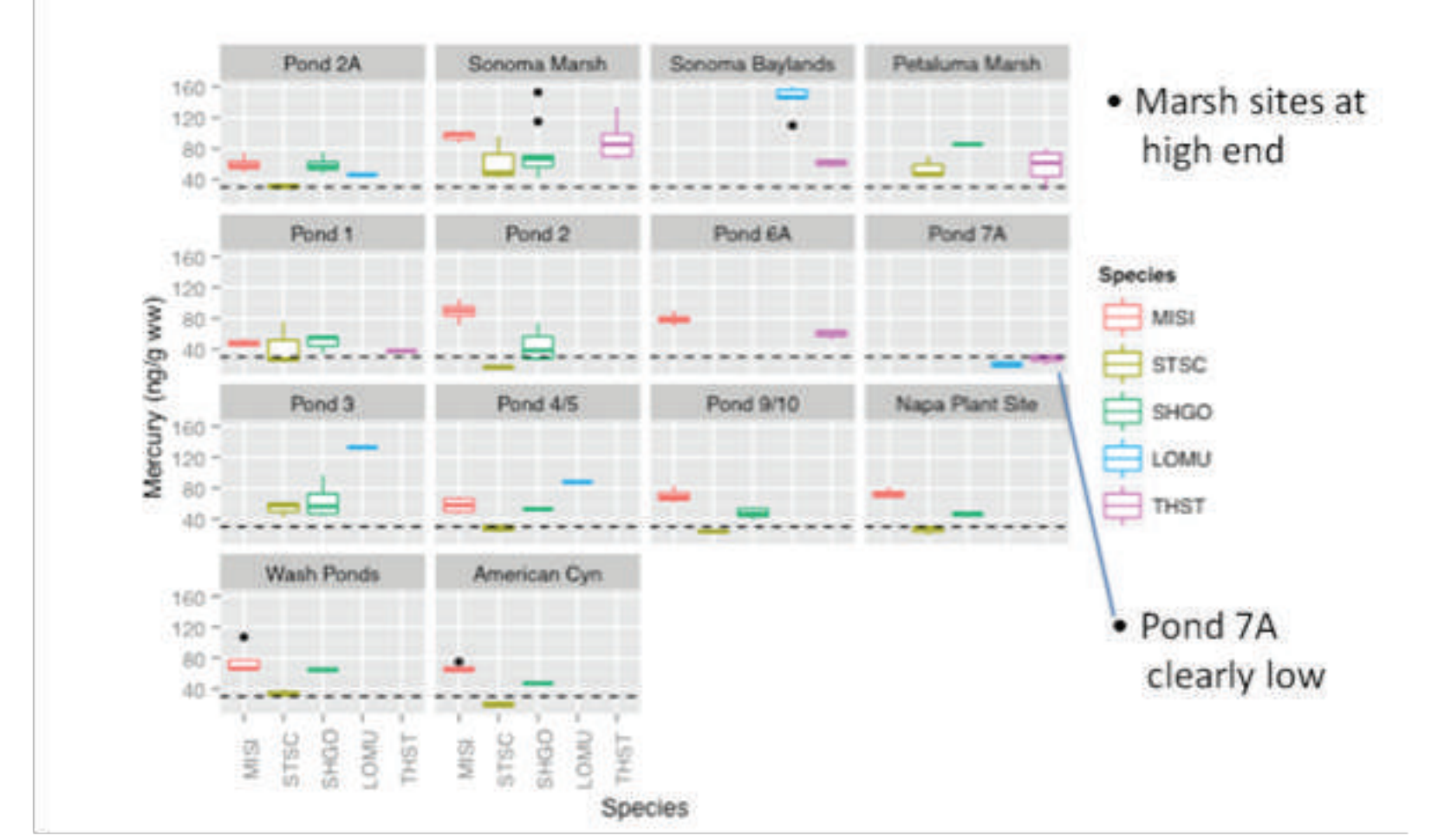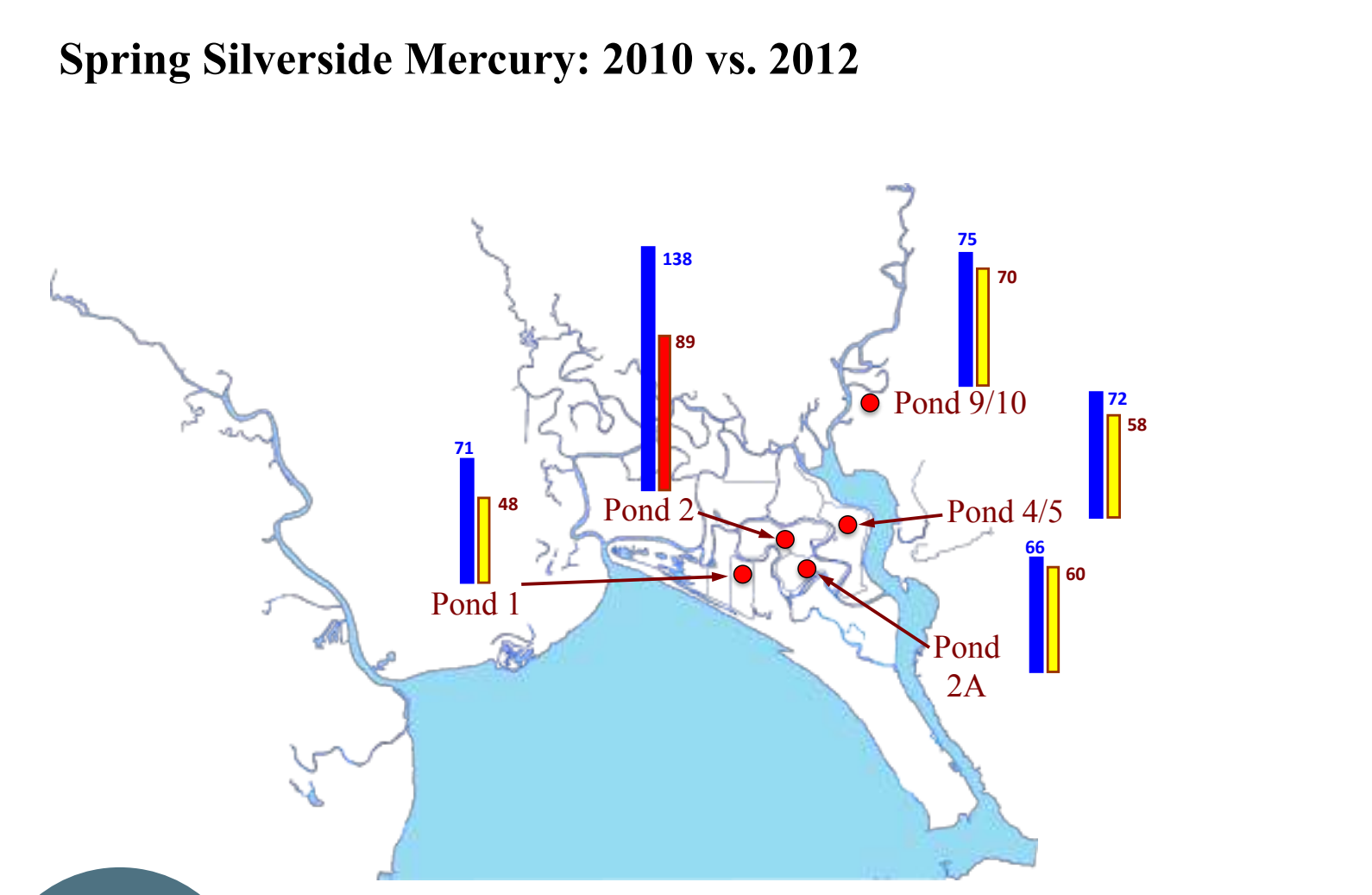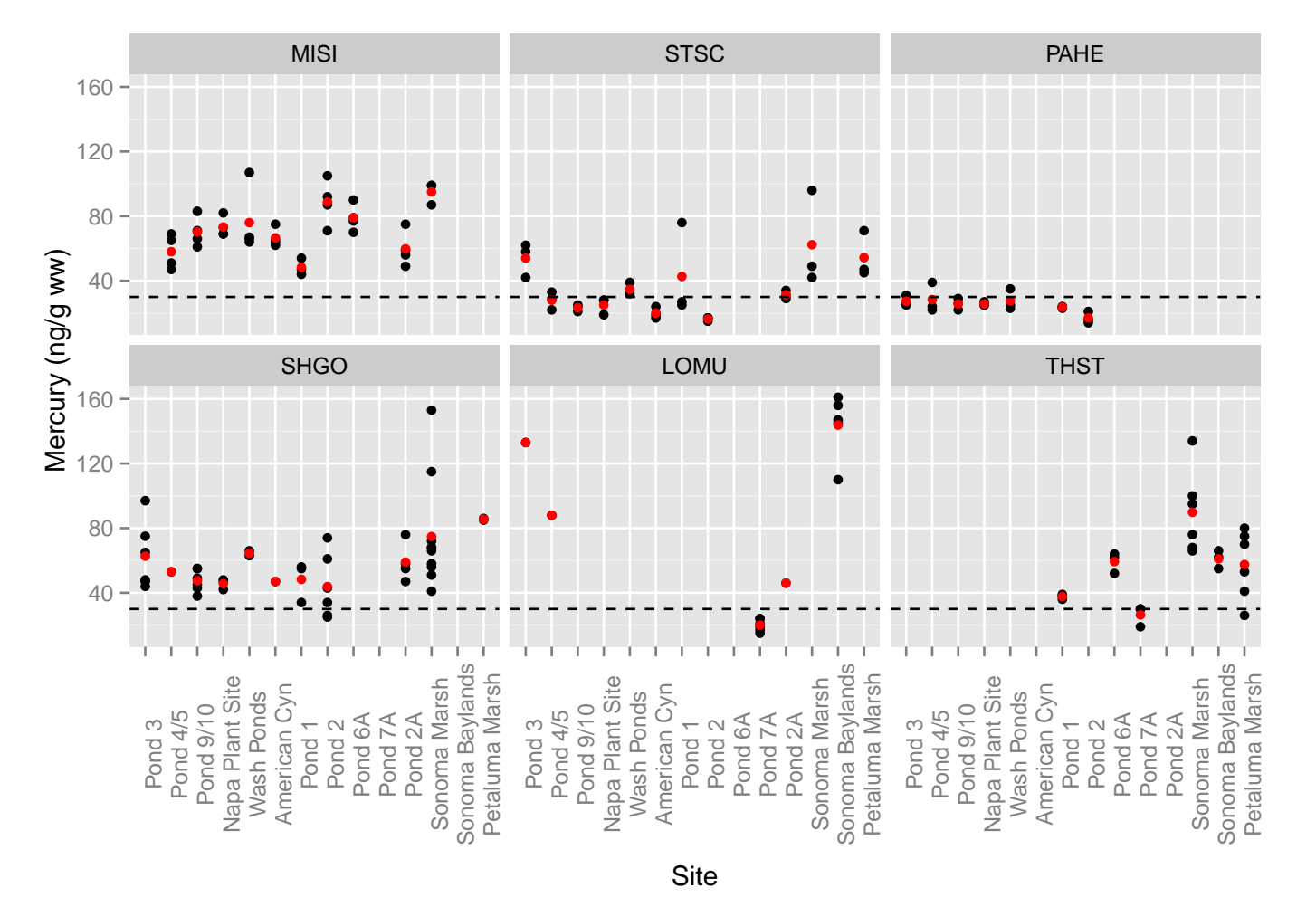(*Menidia audens*)

STUDY DESIGN

The design for this project was developed with input from a Science Advisory Group consisting of experts in biosentinel monitoring for mercury and the ecology of potential biosentinel species. The Science Advisors made the following recommendations:

- Monitoring should answer management questions related to beneficial uses of wetlands.

- Biosentinels should accurately represent MeHg risk at a small spatial and temporal scale.

- Sampling should be done for each major habitat type because MeHg risk and wildlife support differ between habitats.

- Sample when ecological risk is highest (breeding season for piscivorous birds).

MANAGEMENT QUESTIONS

The approach and sampling plan were vetted with local stakeholders, who articulated the following **FOUR** management questions

1 What is the current potential for impairment of beneficial uses due to MeHg in each major habitat of interest in the North Bay intertidal habitat restoration projects?

2 How will the status of impairment due to MeHg in each major habitat of interest change over a timescale of years in response to the project?

3 How do the status and trends in impairment due to MeHg at this project compare to status and trends in impairment in other project and non-project wetlands in the region?

4 Will tidal marsh restoration introduce a problematic amount of MeHg into the Bay?

Spring Silverside Mercury: 2010 vs. 2012

Threespine stickleback: mean mercury ± std dev

- good differentiation where present
- Pond 6A vs 7A
- Highest in marshes
- High marsh cuts vs adjacent slough
- High marsh cuts vs perched ponds

- Marsh sites at high end
- Pond 7A clearly low

1 INTERIM RESULTS
Most fish are above the TMDL small fish threshold (30 ppb).

MONITORING RECOMMENDATIONS
Sample species that are most abundant and best represent wildlife using the site.

2 INTERIM RESULTS
This study will establish a baseline for future monitoring. There are not enough data yet to determine long term trends.

MONITORING RECOMMENDATIONS
Sample a suite of biosentinels in order to monitor trends over time as communities shift and habitats evolve.

3 INTERIM RESULTS
Restoration sites showed MeHg levels similar to or below MeHg levels at unrestored marsh reference sites.

MONITORING RECOMMENDATIONS
Sample widespread species with small home ranges that are capable of reflecting differences in MeHg between sites. Sample secondary species as well because the same biosentinels may not be available at every site.

4 INTERIM RESULTS
The high MeHg seen in slough biosentinels next to the marsh suggests there is some MeHg export.

MONITORING RECOMMENDATIONS
MeHg loading from restoration projects is challenging to measure using biosentinels or other tools and is probably not a major factor in observed impairment at the regional scale (e.g., bird and fish tissue levels).

CONCLUSIONS/NEXT STEPS

- Need to prioritize management questions. Set up monitoring in different ways to answer different questions.

- Regional coordinated monitoring can answer management questions in a cost-effective way