



Seasonal Dynamics of Surface Water Mercury Speciation and Partitioning in Two Contrasting South San Francisco Bay Salt Ponds: The Influence of Primary Production

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Background:

One goal of the South Bay Salt Pond Restoration Project (SBSRP) is to increase wildlife habitat. To this end, and to accommodate planned changes in Pond A8 that would decrease bird nesting habitat, Pond A12 was partially drained to increase interior island habitat for nesting birds. As part of a larger study to investigate the effectiveness of this management action on bird nesting recruitment, we examined water column mercury (Hg) dynamics in Pond A12 and compared and contrasted these to a control pond (A11), which was not drained.

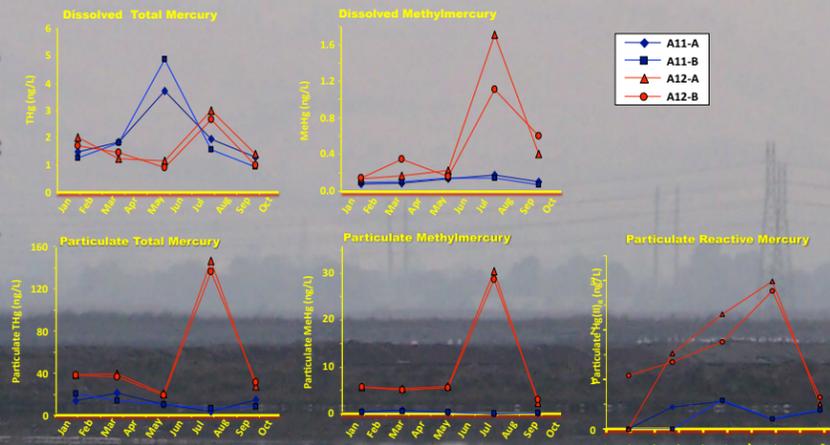
Methods:

Surface water was sampled bimonthly, between January and September 2008, at two shoreline sites within both Ponds A11 and A12. Water samples were collected using trace metal clean techniques, stored chilled in dark bottles, and filtered (0.45 µm) the same day to collect both particulate and dissolved total mercury (THg) and methylmercury (MeHg). Particulate samples were also collected for total suspended solids (TSS), chlorophyll-a (Chl-a), and inorganic 'reactive' mercury (Hg(II)_R). The dissolved fraction was assayed for specific conductivity (S.C.) and dissolved organic carbon (DOC). Standard preservation and assay approaches were used or have been previously documented (Marvin-DiPasquale and others, 2008).



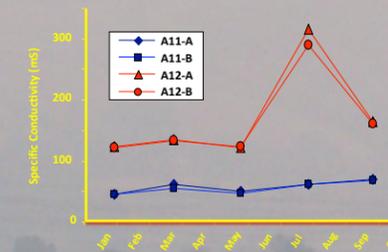
Satellite image showing locations of Ponds A8, A11 and A12, as well as shoreline sampling sites (A and B) within Ponds A11 and A12.

Time Series of Dissolved and Particulate Mercury Species

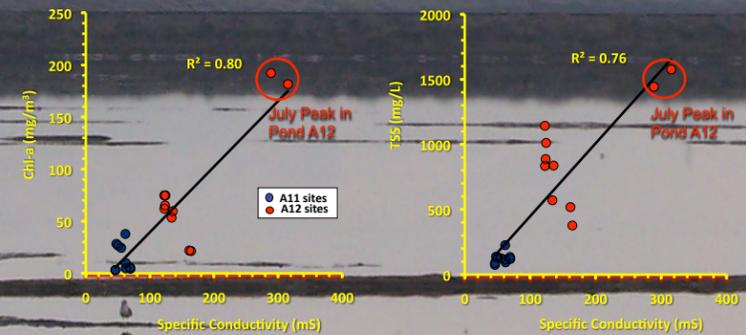


- The majority of both THg and MeHg was associated with the particulate phase (note Y-axis scales).
- Concentrations of all three Hg species were higher in Pond A12 than in A11. Particulate concentrations peaked during July in Pond A12
- This spatial trend paralleled the findings for THg concentrations in bird eggs and fish (see companion poster by Ackerman et al).

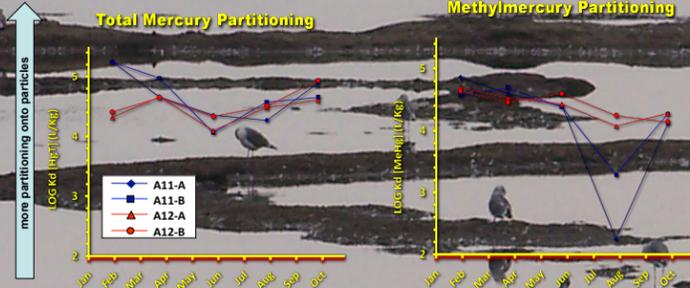
Salinity, Chlorophyll & Total Suspended Solids



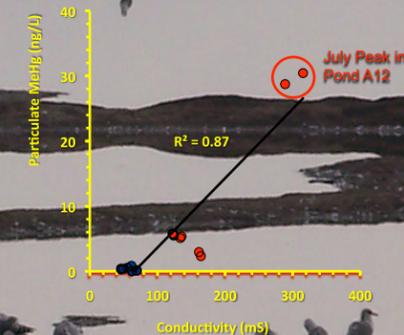
➤ Salinity (measured as specific conductivity) was also higher in Pond A12 and peaked during July



Dissolve-Particulate Partitioning of THg and MeHg

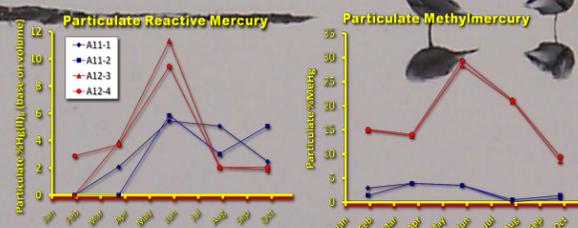


- Partitioning coefficients (log K_d) express the magnitude of Hg species partitioning between particulate and dissolved phases
- log K_d [THg] similar between ponds; log K_d [MeHg] shows high proportion of MeHg in dissolved phase for Pond A11 during July.



Salinity was positively correlated with Chl-a, TSS and particulate MeHg, both temporally and among ponds.

Particulate Hg(II)_R & MeHg (as a Percentage of Particulate THg)



- Hg(II)_R is a measure of the portion of total Hg(II) most available for conversion to MeHg.
- %Hg(II)_R and %MeHg peaked during May in Pond A12.

Conclusion:

These results suggest that phytoplankton density fuels microbial MeHg production and affects the concentration and speciation of Hg in the surface water particulate phase. This was most pronounced in the high salinity pond. Ultimately it is the MeHg concentration in phytoplankton that dictates MeHg concentration in biota. However, it is unclear if the difference in Hg dynamics between the two ponds was directly due to the partial draining of Pond A12, as no baseline data prior to the draining event was available.

Reference:

Marvin-DiPasquale MC, Lutz MA, Krabbenhoft DP, Aiken GR, Orem WH, Hall BD, DeWild JF, and Brigham ME, 2008. Total mercury, methylmercury, methylmercury production potential, and ancillary streambed-sediment and pore-water data for selected streams in Oregon, Wisconsin, and Florida, 2003-04; U.S. Geological Survey Data Series 375, 24 p.