Delta Science Fellows Annual Report
California Sea Grant College Program

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ProjectYear_2A: 1st
ProjectNo_2C: R/SF-32
TypeReport_2B: Interim Questionnaire

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Project Information

ProjectNo_2C: R/SF-32
StartDate_3a: September 2009
EndDate_3b: August 2011
ProjectTitle_4: Copper-binding ligands in the San Francisco Bay Estuary: Evaluating current and future likelihood of copper toxicity events in a perturbed ecosystem

Delta Science Fellow contact information

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Community Mentor (for additional please see #9)

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Additional Research Mentors and Community Mentors

Additional Research Mentors_8:

Additional Community Mentors_9:

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Project Objectives: Please type your responses, and answer the questions in a style appropriate for laymen.

ProjectObjectives_10

The objectives of this project are to determine the concentrations of organic copper-binding ligands and evaluate whether resulting bioavailable (and, therefore, potentially toxic) Cu2+ concentrations approach established toxicity levels (~10^-11 M Cu2+; Brand et al. 1986 Journal of Experimental Marine Biology and Ecology) for microorganisms in North San Francisco Bay and Delta. As copper-binding ligands render dissolved copper inert, an additional component of this work is to determine the sources of these ligands to the estuary (e.g., rivers, surrounding marshlands, and wastewater discharge) as well as potential sinks (e.g., mixing with seawater, light exposure). Dissolved copper speciation measurements will further be used to assess how much additional copper the ambient copper-binding ligands could buffer before bioavailable Cu2+ concentrations reach the likely toxicity threshold.

Summary of progress in meeting each of these goals and objectives

ProgressSummary_11

Field sampling for dissolved copper speciation was conducted in November 2008, with samples collected aboard the R/V Polaris in collaboration with the U.S. Geological Survey. Samples were collected from the Sacramento River, Delta and North Bay (USGS stations 2, 4, 6, 8) as well as from Central Bay near Golden Gate (USGS station 18). Additional samples were collected from the Mossdale Boat Launch (San Joaquin River) and the Suisun City Boat Launch (Suisun Slough).

All field samples to date have been analyzed for total dissolved copper, copper-binding organic ligands, and resulting bioavailable Cu2+ concentrations. A multiple analytical window approach (Buck and Bruland 2005 Marine Chemistry) was employed to assess current bioavailable Cu2+ concentrations as well as to predict how much additional dissolved copper the system can buffer before Cu2+ concentrations reach potentially toxic levels.

Mixing experiments of San Joaquin River water and Golden Gate seawater were conducted to assess the stability of copper-binding organic ligands across the salinity range of the estuary. Mixed samples were also analyzed for dissolved copper and copper speciation.

All field samples and mixing experiment samples were filtered through 0.4 µm (pore size) polycarbonate track-etched membrane filters prior to analysis of dissolved copper speciation. These filters were subsequently analyzed for leachable particulate copper and zinc. Leachable particulate concentrations represent the most bioavailable particulate forms of copper and zinc, defined as the concentrations leached from the filters during a 2 hour pH 2 (25%) acetic acid leach.

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PROJECT MODIFICATIONS: Please explain any substantial modifications in research plans, including new directions pursued. Describe major problems encountered, especially problems with experimental protocols and how they were resolved. Describe any ancillary research topics developed.

Modifications_12

The stop work order and prolonged suspension of the CALFED Fellowship during project year 1 inhibited the planning and logistics of additional sampling trips. As such, I was only able to sample the winter time point in the first year. With the full year reinstatement for project year 2, a spring sampling trip is being planned for 2011, but a summer trip is unlikely but is still pending availability.

To compensate for fewer sampling time periods, additional parameters have been analyzed on the samples collected in project year 1. Leachable particulate copper and zinc have been analyzed on 0.4 µm pore size filters from all sampling stations from November 2008. The leachable particulate metals represent the most bioavailable form of particulate metal suspended in the water column, and are defined as the concentration of metal leached from filtered suspended particles in a 2 hour pH 2 (25%) acetic acid (weak acid) leach. Leached filters have further been retained for possible total particulate metal measurements later this year. The combined particulate and dissolved copper concentrations would allow for a mass balance assessment of measured copper distributions, which, while not a part of the original proposal, would provide additional insight into copper cycling in the Bay.

BENEFITS AND APPLICATIONS: Suggest the relevance of these new findings to management. Describe any accomplishment, that is significant effects your project has had on resource management or user group behavior. Delta Science is looking for "management cues" (see http://science.calwater.ca.gov/pdf/soemgmtcues.pdf).

BenefitsApplic_13

All results are considered preliminary until the completion of the project in 2011.

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PUBLICATIONS: List any publications, presentations, or posters that have resulted from this funded research. Give as many details as possible, including status of paper (e.g., in review; in press), journal name, conference location and date of presentation. Please note (as outlined in the conditions of the award) that each fellow is required to submit an abstract for an oral or poster presentation at each State of the Estuary conference and Delta Science Conference during the duration of the fellowship.

Publications_14

Buck, K.N., B. Foli, S. Ussher, and K. Barbeau. Dissolved copper, copper speciation and leachable particulate copper in the San Francisco Bay Delta and Estuary: Evaluating current and future likelihood of copper toxicity events in a perturbed ecosystem. Poster, 6th Biennial Bay-Delta Science Conference, September 27-29 2010, Sacramento, CA.

Foli, B.A., S. Ussher and K.N. Buck. Copper and zinc distributions in Castle Harbour, Bermuda, using a chemical leach method: Comparison with contaminated San Francisco Bay, California, Delta and Estuary waters. 2010 Final report, Partnerships for Observation of the Global Ocean (POGO) program.
--Expected submission to Bermuda Government, Department of the Environment, Summer 2010.

COOPERATING ORGANIZATIONS: List those agencies and/or persons who provided financial, technical or other assistance to your project since inception. Describe the nature of their collaboration.

CoopOrganiz_15

Bermuda Institute of Ocean Sciences (BIOS): Project Fellow K. Buck is an Assistant Scientist at BIOS. BIOS has provided laboratory and office space, as well as supplementary financial support in the form of salary and supplies.

Scripps Institution of Oceanography (SIO/UCSD): Research mentor K. Barbeau is an Associate Professor at SIO/UCSD, and SIO has provided the logistical support of the financial aspects of the fellowship.

United States Geological Survey (USGS): Community mentor R. Stewart is a Research Scientist at USGS. USGS has generously provided technical support for sampling and a suitable sampling platform (R/V Polaris) for year one of the fellowship.

AWARDS: List any special awards or honors that you, or mentor or members of the research team, have received during the duration of this project.

Awards_16

K. Buck was awarded the Roger Stone Fellowship at BIOS

KEYWORDS: List keywords that will be useful in indexing your project.

Keywords_17

copper, ligands, speciation, leachable particulate copper, leachable particulate zinc

PATENTS: List any patents associated with your project.

Patents_18

N/A

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Additions: Additional information can be added here. Please begin the text with the number of the question you are adding to.

Additions_19

N/A