

Progress Report

Title of the project: Magnitude and extension of copper pollution effects on benthic faunal communities in San Diego Bay

Project Leader: Carlos Neira; Co-PI Lisa Levin

Progress report on activity August 1, 2010 – December 1, 2010

Summary of the whole activity

Main results

(1) In this period we submitted for publication a second paper entitled “**Macrobenthic community response to copper in Shelter Island Yacht Basin, San Diego Bay, California**”. This paper, currently in review in Marine Pollution Bulletin, describes the response of benthic macrofaunal communities to different levels of Cu in San Diego Bay sediments. We found that macrofaunal assemblages significantly differ between sites with “high”, “medium”, and “low” environmental Cu. At sites with high sediment Cu exposure, mean total biomass, body size (individual biomass), and diversity were reduced compared to sites with lower Cu. Peracarid crustaceans were the most affected. Also, in this paper we evaluated the concentration of Cu in tissue of invertebrates in relation to surrounding sediments with differing background Cu concentrations. Cu concentrations in invertebrate tissue ranged from 3.5 to 1712 $\mu\text{g g}^{-1}$. Cu concentration in invertebrate tissues varied between species and within the same species. Some species showed higher Cu concentrations in tissue than in the surrounding environment, whereas other species had lower concentrations. This may reflect species variations in assimilation efficiencies of Cu sorbed to sediment and detritus. These differences also suggest that some species are more sensitive while others have higher tolerances. The mechanisms underlying these results require further investigation, in particular detoxification capabilities, Cu storage capacity and animal excretion abilities. Changes observed in benthic communities, including loss of secondary producers such as amphipods and some polychaetes in sites with high Cu concentration may have substantial consequences for ecosystem function. Loss of these taxa reduce rates of remineralization of OM, as well as prey availability for higher trophic levels. Impaired biomass and body size at high Cu sites may affect potential predators by requiring that they spend more time searching for food and thus that they obtain more food to meet nutritional requirements.

(2) Field experiment: evaluating potential effects of Cu bioaccumulation on mussel growth exposed to waters with differing Cu levels in SIYB. The target mussel species are *Mytilus galloprovincialis* and *M. californianus*.

Results: Currently we are in the final phase of laboratory work dissecting mussels to extract tissue of gills, gonads, muscle, and hepatopancreas to measure levels of Cu. Samples from five of six months total have been already analyzed for Cu concentration with ICP-OES. Data are being processed.

(3) Work in America's Cup (AC), Harbor Island West (HW) and Harbor Island East (HE) is in progress. In the figure below, we shown the mean of three Cu species in the three harbors.

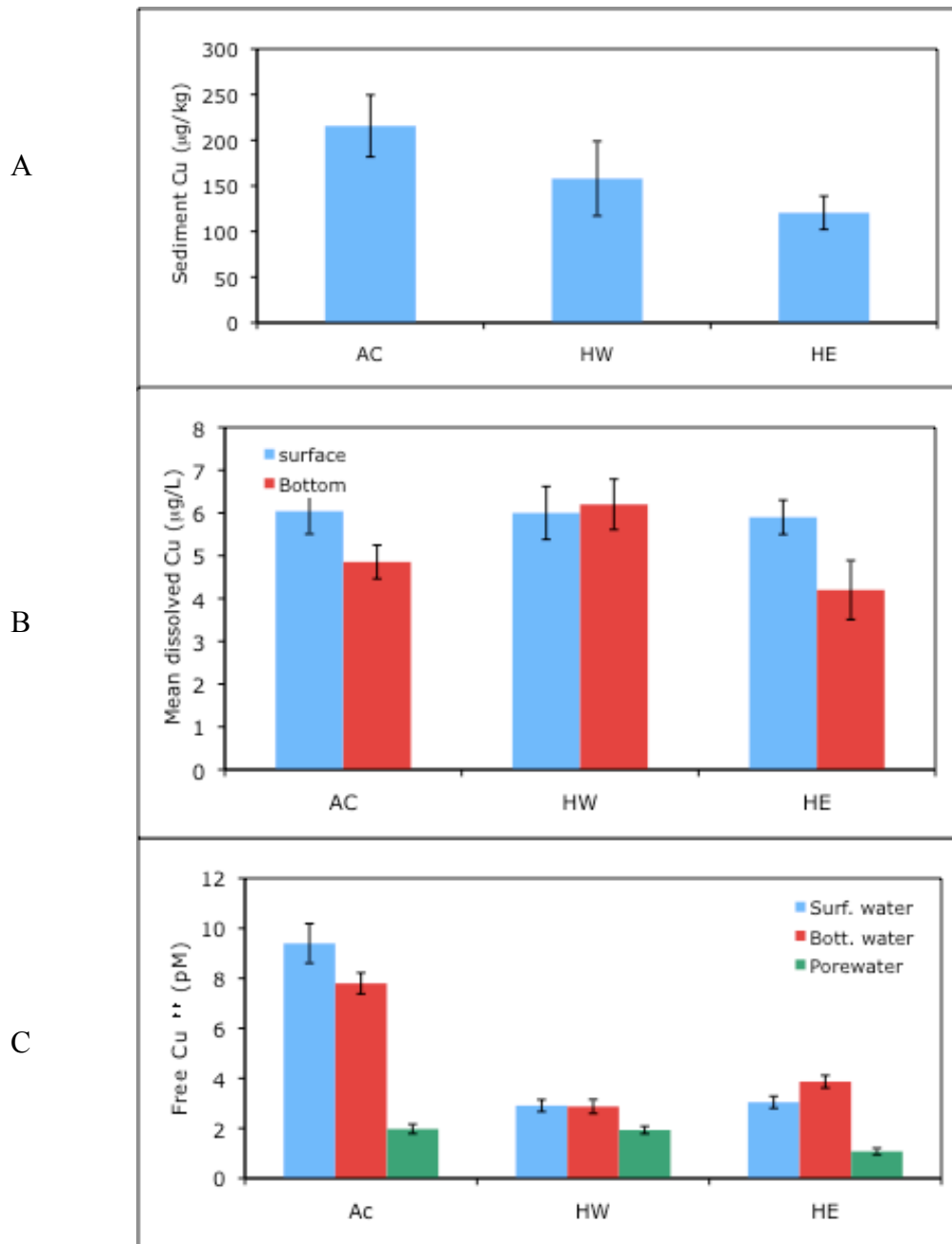


Fig. 1. Mean concentration of (A) sediment Cu (mg/kg), (B) dissolved Cu (surface and bottom water) ($\mu\text{g}/\text{L}$), and (C) free Cu^{++} (pM = picomolar) in three marinas: America's Cup, Harbor Island West and Harbor Island East.

Macrofaunal data for all three marinas are being compiled to conduct univariate and multivariate analyses of community structure.

For each task we carried out the following activities:

Laboratory: Conducting dissection of mussels collected monthly since February 2010, and ICP-OES analysis of four extracted tissues to determine Cu levels.

Desk: Second manuscript submitted for publication (see above). Literature research to obtain historical records of Cu pollution in the bay. Available data are being analyzed and integrated.

Table of activity - percentage carried out

Task	Field	Laboratory	Desk
	Previous/this period	Previous/this period	Previous/this period
Focused sampling	%100 / 100%	%80 / 70%	%100 / 60%

Task in progress:

- field: Finished.
- laboratory: Cu in tissue, CuCC.
- desk: Fauna data integration for further univariate and multivariate analyses.

Deliverables

Report produced