

# TCRF Report on Hernando Bacosa: Results Obtained From Funds

PI: Santschi, P.

In the 3 months he stayed here, he worked up 2 manuscripts for publication in Marine Pollution Bulletin.

- 1) Bacosa, H.P., Steichen, J., Kamalanathan, M., Windham, R., Lubguban, A., Labonte, J., Kaiser, K., Hala, D., Santschi, P.H., Quigg, A.S. 2019. Polycyclic aromatic hydrocarbons (PAHs) in Galveston Bay, Texas (USA) following the 2017 Hurricane Harvey.

Abstract: “Hurricane Harvey is the wettest tropical cyclone in US history that brought unprecedented rainfall and widespread flooding in Houston, Texas. These floodwaters largely emptied into the Galveston Bay. We collected surface water samples during the five sampling cruises from 10 stations along a transect in Galveston Bay to investigate the concentrations and sources of 16 priority polycyclic aromatic hydrocarbons (PAHs) a few days after the flooding. The PAHs concentrations ranged from 19 to 167 ng/L and the highest levels (102, 103, 167 ng/L) were detected during the first sampling event. Four sites had elevated concentrations of benzo[a]pyrene that exceeded the Texas Standard for Surface Water (>2.5 ng/L) The average total PAHs at first sampling (71 ng/L) was reduced to 34 ng/L in the second sampling and levelled off in the succeeding sampling events. Naphthalene, phenanthrene, flouranthene and pyrene were the dominant PAHs, while benzo anthracenes and acenaphthene dominated in the last sampling event. Out of 50 samples collected, about 60% were of pyrogenic origin, one from petrogenic origin, and the rest were of mixed sources.”

- 2) Bacosa, H.P., Kamalanathan, M., Cullen, J., Shi, D., Xu, C., Schwehr, K.A., Hala, D., Lubguban, A.A., Wade, T.L. Knap, A.H., Santschi, P.H., and Quigg, A.S. 2019. Marine snow aggregates are enriched in polycyclic aromatic hydrocarbons (PAHs) in oil contaminated waters; insights from a mesocosm study.

Abstract: “Microbial heterotopic metabolism in the ocean is fueled by the supply of nutrients acquired via exoenzymes that catalyze depolymerization of high-molecular weight into low-molecular weight compounds. Although factors regulating the production of these exoenzymes, and to some extent their correlation with the microbial community (bacteria, phytoplankton), are well known for soil and sediment systems, less is known for marine ecosystems. This study focuses on addressing these challenges using a 16-day mesocosm study that compared a control (seawater only) to water accommodated fraction (WAF) of oil exposed natural community. Analysis of exoenzymes  $\beta$ -glucosidase, leucine amino-peptidase, alkaline phosphatase, and lipase suggest that dissolved nutrient concentrations are critical in regulating their production. Stronger correlations between carbon acquiring enzymes and nitrogen acquiring enzymes was demonstrated. We found the correlation of carbon-acquiring enzymes predictably varies with the nature of the available primary carbon source. A strong correlation between organic-carbon and particular exoenzymes demonstrates their significance in providing the required elements to aid microbial productivity. Lastly, we show that similar exoenzyme activity patterns are not necessarily an indication of similar microbial community composition, suggesting a redundancy of exoenzyme functions among the marine microbial community and the substrate

availability in the marine environment. Overall, we provide new insights into several previously unknown aspects of marine exoenzymes.”

In addition, he is also working on a third publication, in collaboration with Dr. Wei-Chun Chin from UC Merced. Finally, he spent about 10 days at TAMU Corpus Christi to work with Dr. Jian Sheng on finalizing experiments that he initiated while at TAMUG.

How will these results help to the advance of sciences in the State of Texas:

As can be seen from the abstracts of the manuscripts he produced, his work on

- 1) PAHs from hurricane washout into Galveston Bay, greatly benefit our understanding of resilience of ecosystems, in particular the effectiveness of the self-cleansing capacity of Galveston Bay, which reduced PAH concentrations to ambient concentrations within a few days after the event.
- 2) The relationships between oil spill effects on ecosystems and microbially produced exopolymeric substances (EPS) demonstrated the redundancy of exoenzyme functions among the microbial community and the substrate availability in the marine environment. Thus, it strengthens our understanding of the resilience of Gulf ecosystems towards oil contamination.