

# **Report as of FY2007 for 2006NV104B: "Microbial and Phytoplankton Impacts on Endocrine Disrupting Contaminants: Las Vegas Wash and Lake Mead, NV"**

## **Publications**

Project 2006NV104B has resulted in no reported publications as of FY2007.

## **Report Follows**

## Synopsis

### Annual Report

March 1, 2007 through February 28, 2008

#### Problem and research objectives

Las Vegas Wash, a tributary which enters the Boulder Basin of Lake Mead, NV, is primarily supplied by tertiary treated wastewater. Various endocrine disrupting chemicals (EDCs), with the potential to adversely affect the reproductive systems of fish and other aquatic life, have been found in water and sediment from Las Vegas Wash and Las Vegas Bay. Common carp, a surrogate for endangered species such as the razorback sucker, have been collected from this system and found to contain high concentrations of synthetic organic chemicals and altered levels of endocrine disrupting biomarkers. During this and the prior contract period, I have developed a relationship with a research team of USGS and USFWS researchers investigating EDC-related phenomena in Lake Mead. Members of this team (e.g. Michael Rosen, USGS, Carson City, NV) are pursuing a "cradle to grave" approach and indicate a growing interest in the role of natural microorganisms for mediating the environmental fate of these and other persistent organic chemicals. Las Vegas Wash, functionally a river of treated wastewater, provides a unique environment to study the impacts of microorganisms upon the fate of EDCs. As stated in our initial proposal, a major objective of our project has been to develop a sustainable research program at DRI focused on the role of environmental microorganisms in mediating the persistence of emerging contaminants. The aforementioned relationship with USGS and more recently a collaboration with Southern Nevada Water Authority are detailed below.

#### Methodology

Aerobic cultivation-based approaches have been utilized to date to begin to assess the physiological and phylogenetic range of bacteria that impact these contaminants. Enrichment cultures and quantitative dilutions using the estrogens (ethinylestradiol, estradiol and estrone, EE2, E2, and E1) as sole carbon sources were prepared using a defined artificial surface water medium and samples from various sites along the Las Vegas Wash. High performance liquid chromatography (HPLC) and Gas Chromatography/Mass Spectrometry (GC/MS) was used to quantitatively analyze the consumption of EE2, E2 and E1 in cultures. Most probable number (MPN) methods were used to determine abundance of estrogen-degrading microorganisms in Las Vegas Wash and several isolates have been identified using rRNA-based molecular approaches.

#### Principal findings and significance

Preliminary work has focused on identifying microorganisms within Las Vegas Wash with estrogen-degrading capabilities:

- A collection of aerobic EDC-degrading microorganisms is being developed and characterized.
- One morphologically distinct (pink) microorganism (*Methylobacterium* sp.) was shown to grow with E2 as a sole carbon source and is able to oxidize E2 to E1, leading to eventual complete degradation of E1.
- Degradation was quantified using HPLC and GC/MS methods in selected ion monitoring mode.
- Further quantification methods involving extremely low, environmentally relevant concentrations (ppt) are currently under development in collaboration with the Southern Nevada Water Authority.
- A Yeast Estrogen Screening (YES) Assay is being developed in order to measure microbial degradation of additional estrogenic compounds (nonylphenols, alkylphenols) at ppt concentrations.

#### Information transfer activities

Presentations:

**Moser, D.P., Blunt, S.M.** 2007. Microbial degradation of endocrine disrupting contaminants in Las Vegas Wash and Lake Mead. Principle Investigator Meeting. NPS Aquatic Safety Center in Boulder City. Nov. 09, 2007

**Blunt, S.M., D.P. Moser.** 2008. Microbial degradation of endocrine disrupting contaminants in Las Vegas Wash. Interagency Water 2025 Meeting. Las Vegas, NV. Mar. 21, 2008

**Moser, D.P.** 2008. Environmental microbiology lab at DRI. Introductory talk given to Applied Research and Development Group, Southern Nevada Water Authority. Henderson, NV. Apr. 10, 2008

#### Student support

UNLV School of Life Sciences Masters' student Susanna Blunt has been supported on this grant at a rate of 50% (the other 50% from NPS/USGS SNPLMA funds). Susanna is now entering her second year. We have subsequently obtained additional funds for Susanna's continued training from Southern Nevada Water Authority.

#### Return on investment

This initial award was treated as seed money to establish a program in endocrine disruptor microbiology at DRI. My initial funds we used in FY 2006 to supplement an undergraduate research project (NSF EPSCoR) to Karen Levy of UNLV focused on microbial EDC microbiology. Ms Levy has subsequently gone on receive a prestigious Amgen fellowship at Columbia University and most recently a Goldwater scholarship. Karen's data was utilized to leverage a cooperative agreement with USGS for \$57,000 in 2007. This funding was utilized to

supplement Susanna Blunt's Masters' NIWR-funded studies at UNLV and to further develop EDC microbiology at DRI. Early successes in this work were used to forge a relationship with Southern Nevada Water Authority (Shane Snyder and Ben Sanford, Applied Research and Development Group) that continues today. This relationship was recently formalized (June of 2008) in the form of a student internship at SNWA where Susanna is receiving state of the art analytical chemistry training focused on low concentration measurements of estrogen-like compounds essential for the continuation of our initial study.