Playing hide and seek: Physical factors influencing the presence of submerged macrophytes in the Jemez Mountains

Virginia F. Thompson, University of New Mexico

Although not a ubiquitous aquatic ecosystem component, when present submerged aquatic macrophytes (SAMs) perform the key functions of water quality enhancement, habitat structure, food resources, and nutrient cycling. Normally catalogued and studied in lower elevation areas, little is known about SAMs in high elevation areas. We observed SAMs in multiple higher elevation (>2,500 m) stream systems in the Jemez Mountains. We investigated whether elevation alone or a combination of elevation and other factors determines the presence of SAMs at high elevation. We measured physical characteristics (depth, width, velocity, estimated discharge, canopy cover, elevation and stream gradient) of 15 different study locations on three river systems (East Fork Jemez, San Antonio, and Guadalupe/Cebolla) that were chosen based on an assessment using digital orthography. Univariate and multivariate statistical analyses (Mann-Whitney U, PCA, discriminant function analysis) were conducted to determine which combinations of the measured physical factors are most likely to promote SAMs in the Jemez Mountain river systems. SAMs were not present at all sites, and our analyses were able to predict with greater than 87% accuracy the combinations of factors that allow the two most dominant SAM species to exist in the field. We found that deeper, slower moving, narrower, lower gradient stream reaches in the Jemez were the most likely to host SAMs. These factors are similar to those found to control SAM presence at lower elevations, illustrating that growing at high elevation alone did not change the control of these factors on the presence of SAMs.

Keywords: submerged aquatic macrophytes; aquatic ecosystems; high elevation; presence/absence; modeling

Dynamic Pilot-Scale Algal Turf Scrubber® on Dairy Wastewater by Microbial Community Analysis

Juchao Yan[1*], David Arellano[1], Blake Hovde[2], Anand Kumar[2], Armand Earl Ko Dichosa[2]

[1]Department of Physical Sciences, Eastern New Mexico University, Portales, NM
[2]Bioscience Division, Los Alamos National Laboratory, Los Alamos, NM

Algal turf scrubber® (ATS) is a cost-effective and point- and non-point source treatment method for recycling the aquatic nutrients while producing biomass suitable for various applications. However, its global deployment is not implemented. Uncontrolled microbial communities, typical of outdoor operations that result in low biomass productivity and poor biomass quality, seems to be the primary reason. To address this, researchers need to explore the optimal algal/bacterial assemblages, conducive to the highest biomass productivity and most efficient nutrient removal and adaptable to local conditions (including climate and wastewater characteristics).

In this talk, we present our recent taxonomic and metagenomic analyses for the algal/bacterial communities at four sampling locations of our ATS on dairy wastewater. The sampling intervals were 20 ft down a 100 ft floway. For taxonomic analyses, duplicate samples were collected in October 2017. *Stigeoclonium sp*. and *Cladophora sp.*were two dominant filamentous species. *Stigeoclonium sp*. became more dominant than *Cladophora sp*. at 60 and 80 ft. *Gomphonema sp*. was the dominant diatom at all four sampling locations, but became less abundant along the floway. *Oscillatoria sp*. began to appear at 60 and 80 ft, but in very low abundance. For metagenomic analyses, replicate samples were collected in the end of July 2017. Phormidium and pseudanabaenaceae were organisms highly represented at 20 ft. Bacteroidales, bacteroidaceae, and burkoldaria were organisms highly represented at 60 and 80 ft. Interestingly, our results show that ATS is a highly dynamic system, whereby sulfur-based metabolism appears to dominate the initial floway then converts to a nitrogen-based metabolism at the terminal end.

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Keywords: Algal turf scrubber®, dairy wastewater, and microbial community

Prevalence of Wolbachia in field-caught *Aedes aegypti* mosquitoes

Aditi Kulkarni, New Mexico State University

Wolbachia species are natural endosymbionts of approximately 60% of all insect species. The bacteria can manipulate host reproduction through a mechanism known as cytoplasmic incompatibility. Furthermore, certain *Wolbachia* strains can interfere with viral replications in infected mosquitoes. The mosquito *Aedes albopictus* is commonly infected with *Wolbachia*. However, it is controversial if a natural *Wolbachia* infection exists in *Aedes aegypti*, a primary vector for arboviruses including dengue and Zika virus. During a microbial survey in field caught *Ae. aegypti* from New Mexico, *Wolbachia* infection was identified by *Wolbachia* diagnostic PCR assays. *Wolbachia* infected *Ae. aegypti* were detected in samples collected in all eight surveyed locations during May-October 2017. *Wolbachia* prevalence at these locations ranged from 15-100%, with an average prevalence of 57.4% among the 148 individuals screened. Further, we have also identified *Wolbachia* from the wild-caught *Ae. aegypti* from St. Augustine, Florida, with a low prevalence of 4.3%. These bacteria were however not detected in *Ae. aegypti* populations from Deer Park, Harris County, Texas. A *Wolbachia* infected *Ae. aegypti* colony has been initiated, which provides an opportunity to study the impact of the natural *Wolbachia* infection on various life traits of this mosquito vector.

Probability of Sex Change in Fishes

Brian Pasko (presenter), Eastern New Mexico University
Tom Brown, Eastern New Mexico University
Marvin Lutnesky, Texas A&M, San Antonio

Abstract: Fish stocks are in decline worldwide. Despite a large science for the study of population dynamics, management practices appear insufficient to sustain populations. Many important fish species change sex as part of their life cycle. This change affects the dynamics of a population and therefore can effect both the sustainability of a fishery as well as the health and continuance of a species in general. Various social and environmental cues contribute to sex change in such species, including encounter rate between individuals. How an individual female processes these cues affects when/if that female changes sex.

We will present the results from a computer simulation that models a territorial, haremic, protogynous species. This simulation explores the probability that a female will change sex under several different stimulus processing models. This simulation includes a male, an alpha female (the sex-changing agent) and a number of subordinate females moving in hexagonal territories. These agents move according to rules that simultaneously maximize number of interactions while minimizing time between interactions. We find that the probability of sex change is very sensitive to both territory size and the encounter rate threshold model at action.

Keywords: Behavioral ecology, Computer simulation, Sex-changing fishes