

INVESTIGATOR'S ANNUAL REPORT

National Park Service

All or some of the information provided may be available to the public

Reporting Year: 2005	Park: Yellowstone NP
Principal Investigator: Dr Sarah Boomer	Office Phone: (503) 838-8209 Email: boomers@wou.edu
Address: Dept. of Biology Western Oregon University 345 Monmouth Ave. Monmouth, OR 97361 US	Office Fax: (503) 838-8072
Co-Investigators: Name: Kelly Shipley Phone: (503) 838-8209 Email: klshipley31@hotmail.com	
Permit#: YELL-2005-SCI-2160	
Park-assigned Study Id. #: YELL-02160	
Project Title: Molecular ecology of photosynthetic hot spring bacteria that resemble <i>Heliobacterium oregonensis</i>	
Permit Start Date: Mar 01, 2005	Permit Expiration Date Dec 31, 2005
Study Start Date: Mar 01, 2005	Study End Date Dec 31, 2005
Study Status: Continuing	
Activity Type: Research	
Subject/Discipline: Microbes	
Objectives: Identification of novel red layer bacteria and chemical characterization of select red layer microbial communities found in Yellowstone National Park.	
Findings and Status: <p>Major research findings include two areas of progress: (1) the collection of site information from three long-term monitoring sites in Yellowstone (Fairy, Hillside, and Imperial); (2) mat formation studies (set up in May 2004 and collected through July 2005 at Fairy run-off).</p> <p>Summer monitoring activities involve methods and findings we have described previously (site characterization, water analysis, mat microscopic evaluations, and pigment assessment). Ongoing data continue to show site-specific chemical profiles, all of which are archived on our on-line RLMO database. DNA-based monitoring, however, was not successful this year because we attempted to teach these methods via workshops for teachers, none of whom had significant lab experience. Consequently, we have archived mat samples for DNA analysis once the entire 5-year monitoring project is done and we can target specific timepoints/samples of interest.</p> <p>After a pilot study in 2003/4, we began a formal study in May 2004 to study whether layered photosynthetic mat systems with red layers could be 'grown' in situ using sterile glass rods that were partially submerged in the Fairy Spring run-off channel. In the past year, Jennifer Esparza (completing an undergraduate thesis about this work, with additional support from her own ASM Undergraduate Research Fellowship) collected 4 rod replicates at 4 timepoints: at 1, 2, 3.5 and 12 months. One-year rod growth was so prolific that Jenn had to dissect the sample into visible green and red layers - the only sample timepoint for which macroscopic layering was apparent. Jenn performed several analyses on each of the samples. After weighing and averaging rod contents, Jenn suspended samples and prepared equivalent-sized aliquots - used for the following: (1) pigment analysis; (2) microscopic</p>	

analysis of phototrophic community members (3) 16S analysis (2 libraries of clones/sample - all Bacteria and GNS/Chloroflexi-specific); (4) and, finally, limited culture-based studies using simple media (Nutrient, MacConkey, Starch and Casein). The latter were meant solely to get a relative picture of media-selectable chemotroph diversity.

Some trends from Jenn's 16S data: after one month of biofilm growth, Jenn observed 55% chemotroph-like 16S sequences, 40% Cyanobacterial 16S sequences, and 5% GNS/Chloroflexi sequences using Bacterial primers. When she analyzed the same sample using GNS/Chloroflexi primers, all isolates were green Chloroflexus. At 2 and 3.5 months, similar distributions were observed, although Cyanobacteria steadily increased to nearly 70%. After 1 year, however, the outer green layer of the biofilm contained 71% chemotroph-like, 14% Cyanobacteria, and 5% Chloroflexus, and 1% Roseiflexus using Bacterial primers. The application of GNS/Chloroflexi primers to this layer showed 50% green Chloroflexus and 50% red Roseiflexus. The inner red layer of the 1 year biofilm contained 100% Chloroflexi using Bacterial primers (91% green Chloroflexus-like and 9% red Roseiflexus-like). 16S data were supported by pigment and microscopic data and, interestingly, even Jenn's culture results correlated with retrieved chemotroph-like sequences (i.e. supporting DNA-based sightings of Thermus and Geobacillus). In general, we remain intrigued by the chemotroph data - particularly their high initial colonization. Given how difficult GNS/Chloroflexi are to isolate in culture (and knowing they typically use photoheterotrophy - not photoautotrophy), we wonder whether the initial establishment by chemotrophs is necessary to provide some key carbon compound. Lastly, Kelly (my research assistant) and I are analyzing companion libraries of Fairy Spring water filtrates so that correlations between timepoint-matched water microbial content data can be made for what we anticipate will be a very good full manuscript for AEM, to be submitted over the summer of 2006.

For this study, were one or more specimens collected and removed from the park but not destroyed during analyses?	
Yes	
Funding provided this reporting year by NPS:	Funding provided this reporting year by other sources:
0	120242
Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college	
Full name of college or university:	Annual funding provided by NPS to university or college this reporting year:
n/a	0