

INVESTIGATOR'S ANNUAL REPORT

National Park Service

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

Reporting Year: 2003	Park: Yellowstone NP
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Permit#: YELL-2003-SCI-2160	
Park-assigned Study Id. #: YELL-02160	
Project Title: Molecular ecology of photosynthetic hot spring bacteria that resemble <i>Heliothrix oregonensis</i> .	
Permit Start Date: Mar 20, 2003	Permit Expiration Date Dec 31, 2003
Study Start Date: Mar 20, 2003	Study End Date Dec 31, 2007
Study Status: Continuing	
Activity Type: Research	
Subject/Discipline: Microbes	
Objectives: The objectives of this year's study included the following: Start year one of our five-year longitudinal monitoring of three established red layer containing microbial mats (Hillside, Fairy, Spray, and Imperial). Monitoring this year included assessment of water chemistry (1 L geothermal water) and collection and analysis of geothermal water (2L) for microbial content. These objectives form the centerpiece of our newly renewed NSF-MO grant (February 15, 2003-February 15-2007); I submitted a full copy of this grant last May to Christine Hendrix. All data are being uploaded to our ongoing RLMO database. To set up a microbial mat formation study in situ at Fairy Springs. We received special permission to set up 16 sterile glass rods in the downstream run-off channel of Fairy Springs (between Spray Geyser and Sentinel Meadows). We collected four rods at our first planned timepoint (4 weeks) but were unable to collect at our second planned timepoint (12 weeks) because of bison. We are planning to collect in April, 2004 and July, 2004. This objective was a final objective for our last NSF-MO grant and will continue to be a side-project on our renewed grant. To set up enrichment cultures from a Hillside Spring red layer sample using novel media that was designed to mirror measured water chemistry at this site. This objective was the basis for a special American Society for Microbiology undergraduate research fellowship project designed and carried out by Terry Manning under my supervision.	

To perform a new red layer community survey at Shoshone Basin and thermal areas in the Bechler Canyon. We located and sampled one new red layer site at Ferris Fork. This objective was a final objective for our last NSF-MO grant and will continue to be a side-project on our renewed grant.

Findings and Status:

Notable findings for each of the above objectives include the following:

As hypothesized, seemingly similar Red Layer Microbial Observatory (RLMO) sites (appearance, pH, temperature, layering) show distinct chemical profiles. Using Hach field test kits (15 salts and metals), we measured and databased water chemistry information in late June and will continue to monitor these sites ' expanding our efforts to include a biannual monitoring (June and September) and more chemical parameters (to include some organic compounds). The latter expansion of goals came about as a direct result of sharing data with other Yellowstone microbiologists and geochemists at the TBI-sponsored meeting at Old Faithful this October.

We assessed microbial content in geothermal water at two time-points (June and September), demonstrating a massive increase in filament counts (1000s/L in early summer to 50,000s/L range in late summer). These radical differences prompted us to expand our water chemistry assessment to two timepoints a year. Molecular analysis on these populations is in progress at this time (i.e. not all filtered water samples have been destroyed)

The first timepoint collection of our mat formation studies (1 month after set-up) demonstrated that the primary microbes to colonize are green photosynthetic Cyanobacteria. Although Cyanobacteria are the dominant organisms (based on microscopy, pigment, and DNA evidence), we have evidence (again ' microscopic, pigment, and DNA) that a small population of Green Nonsulfur filaments are embedded among this thriving green layer. We hypothesize, over time, that a distinct red underlayer will form and will, in our future collections, be analyzing population dynamics. Our hopes to collect four additional replicate rods in October were unfortunately dashed by several herds of bison around the spring.

Terry Manning's attempts to enrich novel red layer bacteria using site-directed media were informative. Although Terry never fully isolated any single organism, he was able to tease out a co-culture that consisted of yellow Chloroflexus-like filaments (closely related to a Yellowstone-derived isolate described by Ward) and Bacillus-like rods. In general, Terry determined that site-specific media altered the outcome of selected microbes (as compared with published GNS media) but did not specifically improve retrieval of GNS like organisms. The most promising growth of GNS, however, was sustained on sterilized geothermal water directly from the spring. Many of Terry's enrichments yielded novel microbial sequences, based on DNA evidence. These data are currently being analyzed and will be available on the RLMO Database shortly.

Finally, we located and sampled one red layer site at Ferris Fork during our new survey of the Bechler Canyon region (late August, 2003). Microscopic and pigment analysis support that this sample contains novel red GNS bacteria. DNA analysis of this site is underway at this time (i.e. this sample has not been destroyed yet).

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	136502
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:
Western Oregon University	0