

Project Summary

Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Experimental determination of the role of Phosphorus on the growth of *Didymosphenia geminata* in the Kootenai River, Montana, downstream from Libby Dam

Type of Project: Research

Project Discipline: Natural Resources

Funding Agency: US Army Core of Engineers

Other Partners/Cooperators: Colorado State University

Effective Dates: 8/2/2012 - 7/31/2013

Funding Amount: \$96,654

Investigators and Agency Representative:

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Project Abstract: *Didymosphenia geminata* (Didymo) is a non-native aquatic stalked diatom that can thrive in low nutrient lotic environments, often forming dense algal blooms that block sunlight and disrupt ecological processes (USDA 2010). Didymo blooms can greatly reduce the aesthetic qualities of public waters and the abundance and diversity of native flora and fauna by decreasing habitat quality (USDA 2010; Kirkwood et al. 2007; Marshall 2007). Recent research suggests that water chemistry, along with other environmental factors such as water transparency, U.V. light, nutrient availability, water temperature, and climate change may regulate Didymo growth, colonization, and distribution (USDA 2010; Kirkwood et al. 2007; Bothwell et al. 2006; Kilroy et al. 2005; Sherbot and Bothwell 1993).

A large-scale nutrient rehabilitation program to rebuild fisheries by increasing primary production in the Idaho portion of the Kootenai River is currently being implemented by the Kootenai Tribe of Idaho (KTOI) and Idaho Department of Fish and Game (IDFG). Lake Koocanusa, the reservoir created by Libby Dam in Montana, acts as a nutrient sink retaining approximately 63% of total phosphorus (P) and 25% of total nitrogen (N). Phosphate fertilizer (10-34-0 solution) is added to the river at the Montana and Idaho during June through September annually to achieve a concentration of 3.0 µg/L of phosphate.

The specific objective of this study will be to determine the effects of adding phosphate fertilizer (10-34-0 solution) to achieve a concentration of 3.0 µg/L of phosphate, duplicating the season of nutrient addition implemented by KTOI and IDFG (June through September), to *D. geminata* mat density and cell division in an experimental flume.

An experimental flume approach is proposed to test the above hypotheses (as well as those of collaborating researchers from SDSMT) at the Libby Dam site. A semi-mobile flume system similar to those used in research by Bothwell and Kilroy (2011), Kilroy and Bothwell (2011) and Bothwell (1988) is proposed for several reasons:

- Evaluation techniques will follow established and published protocols currently in use for research on *D. geminata*, allowing comparison of results across studies.
- Testing must include a highly versatile system created in a modular manner, which allows manipulation of individual replicated channels to test a multitude of hypotheses.
- Tests will allow experiments with different sun angles.
- Experimental sampling platform will be land-based, affording easy access for single individual researchers regardless of volume releases from Libby Dam, rather than teams of researchers necessary for a floating array.
- Data collection and analysis to verify system capabilities to measure the effects of elevated phosphorus concentrations on *D. geminata* growth and reproduction

Field flume testing will be such that hydraulic conditions within the broad range of *in situ* values for systems that experience blooms of *D. geminata* can be examined. Large volume header tanks will be filled with river water extracted from the Kootenai River below Libby Dam and used to feed individual mixing tanks (5-30 L) at the head of each channel which will be used to mix (via mass balance and peristaltic pumps) Phosphorus before emptying into each experimental channel.

Outcomes with completion dates: July 31, 2012

Keywords: Phosphorus, *Didymosphenia geminata*, diatom, Kootenai River, Montana, Libby Dam, US Army Core of Engineers, University of Idaho

