Project Summary
Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Yellowstone Lake Plankton 30 Years after Invasion by Lake Trout

Discipline: Natural
Type of Project: Research
Funding Agency: National Park Service
Other Partners/Cooperators: University of Wyoming
Student Involvement: Yes, student technicians
Effective Dates: 06/11/2016 – 5/31/2019
Funding Amount: $31,981

Investigators and Agency Representative:
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Project Abstract: Trophic cascades occur when a top predator changes the food web structure (e.g., Power 1990, Carpenter et al. 2001) and biomass alternates between high and low at lower trophic levels. Prior to the lake trout invasion, cutthroat trout had high numbers (1-4 million >350 mm total length), zooplankton (crustaceans that live in the open water) and amphipods (crustaceans that lives on the lake bottom) had lower biomass, and phytoplankton (algae that live in the open water) had high biomass (Tronstad et al. 2010, Wilmot et al. in press). However, after the introduction of lake trout, cutthroat trout numbers declined (Koel et al. 2002), zooplankton and amphipod biomass increased, and phytoplankton biomass decreased (Tronstad et al. 2010, Wilmot et al. in press). Lusha sampled and resorted historical samples during her dissertation and investigated the degree to which lake trout had caused a trophic cascade in Yellowstone Lake. Results showed that lake trout dominated Yellowstone Lake in 2004 and altered the ecosystem to one with four trophic levels compared to pre-lake trout conditions (1977-1980). The lake trout removal program has intensified since 2010 and lake trout are now declining. We would like to resample lower trophic levels in Yellowstone Lake to investigate the food web. Understanding lower trophic levels can provide excellent information about dynamics at high trophic levels. For example, lower trophic levels will indicate the degree to which lake trout dominated lake or if the lake is shifting back to a three trophic levels ecosystem where cutthroat trout dominate the food web. The information is useful to managers to understand what abundance of lake trout is needed to return the food web back to its historical configuration. We will compare historical data, 2004 data and new data collected during summer 2016 to evaluate the configuration of the food web in Yellowstone Lake.

Objectives

1. Estimate phytoplankton composition, overall densities, and chlorophyll a, and examine variation among four subbasins of Yellowstone Lake throughout the open water season,
2. Estimate densities and sizes of zooplankton by major taxa and examine variation among four subbasins of Yellowstone Lake throughout the open water season,
3. Estimate densities of benthic invertebrates by major taxa and examine variation among four subbasins of Yellowstone Lake throughout the open water season,
4. Compare results to historical data to determine if the configuration of the food web has shifted due to recent changes in the Yellowstone Lake fish populations.

Keywords: Yellowstone Lake, phytoplankton, lake trout, Yellowstone National Park, University of Wyoming