

Project Summary
Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Evaluation of Methods to Induce Mortality in Lake Trout Embryos

Discipline: Natural
Type of Project: Research
Funding Agency: National Park Service
Other Partners/Cooperators: Montana State University
Student Participation: Yes, grad student
Effective Dates: 7/1/2014 - 1/31/2018
Funding Amount: \$172,082

Investigators and Agency Representative:

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Project Abstract: Lake trout have been intentionally or inadvertently introduced into many lakes throughout the west (Martinez et al. 2009), and the establishment of non-native lake trout populations often causes declines in native species abundance. For example, introduced lake trout (*Salvelinus namaycush*) threaten to extirpate native Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) in Yellowstone Lake, Yellowstone National Park. Consequently, it was deemed that suppression of the lake trout was needed to conserve Yellowstone cutthroat trout in Yellowstone Lake. Gillnetting is the primary method used to suppress lake trout in Yellowstone Lake and this method has been used since the program began in 1995. Unfortunately, lake trout are not the only fish species collected in gill nets. Some Yellowstone cutthroat trout are captured in gill nets and die, thus the exploration of alternative methods to suppress lake trout to minimize bycatch of the targeted species is gaining popularity.

Currently, the use of electricity as an alternative suppression method has received considerable attention. Studies have shown that application of electrofishing techniques can increase mortality of fish embryos (Dwyer et al. 1993; Dwyer and Erdahl 1995; Bohl et al. 2010). Most studies have been aimed at providing criteria to reduce mortality of embryos, but it has been suggested that electroshock-induced mortality of embryos may be a means for eradicating unwanted fishes (Bohl et al. 2010). However, application of electrofishing techniques to induce mortality of embryos in lake environments poses certain challenges. Some of these challenges were recently overcome in Swan Lake, Montana. An electrofishing grid was developed and implemented in 2013 in Swan Lake, Montana that caused greater than 90% mortality in embryos up to 20 cm in the substrate (Brown and Guy, Montana Cooperative Fishery Research Unit, unpublished data). The electrofishing grid was also developed for the National Park Service, Yellowstone Lake, but never implemented because of the Federal Government shutdown in fall of 2013. Part of this project will be to experimentally evaluate the efficacy of the electrofishing grid in Yellowstone Lake.

Suction dredging is also being considered as a viable alternative suppression method because suction dredging has been found to entrain and cause mortality in fish eggs (Harvey and Lisle 1998). For example, 100% mortality occurred in un-eyed eggs of cutthroat trout (Griffith and Andrews 1981). This project will also experimentally evaluate the efficacy of the suction dredge in inducing mortality in lake trout embryos.

Objectives

1. Determine whether the electrofishing grid developed by Brown and Guy (2013, unpublished) will cause substantial (> 90%) mortality in lake trout embryos at lake trout spawning areas.
2. Evaluate the efficacy of suction dredging to cause substantial (>90%) mortality in lake trout embryos at lake trout spawning areas and in the laboratory.

Approach

The first objective of this study will involve controlled field experiments (final experimental design to be determined after the 2014 preliminary field season) to evaluate the effects of electrofishing duration (i.e., amount of time embryos are exposed to a mobile electric field) and embryological stage on mortality of embryos. The study design will be similar to Brown and Guy (unpublished). This objective will address the key uncertainty of whether the electrofishing grid will be a viable method in Yellowstone Lake given the water conductivity and substrate type differences with Swan Lake.

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Similarly, the second objective will be conducted through a series of in situ field and laboratory experiments (final experimental design to be determined after the 2014 preliminary field season) to determine the efficacy of the suction dredge. Experiments will be designed to determine percentage of embryos recovered at varying interstitial depths and mortality rates.

Expected Benefits:

It is likely that the electrofishing grid will produce similar results to Brown and Guy (unpublished) and thus be a viable method for suppressing embryos in Yellowstone Lake. However, less is known about the suction dredge technique, but is a likely a viable suppression method given the limited literature on causing mortality in trout. Having additional "tools" for suppression will be beneficial to the overall suppression program especially as lake trout become more difficult to catch in the gill nets resulting in higher bycatch of Yellowstone cutthroat trout per lake trout captured.

Keywords: Lake Trout, embryo, mortality, Yellowstone National Park, Montana State University, Yellowstone Park Foundation