

Investigation of Yellow Bullhead Tolerance to Antimycin and Rotenone

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INTRODUCTION

In order to prepare for renovation of Fossil Creek during Fall 2004, biologists needed to know appropriate concentrations of antimycin-A to use in order to effectively remove all non-native fish from the stream. It was already known that yellow bullhead (*Ameiurus natalis*) would be the most tolerant species to this toxin, but project planners hoped to determine the minimum quantity of antimycin necessary for elimination of the species. Therefore, preliminary bioassay studies were carried out in fiberglass tanks at the Irving Power Plant adjacent to Fossil Creek. This site was ideal, as it received water directly from the stream channel, thus eliminating any possible unknown effects that might have been caused by differences in water quality. Preliminary results (below) indicated that antimycin would not be effective at removal of yellow bullhead, so additional work was done using rotenone as a toxicant, to see if results and cost-effectiveness could be improved.

All work with antimycin was conducted and completed by Dave Weedman (Weedman, in prep.). I conducted tests with rotenone at Bubbling Ponds Hatchery.

METHODS

On August 6, 2004, Frank Agyagos (AGFD), Janie Agyagos (USFS) and I collected 64 yellow bullhead from Scholtz Lake, a small stock tank SE of Williams, Arizona. Hoop nets were baited with canned dog food as an attractant, and nets were fished for approximately 3 h (1930-2230 hrs). Fish were placed into a hatchery hauling tank that contained artesian spring water from Page Springs Hatchery, and transported to Bubbling Ponds Hatchery. Fish were held in fiberglass tanks that were filled with through-flowing artesian spring water (18.6 C, 110 ppm CaCO₃, pH 7.6), and fed daily with commercial trout chow. The fish were given prophylactic treatments of malachite green on 3 consecutive days to eliminate external pathogens. On August 10, 2004, Shawna Kisling (AGFD) transported 55 of the yellow bullhead to holding tanks at the Irving power plant on Fossil Creek. Dave Weedman conducted bioassay tests on yellow bullhead and several other species between August 10-12, using Fintrol (antimycin-A).

On October 1, 2004, Shawna Kisling and I again collected yellow bullhead from Scholtz Lake. Hoop nets were fished as before, but only 17 yellow bullhead were

captured. These fish were transported to Bubbling Ponds Hatchery, and treated as with malachite green, as before. On October 25-27, I tested yellow bullhead resistance to rotenone, using standard bioassay techniques. Rotenone was used at concentrations of 50, 100, 1000 and 2000 ppb (see results for calculations). Fish were observed either directly or by means of video tape, so that exact time of loss of equilibrium and death could be determined. Death was determined by cessation of opercular movement.

RESULTS

Antimycin tests results will be reported by Dave Weedman (Weedman in prep.). Briefly, Fossil Creek was to be treated with 50 ppb antimycin, but tests at the Irving power plant indicated that 4 out of 5 bullhead were still alive after 22 h 40 min, when exposed to a concentration of 800 ppb antimycin. In addition, the four living fish showed no signs of stress, so the one fish that succumbed might have been an aberration.

Rotenone proved to be a better toxicant for elimination of yellow bullhead (Table). The rotenone label calls for a treatment of 3 ppm in order to remove bullhead from ponds. However, in tests at 2 ppm, bullhead were dead after only 130 min, and at 1 ppm, all bullhead were killed within 180 minutes.

Table. Bioassay test results using rotenone to kill yellow bullhead, at Bubbling Ponds Hatchery.

Test	Time	Species	N	Gallons of Water	Temp	pH	mL Rotenone (5%)	ppb	Time to loss of equilibrium	Time to Mortality
1	0945	AMNA	1	176.667	16 C	7.6	0.67	50	3:41 h	7:36 h
			1	176.667	16 C	7.6	0.67	50	4:14 h	?
			1	176.667	16 C	7.6	0.67	50	6:01 h	?
2	0940	AMNA	1	176.667	16 C	7.6	1.34	100	Still alive after six hours, but weak	
			1	176.667	16 C	7.6	1.34	100		
			1	176.667	18 C	7.6	1.34	100		
3	0940	AMNA	1	176.667	18 C	7.6	13.4	1000	0:32 h	2:30 h
			1	176.667	18 C	7.6	13.4	1000	1:11 h	3:00 h
			1	176.667	18 C	7.6	13.4	1000	1:16 h	3:00 h
4	1415	AMNA	1	176.667	18 C	7.6	26.8	2000	0:35 h	2:10 h
			1	176.667	18 C	7.6	26.8	2000	0:55 h	2:10 h
			1	176.667	18 C	7.6	26.8	2000	1:05 h	2:10 h

DISCUSSION

In spite of the work completed during this study, the Fish and Wildlife Service and Forest Service decided not to use rotenone as a toxicant in the renovation of Fossil Creek. The renovation, therefore, was intended to remove all non-native species from Fossil Creek, except yellow bullhead. It is hoped that the native fish fauna will be able to recover and expand in Fossil Creek, in spite of the continued existence of this non-native predator. Should Fossil Creek require another renovation in the future, rotenone should be considered for use, as this toxicant would likely be effective at removing all fish species from the stream.