Toxicity of Fintrol® (Antimycin) and Prenfish® (Rotenone) to Slimy Sculpin

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Abstract

In 96-hr acute toxicity tests on slimy sculpins with Fintrol® exposures of 4 to 240 µg/L, the LC50 was 6.1 µg/L; and with Prenfish® exposures of 0.0156 to 1 mg/L, the LC50 was 0.024 mg/L. The highest concentration of Fintrol that had no observable effect was 4 µg/L. Fintrol was less toxic to slimy sculpins than Prenfish at levels prescribed by their labels to completely remove trout. The Fintrol Use Direction Leaflet describes sculpins as sensitive species, but our results showed this species response is similar to highly resilient species such as the channel catfish (96-hr LC50 9.0 –21.7). The response of slimy sculpins to Prenfish was similar to other salmonids.

Key words: Antimycin, Fintrol®, piscicide, Prenfish®, rotenone, slimy sculpin, sculpin.

Introduction

Some conservation programs for native trout species in the western United States use piscicides such as rotenone or antimycin to remove non-native fish from lakes and streams in preparation for native trout re-introductions. Because the habitat and range of several sculpin species overlap those of many western native trout species (Scott and Crossman 1973), use of piscicides for trout conservation should consider potential impacts to other non-target or native species present in a treatment area, such as sculpins. There is no known information available that assesses rotenone toxicity to sculpins and only limited information about antimycin toxicity to sculpins (Gilderhus et al. 1969). The slimy sculpin (*Cottus cognatus*) is a common sculpin species in western Montana (Holton and Johnson 2003) and a good candidate for conducting a toxicity assessment. We conducted this study to assess the acute toxicity of two commercial formulations of piscicide, Fintrol® (10% antimycin) and Prenfish® (5% rotenone) to the slimy sculpin.

Methods and Materials

To assess acute toxicity we used the 96-hr renewal technique described by the American Society for Testing and Materials (E 729-96) (ASTM 2002) with some modifications. Because the slimy sculpin is an uncommon species for this type of testing, and availability is limited by wild sources, we used fish from multiple year classes. We collected sculpins from East Spring Creek near Kalispell, Montana, in April 2006 using a battery-powered electrofisher (pulsed DC, 300-V, 30-Hz duty cycle) and immediately transferred them to a Montana Fish Wildlife and Parks laboratory facility in Kalispell. The fish were quarantined in an 1850-L tank for 16 days, and actively fed on a diet of dipteran larvae and arthropods until food was discontinued 48 hr prior to the tests. We observed no negative impacts from electrofishing (Barrett and Grossman 1988, Snyder 2003). Water for quarantine and testing came from East Spring Creek (total alkalinity, 214 mg/L; conductivity, 426 µS/cm; hardness, 224 mg/L; pH, 7.9; mean daily temperature 10.7 °C [9.8- 12.1]). During the quarantine and testing dissolved oxygen (DO) was measured twice daily with a digital meter and the mean daily DO was 85 (84-86) percent of saturation. The test chambers were

55-L glass aquaria. We added 20 L of stream water and five sculpins to each chamber (0.7 g/L loading).

To remain consistent with the product labels, references to concentrations of Fintrol and Prenfish are of active ingredient and formulation, respectively. We tested seven concentrations of Fintrol (4, 6, 8, 10, 60, 120, 240 μg/L active ingredient) and one non-treated control, and six concentrations of Prenfish (0.0156, 0.03125, 0.0662, 0.125, 0.25, 1 mg/L formulation) and one non-treated control. Each test concentration and control was replicated once to assess variation in response. We randomly arranged the aquaria in the lab. The primary purpose of the renewal technique was to periodically expose the test organisms to fresh test solution of the same composition (ASTM 2002, section 3.2.3). We did this by replacing the test solution in each chamber every 24 hr with freshly prepared stock solutions and fresh water mixed at the appropriate concentrations. Water in the non-treated controls was similarly replaced every 24 hr.

Mortality inspections occurred each day at 1, 2, 4, 8, 12, and 24 hr. Results from each replicated test concentrations were pooled (five fish replicate = 10 fish concentration) to calculate mortality at each concentration. During the Fintrol test, one fish in a non-treated control chamber died at 96 hr, but this loss was within the acceptable limit described by ASTM (section 13.1.7) (2002). We determined the 96 hr LC50 (median lethal concentration) values and 95-percent confidence intervals (C.I.) using the Probit Method (Finney 1978) and the Trimmed Spearman-Karber Method (Hamilton et al. 1977) with the U.S. Environmental Protection Agency's Probit Analysis Program, version 1.5 and the Trimmed Spearman-Karber Method Program, version 1.5.

Results

Our tests showed Fintrol was toxic to slimy sculpins at concentrations ranging from 6 to 240 μg/L (Fig. 1). The highest concentration at which no mortality was

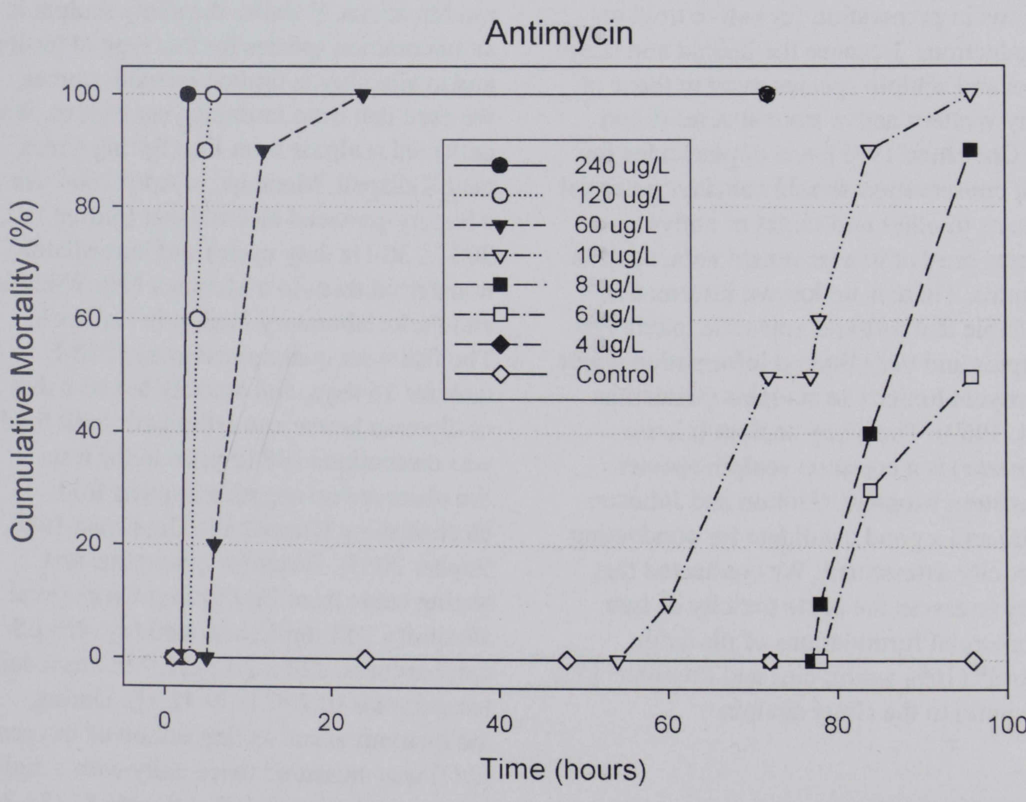

Figure 1. Toxicity of Fintrol (antimycin) to slimy sculpins in 96-hr laboratory tests.

observed was 4 μg/L, and at 10 μg/L the first mortality (10%) occurred after 60 hrs. The 96-hr LC50 for Fintrol was 6.1 μg/L (95% C.I. 5.1-6.9 μg/L). Complete mortality occurred after 8 hr exposure to concentrations of ≥ 120 μg/L, and after 24 hr exposure to 60 μg/L. We observed only slight discoloration of some sculpins exposed to Fintrol, and no apparent differences in swimming or other behavior between the treated and control fish.

Prenfish concentrations of ≥ 0.25 mg/L caused 100 percent mortality after two hours of exposure (Fig. 2). At these concentrations, the fish swam erratically and exhibited surface gulping behavior commonly associated with rotenone toxicity. The lowest exposure used in this test (0.0156 mg/L) caused 10 percent mortality at 96 hr. The 96-hr LC50 for Prenfish was 0.024 mg/L (95% C.I. 0.018-0.031 mg/L).

Discussion

Sculpins are listed on the Fintrol Use Direction Leaflet as a sensitive species that can be completely removed from a water body with concentrations of 5 to 10 μg/L. Correspondence with the manufacturer during our tests indicated the information on the leaflet has not been updated since 1975 (M. Romeo, Aquabiotics Corp, personal communication, 2006), and we were able to find only a single reference in the scientific literature regarding Fintrol [antimycin] toxicity to the mottled sculpin (*Cottus bairdi*). Gilderhus et al. (1969) reported antimycin applications of 15 μg/L for 5 hr and 10 μg/L for 10 hrs in two Wisconsin streams resulted in complete mortality of mottled sculpins. Our results indicated that 5-10 μg/L would be insufficient to completely remove slimy sculpins during a typical 8-hr stream treatment. Only concentrations >120 μg/L resulted in complete mortality within 8 hr, and at the highest label-recommended concentration (10 μg/L), mortality of slimy sculpins did not start until after 60 hrs of exposure. The results of our tests show that this species response is closer to other non-scaled fishes like the channel catfish (*Ictalurus punctatus*), which

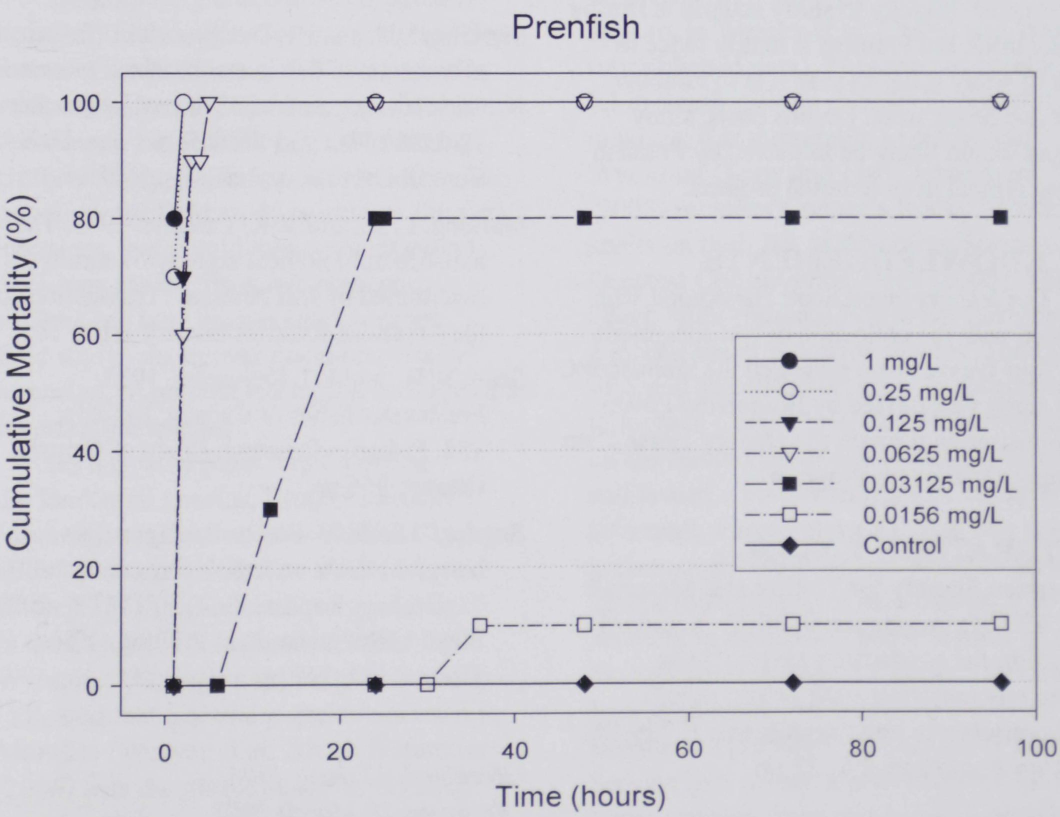

Figure 2. Toxicity of Prenfish to slimy sculpins in 96-hr laboratory tests.

has 96-hr LC50 values ranging from 9.0 to 21.7 µg/L (Berger et al. 1969, Marking and Dawson 1972). When compared to toxicity results of rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*) and lake trout (*S. namaycush*) (Berger et al. 1969), our results show Fintrol is between 87 and 152 times less toxic to slimy sculpins.

The results of our tests and comparisons with toxicity information on other fish species suggest Fintrol would not have an impact on slimy sculpins during a typical 8-hr treatment. As recommended by the Fintrol Use Direction Leaflet, applicators should consider conducting on site assays to evaluate species sensitivity and make adjustments for differences in water chemistry at each site.

We could not find any published literature on the toxicity of rotenone to sculpins.

Marking and Bills (1976) reported toxicity results for twenty-one fish species tested under conditions similar to ours, using similar rotenone formulations. Their 96-hr LC50 values of three salmonid species were: rainbow trout, 0.046 mg/L; brook trout, 0.044 mg/L; and lake trout, 0.026 mg/L. Our results show that Prenfish toxicity to slimy sculpin is similar to lake trout, but Prenfish is nearly twice as toxic to slimy sculpins than it is to rainbow trout and brook trout. On this basis, slimy sculpin would likely be impacted by Prenfish during typical trout removal projects.

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