



U.S. Fish & Wildlife Service

Aquatic Animal Drug Approval Partnership

DRUG RESEARCH INFORMATION BULLETIN

Efficacy of AQUI-S®: Group Sedation vs. Individual Sedation

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4050 Bridger Canyon Road, Bozeman, Montana, 59715, USA***The drug sponsor has discontinued all activities in pursuit of an FDA approval for AQUI-S®.**

AQUI-S® (50% isoeugenol) is a candidate for U.S. Food and Drug Administration Center for Veterinary Medicine (CVM) approval for use as a zero-withdrawal anesthetic in aquaculture and fisheries management to sedate all freshwater finfish for management and handling purposes. As such, fish treated with AQUI-S® could be stocked, released, or harvested immediately following recovery from treatment.

The U.S. Fish & Wildlife Service's Aquatic Animal Drug Approval Partnership program has been actively participating in the AQUI-S® approval process. For example, we have conducted two target animal safety studies and numerous efficacy studies to be included in a New Animal Drug Application (NADA) in support of the drug's U. S. approval. In nearly all of our AQUI-S® efficacy studies, and as per CVM guidance, test fish were individually sedated to "handleable" (herein defined as a fish that has lost equilibrium, stopped swimming, lost reactivity to external stimuli except for strong pressure, and is easily hand-captured, held above the water surface, and measured for length). However, it is common practice in both aquaculture and fisheries management to sedate fish in small groups (e.g., 5 – 20 fish per group). Therefore, in 2005, we conducted three AQUI-S® efficacy studies to investigate if time to handleable was similar between group-sedated and individually sedated fish.

Methods

All three studies were conducted at 20 mg/L AQUI-S® (currently, the lowest efficacious concentration proposed for the product label). **Study 1** was conducted on rainbow trout *Oncorhynchus mykiss* fingerlings (mean length ~4 cm, water temperature ~12°C). **Study 2** was conducted on channel catfish *Ictalurus punctatus* juveniles (mean length ~22 cm, water temperature ~25°C). **Study 3** was conducted on walleye *Sander vitreus* fingerlings (mean length ~6 cm, water temperature ~22°C).

In each study, test fish were either sedated to handleable as part of a group (Treatment 1) or individually (Treatment 2). Each replicate (N = 3 or 4) of group-sedated fish consisted of simultaneously placing 10 fish into a single container of 20 mg/L AQUI-S® and timing each fish to handleable. Each "replicate" of individually sedated fish consisted of placing a single test fish into each of 10 containers of 20 mg/L AQUI-S® and timing each fish to handleable. For each group sedated and individually sedated replicate, median time to handleable (to the nearest 0.1 min) was determined [(5th longest time + 6th longest time) ÷ 2; n = 10 fish] and used as the primary response variable. Subsequently, "average median time to handleable" was calculated for group sedated treatments and individually sedated treatments (sum of median time for all replicates ÷ number of replicates). Average median time-to-handleable values were used to make qualitative comparisons between group-sedated and individually sedated fish. Also, in each study, water temperature, dissolved oxygen concentration, and pH of the AQUI-S® solution in each container was measured once (Table 1).

Results

In all three studies, there appeared to be little substantive difference in average median time to handleable between group-sedated and individually sedated fish (Tables 2 – 4). In two studies (rainbow trout and channel catfish), average median time to handleable for group-sedated fish was slightly greater (range, 0.3 – 0.5 min) than average median time to handleable for individually sedated fish. In the other study (walleye), average median time to handleable for group-sedated fish was slightly less (0.1 min) than that for individually sedated fish. No mortality or adverse effects were observed during any of the three studies.

Discussion

Overall, the time to handleable data generated in all three studies suggest that (given a sufficient volume of AQUI-S® solution relative to fish number and size) there is no “group effect” that substantively alters the time required to sedate a fish to handleable. Study results, which were summarized in detailed Final Study Reports, were submitted to and accepted by CVM’s Aquaculture Team. As such, the individually sedated time-to-handleable data generated in numerous other AQUI-S® efficacy studies should be representative of real-world scenarios in which fish are sedated to handleable in small groups.

Acknowledgments

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Table 1. Mean length of test fish and water quality conditions under which test fish were sedated to handleable at 20 mg/L AQUI-S®.

Study	Mean length (cm)	Mean water temperature (°C)	Mean dis-solved oxygen concentration (mg/L)	Mean pH
Individually sedated				
1 (RBT)	4.3	12.2	8.0	7.96
2 (CCF)	22.0	25.1	6.3	nc*
3 (WAE)	6.1	21.7	8.4	8.33
Group-sedated				
1 (RBT)	4.4	12.5	7.9	7.95
2 (CCF)	22.5	24.9	6.2	nc
3 (WAE)	6.1	21.7	8.5	8.32
Footnote: * = not collected				

Table 2. Study 1 - Median time to handleable for rainbow trout (mean length, 4.3 cm) group-sedated or individually sedated at 20 mg/L AQUI-S® (water temperature, 12°C).

Replicate	Median time to handleable (min)	
	Group sedation	Individual sedation
1	5.2	4.8
2	4.7	4.9
3	4.9	4.8
4	5.9	5.2
Average median time	5.2	4.9

Table 3. Study 2 - Median time to handleable for channel catfish (mean length, 22.4 cm) group-sedated or individually sedated at 20 mg/L AQUI-S® (water temperature, 25°C).

Replicate	Median time to handleable (min)	
	Group sedation	Individual sedation
1	7.1	6.4
2	6.7	5.5
3	5.1	5.6
Average median time	6.3	5.8

Table 4. Study 3 - Median time to handleable for walleye (mean length, 6.1 cm) group-sedated or individually sedated at 20 mg/L AQUI-S® (water temperature, 22°C).

Replicate	Median time to handleable (min)	
	Group sedation	Individual sedation
1	5.9	5.3
2	5.1	6.2
3	6.1	5.9
Average median time	5.7	5.8

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