Efficacy of Virkon Aquatic® To Disinfect Wading Gear Infested with New Zealand Mudsnails

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Abstract: New Zealand mudsnails (NZMS) (*Potamopyrgus antipodarum*) are a harmful invasive species. First found in Idaho, NZMS are now found in many regions of nearly all of the Western US. NZMS have high reproductive rates and are clonal; thus one female snail can begin a colony. The snails have an operculum that can close and keep snails alive for several days, and small snails can easily be lodged on wading gear. Virkon Aquatic® is labeled as a disinfectant for use against fungi, bacteria, and viruses, and is used in many fish hatcheries. This study determined the effective concentration and time exposure of Virkon Aquatic required to kill 100% of NZMS on wading gear with rubber, felt, and neoprene soles. We also evaluated any damage that Virkon Aquatic® caused to the waders. We determined that an immersion exposure of 15, 20 and 30 minutes in 2% Virkon Aquatic will kill all snails (adult and neonates). We propose that this procedure be used in field and hatchery applications providing anglers, biologists, and others using wading gear with an alternative way to reduce risks of spreading the invasive NZMS to other locations.

Introduction

New Zealand mudsnails are invasive species in North America first identified in the Snake River basin in Idaho in 1987 (Bruce and Moffitt 2009). NZMS are problematic in the United States because they have extremely high reproductive rates and in high densities can consume 75% of primary productivity in their habitat, threatening the balance of the aquatic ecosystems. Native macro-invertebrates compete with the NZMS for food and habitat use (Hall et al. 2006). One significant transportation vector of the NZMS is attachment to equipment such as wading gear used by anglers or biologists in streams that are infested with NZMS.

Virkon Aquatic is used as a disinfectant in fish hatcheries against fish pathogens (fungi, viruses, and bacteria) on nets and gear. The disinfectant breaks down in the presence of organic material; the resulting products are environmental salts (Syndel Laboratories Ltd 2008). Therefore, this disinfectant would be relatively easy to use in the field if ground applied.

Recent experiments conducted at the University of Idaho confirmed that a 2% solution of Virkon Aquatic was effective at killing NZMS in a static 20 minute exposure. This study determines the effective concentration, time, and application method (spray or bath) of Virkon Aquatic required to kill 100% of the snails on wading gear, specifically looking at felt, neoprene, and rubber soled waders.

Tote of New Zealand mudsnails

Mixing 2% Virkon Aquatic solution using 200g of Virkon Aquatic Powder and 10L of de-ionized water.

Methods

Snails for testing were collected from springs at Hagerman National Fish Hatchery, Hagerman, Idaho and shipped to the University of Idaho. Snails were maintained in static water with vegetation at 15 C.

SPRAY vs. BATH

See poster by Barenberg et al. (Feb 2010) on Efficacy of Virkon Aquatic® To Disinfect Wading Gear Infested with New Zealand Mudsnails.

WADERS

Three waders were placed in a tote containing NZMS for approximately 20 to 60 minutes to allow for passive colonization. The snail covered waders were then placed in a 0% or 2% concentration of Virkon Aquatic for 15, 20, or 30 minute intervals. As controls, we exposed snail infested waders to aged water. At the end of each experiment, the waders were rinsed in three baths of tap water and placed on a cart to dry. The waders were inspected after each bath to ensure all NZMS had been removed. NZMS were recovered from each bath and from the test solutions using a sieve. They were rinsed in three baths and placed into recovery cups using aged water. NZMS were observed at 24 and 48 hours to assess their survival. At least 100 snails were tested in each test system. Chemical levels of the 0% and 2% test solutions were recorded using a YSI multiprobe meter and Virkon Aquatic test strips.

Damage was assessed by conducting pre-inspection and post-inspection observations of the waders before and after they were exposed to Virkon Aquatic. Several categories of damage were assessed including: cracks, holes, stains, discolorment, and tears.

New Zealand mudsnails attached to felt waders

New Zealand mudsnails attached to rubber waders

New Zealand mudsnails attached to neoprene waders

Results

SPRAY vs. BATH

Spray applications and 1% Virkon Aquatic did not kill 100% of the NZMS (See Table 1 and Table 2 on Barenberg et al. (Feb 2010) Efficacy of Virkon Aquatic® To Disinfect Wading Gear Infested with New Zealand Mudsnails).

WADERS

Some mortality was observed with NZMS held in control solutions with no Virkon Aquatic (maximum 7%; Table 1). The 2% concentration was 100% effective at each time interval (15, 20, 30 minutes) on all wader types (Felt: Table 1, Rubber: Table 2, Neoprene: Table 3). No neonates survived in bath exposures at 2% Virkon Aquatic.

The number of NZMS that attached to the felt waders after three experiments ranged from 108 snails to 247 snails (Table 1). The number of snails that attached to the rubber waders after four experiments ranged from 48 snails to 532 snails (Table 2). The number of NZMS that attached to neoprene waders after 3 experiments was 152 snails to 967 snails (Table 3). No damage was observed on the waders that were exposed to 2% Virkon Aquatic solution. No differences were found in pH, temperature, conductivity, and ORP of the solutions throughout tests.

Table 1: Summary of total number of snails, mortality, and number of neonates alive in tests of bath disinfection experiments with NZMS on felt bottom waders.

Felt Boot Results					
Conc.	Time Min	Total # Of Snails	% Mortality	Stand Dev	Total # neonates (alive)
0%	15	150	7%	0.03	6
	20	116	3%	0.02	5
	30	108	5%	0.03	8
2%	15	174	100%	0.00	0
	20	233	100%	0.00	0
	30	247	100%	0.00	0

Table 2: Summary of total number of snails, mortality, and number of neonates alive in tests of bath disinfection experiments with NZMS on felt rubber waders.

Rubber Boot Results					
Conc.	Time Min	Total # Of Snails	% Mortality	Stand Dev	Total # neonates (alive)
0%	15	56	0%	0.00	13
	20	48	4%	0.06	30
	30	113	6%	0.04	31
2%	15	233	100%	0.00	0
	20	207	100%	0.00	0
	30	532	100%	0.00	0

Table 3: Summary of total number of snails, mortality, and number of neonates alive in tests of bath disinfection experiments with NZMS on neoprene bottom waders. TNTC = too numerous to count; NA = Not Applicable.

Neoprene Boot Results					
Conc.	Time Min	Total # Of Snails	% Mortality	Stand Dev	Total # neonates (alive)
0%	15	967	0.5%	NA	TNTC
	20	267	1%	0.002	TNTC
	30	235	2%	NA	TNTC
2%	15	152	100%	0.00	0
	20	216	100%	0.00	0
	30	730	100%	0.00	0

Discussion

SPRAY vs. BATH

See poster by Barenberg et al. (Feb 2010) on Efficacy of Virkon Aquatic® To Disinfect Wading Gear Infested with New Zealand Mudsnails.

WADERS

The 2% solution bath was 100% effective in killing NZMS at 15, 20, and 30 minutes. It is recommended to leave the waders in 2% Virkon for longer than 15 minutes if possible to ensure mortality. On a few occasions during our pilot studies we only had 99% mortality in our baths. We found some mortality in control exposures (no Virkon) likely from handling mortality before exposure to the test solutions. The felt and neoprene soles of the waders could easily have picked up several dead snails on the bottom of the tote. Consistencies in the chemical properties of Virkon Aquatic confirmed that this disinfectant can be used repeatedly without losing its effectiveness.

Our goal was to collect a total of 100 NZMS for replicate in the different solution concentrations. We met this goal in only three experiments with felt and neoprene waders. We had the toughest time getting snails to attach to the rubber waders, which is way we had to conduct that experiment 4 times. These experiments demonstrate the affinity of NZMS for felt and neoprene waders, and their risk as vehicles for NZMS.

As expected Virkon Aquatic did not have any damaging effects on the waders that were used in this study. However, this study was conducted over a relatively short time span (~4 months). Further experiments should involve a more repeated exposures of waders to Virkon Aquatic at a 2% concentration.

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