

New Zealand Mud Snails in the Putah South Canal

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Introduction

On October 30, 2003, biologist, Ken Davis incidentally discovered a population of New Zealand Mud Snails (NZMS), *Potamopyrgus antipodarum*, in Putah Creek while conducting surveys to catalogue the native aquatic invertebrates of that system. The Putah Creek discovery was the first appearance of the organism west of the Sierra. Since this initial finding, NZMS have been found in the Mokelumne, Calaveras, and Napa Rivers.

Since the initial discovery of NZMS in the Putah Creek inter-dam reach, between Monticello and the Putah Diversion Dams, the snails have spread approximately 6 miles downstream from the epicenter at Fishing Access #3 (FA#3) as of last fall after sustained high flood flows the previous winter. It is very likely that the limit of infestation has moved farther downstream due to flood flows in Putah Creek. Continuous migration of NZMS from areas of high concentration via water current has been documented in Putah Creek. Current population density estimates at FA#3 are upwards of 50,000 NZMS/m² and between 20,000 and 40,000 NZMS/m² in lower Putah Creek.

The infested reach includes the intake to the Putah South Canal (PSC). The first colonization of the PSC by NZMS was discovered within the first 1.5 miles of the PSC on March 21, 2005. Further delineation of the geographic limit of spread in the PSC is currently being conducted.

Background

The PSC is a concrete canal approximately 30 miles long that conveys up to 900 cubic feet per second (CFS) from Putah Creek above the Putah Diversion Dam to the Terminal Reservoir west of Fairfield at the foot of the Green Valley hills. The water is delivered to agricultural users and domestic water treatment plants at various points. Along its course, the PSC crosses several natural water-ways, two of which are currently used to convey water discharged from the canal. Sweeny Creek is used to convey water to Maine Prairie Water District. Excess water from the system is occasionally spilled down Green Valley Creek, a local native steelhead stream. The PSC is typically in full operation from April through October with peak flows occurring during the summer months.

The PSC is prone to algal blooms that can restrict water conveyance to some users in the lower portion of the system. Algae are controlled chemically using weekly copper sulfate treatments employed in a plug flow methodology. Penta-Hydrate is added at 3 to 4 discrete locations along the canal at a rate of 1-2 lbs. per CFS. The initial concentration at the injection points is approximately 6 ppm; which often reduces to 1 ppm approximately 6 miles downstream when the biomass concentration is high. The treatments are most effective when the velocities in the canal are high. During the winter time the canal flow rate is too low to conduct effective treatments.

The PSC is cleaned annually at the end of irrigation season over a 2 to 3 month period. During cleaning, the canal is drained reach by reach and all organic matter and sediment is mechanically removed.

Definitive information in the literature regarding NZMS is limited. A literature summary developed by David Bergendorf of the USFWS, outlining relevant knowledge, is attached as background for the NZMS. In addition to the literature, the Solano County Water Agency has funded some aquatic toxicology studies that were conducted by the Department of Fish and Game at the Water Agency's direction. Four constituents that are acceptable for use in a drinking water supply, copper sulfate, potassium permanganate, chlorine, and salt, were tested to determine effective mortalities on NZMS. Methodology and results of those studies are also attached. From the results of these studies, potassium permanganate showed the most promising mortality rate at relatively lower concentrations than the others. The literature has also cited a product called Bayluscide as an effective NZMS control agent.

Concerns

The impacts of the NZMS infestation on water conveyance infrastructure, and agricultural and drinking water supply are unknown. Their ability to reach localized high densities and anecdotal information that suggests they can potentially impact water delivery systems has potential management consequences. In addition to operational issues, the PSC could also become a shortcut for the NZMS to spread to other waterways of the County, such as Sweeney Creek and Green Valley Creek. The potential ecological consequences of NZMS spreading to natural systems like Green Valley Creek and ultimately the Sacramento-San Joaquin Delta might take decades to realize.

The distribution of NZMS in Putah Creek renders any conceivable eradication strategies in Putah Creek infeasible due to potential ecological effects. Since the PSC is not a natural waterway there may be some additional latitude in treatment methodologies that can be deployed from a regulatory aspect that are not possible in Putah Creek.

What We Know So Far

- During the water delivery season of 2004, NZMS were present in Putah Creek above and below the PSC intake but they did not appear in the PSC until after the water season (October) and the canal cleaning operation.

What We Don't Know

- Does the current alga treatment methodology provide any level of control to manage the spread of NZMS in the PSC? Or was this merely coincidental?
- Could the current alga treatment methodology be modified to achieve control of both alga and NZMS?
- Potassium permanganate is a strong oxidant. Could Potassium Permanganate be utilized as the alga control agent instead of copper sulfate to achieve control of NZMS and alga at the same time?

- Could Bayluscide be safely utilized in the PSC to control NZMS?
- Are there any other allowable constituents (drinking water compatible) that could be investigated? (Hydrothol, etc.?)
- Are there any mechanical methods that may be employed to inhibit NZMS migration into the PSC? (Air curtain, UV light, etc.?)
- Can pre-ozonation or any other standard pre-treatments effectively control NZMS?
- What impacts could the NZMS have on water treatment plant operations?
- Some literature suggests that crayfish will prey on NZMS. Will the crayfish in Putah Creek respond in a manner to provide some control of NZMS?