AQUATIC ECOSYSTEM RESEARCH
A Freshwater Conservation Company

MEMO

Date: December 22nd, 2015

To: Carey Fiertz, President – Twin Lakes Association

From: Aquatic Ecosystem Research, 1204 Main St., Box 161; Branford, CT 06405

RE: Snail Survey

Dear Carey,

Attached to this letter is the snail survey that was conducted by Biodrawversity during late September. That document outlines their findings including recommendations for chemical considerations and future monitoring. The following are some highlights from that report:

- 11 snail species were found in East Twin Lake during 2015, four less than were in 1983.
    - 8-10 species per site.
- 13 snail species were found in West Twin lake during 2015, three less than were found in 1983.
    - 3-11 species per site.
- Two state listed species were in both lakes.
    - *Stagnicola catascopium*
    - *Valvata tricarinata*
- *Fossaria galbana* was not found during this initiative.
- Recommendations include:
    - Lake management planning.
    - Careful consideration of herbicide choice and responsible use.
    - Surveying of the invertebrate community on a 4-5yr basis.

If you have any questions regarding this report, its findings, or recommendations, do not hesitate to contact me at mjunewells@aerlimnology.com or 860-576-8628.

Sincerely,
AQUATIC ECOSYSTEM RESEARCH

Mark June-Wells, Ph.D.
NALMS Certified Lake Manager
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REPORT

Aquatic Snail and Mussel Survey in the Twin Lakes (Salisbury, Connecticut)

prepared for

Aquatic Ecosystem Research (AER)
1204 Main Street, Branford, CT

prepared by

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206 Pratt Corner Road, Leverett, MA

December 2015

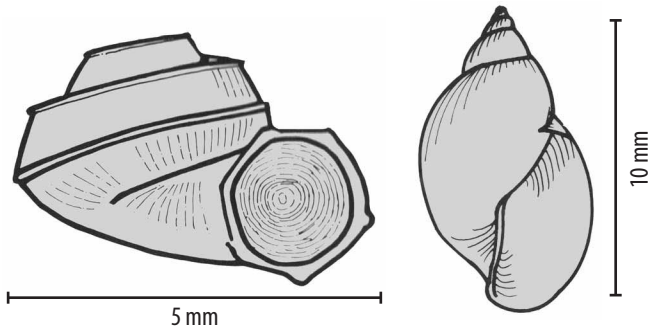
Survey site 2 in East Twin Lake.

INTRODUCTION

Biodrawversity conducted an aquatic snail and mussel survey in East Twin Lake and West Twin Lake in Salisbury, Connecticut, to assist with the environmental review and permitting for aquatic plant management. Target snail species include *Valvata tricarinata*, *Stagnicola catascopium*, and *Fossaria galbana*. Of these, only *V. tricarinata* had been previously documented in both lakes, and *S. catascopium* had been documented only in East Twin Lake (Jokinen 1983). In Connecticut, *V. tricarinata* occurs primarily in calcium-rich lakes in the upper Housatonic basin and exists on a variety of substrates, often with detritus and aquatic vegetation (Jokinen 1983). In Connecticut, *S. catascopium* occurs in only two calcium-rich lakes in the upper Housatonic Basin where it was found "buried in the sand", and a morphologically distinct form also exists in the lower Connecticut River (Jokinen 1983). Data for *F. galbana* is scarce; it was not reported to occur in Connecticut (Jokinen 1983) or New York (Jokinen 1992). Burch and Jung (1992) describe its range as "*Great Lakes-St. Lawrence River basin northward in the region west of James Bay…northwestward into the boreal forest region to the vicinity of Great Slave Lake*."

Based on this described range, and its morphological similarity to other species of *Fossaria* that are known to occur in Connecticut lakes, the validity of an *F. galbana* record from the Twin Lakes is questionable. The survey had the following objectives:

1. Determine the species composition of aquatic snails and mussels in East and West Twin Lake.
2. Characterize habitat use and availability for snails and mussels, particularly state-listed species.
3. Provide recommendations for minimizing adverse effects of aquatic plant management on the snail and mussel fauna in East and West Twin Lake.



Valvata tricarinata (L) and *Stagnicola catascopium* (R) (Jokinen 1992).

Figure 1. Snail and mussel survey sites in East and West Twin Lake (Salisbury, CT), showing locations where state-listed snail species were found.

METHODS

Two biologists completed the survey over a 3-day period, from September 27 to 29, 2015. Snails and mussels were surveyed in available aquatic habitats at 17 locations (7 in East Twin Lake, 10 in West Twin Lake; Figure 1, Table 1). Sites were selected to provide adequate spatial coverage in all three basins, and to capture the diversity of habitats present. Published habitat descriptions for the three target snail species were generally non-specific and therefore provided very little insight into where species might occur within each lake. Nearly all survey sites contained habitats that were suitable for one or more of the target species. Deep water below the thermocline, where chemical/physical conditions typically preclude snails and mussels, were excluded from the survey. Basic habitat parameters (water depth, substrate, and aquatic vegetation) and photographs were recorded at each site.

Sampling methods included a combination of aquatic D-nets, basket sieves, and hand-picking while snor-

Table 1. Survey sites, dates, and methods (see Figure 1).

Lake	Site	Survey Date	Survey Method		
			SCUBA	Snorkel	D-Net
East Twin	1	9/27/15		X	X
East Twin	2	9/27/15		X	X
East Twin	3	9/27/15	X		X
East Twin	4	9/27/15		X	X
East Twin	5	9/27/15		X	X
East Twin	6	9/28/15		X	X
East Twin	7	9/28/15			X
West Twin	1	9/28/15		X	X
West Twin	2	9/28/15		X	X
West Twin	3	9/28/15		X	X
West Twin	4	9/28/15	X	X	X
West Twin	5	9/28/15			X
West Twin	6	9/28/15		X	X
West Twin	7	9/28/15		X	X
West Twin	8	9/29/15		X	X
West Twin	9	9/29/15		X	X
West Twin	10	9/29/15		X	X

keling and SCUBA diving. Mussels were identified and photographed in the field and released unharmed. Representative snail samples were collected, preserved in alcohol, and identified under a dissecting microscope using keys of Jokinen (1983, 1992) and Burch and Jung (1992).

RESULTS

Target Species: *V. tricarinata* was found at five of seven sites in East Twin Lake. One of the two sites where it was not found was the deepwater site (Site 3) where very few other snail species were found. Based on available habitat and presence of other snail species, it seems likely that *V. tricarinata* existed at Site 4 but was missed during the survey. In West Twin Lake, *V. tricarinata* was found only at sites 1 and 2 in the lake's southern basin; each of these sites had diverse substrates (including coarse rock and ledge) and dense submergent vegetation (especially *Chara* sp.). It was not found in the northern basin, despite some of these sites having similar habitat and similar snail communities, and may have been undersampled. *V. tricarinata* does not seem to have a strong affinity for any specific habitat parameter; it was found in a range of substrate types and often in the presence of vegetation and detritus.

S. catascopium was uncommon; a few individuals were found at Site 1 in East Twin Lake and Site 1 in West Twin Lake, and of these, only 3-4 were live [shells of all snails were typically far more abundant than live snails]. Jokinen (1983) described its habitat as "buried in the sand"; we are not sure how accurate this description is and if it suggests that other substrate types (e.g., mud, gravel, cobble, detritus, vegetation) are not suitable habitats. Sand was present at both sites where *S. catascopium* was found, but sand was also prevalent at several sites where *S. catascopium* was not found. It may simply be uncommon and therefore difficult to detect in these lakes.

Snorkeling in shallow rocky areas at Site 1 in East Twin Lake.

Large sieve used to sift through dredged sediment for snails.

We did not find any snails that match the illustrations or descriptions of *F. galbana* in Burch and Jung (1992). *Fossaria modicella* was found during this survey, and it was also reported in East Twin Lake by Jokinen (1983).

Snail Community: Eleven snail species were found in East Twin Lake, which is four fewer than what was reported by Jokinen (1983). Species richness ranged from 8 to 10 for all sites, except the deepwater site (Site 3) where only two species were found. Numerically dominant species included the non-native *Vi-*

Table 2. Snail and bivalve species found in East and West Twin Lake, compared to Jokinen (1983). Asterisk indicates state-listed species.

	East Twin Lake									West Twin Lake										
Species	**Jokinen**	**This Study**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**Jokinen**	**This Study**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Snails																					
Amnicola limosa	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Campeloma decisum	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cipangopaludina chinensis	X																				
Ferrissia parallela	X																				
Fossaria modicella	X	X	X					X			X	X									X
Gyraulus deflectus	X									X	X								X		X
Gyraulus parvus	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X			X	X	X
Helisoma anceps	X	X	X	X		X		X	X	X	X	X	X	X	X	X	X		X		X
Helisoma campanulatum	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X			X	X	X
Physa ancillaria	X	X					X	X	X	X	X	X		X	X	X		X			
Physa heterostropha	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X		X	X		X
Promenetus exacuous	X																				
Pseudosuccinia columella										X	X				X						
*Stagnicola catascopium**	X	X	X								X	X									
*Valvata tricarinata**	X	X	X	X			X	X	X	X	X	X	X								
Viviparus georgianus	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Bivalves																					
Pyganodon cataracta											X	X		X	X	X					X
Elliptio complanata											X		X	X	X	X	X	X	X	X	X
Dreissena polymorpha		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Number of Snail Species	15	11	10	8	2	8	8	10	9	10	13	11	8	8	9	8	3	5	8	5	10
Number of Bivalve Species	0	1	1	1	1	1	1	1	1	0	3	2	2	3	3	3	2	2	2	2	3

Table 3. Habitat parameters recorded at each of the survey sites in East Twin Lake and West Twin Lake.

		Water	Substrate						
Lake	**Site**	**Depth (ft)**	**Silt**	**Sand**	**Gravel**	**Cobble**	**Ledge**	**Detritus**	**Aquatic Vegetation**
East Twin	1	1-5	X	X	X		X		*Chara* widespread and abundant, other submergent species common in deeper water
East Twin	2	1-4	X	X	X	X		X	High coverage of submergent, floating, and emergent species
East Twin	3	10-15	X	X	X				High coverage of *Chara* and other submergent species
East Twin	4	1-5	X	X	X	X	X		*Chara* widespread and abundant, other submergent species common in deeper water
East Twin	5	1-5		X	X	X	X		*Chara* abundant
East Twin	6	1-6	X			X	X	X	High coverage of *Chara* and other submergent species in deeper water
East Twin	7	<3	X	X	X	X			*Chara* common, patches of pond lilies, some emergent species
West Twin	1	<5	X	X	X	X	X	X	*Chara* widespread and abundant, other submergent species common in deeper water
West Twin	2	1-4	X	X	X	X		X	*Chara* and other submergent species common offshore; some pond lilies
West Twin	3	1-5	X	X	X	X			High coverage of *Chara* and other submergent species in deeper water
West Twin	4	1-15	X	X	X				High coverage of *Chara* and other submergent species in deeper water
West Twin	5	<3	X	X	X			X	High coverage of submergent, floating, and emergent species
West Twin	6	2-4	X		X			X	High coverage of submergent, floating, and emergent species
West Twin	7	1-5	X					X	*Chara* widespread and abundant
West Twin	8	1-4	X		X		X	X	Sparse submergent species; emergent and floating vegetation and algae common
West Twin	9	1-5			X	X	X	X	Moderate amounts of algae and vegetation (submergent and floating-leaved)
West Twin	10	1-4	X	X	X		X	X	High coverage of *Chara* and other submergent species

viparus georgianus and the native *Amnicola limosa*, and other common species included *Physa heterostropha*, *Campeloma decisum*, *Helisoma anceps*, *Helisoma campanulatum*, *Gyraulus parvus*, and *V. tricarinata*.

Thirteen snail species were found in West Twin Lake, which is three more than what was reported by Jokinen (1983). Species richness ranged from 3 to 11. Species richness was generally higher in at sites with more diverse substrate types and vegetation communities, especially areas with both fine sediments and coarse rock (cobble and ledge) such as Site 1 and Site 10. Lowest species richness (3) was found at Site 6, where aquatic vegetation was very dense and substrate was only silt and gravel. As in East Twin Lake, numerically dominant species included the non-native *Viviparus georgianus* and the native *Amnicola limosa*. Other common species included *Physa heterostropha*,

Survey site 1 in East Twin Lake.

Campeloma decisum, *Helisoma anceps*, *Helisoma campanulatum*.

Mussel Community: No live native mussels were found in East Twin Lake, but zebra mussels were found at every sampling site. It is possible that native mussels existed in deeper areas of East Twin Lake that were not sampled as intensively as shallow areas. However, the seven survey sites in East Twin Lake contained a large amount of very suitable mussel habitat, and zebra mussels have have completely decimated the mussel population. In West Twin Lake, *Pyganodon cataracta* was found at five sites, *Elliptio complanata* was found at nine sites, and zebra mussels were found at all ten sites. Native mussels were often fouled with zebra mussels.

Native Eastern Elliptio (*Elliptio complanata*) fouled with zebra mussels.

DISCUSSION

East and West Twin Lake harbor two species of aquatic snails that are listed as Special Concern in Connecticut due to their highly restricted distributions in the state. Based on survey results and observed/documented habitat preferences of target snail species, *V. tricarinata* is widely distributed in shallow water (<10-15 ft) around the perimeter of East Twin Lake. It was found less frequently in the southern basin of West Twin Lake, and was not found in the shallow northern basin of West Twin Lake. *Stagnicola catascopium* was also documented in East and West Twin Lake, but at much lower density and at fewer survey sites. Given the challenges of identifying these species in the field due to their small size and morphological similarity to related species including the challenges of detecting rare species during short-term qualitative studies, we are not confident that these species are absent at the sites where they were not detected. Therefore for the purposes of planning lake management activities, we suggest that both lakes be considered actual or potential habitat for two state-listed snails.

The presence of a third species, *F. galbana*, is inconclusive and there is uncertainty about the validity

Survey site 1 in West Twin Lake.

of past records and the taxonomy of the species. CT DEEP considers it "believed extirpated" in Connecticut. Burch and Jung (1992) describe its range as "*Great Lakes-St. Lawrence River basin northward in the region west of James Bay…northwestward into the boreal forest region to the vicinity of Great Slave Lake*." It is not included in monographs on the snails of Connecticut (Jokinen 1983), or New York (Jokinen 1992), nor has it been documented in lakes of Massachusetts. Based on published descriptions of its range and other regional publications that do not include it, the historic presence of *F. galbana* in Connecticut is dubious.

East and West Twin Lake are two of Connecticut's best examples of naturally calcareous lakes; each lake supports a broad range of flora and fauna that prefer calcareous conditions. Considering both the presence of state-listed snail species and the high biodiversity of East and West Twin Lake, any lake management planning should carefully consider risks/benefits and employ tools that provide effective control while minimizing ecological impacts.

Some herbicides may have lethal or sublethal toxic effects on aquatic snails. Therefore if chemical control of invasive plants is proposed, we recommend that the type(s) of chemicals used is carefully considered; and, encourage conservative herbicide use regarding both dosage and spatial extent of treatments. Updated mapping of the distribution of target plant species would also help in the development of a holistic management plan that targets specific areas rather than simply conducting lake-wide treatments.

Non-chemical control of aquatic plants, such as harvesting, may be effective in discrete patches and may help to reduce widespread use of chemicals. In general, mechanical plant removal is more benign than chemical treatments regarding the effects on aquatic snails. It is likely that a combination of chemical and physical control techniques would be necessary for East and West Twin Lake. This should be thoroughly detailed in an updated lake management plan.

Chemical control of aquatic plants has been conducted in East and West Twin Lake for the last decade. However, non-native aquatic macrophyte species still persist throughout each lake, which suggests that efforts have only managed, not eradicated the target species. Therefore, we can assume that control efforts, whether chemical or physical, will continue indefinitely. To our knowledge, there was neither a baseline study of aquatic fauna prior to chemical treatments nor any biological monitoring in the last decade to determine if treatments were adversely affecting aquatic fauna. Moving forward, we suggest that biological monitoring of aquatic snails/invertebrates, be incorporated into a long-term lake management plan for East and West Twin Lake. Repeatable semi-quantitative or quantitative monitoring for these taxa, completed at 4-5 year recurrence intervals, would probably be adequate for this purpose.

LITERATURE CITED

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