AQUATIC ECOSYSTEM RESEARCH
A Freshwater Conservation Company

MEMO

Date: November 12th, 2020

To: Grant Bogel, President – Twin Lakes Association

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

RE: Snail Survey

Dear Grant,

Attached to this letter is the snail survey that was conducted by Biodrawversity on July 2nd, 2020. 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 2020; the same number of species that were detected in 2015 and four less than were found in 1983.
    - 7-11 species per site.
- 12 snail species were found in West Twin lake during 2020; 1 less than 2015 and three less than were found in 1983.
    - 7-12 species per site.
- Two state listed species were in both lakes.
    - *Stagnicola catascopium*
    - *Valvata tricarinata*
- One non-native snail species was found during this survey:
    - *Cipangopaludina chinensis* (Chinese Mystery Snail)
- *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 an 8-10yr 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

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NALMS Certified Lake Manager
ESA Certified Ecologist

REPORT

Freshwater Snails and Bivalves in East and West Twin Lake: 2020 Monitoring

prepared for

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

prepared by

Biodrawversity LLC
206 Pratt Corner Road, Leverett, MA

November 2020

Survey site 6 in East Twin Lake.

INTRODUCTION

Biodrawversity LLC conducted an aquatic snail and bivalve survey in East Twin Lake and West Twin Lake in Salisbury, Connecticut, to assist with ongoing aquatic plant management in these lakes. The Connecticut Department of Energy and Environmental Protection (CTDEEP) requested monitoring to help understand the potential effects of plant management on, and how best to conserve, the molluscan fauna in these lakes, particularly three state-listed snail species. Target snail species included *Valvata tricarinata*, *Stagnicola catascopium*, and *Fossaria galbana*.

Of these three species, Jokinen (1983) documented *V. tricarinata* in both lakes, and *S. catascopium* only in East Twin Lake. *V. tricarinata* and *S. catascopium* were found in both East and West Twin Lake in 2015 (Biodrawversity 2015). 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 only in calcium-rich lakes in the upper Housatonic Basin, 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. Biodrawversity (2015) did not detect *F. galbana* in East or West Twin Lake.

The 2020 survey repeated the 2015 survey, with identical survey objectives and methods, but with fewer survey sites (six per lake) in 2020. The survey had the following objectives:

- Determine the species composition of aquatic snails and bivalves in East and West Twin Lake.
- Characterize habitat use and availability for snails and mussels, particularly state-listed species.

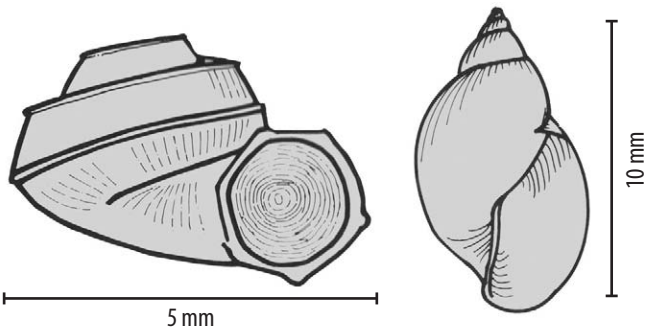
METHODS

Two biologists completed the survey in two days: July 2-3, 2020. Snails and bivalves were surveyed in available aquatic habitats at 12 locations (6 in East Twin Lake, 6 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

Figure 1. Snail and mussel survey sites in East and West Twin Lake (Salisbury, CT), showing locations where state-listed snail species were found. Site numbers are not continuous because they are consistent with the 2015 report, which included more sites than the 2020 survey.

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 and 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



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

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

Lake	Site*	Survey Date	Survey Method		
			SCUBA	Snorkel	D-Net
East	1	7/3/2020		X	X
East	2	7/3/2020		X	X
East	4	7/2/2020		X	X
East	5	7/2/2020		X	X
East	6	7/2/2020		X	X
East	7	7/2/2020		X	X
West	1	7/2/2020		X	X
West	2	7/2/2020		X	X
West	3	7/2/2020		X	X
West	4	7/2/2020	X	X	X
West	5	7/2/2020		X	X
West	10	7/2/2020		X	X

*Site numbers consistent with 2015 report, which included more survey sites than the 2020 study.

snorkeling and SCUBA diving. Mussels were identified to species, 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). Pea clams (*Pisidium* sp.) and fingernail clams (*Musculium* sp.) were also collected or documented, but only identified to genus.

RESULTS

Target Species: *V. tricarinata* was found at four of six sites in East Twin Lake, which is consistent with the 2015 survey results. In West Twin Lake, *V. tricarinata* was found at sites 1 and 2 in the lake's southern basin, and Site 10 at the north end of the lake; each of these sites had diverse substrates (including coarse rock and ledge) and dense submergent vegetation (especially *Chara* sp.). *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 three sites in East Twin Lake (sites 1, 5, and 7) and two sites in West Twin Lake (sites 1 and 10). Very few live *S. catascopium* were found at each site. Similar to 2015, 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. It seems to be uncommon and therefore difficult to detect in these lakes. As in 2015, 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).

Survey site 1 in West Twin Lake.

Sieving for snails in East Twin Lake.

Large sieve used to sift through dredged sediment for snails.

Snail Community: Eleven snail species were found in East Twin Lake, which is four fewer than what was

Table 2. Snail and bivalve species found in East and West Twin Lake in 2020, compared to Jokinen (1983) and the 2015 survey.

	East Twin Lake			2020 Survey Site*						West Twin Lake			2020 Survey Site*					
Species	**Jokinen**	**2015**	**2020**	**1**	**2**	**4**	**5**	**6**	**7**	**Jokinen**	**2015**	**2020**	**1**	**2**	**3**	**4**	**5**	**10**
Snails																		
Amnicola limosa	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
Cipangopaludina chinensis	X											X	X					
Ferrissia parallela	X																	
Fossaria modicella	X	X	X	X			X				X	X	X					X
Gyraulus deflectus	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							
Stagnicola catascopium	X	X	X	X			X		X		X	X	X					X
Valvata tricarinata	X	X	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
Bivalves																		
Pyganodon cataracta			X			X	X	X			X	X	X		X	X	X	X
Elliptio complanata			X	X					X		X	X		X	X	X	X	X
Pisidium sp.			X	X		X	X	X	X			X	X	X		X	X	X
Musculium sp.			X					X										
Dreissena polymorpha		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Number of Snail Species	15	11	11	11	7	7	11	8	10	10	13	12	12	9	7	7	7	10
Number of Bivalve Species	0	1	5	3	1	3	3	4	3	0	3	4	3	3	3	4	4	4

*Site numbers consistent with 2015 report, which included more survey sites than the 2020 study.

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)**	**Si**	**S**	**G**	**C**	**B**	**BR**	**Aquatic Vegetation**
East	1	1.0 - 3.0	X	X	X	X	X	X	*Chara* widespread and abundant, other submergent species common in deeper water
East	2	1.0 - 3.5	X	X					High coverage of submergent, floating, and emergent species
East	4	1.0 - 4.0		X	X	X	X	X	*Chara* widespread and abundant, other submergent species common in deeper water
East	5	1.0 - 4.0		X	X	X	X		*Chara* abundant
East	6	1.0 - 6.0	X	X	X			X	High coverage of *Chara* and other submergent species in deeper water
East	7	1.0 - 3.0	X	X	X	X	X		*Chara* common, patches of pond lilies, some emergent species
West	1	1.0 - 5.0	X		X	X		X	*Chara* widespread and abundant, other submergent species common in deeper water
West	2	1.0 - 4.0	X	X	X	X		X	*Chara* and other submergent species abundant away from the shoreline, some pond lilies
West	3	1.0 - 5.0	X	X	X				*Chara* and other submergent species abundant in deeper water
West	4	1.0 - 10.0	X	X	X				*Chara* and other submergent species common in deep water; emergent species common in shallows
West	5	1.0 - 3.0	X	X	X	X			*Chara* and other submergent species abundant in deeper water
West	10	1.0 - 4.0	X	X	X	X		X	Submergent, floating, and emergent species abundant

*Substrate abbreviations: Si = Silt, S = Sand, G = Gravel, C = Cobble, B = Boulder, BR = Bedrock

reported by Jokinen (1983). Species richness ranged from 7 to 11 among all sites. Numerically dominant species included the non-native *Viviparus georgianus* and the native *Amnicola limosa*, and other common species included *Physa heterostropha*, *Campeloma decisum*, *Helisoma anceps*, *Helisoma campanulatum*, *Gyraulus parvus*, and *V. tricarinata*.

Twelve snail species were found in West Twin Lake, which is three more than what was reported by Jokinen (1983) and one fewer than what was found in 2015. One species found in 2020 that was not found in 2015 was the non-native chinese mystery snail, *Cipangopaludina chinensis*, but the 2020 did not detect two species that were found in 2015: *Pseudosuccinia columella* and *Gyraulus deflectus*. Species richness ranged from 7 to 12 among sites. Species richness was generally higher in at sites with more diverse substrate types and vegetation communities, especially areas

Survey site 1 in East Twin Lake.

Representative lake bottom photos in East and West Twin Lake.

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

with both fine sediments and coarse rock (cobble and ledge) such as Site 1 and Site 10. 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*, *Campeloma decisum*, *Helisoma anceps*, and *Helisoma campanulatum*.

Bivalve Community: Two species of native mussels, *Pyganodon cataracta* and *Elliptio complanata*, were found in both East Twin Lake and West Twin Lake. Very few live native mussels were found in East Twin Lake, and both species were more numerous in West Twin Lake. Zebra mussels (*Dreissena polymorpha*) were found at every sampling site. Native *Pisidium* sp. were found at most survey sites in both lakes, and native *Musculium* sp. was found in East Twin Lake. Neither *Pisidium* sp. nor *Musculium* sp. were recorded in 2015, but we think they were undersampled. Native mussels were often 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 West Twin Lake. *S. catascopium* was also documented in East and West Twin Lake, but at much lower density and at fewer survey sites. Given 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 *V. tricarinata* and *S. catascopium*.

The presence of a third species, *F. galbana*, remains inconclusive and there is uncertainty about the validity of past records and the taxonomy of the species. CTDEEP 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 ~15 years. However, non-native plant species still persist throughout each lake, which suggests that efforts

have only managed, not eradicated these plant species. Therefore, we can assume that plant management efforts, whether chemical or physical, will continue indefinitely. To our knowledge, there was not a baseline study of aquatic fauna prior to chemical treatments. The 2015 and 2020 surveys provide qualitative data on snail and bivalve species occurrence, relative abundance, and habitat, but are not designed to determine specifically if or how plant management is adversely affecting the snail or bivalve community. Moving forward, we suggest that this type of biological monitoring (i.e., the 2015 and 2020 surveys) may provide an adequate snapshot of the snail and bivalve communities, and therefore should remain part of the long-term lake management plan for East and West Twin Lake. Repeating this survey every 8-10 years would probably be adequate for this purpose, unless there was a significant change in plant management efforts that might have greater non-target effects.

LITERATURE CITED

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