First Zebra Mussel Found in Comfort Lake in July, 2017

Zebra Mussel Rapid Response Assessment for Comfort Lake, Chisago Co, MN, July 21, 2017

Prepared for:
Comfort Lake-Forest Lake Watershed District and Comfort Lake Association

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Results of the Search: The first zebra mussel observation in Comfort Lake, Chisago County, was reported by a lake resident on July 12, 2017 and was found to the east of the public access (Site 1). Another zebra mussel was found by the same resident on July 16 (Site 2). On July 21, 2017, volunteer searchers from the Comfort Lake Association, 2 from the CLFLWD, 3 from the MnDNR and 2 from Blue Water Science conducted a rapid response assessment to look for additional zebra mussels in Comfort Lake. The searchers spent a total of 26 hours to search 1,810 feet of shoreline. An estimated 3,630 objects in Comfort Lake were examined (Table 1). Five zebra mussels at 4 sites were found in Comfort Lake on July 21, 2017.

Table 1. Search results for the zebra mussel inspection sessions on July 21, 2017.

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Total
Site description	East of Landing	Point (DNR + searcher)	WP 3	WP 4	WP 5 + 5B	WP 6 - N 2nd knob	WP 6 west side	WP7 west side	Landing	--
Duration of search at this site (minutes)	60	45 + 60	15	15	15 + 60	15	15	30	60	--
Number of searchers	1	3 + 1	4	4	4 + 2	4	2	2	12-14	**14**
Total search time (minutes)	60	135 + 60	60	60	60 + 120	60	30	60	840	**26 hours**
Number of objects (rocks, branches, etc) examined in duration of the search (estimated)	180	400 + 120	150	150	120 + 50	180	60	120	2100	**3,630**
Length of shoreline searched (ft)	150	400	200	100	70 + 100	150	70	70	500	**1,810**
Range of water depths (ft)	0 - 3	0 - 10	0 - 4	0 - 4	0 - 4	0 - 4	0 - 4	0 - 4	0 - 10	--
Total number of zebra mussels found	1	1		1					2	**5**
Approximate size of zebra mussels (less than $^3/_4$ in, greater than $^3/_4$ in)	17 mm	17 mm		16 mm					17, 19 mm	**16 - 19 mm**
Substrate	sand, rocks, branches	sand, rocks	rip-rap	willow	willow, sand	sand, branches	rip-rap, sand, and muck	rip-rap, sand, and muck	sand and rock	--
Search methodology	wading	wading, snorkeling, diving	wading, snorkeling	wading, snorkeling	wading, snorkeling	wading, snorkeling	wading, snorkeling	wading, snorkeling	wading, snorkeling, diving	--
Search efficiency*	--	--	--	--	--	--	--	--	10%	--

* search efficiency is conducted by randomly placing 10 marbles in a search area. Searchers pick up the marbles that are found in the course of searching for zebra mussels in the area. The number of marbles recovered represents an approximation of search efficiency at a site.

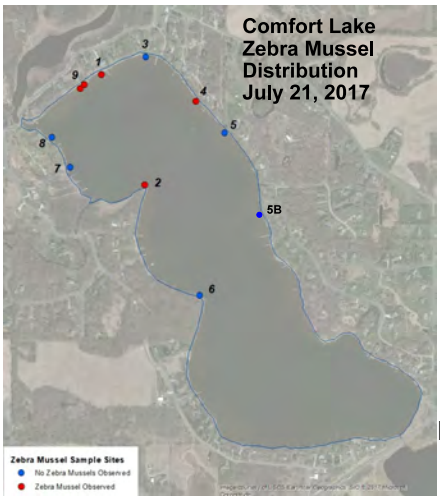

Figure 1. Location of the search sites on July 21, 2017.

Locations of Zebra Mussels Found in Comfort Lake

Initially, 2 zebra mussels were found by a Comfort Lake resident in Comfort Lake. On July 21, 2017 a rapid response zebra mussel search by Comfort Lake volunteers and others was conducted and 3 additional zebra mussels were found (Figure 2). A total of 5 zebra mussels were found from 4 locations. Zebra mussels ranged in size from 15 to 19 mm in length.

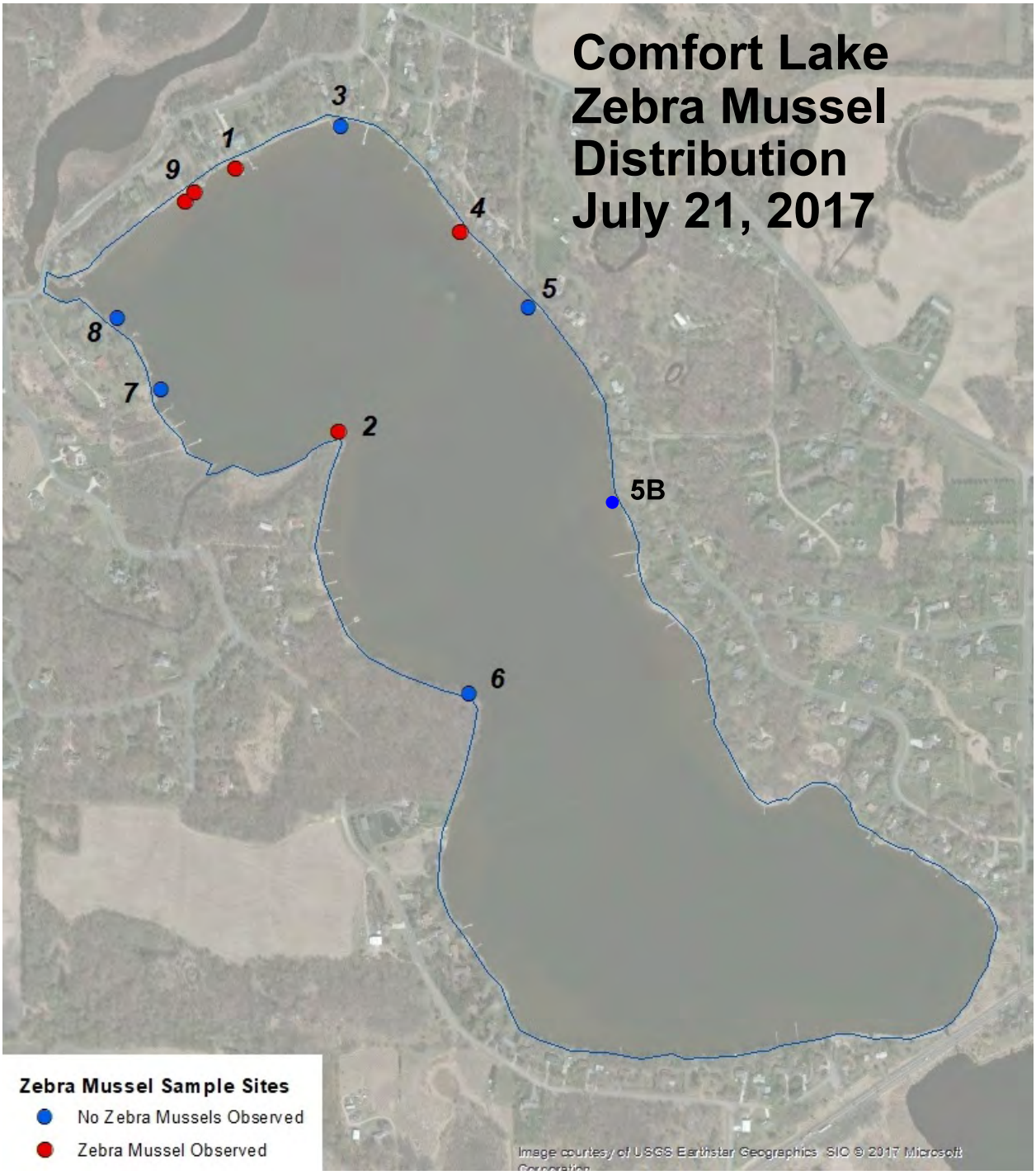

Figure 2. Five zebra mussels were found at 4 areas on July 21, 2017 (red dots) by Comfort Lake volunteers and Blue Water Science.

Comfort Lake Zebra Mussels

Only adult zebra mussels were found during the Comfort Lake zebra mussel search on July 21, 2017 (Figure 3). Sizes ranged from 16 mm to 19 mm. All 5 zebra mussels were found as solitary individuals on a rock or a branch.

Figure 3. Zebra mussel sizes in Comfort Lake, collected on July 21, 2017. (Photo from MnDNR).

Rapid Response Plan for Zebra Mussels

A total of 5 zebra mussels have been found at 4 locations in Comfort Lake as of July 21, 2017. A previously prepared rapid response plan, shown in Table 2, has a number of steps. The actions on July 21, 2017 involved Steps 2.1 and 2.2 (blue shading in Table 2). Based on the findings from Step 2.1, Step 2.3 was not needed. Step 3, the Rapid Response Action, was determined after evaluating available information. The Rapid Response Action is summarized on the next page.

Table 2. Tasks and assignments for an early detection and rapid response plan for Comfort Lake, Chisago County, Minnesota.

	Comfort Lake Association	CLFL Watershed District	Chisago County	MnDNR	Treatment Contractor	BWS
1. Early Detection						
1.1. Create website information.	May-Aug					
1.2. Designate contact person.	May					
1.3 Install plate samplers around the lake. Check monthly. Remove in October.	Jun-Oct					Jun
1.4. Conduct training session for volunteer searchers.	Jun	Jun				Jun
1.5. Conduct monthly targeted searches (Apr-Oct).						Apr-Oct
1.6. Press release if zm are found.	X		X	X		
2. Rapid Response Assessment						
2.1. Conduct an initial exploratory search after the first report of a zebra mussel observation.	X	X		X		X
2.2. Organize and train lake resident searchers for a full search effort.	X	X				X
2.3. Conduct an expanded targeted search with diving (if needed).	X	X		X		X
3. Rapid Response Action						
3.1. Meet to determine treatment options.	X	X		X		X
3.2. Action is to conduct long term monitoring and small scale control projects in the future.	X	X		X		
3.3. Action is to attempt an eradication project	X	X	X	X	X	X
3.3.1. Close public access, if necessary.	X		X	X		
3.3.2. Set-up containment area.					X	
3.3.3. Treat area within the containment area.					X	
3.3.4. Evaluate treatment.				X		X
3.4. Report all findings and results.	X		X	X		X

Zebra Mussel Eradication Index and a Recommended Action Plan

Ten criteria are considered when evaluating a potential success of conducting a zebra mussel eradication treatment. Points are assigned on a scale from 0 to 100 for each criterion. Points are added up and the higher the score, the higher the probability for a successful eradication.

Christmas Lake is used as a reference lake. Christmas Lake, Hennepin County, had an eradication treatment in April of 2015. However zebra mussels were observed later in Christmas Lake. The Zebra Mussel Eradication Index score for Christmas Lake was 810. When index scores are less than 800 the probability of a successful eradication attempt diminishes.

The Comfort Lake index score of 360 is low enough to indicate that an eradication attempt has a very low probability to succeed.

Based on available information an eradication attempt would have a low probability of success and is not recommended for Comfort Lake. Instead the recommended action is to continue lake monitoring and conduct small scale zebra mussel control projects in the future.

Comfort Lake Zebra Mussel Index Scores

Criteria	Scores for the Zebra Mussel Eradication Index		
	Poor 0 - 30	Fair 30 - 60	Excellent 60 - 100
1. Minimum of 30 hours and 7,000 objects checked monthly in early detection surveys. Plate or tube samplers should be deployed and checked monthly.		**30** (several plate samplers were used)	
2. Monthly early detection inspections indicate zebra mussels came into the lake within a month. Alternatively, there is specific knowledge of a recent introduction on an object (for example recent installation of a used boatlift with zebra mussels).		**40** (plate samplers checked monthly)	
3. Rapid response assessment involves up to 90 hours of additional searching and 20,000 objects should be checked.		**50** (23 hours, 4300 objects checked)	
4. Zebra mussels are found at 1 or 2 sites. If three sites or more are found the probability of eradication decreases.	**20** (3 sites)		
5. Zebra mussels should be immature. It has to be assumed immature zebra mussels were introduced on objects detached and reattached to new objects. Presence of mature zebra mussels indicates the probability of ongoing spawning.		**30** (all adults present)	
6. Individual mature zebra mussels should be separated by distance. If two or more mature zebra mussels are found in close proximity successful spawning is likely to have occurred and dispersal of veligers and juveniles may be widespread but undetected.			**60** (individual mature zebra mussels found at several sites)
7. Wave action on containment barriers along open stretches of shoreline causes leakage of treatment water and dilution by lake water reducing the chemical concentration of the toxic agent within the containment area. It is best if the containment area is in a secluded location such as a bay or a cove.	**30** (open shorelines)		
8. Treatment area should be at least 3 times larger than known area of distribution at a site. A total area greater than 10 acres will be difficult to administer.	**20** (estimate of 30 acres of treatment)		
9. The probability of reintroduction should be low. Is the public access gated, are inspectors present from sunup to sundown, etc? Also do nearby lakes have zebra mussels?	**20** (Forest Lake and White Bear Lake have zebra mussels)		
10. The smaller the lake the better. The odds of a successful eradication for lakes greater than 300 acres in size is low.		**60**	
Total Score	**360**		

What Will Zebra Mussels Do in Comfort Lake?

Zebra mussels are present in Comfort Lake. One of many questions is what kind of a population will they produce. Based on available data it appears conditions would support mostly light growth (Table 3). The high chlorophyll levels indicate blue-green algae are dominant in late summer. Zebra mussels are not able to ingest the filaments and colonies of blue-green algae and would likely be food limited in Comfort Lake.

Table 3. Water column zebra mussel suitability criteria and Comfort Lake water column conditions.

		Little Potential for Adult Survival	Little Potential for Larval Development	Moderate (survivable, but will not flourish)	High (favorable for optimal growth)
Shell Formation Factors					
Calcium (mg/l)	**Comfort Lake**				**45.9 (2012)**
	Mackie and Claudi 2010	*<8*	*8 - 15*	*15 - 30*	*>30*
pH	**Comfort Lake**				**8.3 (2012)**
	Mackie and Claudi 2010	*<7.0 or >9.5*	*7.0 - 7.8 or 9.0 - 9.5*	*7.8 - 8.2 or 8.8 - 9.0*	*8.2 - 8.8*
Alkalinity* (as mg $CaCO_3$/l)	**Comfort Lake**				**146 (2012)**
	Mackie and Claudi 2010	*<30*	*30 - 55*	*55 - 100*	*100 - 280*
Conductivity* (umhos)	**Comfort Lake**				**440 (2012)**
	Mackie and Claudi 2010	<30	30 - 60	60 - 110	>110
Food Factors					
Chlorophyll a (ug/l) (June-Sept)	**Comfort Lake**		**22.3 range: 9.8 - 32 (2012)**		
	Mackie and Claudi 2010	*<2.5 or >25*	*2.0 - 2.5 or 20 - 25*	*8 - 20*	*2.5 - 8*
Secchi depth (m) (June-Sept)	**Comfort Lake**		**1.8 range: 0.85 - 1.55 (2012)**		
	Mackie and Claudi 2010	*<1 or >8*	*1 - 2 or 6 - 8*	*4 - 6*	*2 - 4*
Total phosphorus (ug/l) (June-Sept)	**Comfort Lake**				**32.3 range: 10 - 62 (2014)**
	Mackie and Claudi 2010	*<5 or >50*	*5 - 10 or 35 - 50*	*10 - 25*	*25 - 35*
Substrate Factors (Dissolved oxygen and sediment composition)					
Dissolved oxygen (mg/l)	**Comfort Lake**	**>15 ft (2012)**	**10 - 15 ft (2012)**	**5 - 10 ft (2012)**	**0 - 5 ft (2012)**
	Mackie and Claudi 2010	*<3 mg/l*	*3 - 7 mg/l*	*7 - 8 mg/l*	*>8 mg/l*
Bottom substrate	Comfort Lake	**15%**		**80%**	**5%**
		soft muck with no hard objects		muck, silt, sand	rock or wood

Comfort Lake Zebra Mussel Suitability

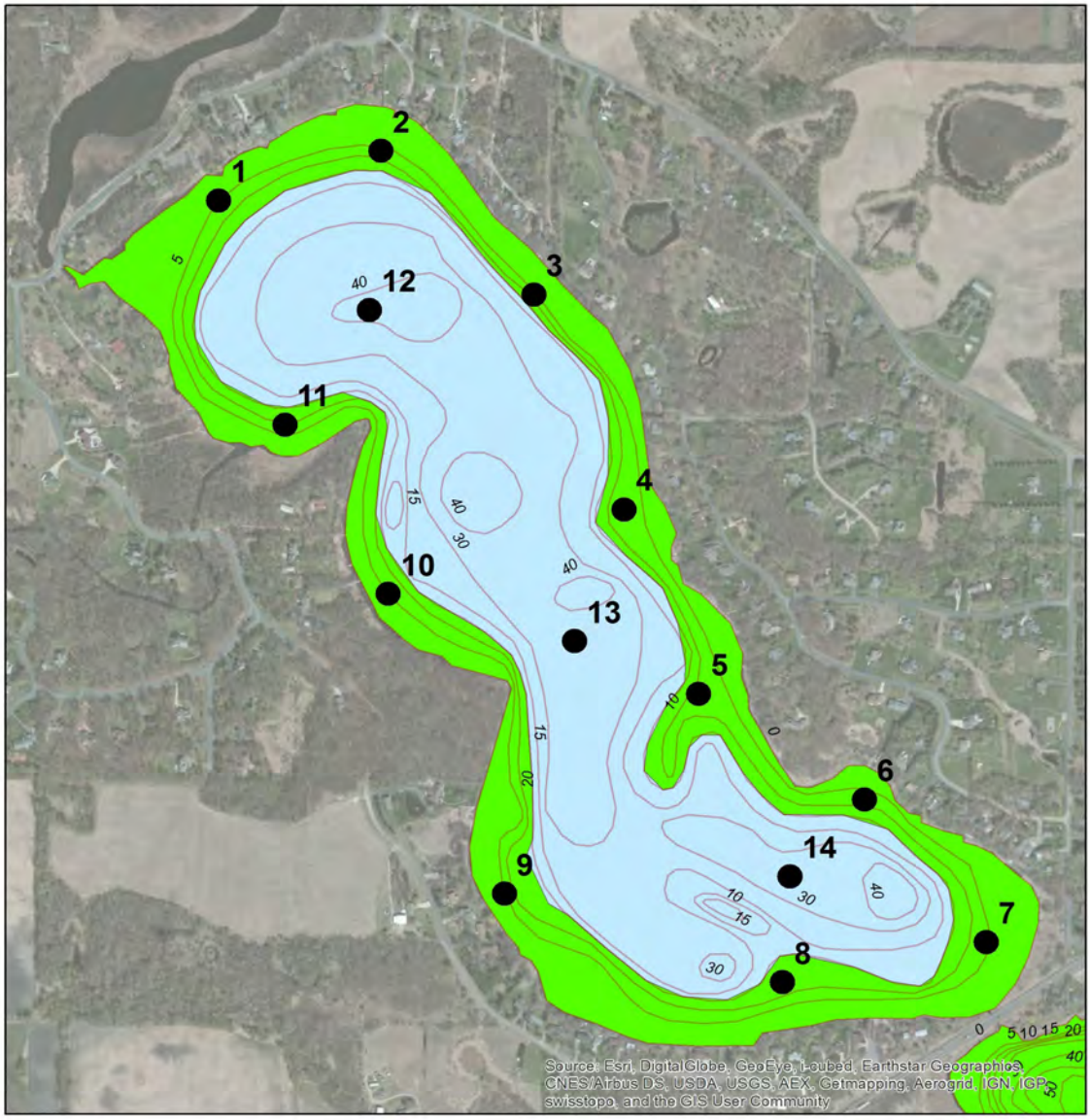

Figure 4. Zebra mussel growth would be limited to the nearshore areas of Comfort Lake (green shading). Chlorophyll levels in Comfort Lake are high indicating blue-green algae are dominant in summer and would limit zebra mussel growth. Blue shading indicates areas of low dissolved oxygen in Comfort Lake and would not support zebra mussel growth. Key: Green shading = light growth and blue shading = no growth.

Comfort Lake Searchers in Action

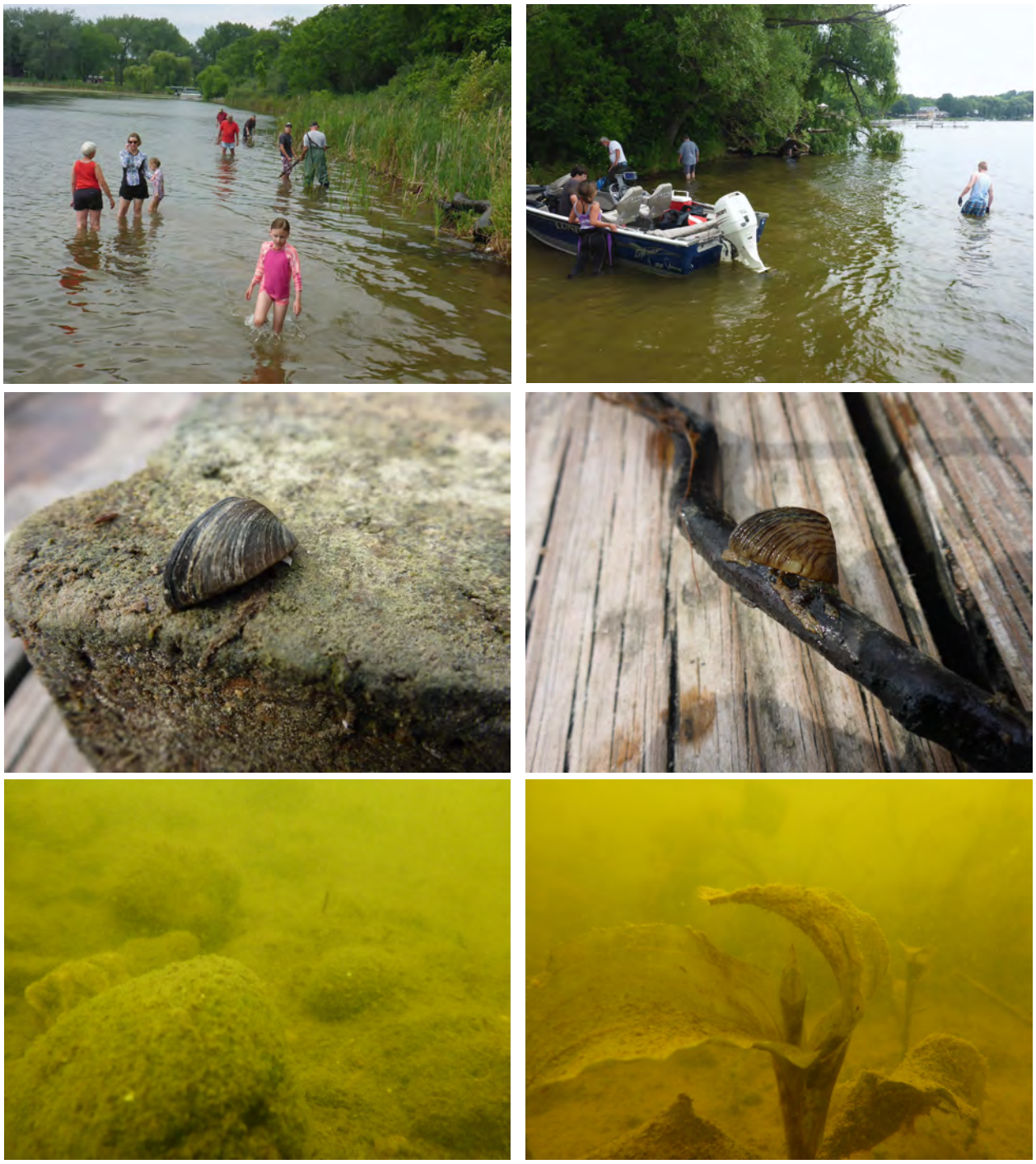

Figure 5. [top-right and left] Comfort Lake volunteer searchers on July 21, 2017. [middle-right and left] Zebra mussels found in Comfort Lake on July 21, 2017. [bottom-left and right] Bottom conditions of Comfort Lake during the search of zebra mussels on July 21, 2017.