Follow-up Survey of Asian clams (*Corbicula fluminea*) in Owasco Lake, Cayuga County, NY, 2013

A Report to the Cayuga County Soil and Water Conservation District, Cayuga County Dept. of Planning and Economic Development, and the Cayuga County Water Quality Management Agency's Owasco Lake Asian Clam Task Force

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Ed Wagner, Owasco Town Supervisor, Cayuga Community College, and Owasco Lake Asian Clam Task Force
Dick Coalson, Owasco Lake Asian Clam Task Force
Sarah Meyer, Finger Lakes Institute
Kirsten Goranowski, Finger Lakes Institute
Dave Wasileski, Owasco Marine

Introduction

After the discovery of Asian clam (*Corbicula fluminea*) in Owasco Lake in September 2010, Cayuga County was assisted by the Darrin Fresh Water Institute, InnerSpace Scientific Diving, and Scientific Diving International in conducting diving surveys of Asian clams in 2011 and 2012. To further this work, Cayuga County contacted Mr. Resler of InnerSpace Scientific Diving in the summer of 2013 to inquire about his assisting Cayuga County divers in surveying areas of Owasco Lake for two days, with the County doing its own data analysis and reporting.

On July 29 and 30, 2013, Owasco Lake was surveyed for Asian clams under the direction of Mr. Resler. Volunteers from the Cayuga County Water Quality Management Agency's Asian Clam Task Force and the Finger Lakes Institute assisted with the survey and Owasco Marine provided a pontoon boat. Partial funding was supported by a grant/cooperative agreement from the U.S. Department of the Interior, Fish and Wildlife Service.

The objectives of the 2013 diving survey were as follows:

1. Determine if the 2012-2013 winter drawdown of the lake effectively kills the clams by freezing;
2. Determine if the substrate influences clam survival; and
3. Check other areas of Owasco Lake for live Asian clams.

Sampling Methods

To search for Asian clams, divers fanned the bottom sediments with their hands or sieved sediments using a 1 mm sieve. To collect samples of Asian clams, all material retained in a 1 mm sieve was collected into a labelled bag and each sample was analyzed for the number of living clams. Each clam was measured to the nearest 0.1mm. Asian clam shells in each sample were also counted and measured. The location of Asian clam sample points can be found in Map 1. Data can be found in Table 4.

Sediment corer

If substrate samples were needed, they were taken using a sediment corer. The coring device consists of a length of 3" ID PVC schedule 40 pipe with an end cap that has a ½" hole drilled through it. The area of the core is 45.6 cm^2 or 1/219.3 of a square meter and the core is taken to a depth of 10 cm. Coring is done by pushing the core tube into the substrate, covering the tube with the cap, placing a finger over the vent hole and withdrawing the contents. If grain size analysis was wanted, contents were retained whole in the field in a plastic bag, placed on ice, then later decanted and transported to Kenney Geotechnical Engineering Services PLLC for analysis.

For quantitative sampling, a ¼ m^2 quadrat was tossed into the water. The geographical reference data was taken for the center of the quadrat and then sediment cores were taken from three random points within the quadrat. The samples were sieved using a 1 mm sieve, retaining all sediment. The materials retained on the sieve were placed on a sorting tray and the live clams were counted and their length measured to the nearest 0.1 mm. The three core samples were combined in a plastic bag, placed on ice and later decanted and transported to Kenney Geotechnical Engineering Services PLLC for grain size analysis. The core data was used to generate a density estimate.

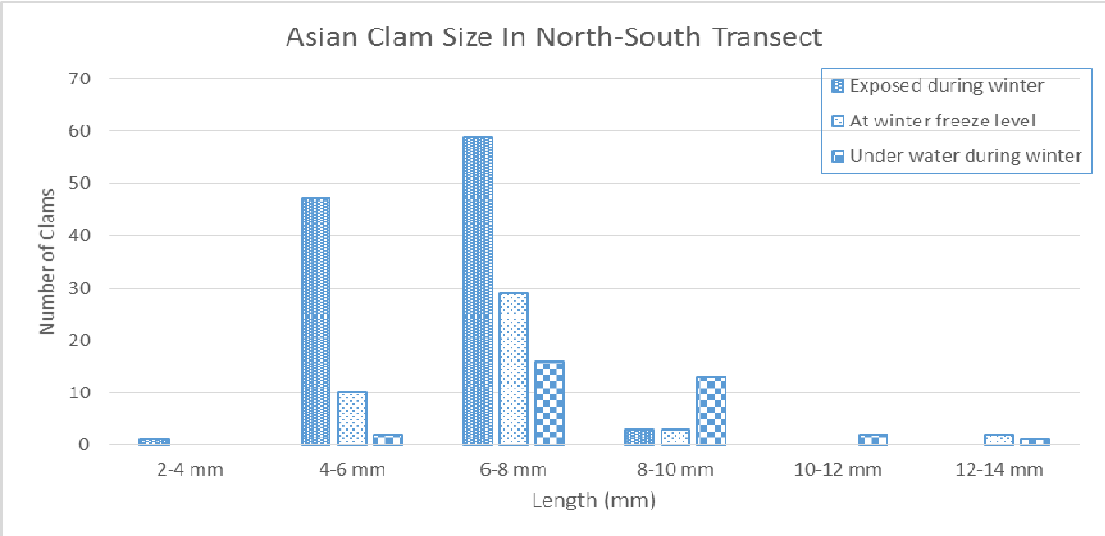
1. Determine if the 2012-2013 winter drawdown of the lake effectively kills the clams by freezing

In the "Preliminary Survey for Asian clams (*Corbicula fluminea*) in Owasco Lake, Cayuga County, NY, 2011" and the "Follow-up Survey for Asian clams (*Corbicula fluminea*) in Owasco Lake, Cayuga County, NY, 2012," lake level management was considered the most prudent and least expensive means for controlling Asian clam populations unless there was an unidentified deeper water refuge. It was thought that if the lake could be lowered to 708 or 709 feet NGVD29 (National Geodetic Vertical Datum of 1929) and an ice cover of 18-24 inches formed, it would eliminate much of the current infestation of the Asian clams. During the 2012-2013 winter drawdown of Owasco Lake, the lowest level the lake reached during freezing temperatures was ~710.1 to 710.12 feet NGVD29.

Divers sampled along a north-south transect on July 29, 2013 from the shoreline of Deauville Island to the depth at which Asian clams were no longer found. The transect points were numbered 100 to 113 heading towards the shore, then 115 and 116 in deeper waters. During that time, the lake level was approximately 712.30 feet NGVD29. This means that the area of the lake bottom that was exposed to freezing during the winter was under ~2.2 to 2.3 feet of water or less during the summer sampling.

Most of the Asian clams sampled along the transect had lengths that fell within the 4-6mm and 6-8mm ranges (Figure 1). This was especially true of the Asian clams that were found in substrate that would have been exposed during the winter drawdown and those that were at the winter freeze level, where 146 of the 153 live clams were ≤8 mm (95.4%). MacNeill in 2012 stated that "Juvenile clams can reach maturity in 3-6 months or about 6-10 mm in size, and reach 10 to 30 mm in size during their first year depending on food availability and temperatures". Therefore the majority of clams found in substrate exposed during the winter and substrate close to the winter freeze level were most likely the young of the year and were not clams that survived the winter. In fact, there was only one living clam found in the substrate that was exposed during the winter or at the winter freeze level that was larger than 10 mm in size and the number that were between 8-10 mm was very small (6).

Figure 1: Asian clam size in north-south transect



Therefore, it appears that the winter drawdown did have an effect on the survival of Asian clams, in fact causing 100% mortality of clams in the area where the substrate was exposed during freezing temperatures. Since the shallows are populated by very immature clams, it suggests that smaller clams are being transported shoreward to shallow areas, since there are no mature clams in these shallows to reproduce.

2. Determine if the substrate influences clam survival;

Surveys in 2011 and 2012 found living Asian clams at the northern end of Owasco Lake in shallow water of depths ranging from 3 feet to just less than 10 feet (0.914 to 3.05 m). The bottom sediments in this area of Owasco Lake are mainly sand and silty sand in the shallow areas of the lake. As the bottom becomes deeper, the sediments become finer, softer and populated with rooted plants and algae, and clams were not found in these deeper siltier sediments in 2011 or 2012.

Substrate and Asian clam samples were taken in the north end of Owasco Lake to determine if the substrate influences clam survival (see Map 2: Substrate Sample Points 2013). Asian clams were sieved out of the samples using the 1 mm sieve and measured to the nearest 0.1 mm. The sediment samples were placed on ice in a cooler with the clam samples, later decanted and transported to Kenney Geotechnical Engineering Services PLLC for analysis.

Divers took samples south of Deauville Island in areas where larger clams were found; these clams were believed to survive the winter. Two samples (Substrate samples #107 and #108) were taken at the winter freeze level and one taken in deeper water where no Asian clams (Substrate sample #116) were found. Results are shown in Table 1.

Table 1: Samples taken off of the Deauville Island (samples listed from shore to deeper water)

Asian Clam Sample Number	Substrate Sample Number	Depth in feet in winter	D60 (mm)	D10 (mm)	% gravel	% sand	% silt/ clay	Clams larger than 10 mm	Clams 8-10 mm	Total clams	Comments
106	107	Winter freeze level	0.273	0.156	0	99.8	0.2	1	1	36	To the east of the N-S transect
108	109	Winter freeze level	0.276	0.161	0.1	99.9	0	0	2	7	
104	105	0.8-1.3	0.273	0.195	0	99.9	0.1	0	7	21	
102	103	1.3-1.8	0.277	0.161	0	99.7	0.3	1	3	5	
120	120	2.3+	0.274	0.158	0	99.9	0.1	0	10	20	Sample size larger
None	116	~9.8	0.271	0.147	0	97.5	2.5	0	0	0	No clams

For the samples taken off Deauville Island, all substrates fall in the fine sand category (See Table 1). The areas where the larger clams were found are very similar in substrate to those where the smaller clams were found. Substrate sample #116 is from deeper water with no clams and it does have a larger percentage of silt/clay than the other samples taken where the Asian clams were found. However, this substrate can still be considered fine sand.

Three samples were taken off of Poplar Cove along the north-south line where the clam infestation stops (see Map 2: Substrate Sample Points 2013). One sample was taken where live clams were found (Substrate Sample #203), one where no clams were found (Substrate Sample #201) and another at the boundary between where clams were found and not found (Substrate Sample #202). The three samples were taken at approximately the same water depth.

For the samples taken off of Poplar Cove, there doesn't seem to be a great difference in the substrate between where the clams were found and where they were not found (see Table 2). There was slightly more % of silt/clay where the clams were not found, but they still fall under the category of fine sand. This suggests that the Asian clam survival decreases where they can be covered with a small amount of fine sediments.

Table 2: Samples taken off of Poplar Cove

Substrate Sample Number	Clams	Depth in winter	D60 (mm)	D10 (mm)	% gravel	% sand	% silt/clay
201	No	~1.8	0.216	0.086	0	97.7	2.3
202	No	~2.3	0.217	0.084	0.7	95.4	3.9
203	Yes	~1.8-2.2	0.259	0.099	0.4	97.7	1.8

A sample was also taken off of the Pavilion Beach (Substrate Sample #219). There were more larger clams found in the sample taken off the Pavilion Beach but the substrate was very similar to that found off of the Deauville Island Beach (See Table 3).

There were some clams that were found in the softer plant choked sediments near Sucker Brook, however, these sediments are underlain by a hard clay layer. This clay layer allows Asian clams to be supported near the surface of fine sediments where they can respire and feed from the water column and survive in this marginal habitat.

Table 3: Sample taken off of the Pavilion Beach

Asian Clam and Substrate Sample Number	Depth in feet in winter	D60 (mm)	D10 (mm)	% gravel	% sand	% silt/ clay	Clams larger than 10 mm	Clams 8-10 mm	Total clams	Comments
219	1.0-1.1	0.273	0.157	0	99.9	0.1	11	9	22	2 clams were 6-8 mm

Summary

Asian clams appear to be sensitive to slight changes in the substrate. Silt content as little as 2% appears to limit the survival of Asian clams in the north end of Owasco Lake. There are live clams in substrates with up to 1.8% silt/clay, but none at 2.3%, 2.5% or 3.9% silt/clay contents.

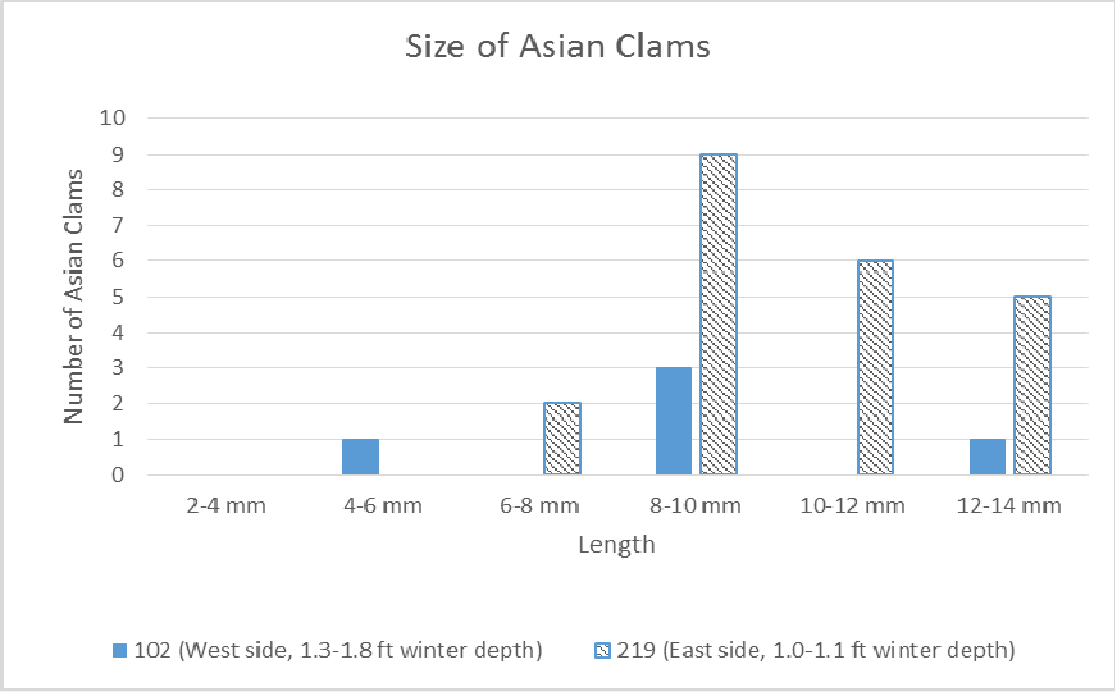
3. Check other sandy areas around Owasco Lake for Asian Clams:

In 2011 it was determined that Burtis Point on the east side of the lake was the only other suitable site for Asian clams in Owasco Lake based on substrate type. Spot checks were conducted at this site and no Asian clams were found. It is our belief that the population has not been transported to the Burtis Point area, or, most of the suitable substrate near Burtis Point is exposed to winter freezing, which limits clam survival.

4. Other observations:

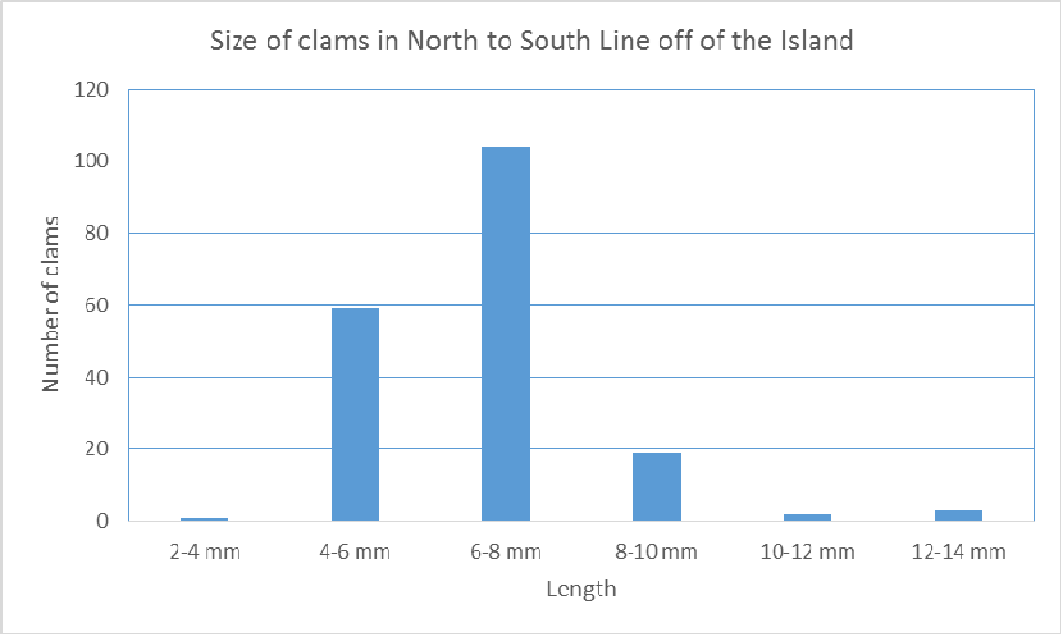
There are basically two population groups of Asian clams in the lake; one to the east of the Owasco Lake outlet channel and one to the west of the outlet channel. A comparison of two spot samples taken at approximately the same winter depth (1.0-1.8 feet) showed more large (adult) clams on the east side than was found on the west side (see Figure 2). There may be conditions on this side of the lake that allows for more Asian clams to survive, such as warm flowing water inputs from Sucker Brook during the winter.

Figure 2: Comparison of the size of Asian Clams from the east side versus the west side of the lake in samples taken from sites with similar winter depths.



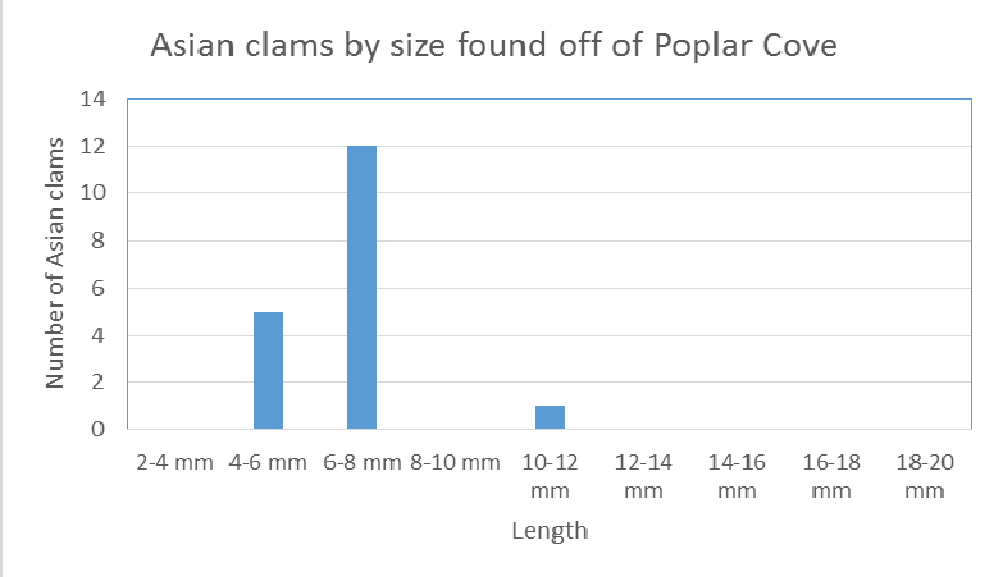
The lengths of clams collected off of Deauville Island in an approximately north to south line (Asian Clam Samples #101 through #115) are charted below and lengths ranged from 2-4 mm to 12-14 mm with the majority under 8 mm. Mean size in 2012 was 8.1 mm (0.32 inches). This shows that clams found in 2013 were smaller and younger. It appears that smaller clams are being transported shoreward to repopulate areas where mortality was undoubtedly greatest during the preceding winter.

Figure 3: Asian clam sizes along a north-south line off of Deauville Island.



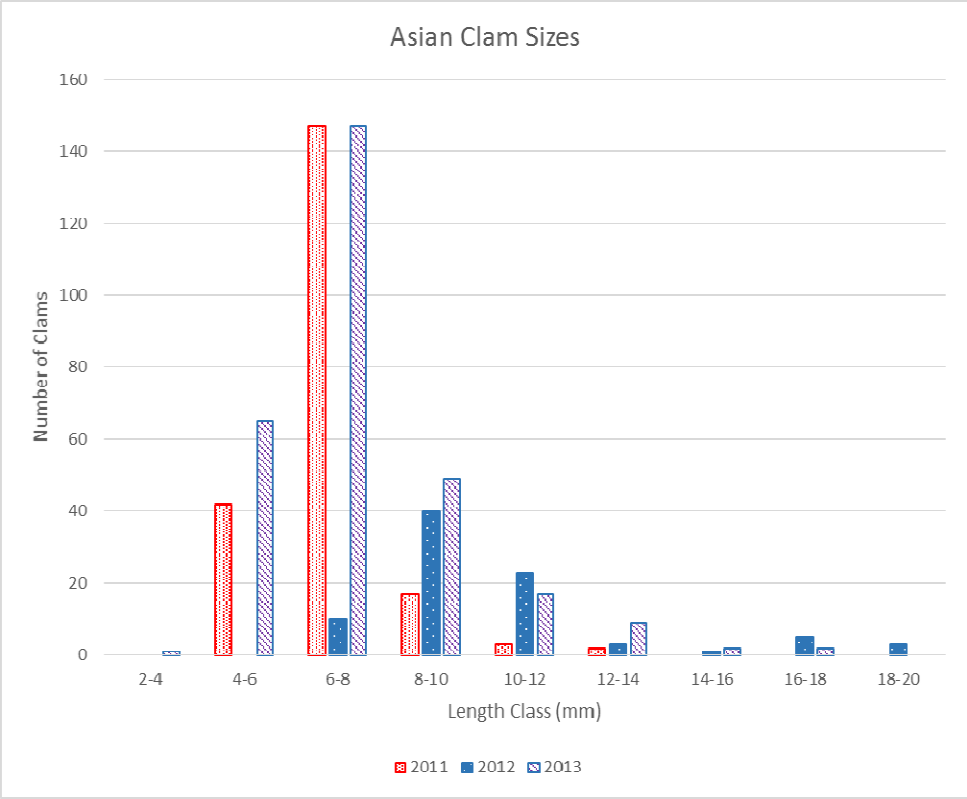
There were very few living clams found off of the west shore off of Popular Cove. In fact, most samples taken had only one living clam in them. As is shown below most were probably young of the year.

Figure 4: Asian clams by size found off of Poplar Cove



The length-frequency of all the Asian clams sampled in 2011, 2012 and 2013 are plotted in Figure 5. The population structure is informative and supports our observation that the Asian clams were smaller and younger in Owasco Lake in 2013 than in 2012. The population in 2011 is mostly at the 4-6 mm and 6-8 mm range which is most likely young of that year. However in 2012, the clams are mostly 8-10 mm and 10-12 mm. These clams could be young of the year, but there are very few. Data suggests that the young from 2011 grew up but suffered significant mortality, but with a portion of the population surviving to reproduce in the spring. Most clams in 2013 were 4-6 mm, 6-8 mm and 8-10 mm, most likely young of the year, which is similar to 2011.

Figure 5: Size-frequency Plot of All Asian Clams Surveyed 2011-2013



Mean Asian clam density in the quantitative sample taken at sample point 120 was 1462 per square meter (m^2). In 2012 Marelli, et al. reported a mean density of 428.81 per m^2 and in 2011 Marelli, et al. reported a mean density of over 1018 clams per m^2. Core data was very variable and the previous years' data had many more core samples while only three were taken in 2013 from one quadrant. Once again our conclusion is that there are occasional dense centers of population in Owasco Lake but overall the population is much less dense than populations reported from other high latitude lakes such as Lake George. The Lake George Asian Clam Rapid Response Task Force reports populations up to 6,000 per m^2.

Management

As indicated in the 2011 and 2012 reports and discussions with members of the Owasco Lake Asian Clam Task Force, management by lowering winter lake level still remains the most prudent and least expensive means for population control. However, it appears that successful winter kill may stimulate spring reproduction as seen by the large 4-6 mm and 6-8 mm clam populations in July 2011 and July 2013. This may necessitate the need for two or three consecutive years of low winter lake levels to effectively reduce the Asian clam population.

East Side/West Side

The population of largest clams in our three years of July surveys has consistently been east of the seawalls at Emerson Park off the Pavilion Beach. In fact, in 2013, nearly 30% of the live clams in the east area were mature clams that had survived the winter, versus less than 6% off of Deauville Island. This is possibly due to warm water entering from Sucker Brook or an upwelling of groundwater in the winter, and/or less shifting sand. This area also has less boating and recreational activity than the area west of the seawalls off of Deauville Island. The area off of Deauville Island has a larger expanse of shallow sandy area for boats to anchor in. The higher boat traffic and more shifting sand would greatly complicate efforts to mat or smother Asian clams off of Deauville Island. Therefore, the eastern area appears to be more ideal for experimenting with smothering the clams with matting or silt addition. If the mature Asian clam population in the eastern area remains high in 2014, some type of matting or smothering pilot project should be considered for this area, if funding for such an effort can be secured.

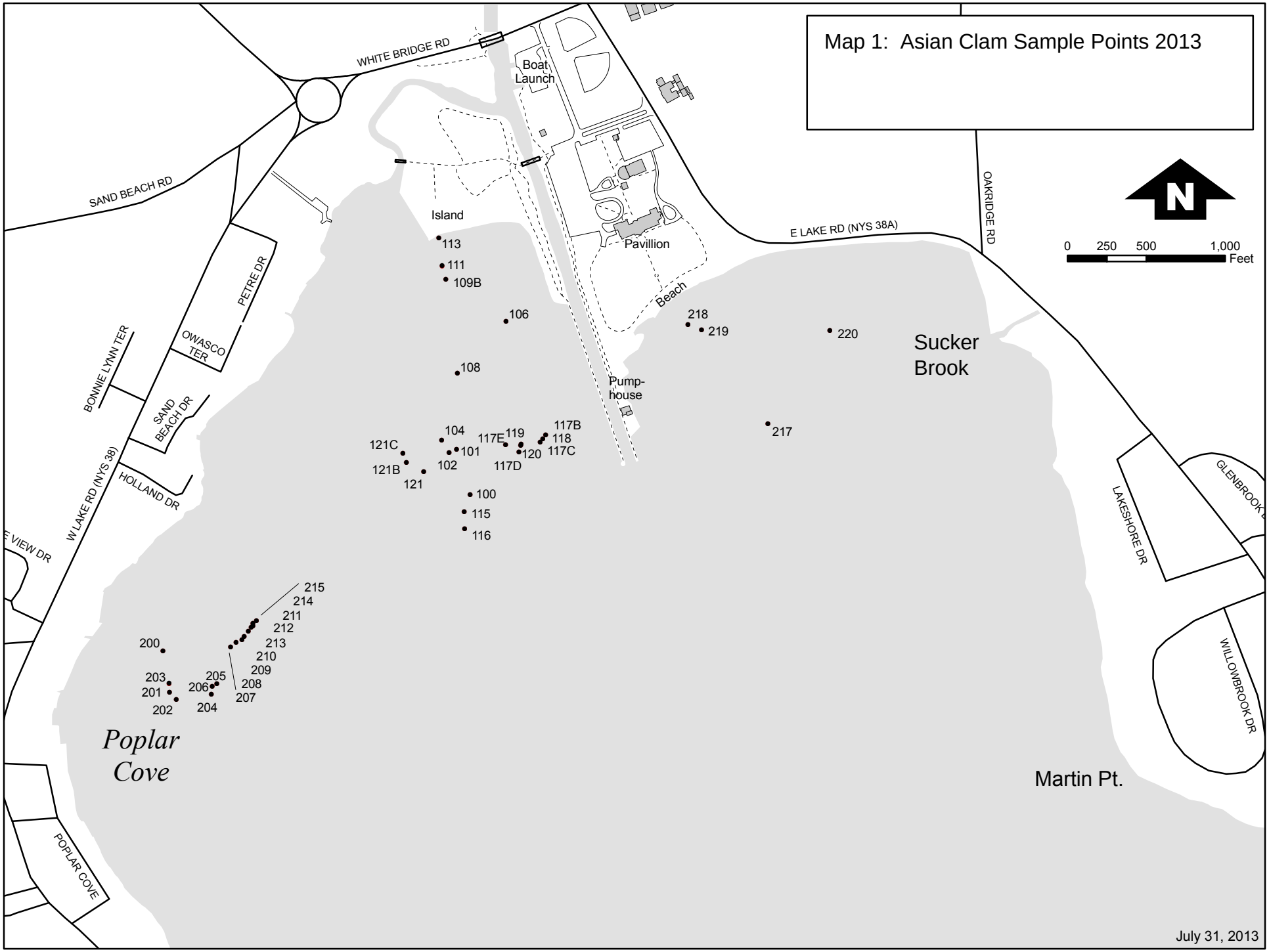
Bibliography

Dan C. Marelli, Ph.D., Steven Resler, and Sandra Nierzwicki-Bauer, Ph.D. (August 25, 2011). "Preliminary Survey for Asian clams (Corbicula fluminea) in Owasco Lake, Cayuga County, NY: A Report to the Cayuga County Soil and Water Conservation District."

Dan C. Marelli, Ph.D., Steven Resler, Sandra Nierzwicki-Bauer, Ph.D., and Brett D'Arco (September 10, 2012). "Follow-up Survey for Asian clams (Corbicula fluminea) in Owasco Lake, Cayuga County, NY: A Report to the Cayuga County Soil and Water Conservation District, Cayuga County Dept. of Planning and Development, and the Owasco Lake Asian Clam Task Force."

Lake George Asian Clam Rapid Response Task Force (April 2011). "Plan to Contain and Eradicate the Infestation of the Invasive Species Asian Clam in Lake George."

Map 1: Asian Clam Sample Points 2013


Map 1: Asian Clam Sample Points 2013
WHITE BRIDGE RD
Boat Launch
SAND BEACH RD
Island
Pavillion
E LAKE RD (NYS 38A)
OAKRIDGE RD
PETRE DR
OWASCO TER
BONNIE LYNN TER
SAND BEACH DR
HOLLAND DR
W LAKE RD (NYS 38)
Beach
Pump-house
Sucker Brook
LAKESHORE DR
GLENBROOK
WILLOWBROOK DR
POPLAR COVE
Poplar Cove
Martin Pt.
N
0 250 500 1,000 Feet
July 31, 2013
113
111
109B
106
108
104
101
102
100
115
116
121C
121B
121
117E
119
120
117B
118
117C
117D
218
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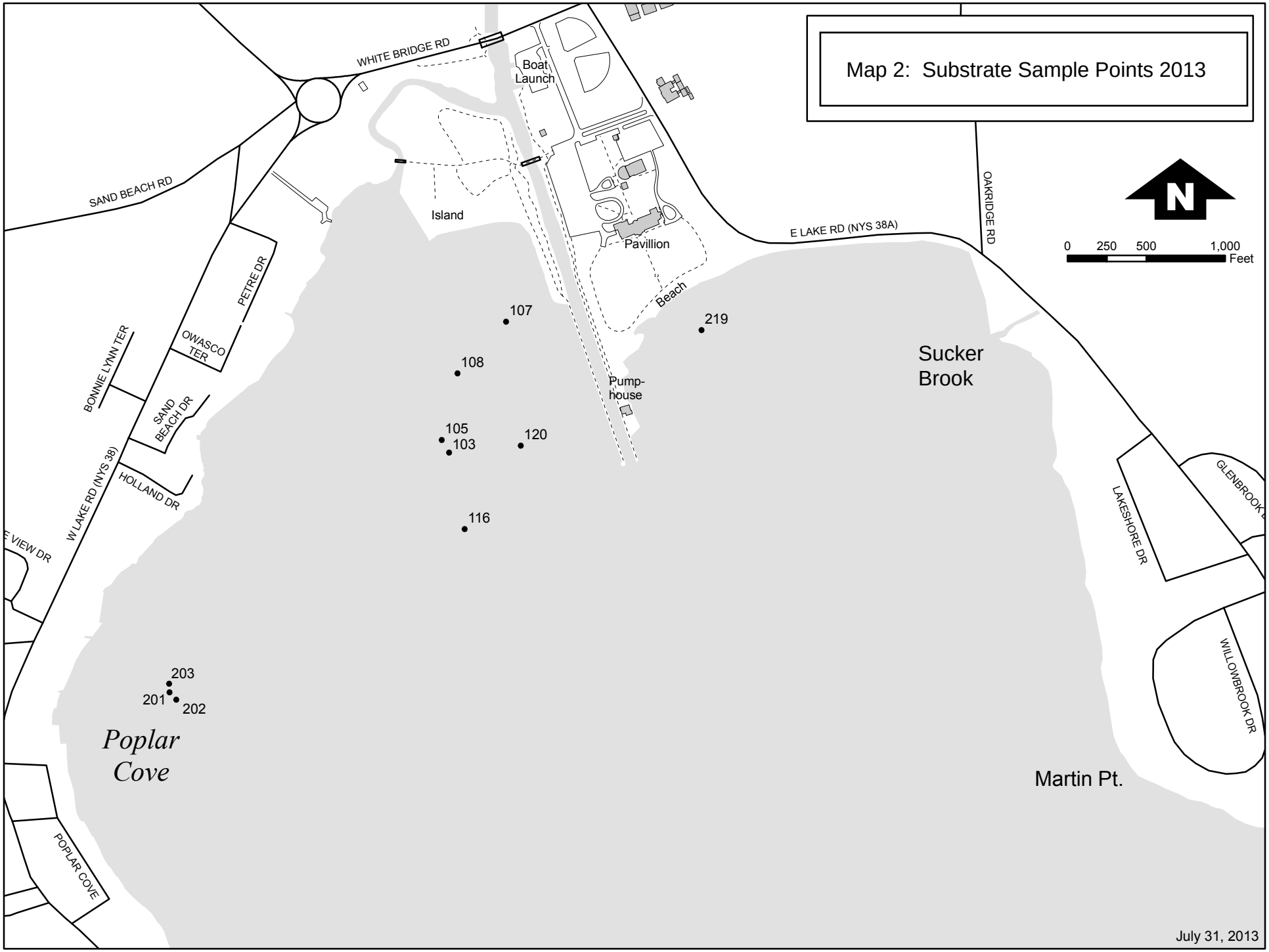
Map 2: Substrate Sample Points 2013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BONNIE LYNN TER
SAND BEACH DR
HOLLAND DR
W LAKE RD (NYS 38)
Beach
Pump-house
107
108
105
103
120
116
219
Sucker Brook
LAKESHORE DR
GLENBROOK
WILLOWBROOK DR
203
201
202
Poplar Cove
POPLAR COVE
Martin Pt.
N
0 250 500 1,000
Feet
July 31, 2013

Table 4: Asian Clam Sample Point Data

Table 4: Asian Clam Sample Point Data

Sample number	Asian Clam, no or Sed sample	2-4 mm	4-6 mm	6-8 mm	8-10 mm	10-12 mm	12-14 mm	14-16 mm	16-18 mm	18-20 mm	Live	Dead	Depth	Notes
101	Asian Clam			3	3						6	1	4.00	
102	Asian Clam		1		3		1				5	4	3.5 to 4	
103	102 Sed sample												3.5 to 4	
104	Asian Clam		1	13	7						21	70	3.0 to 3.5	
105	104 Sed sample												3.0 to 3.5	
106	Asian Clam		9	25	1		1				36	11	2.2 to 2.3	winter freeze level
107	106 Sed sample												2.2 to 2.3	winter freeze level
108	Asian Clam		1	4	2						7	68	2.2 to 2.3	winter freeze level
109	108 Sed sample												2.2 to 2.3	winter freeze level
109B	Asian Clam		25	39	1						65	0	2.00	exposed in winter
110	109 Sed sample												2.00	exposed in winter
111	Asian Clam	1	22	10	1						34	0	2.00	exposed in winter
112	111 Sed sample												2.00	exposed in winter
113	Asian Clam			10	1						11	0	1.70	exposed in winter
114	No sample												0.00	exposed in winter
115	Asian Clam					2	1				3	0	5 to 7	
116	Sed sample												12.00	
117A to E	No sample												4.5 +	
118	Asian Clam			5	1	1	1	2	1		11	4	4.5 +	
119	Asian Clam			5	3	2			1		11	3	4.5 +	
120A	Asian Clam			1	4						5	2	4.5 +	
120B	Asian Clam			7	4						11	2	4.5 +	
120C	Asian Clam		1	1	2						4	3	4.5 +	
121A	Asian Clam			4	1	1					6	101	not listed	
121B	No sample												not listed	
121C	No sample												not listed	
Totals west side		**1**	**60**	**127**	**34**	**6**	**4**	**2**	**2**	**0**	**236**	**269**		**5.9% ≥ 10 mm**

Table 4: Asian Clam Sample Point Data

Sample number	Asian Clam, no or Sed sample	2-4 mm	4-6 mm	6-8 mm	8-10 mm	10-12 mm	12-14 mm	14-16 mm	16-18 mm	18-20 mm	Live	Dead	Depth	Notes
200	Asian Clam			7							7		3	
201	Sed sample	0	0	0	0	0	0	0	0	0	0		4	No live clams
202	Sed sample										0		4.5	No live clams
203	Sed sample										0		not listed	Live clams
204	No sample										0		6	Line clams & no clams
205	Asian clam			1							1		6 to 7	
206	Asian clam		1								1		6 to 7	
207	Asian clam			1							1		6 to 7	
208	Asian clam		2	1							3		6 to 7	
209	Asian clam			1							1		6 to 7	
210	Asian clam		1								1		6 to 7	
211	Asian clam		1								1		6 to 7	
212	Asian clam			1		1					2		6 to 7	
213	No sample										0		6 to 7	Asian clams present
214	No sample										0		6 to 7	Asian clams present
215	No sample										0		6 to 7	Asian clams present
216	No sample										0		2 to 6	No clams
217	No sample										0		2 to 6	No clams
218	No sample										0		3+	Small clams
219	Asian clam			2	9	6	5				22		3.25	Asian clams
219B	Sed sample										0		3.25	
220	Asian clam			6	6	4					16		3 to 5	Asian clams
Totals east side		**0**	**5**	**20**	**15**	**11**	**5**	**0**	**0**	**0**	**56**			**29% ≥ 10 mm**
Total all		**1**	**65**	**147**	**49**	**17**	**9**	**2**	**2**	**0**	**292**	**269**		

Appendix 1: Asian Clam Survey and Sand/Substrate Sampling: September 13, 2011

Appendix 1

Asian Clam Survey and Sand/Substrate Sampling: September 13, 2011

Survey conducted by:

Ed Wagner, Owasco Town Supervisor and Owasco Lake Asian Clam Task Force
Dick Coalson, Owasco Lake Asian Clam Task Force
Don Seitz, Owasco Lake Asian Clam Task Force
Robyn Warn, Citizen
Bruce Natale, Cayuga County Department of Planning and Economic Development

Conditions:

Very windy and choppy (1 ½ to 2 ½ foot waves). National Weather Service in Syracuse reported that September 13th was the windiest day of the month with average 10.4 mph winds from the west southwest. The wind seemed to be from the south or southwest on the lake. Water was murky, especially bottom 1 to 3 feet. All field notes got very wet and hard to transcribe.

Purposes:

Confirm clams in 6 to 8 feet of water where not seen in July 2011. Plus, collect sand samples to see if clam beds are effected by sand size.

Analysis:

Sand lab analysis was conducted by Anthony DeCaro and Dick Coalson. The sand lab report was created by Dick Coalson.

Table 1: 2011 Sand Data:

	Sands				
Location	**Fine and Medium (0.25-0.50 mm)**	**Fine (0.125-0.25 mm)**	**Very Fine (0.063-0.125 mm)**	**Silt/Clay (<0.063mm)**	**Clams**
B1	**70**	24	2	0.7	Clams present
SB1	**58**	33	7	0.5	Deep edge of clam bed
B3	**67**	29	<2	0.7	Clams present
B4	**53**	44	2	0.4	No clams. Very weedy.
B5	42	**52**	5	0.4	Clams present
SB5	37	**58**	4.2	0.6	Deep edge of clam bed
SB6	12	**77**	10.3	0.9	Deep edge of clam bed
B7	24	**69**	6.3	0.4	N/A
SB7	19	**74**	6.7	0.7	Edge of clam bed
B8	22	**75**	2	0.3	N/A

B= Buoy
S= South of
1= Closest buoy to west pier with #8 being the furthest point west.
Bold=Dominant size class for this location (>50%)

Observations:

1. Overall, the lake bottom off of Deauville Island is essentially very clean fine and medium sand, ranging from 89% to 97% in those particle sizes.

2. The lake bottom at the western buoy line is essentially all clean sand, 93% to 97% medium and fine sands.

3. The cleanest sands are closest to the outlet channel pier and the sands contain more fine sediments towards the west and to the south (deeper).

4. The deep edge of the clam bed was generally south of the buoy line in water that was roughly 8 to 10 feet deep.

5. Along the buoy lines clams were present and the very fine sand/silt/clay content of the substrate was 3.7%. South of buoy line, where the clam bed ended, the very fine silt/silt/clay content was 7.7%.

6. In 2011, samples were taken on a very choppy day with some murkiness in the water column. This suggests that the silt/clay may have re-suspended and were not present in the sand samples. See Table 2.

Table 2: Silt/Clay Concentrations in Sediment Samples taken in 2011 and 2013.

Year	**Silt/Clay Percentage (<0.125 mm)**	**Location**
2011	0.34 to 0.88%	All
2013	0.0 to 2.5%	Off Deauville Island
2013	1.8 to 3.9%	Poplar Cove (to the SW)

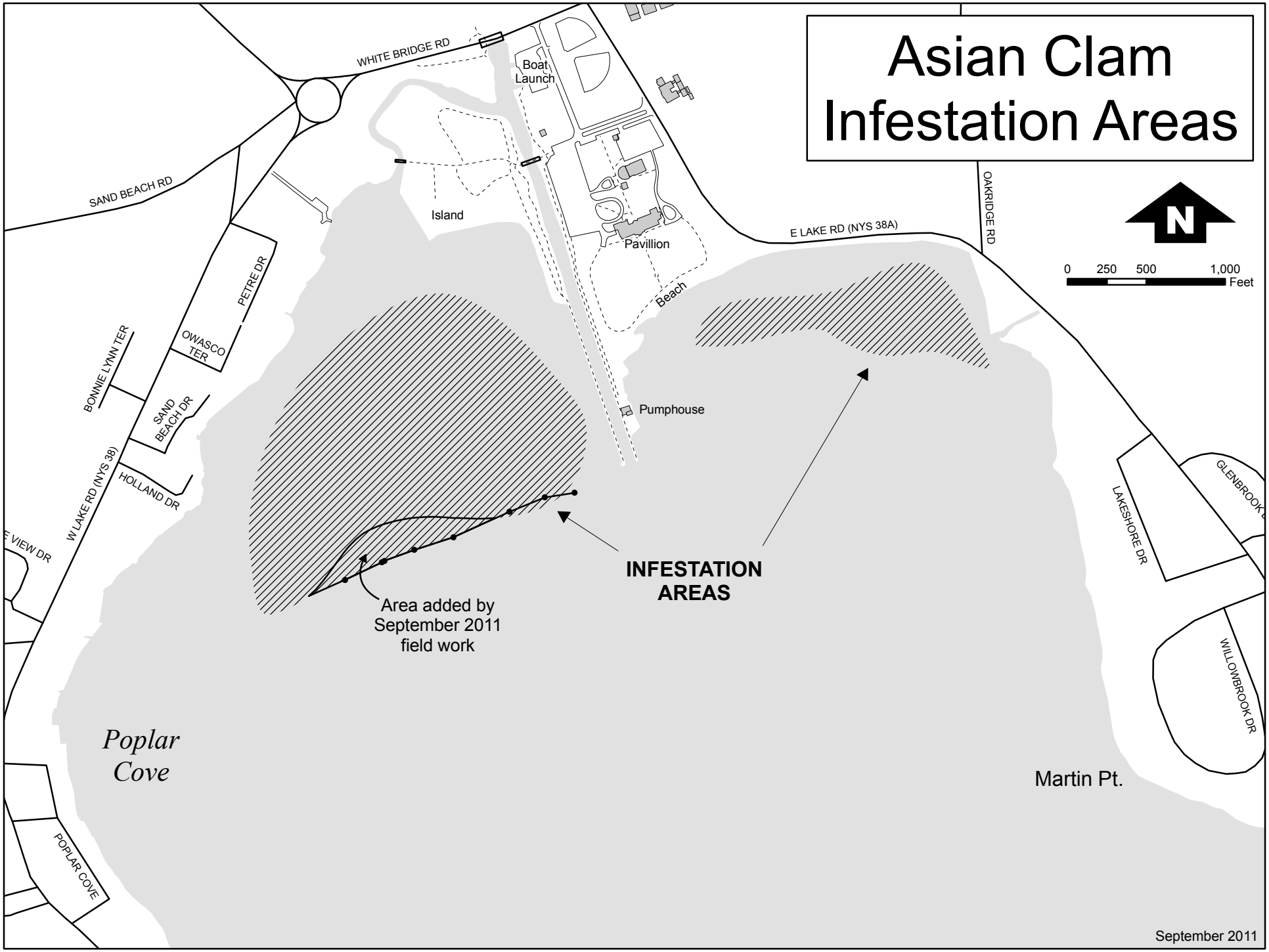
Conclusions:

1. The clam beds appear to end south of the buoy line due to the weed beds and/or the very fine sand and silt/clay present in the deeper water. Therefore it appears that Asian clam survival is negatively affected by either the weed beds or the fine sediment.

2. Clams appear to be more impacted by neighboring weed beds than by the percent of silt/clay. Around Buoy #4 there was clean sand but it was very weedy and there were no clams present. The buoy anchor appears to allow the weed bed to form in this location, despite the constantly shifting sands in the area.

3. The observation that the cleanest sands are closest to the outlet channel suggests that wave action keeps very fine sands and silt/clay in suspension, then the very fine sands and silt/clay exit the lake via the seawall channel or move out to deeper areas of the lake.

4. Sediment/substrate samples should be collected when winds are calm and the water column is clear to prevent loss of the very small silt and clay particles to re-suspension due to wave action.


Asian Clam Infestation Areas
WHITE BRIDGE RD
Boat Launch
SAND BEACH RD
Island
Pavillion
E LAKE RD (NYS 38A)
OAKRIDGE RD
N
0 250 500 1,000 Feet
PETRE DR
OWASCO TER
BONNIE LYNN TER
SAND BEACH DR
HOLLAND DR
W LAKE RD (NYS 38)
Beach
Pumphouse
INFESTATION AREAS
Area added by September 2011 field work
LAKESHORE DR
GLENBROOK
WILLOWBROOK DR
Poplar Cove
Martin Pt.
POPLAR COVE
September 2011