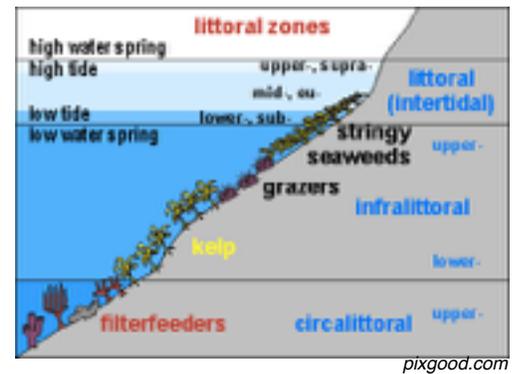


Lake Champlain is the sixth largest lake in the United States. It borders the states of Vermont and New York; the countries of US and Canada and provides direct routes to the North Atlantic ocean via the Champlain Canal and Hudson River to the south and the Chambly Canal and St. Lawrence River to the north. Lake Champlain spans 114 miles and has regions of industry and agriculture, with both urban, and rural populations around its shores. Over the last decade, there has been a great deal of focus on the lake related to chemical pollution related to nitrogen, phosphorus and farm runoff, but very little on marine debris.

Marine debris is not just an ocean problem. It has the same potential to cause significant harm to a lake ecosystem, its creatures and the food web via entanglement, ingestion and the breakdown of organic compounds; as well as posing a threat to recreation, human safety and economic vitality. Therefore, in June of 2013, Rozalia Project conducted a shoreline sediment debris study to investigate the concentration, distribution and type of debris found on the shores of Lake Champlain.

**METHODS**

For this study, we collected and examined 40 sediment samples taken in 9 locations around Lake Champlain. The samples were collected using a Ponar sediment grab (for in-water samples) or by filling 0.9L containers via a small shovel within three zones (see figure, right): the supralittoral zone (rarely submerged, above spring high tide line), eulittoral zone (between the spring high tide line and the spring low tide line), and the sublittoral zone (rarely dry, extends into the water beginning at the spring low tide line). Some leaf ground cover was included if present.



Each of the samples were washed through sieve buckets with a smallest size of 541 microns. Then, the entire sample was sifted through, inspected and sorted by hand. No microscopes were used.



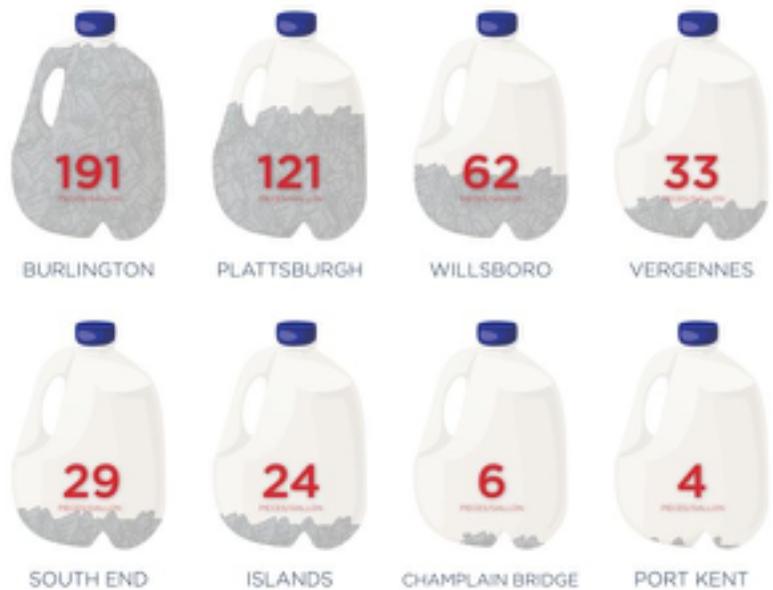
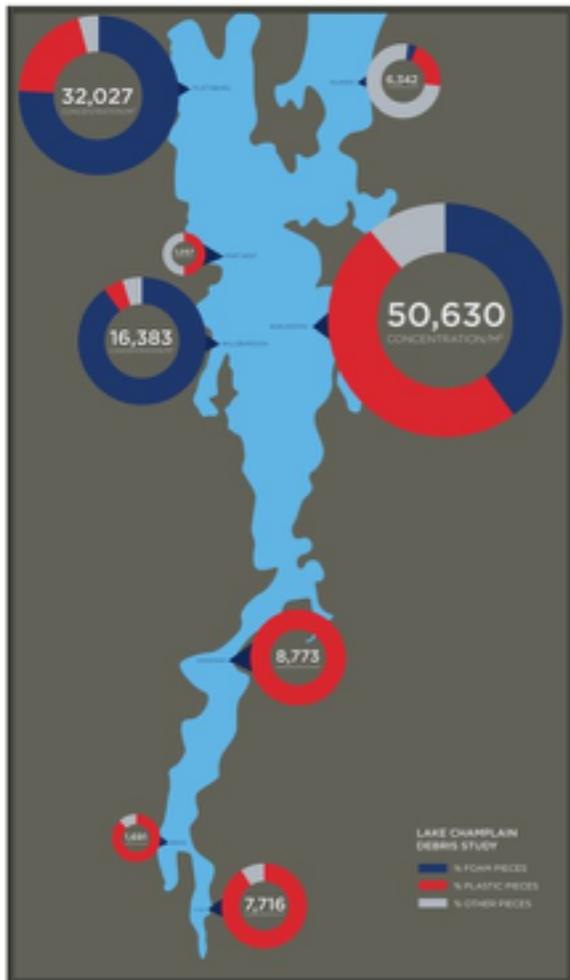
All inorganic debris was recorded on Rozalia Project’s trash data sheet. Pieces of debris made of plastic or foam whose purpose could no longer be identified, as well as scraps of monofilament or rope fibers were measured and marked as:

- Micro: 0-5mm
- Small: 5-30mm
- Large: >30mm



## RESULTS

Zone	total pieces	total samples	Average Concentration pieces/m <sup>3</sup>	% plastic pieces	% foam pieces
Plattsburgh	273	9	32,027	20%	76%
Burlington	383	8	50,630	49%	40%
Willsborough	62	4	16,383	5%	90%
Vergennes	25	3	8,773	100%	0
South End	22	3	7,716	91%	0
Port Kent	2	2	1,057	50%	0
Islands	24	4	6,342	21%	4%
Essex	0	1	0	0	0
Champlain Bridge	8	5	1,691	88%	0



Above: Infographic depicting concentration of debris per gallon milk jug by zone.

Left: Map showing average concentration of debris by zone and ratio of plastic, foam and other debris pieces.

Of the total 799 pieces of debris found, there were 20 different types of trash.

#### **Top 10 items**

1. Microfoam, 418
2. Microplastic, 260
3. Plastic sheeting/tape, 37
4. Small plastic, 26
5. Glass pieces, 15
6. Large plastic, 11
7. Small foam, 10
8. Large foam, 4
- =9. Food wrappers & Paper/tissue/receipts, 3

#### **Top 3 by material**

1. Foam, 532
2. Plastic, 297
3. Plastic sheeting/tape, 37

#### **Top 3 identifiable items**

1. Resin pellets, 42 (included in microplastic count)
2. Paint chips, 38 (included in microplastic count)
3. Plastic sheeting/tape, 37

### **CONCLUSION**

- There is significant presence of micro-marine debris in the shoreline sediment of Lake Champlain.
- The total potential amount of marine debris in the littoral zone sediment of Lake Champlain is 7,066,124,100 pieces weighing 51.5 tons.
- The concentration is significantly higher near the urban centers of Burlington and Plattsburgh, correlating with the higher population densities. With the highest average concentration of 50,630 pieces/m<sup>3</sup> in Burlington (population: 42,212 city/2012; 156,545 county/2010) and lowest in Essex, NY: 0 trash in samples (population of: 671 town/2010; 38,961 county/2012).
- This, in conjunction with the 88.5 tons/503,317 pieces of trash Rozalia Project & VT Dept. of Labor's teams removed from Vermont's waterways in 2012 post Hurricane Irene, is enough to warrant concern. There is a need to address marine debris in Lake Champlain - its remediation through cleanup and its prevention through education programs and municipal waste strategies: public bins, storm drains, recycling programs and waste management and transportation practices.

### **FUTURE**

- The presence of micro debris presents a threat to Lake Champlain's fish and wildlife because of the potential of persistent organic pollutants adsorbing to the plastics. These pollutants include endocrine disruptors and have the potential to biomagnify and bioaccumulate in the marine and human food chain. There should be thorough analysis and study of Lake Champlain's microplastic to identify the presence of persistent organic pollutants.
- Resin pellets, number one of the identifiable debris items found, are a pre-consumer item that is used in the manufacturing of plastic products. The pellets are melted down to produce a wide variety of goods, from tooth brushes to milk jugs. There is no known industry within the Lake Champlain watershed that currently uses resin pellets, though as recently as 2005, Specialty Filaments, a manufacturer of plastic brush bristles operated within 0.2 miles of Lake Champlain in Burlington's south end. Future study could help determine if the pellets found on the shores of Lake Champlain are from a past source or are currently entering the Lake, and what that transport or source might be.
- Rozalia Project is planning to conduct a water surface debris collection and study in Burlington Bay to further investigate and understand the type, concentration and distribution of marine debris in Lake Champlain.

### **ACKNOWLEDGEMENTS**

Rozalia Project would like to thank and acknowledge our interns: Brooke Winslow, Kate Ranney, Tara Silber, Kaleigh Wilson and Ben Gannon for their hard work, energy and fresh eyes during this study. In addition, we would like to specifically acknowledge the Bonnell Cove Foundation for their support in helping us purchase the sediment grab and sieve buckets and Select Design for the excellent infographics.