Introduction

Microplastics
- Microplastic is defined as a plastic particle <5 mm in diameter (Dris et al. 2015).
- Micropastics can be classified further based on type (e.g., fragment, film, fiber, foam, and pellet) and polymer type (Elliksen et al. 2013).
- Microplastics were documented within the freshwater Laurentian Great Lakes (Elliksen et al. 2013). These findings reported greater densities of microplastics in Lake Erie around urban centers with high population densities.

Nurdles
- Nurdles are a type of pre-production plastic used in industrial settings. They serve as raw materials in the making of larger-scale plastic products. They can be up to 5 mm in size and are often cylindrical in shape (Elliksen 2007).
- Nurdles can degrade over time (sunlight, mechanical) and be consumed by microorganisms such as zooplankton (Elliksen 2007, Cole et al. 2013).

Goals and Hypotheses
- To quantify the abundance and map the spatial distribution of microplastics and nurdles in long-term monitoring samples. 
- Density of microplastics and nurdles will be higher adjacent to industrial centers. 
- The majority of microplastics will be of the fiber type.

Field Methodology

Zooplankton Long-Term Monitoring (LTM)
- Zooplankton samples were collected 2X monthly by vertical plankton tow (30 cm-153 um, 50 cm-250 um nets) tows. Depth varied by site.
- Net retrieval rate was 1 m/s. Tow depth (m), tow type, station, date, and identification number, were noted on each sample.
- Nets were hose rinsed to wash organisms into the cod end until 125 ml sample bottle was ½ full. Cod end was removed; screen cleaned using a spray bottle.

Laboratory Methodology

Nurdle sample processing
- Zooplankton samples were homogenized (n = 2265).
- The entire sample was placed in a beaker. Nurdles were quantified and stored in vials.
- Fourier Transform Infrared Spectroscopy (FTIR) of nurdle representing polyisoprene rubber ribbon composition.

Microplastic sample processing
- Zooplankton samples were homogenized. 20 ml aliquots extracted from the 160 ml sample.
- Sample is placed in a grid-bottom Petri dish, microplastics quantified grid and values extrapolated.
- Conversion tables based on sample depth and net size (n = 1308 samples) – canal and epilimion samples not included.

Results and Discussion

- Of the total 249 microplastics found, 201 were FIBERS (n = 2265) samples.
- The greatest microplastic and nurdle densities occurred at stations located at Missisquoi and other bays, as well as north of Ticonderoga in the southern narrow lake reaches (Fig. 8).
- Twice as many nurdles were found in 2012-13 as compared to 2014-15.
- Nurdle abundance peaks in 2012.
- Microplastic (fiber) abundance peaks in 2015.
- Annual density maps scale absolute abundance to volume of water sampled, adjusting for nurdles at deep sites (e.g., station 19).

Suggestions have been made:
- High densities NORTH are in isolated and limited flow bays (e.g., Missisquoi Bay), which may suggest local source.
- Plastic manufacturing near waterways may release materials into freshwaters (Rehse et al. 2016).
- High densities SOUTH may result from canal-lakehock system.
- Increasing densities at urban centers surrounding the lake (e.g., Plattsburgh, Burlington) may be associated with industrial sites.
- Watershed-wide increases may reflect the 100-year flood April 13-June 19, 2011; peaked May 5, 2011 103.27 ft > sea level.
- Hurricane Irene (Aug 28, 2011)
- Wind currents may explain current trends.

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Future Directions
- Continue processing historical zooplankton samples.
- Overlay historical and current industrial site maps in proximity to the Lake Champlain Basin to identify potential industrial use sources.
- Consult with local industry to determine what raw material (polysoprene?) is used in plastic manufacturing at local sites.
- Develop depth survey to determine which portion of the water column particulates reside.

Literature Cited


