To quantify the abundance and map the distribution of microplastics and rubber nurdles in long-term monitoring samples:

- Abundance of microplastics and nurdles will be higher adjacent to industrial centers.
- The majority of microplastics will be of the fiber type.

**Lake Champlain Long-Term Monitoring Sites**

**Field Methodology**

- Zooplankton Sampling for Long-Term Monitoring
  - Zooplankton samples were collected by vertical net (30cm diameter, 153um mesh) tow beginning just above the sediments to the water surface.
  - Net rested for approximately 30 seconds at the benthos before retrieval.
  - Net retrieval rate was 1m/s. Tow depth (m), tow type, station, date, and identification number, were noted on bottle.
  - Nets were hose rinsed to wash organisms into the cod end. Cod end was removed and screening cleaned using a spray bottle.
  - Wash cod end until 125ml sample bottle is filled (approximately 65 ml).
  - Organisms were narcotized with 10-15 ml of cold club soda (e.g., polypropylene and polyethylene) and heavyweight sediments to the water surface.
  - After 5min buffered 10% formalin-sacrose-rose bengal solution was added to bring volume up to the shoulder to create a final approximate 5% formalin solution concentration (approximately 2.5% formaldehyde concentration).

**Laboratory Methodology**

- Nurdle sample processing:
  - Zooplankton samples were homogenized (n = 400).
  - The entire sample was placed in a tray.
  - Nurdles were quantified and stored in vials.
  - Fourier Transform Infrared Spectroscopy (FTIR) was used to characterize nurdle polymer type.

- Microplastic sample processing:
  - Zooplankton sample was homogenized.
  - A 20ml aliquot was extracted from the 160ml sample.
  - Sample was placed in a grid-bottom Petri dish (evenly distributed).
  - Microplastics were quantified in the grid and values extrapolated.

**Results and Discussion**

- Nurdle distribution is highest at the southernmost end of Lake Champlain, as well as Shelburne and Missisquoi Bays (Fig. 4B).
  - High abundances correspond with Whitehall and Ticonderoga, both sites historically associated with industry.
  - Nurdles and microplastics were primarily found at 0-10m and 40-50m depth (Fig. 5).
  - Depth of particulate is important, as susceptible organisms are distributed throughout the water column.

- Microplastic distribution and abundance is highest at the mid-section of the lake, as well as Missisquoi Bay and south of Westport.
  - Fibers were the dominant microplastic type (Fig. 4B).

- Research has shown microplastic bioaccumulation up the food web in filter feeders, zooplankton, fish, and waterfowl (EPA, 1995; Syberg et al., 2015), and humans (Cauwenbergh, 2014).

- Microplastics are known to leach out plasticizers (e.g., phthalate, BPA) (Bergmann 2015) and absorb toxins (e.g., heavy metals, pathogens) (Bergmann 2015).

**Future Directions**

- Continue processing historical zooplankton samples.
- Identify date of first presence of nurdles in samples.
- Survey for presence of microplastics up the food chain.
- Perform stomach content analysis at fishing tournaments to assess presence of fishing debris (e.g., plastic lures, line, rope).

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**Literature Cited**


