Marine Debris Program - 2009 : COMPLETED PROJECT SUMMARY

Project Title: Measuring Plastic Debris in the North Atlantic Ocean **Award Amount:** $ 62,000

Grantee: Sea Education Association, Inc.

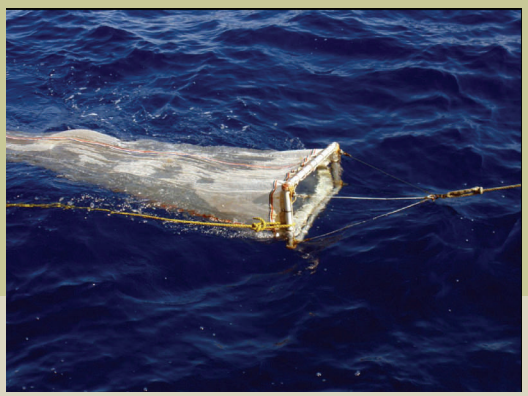
Location: Research cruise will survey 3300 nautical miles of the North Atlantic, from Bermuda east to 40°W, in a saw-tooth cruise track centered around approximately 27°N

Project Term: 04/01/2010—05/31/2011

Results

- Survey the North Atlantic for plastic marine debris.
  - ◊ Sailed on a 34 day expedition to the North Atlantic from Bermuda east to the 40°W longitude to sample plastic marine debris in the water.
  - ◊ Collected more than 48,000 pieces of plastic debris in 128 surface plankton net tows along 30°N latitude.
  - ◊ Collected 23,000 pieces of plastic marine debris in one net tow, which when converted into units of concentration is equivalent to 26 million pieces per square kilometer.
  - ◊ Measured plastic marine debris concentrations greater than 10,000 pieces per square kilometer in each net tow.
  - ◊ Sampled to measured for content of chlorophyll, phosphate, nitrate, and nitrite.
  - ◊ Measured temperature, salinity, density (CTD casts), upper ocean current, wind speed and direction, and turbidity.

- Educate people about plastic marine debris in the North Atlantic.
  - ◊ Created and updated website daily with journal entries, new data, pictures, and 2-3 times a week, videos were uploaded.
  - ◊ Received more than 9,000 unique visits to date through website.
  - ◊ Produced 20 scientific and popular news source publications and interviews about the survey.
  - ◊ Presented results at the SETAC North America Annual Meeting and the 5th International Marine Debris Conference. A scientific manuscript is currently being prepared for submission to a peer reviewed journal.



Summary of Accomplishments:

SEA conducted a 34-day research cruise to the subtropical North Atlantic Ocean, sampling plastic marine debris in 128 plankton net tows between Bermuda and 40 degrees west longitude (the middle of the North Atlantic basin). A cruise website (www.sea.edu/plastics) provided daily updates from sea. The scientific results were presented at the 2010 NOAA Workshop on Microplastic Debris (Tacoma, WA), the 2010 SETAC North America Annual Meeting (Portland, OR), and the Fifth International Marine Debris Conference (Honolulu, HI). Findings have also been communicated through numerous media interviews and public outreach presentations. A manuscript for peer-reviewed publication is also in preparation.

This was one of the first expeditions to sample floating plastic marine debris in the central North Atlantic Ocean, where it is expected to accumulate. Using surface plankton net tows that have been used at SEA for more than 25 years, the long-term plastic marine debris data set was expanded to a previously un sampled region.

The results from the sampling show that plastic debris has accumulated in the central North Atlantic basin in concentrations equal to or greater than the western basin, which SEA has sampled annually for more than 24 years. The eastern extent of the accumulation zone could not be determined from the research cruise; in fact, the largest plastic concentration ever reported (26 million pieces per square kilometer) was observed at the easternmost extent of the cruise track. Thus, the size, extent, and concentration of plastic debris in the North Atlantic accumulation zone remain unknown and in need of further study.

Lessons Learned:

Plastics debris has indeed accumulated in the central North Atlantic basin in concentrations equal to or greater than those in the western basin. The eastern extent of the accumulation zone could not be determined from the research cruise; in fact, the largest plastic concentration ever reported was observed at the easternmost extent of the cruise track. Thus, the size, extent, and concentration of plastic debris in the North Atlantic accumulation zone remain unknown and in need of further study.

Preliminary analysis by collaborators at Woods Hole Oceanographic Institution and Marine Biological Laboratory indicates that diverse microbial communities live on plastic debris, and that the communities on the debris are different from those in surrounding seawater and nearby *Sargassum* (a natural floating substrate). Scanning electron microscopy shows a variety of microbes frequently residing in pits, divots, or grooves in the plastic and giving the appearance of "burning coals in snow". While suggestive of microbial degradation of the plastic material, further analysis is required to determine if the microbes are actually metabolizing the plastic, or if they have simply settled in previously degraded areas on the plastic surface (i.e. physically degraded by weathering and mechanical action).

Additional information about the projects and grant opportunities supported by the Marine Debris 2009 program can be found at www.nfwf.org/marinedebris