



# Analysis of Phytoplankton and Microplastics from ECOA-3 Cruise in the Gulf of Maine Using Flow Imaging Microscopy

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## Introduction

### Gulf of Maine Cruise, August 2022

- Nova Scotia to New Hampshire
- Stations 1-44, each station was measured with the FlowCam at 3 depths; surface, 15m, and 30m.
- ECOA cruise done every 4 years to conduct long term research on climate and the ocean's biogeochemistry.
- Data is in collaboration with Dr. Joaquim of Columbia Lamont-Doherty.

### Focused Questions:

- What is the distribution of Potential Microplastics in the Gulf of Maine?
- Are there spatial trends in Potential Microplastics and Phytoplankton distribution in the Gulf of Maine?

## Phytoplankton & Potential Microplastics

- **Diatoms**
  - Chaetoceros
  - Cocinodiscus
  - Ditylum
  - Skeletonema
  - Thalassiosira
- **Dinoflagellates**
  - Ceratium

### What is a Microplastic?

- The field of microplastics is new and emerging.
- Must be less than 5 millimeters in size & made of plastic debris.
- A contaminant and ubiquitous in the marine environment.
- Bioaccumulation effects are being studied.

**Air Bubble or Microplastic?**

-Representative of the various shapes presented in the data. (8 of 1258)

-46.8% are of circular/ovular shape.

**Possible Categorization**

- 1 & 2 microbeads
- 3, 5, 6, & 8 fragments
- 4 fiber
- 7 fiber or organic root

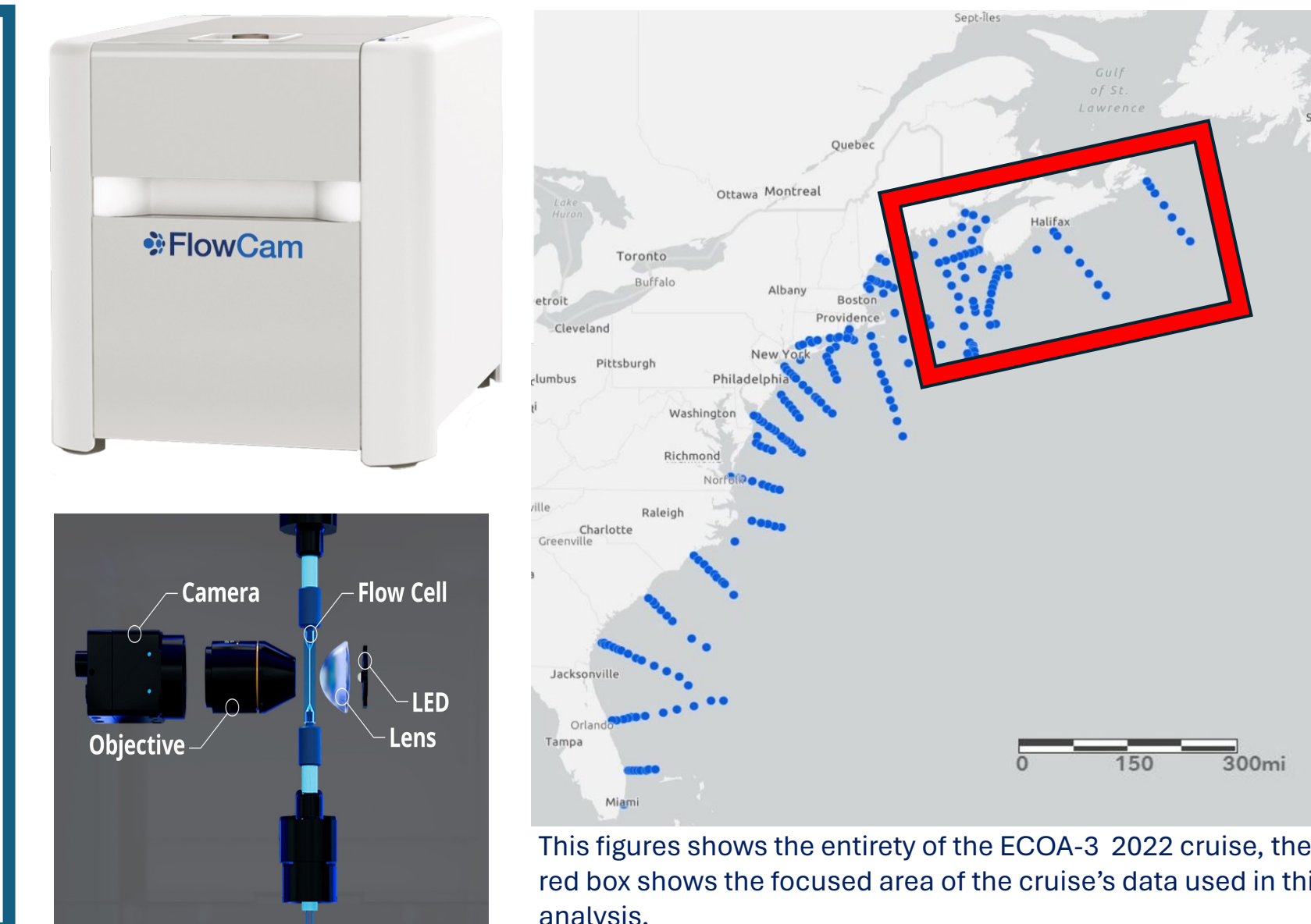
-Representative of 2.2% of Microplastics (3 of 28)

-Currently the definition of a microplastic is under investigation, for some these are air bubbles, & to others these are microplastics.

The paper "Microplastics' Shape and Morphology Analysis in the Presence of Natural Organic Matter Using Flow Imaging Microscopy" by Kim, et. Al. shows similar images and considers them as microplastics and not air bubbles.

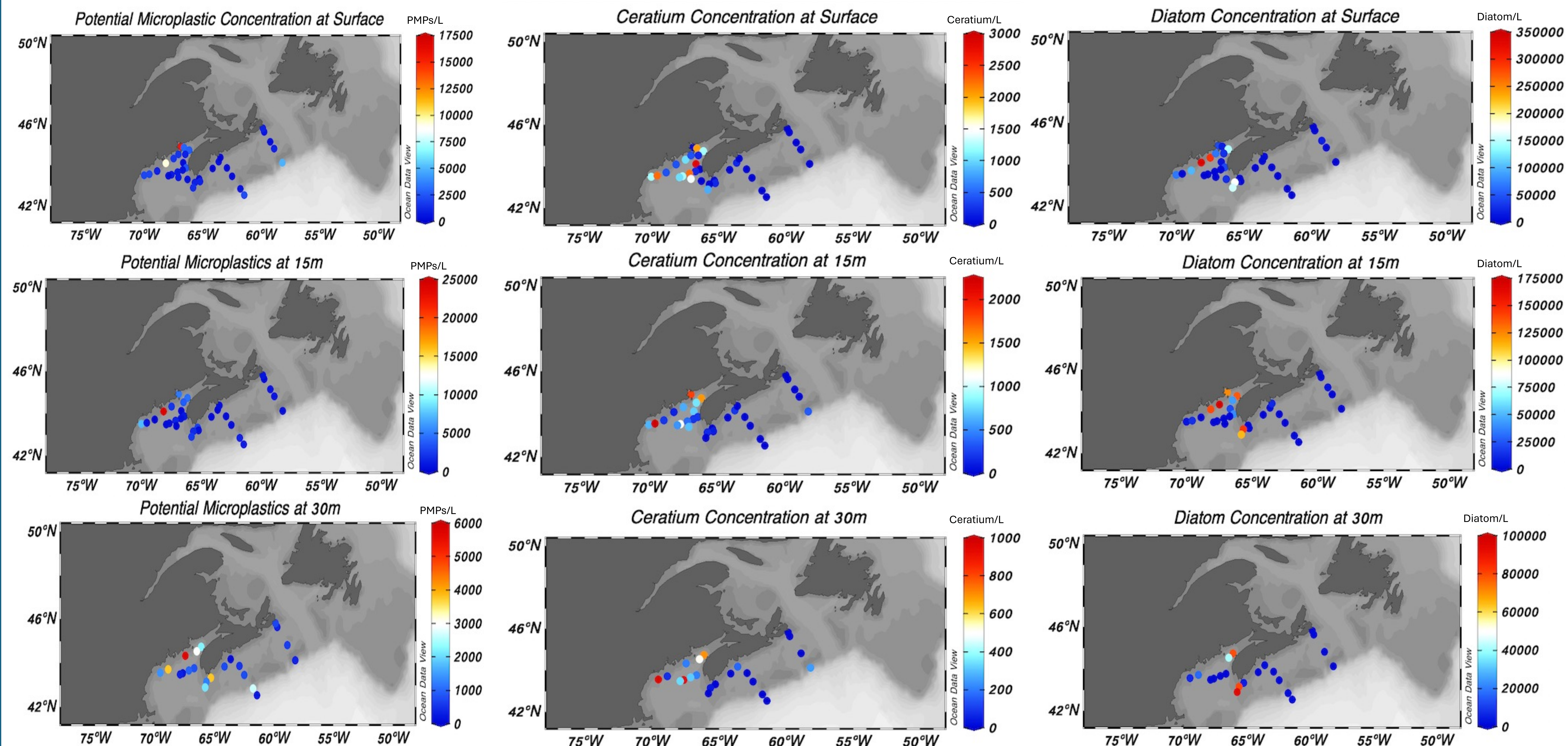
## Methods

- **FlowCam** used to distinguish composition and biovolume with flow through imaging microscopy.
- 4.9ml of water sample injected, selected 30-1000 micron size range of particles.
- **VisualSpreadsheet**® a data analysis software program used to process, filter, and quantify the FlowCam images, 60 hours of manually categorizing images.
- Quantified data inputted to Excel and concentrations calculated by ...  
**(total number of particles at a specific station/depth /4.9)\*1000ml**
- **Ocean Data View (ODV)** a software data package used for visualization and analysis of oceanographic data (created the 9 figures in the results section).



## Results- Nova Scotia to New Hampshire Cruise

Stations 1-44 summed particles	Potential Microplastics	[Potential Microplastics] PMPs/L	Ceratium	[Ceratium] Cells/L	Chaetoceros	[Chaetoceros] Cells/L	Cocinodiscus	[Cocinodiscus] Cells/L	Ditylum	[Ditylum] Cells/L	Skeletonema	[Skeletonema] Cells/L	Thalassiosira	[Thalassiosira] Cells/L
Surface	443	90,408	109	22,245	62	12,653	33	6,735	43	8,776	6,887	1,405,510	118	24,082
15m	443	90,408	87	17,755	26	5,306	49	10,000	77	15,714	5,249	1,071,220	173	35,306
30m	372	75,918	25	5,102	37	7,551	41	8,367	54	11,020	2,205	450,000	90	18,367



## Trends

- Higher overall abundance of Potential Microplastics and Phytoplankton in the Gulf of Maine compared to Nova Scotia.
- There was a higher abundance of Potential Microplastics at all three depths besides that of Skeletonema.
- Locations of high productivity also have high rates of Potential Microplastic abundance.
- Ceratium had a higher biomass in the Gulf of Maine compared to Nova Scotia.
- The abundance of Potential Microplastics and Phytoplankton decreases with increased depth.

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