Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in the Biscayne Bay Surface and Deep Water Profiles

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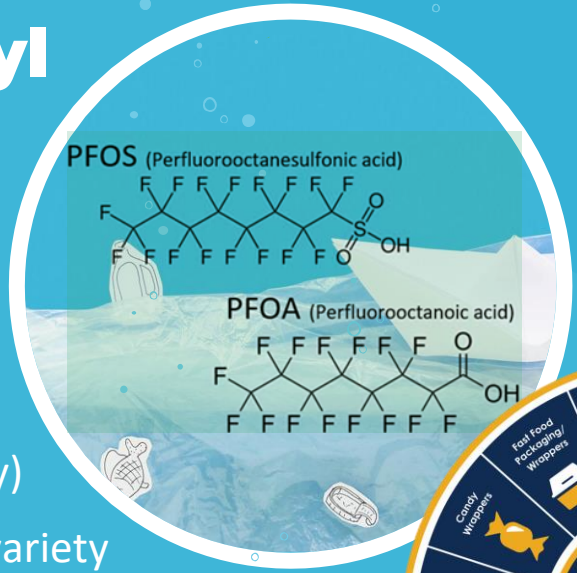
01
What is PFAS?

Discussion of Why the Detection of This Compound
Is Important and Experimental Hypotheses

Per- and Polyfluoroalkyl Substances (PFAS)

- Group of synthetic chemicals composed of fluorine atoms attached to alkyl chains
- Bonds are chemically and thermally stable. (The Strongest Bond In Organic Chemistry)
- First Record of Creation in the 1930s for a variety of applications (Ross, 2019).
  - Non-Stick Cookware
  - Fire Extinguishing Foam
- Linked To Toxic Effects in the 1970s – 1980s



(RPU Water Systems, 2020 - Example of PFAS and Possible Sources)

- Biscayne Bay is an important South Florida Resource with a Vibrant Ecosystem
  - Estuary: freshwater from inland meets the saltwater of an ocean

  (favorable environment for many organisms)

- Hypotheses
  - Spatial distribution of PFAS will be across the Bay (West to East) with a decline in concentrations
  - Surface water samples will be of higher concentrations than deep samples
  - Total PFAS in the Atlantic will be of lower concentrations in comparison to the Bay

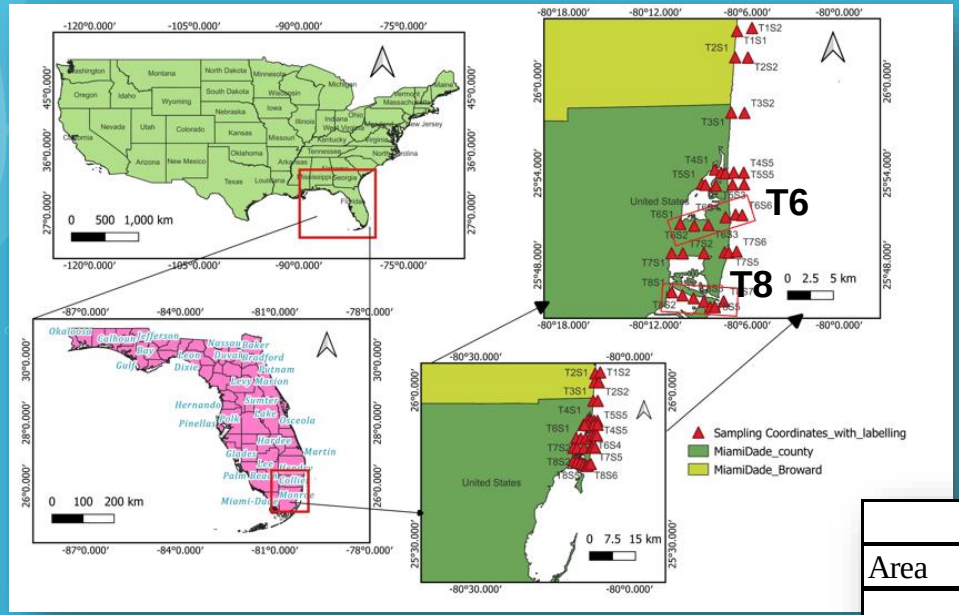
(Salman, 2022 – Biscayne Bay Aerial View)

Study and Sample Collection Area

02
Methodology

Explanation Behind Sample Collection, Sample Preparation, and Instrumental Analysis

Sample Collection (Field Work)



(Ogunbiyi – Sample Collection Map)

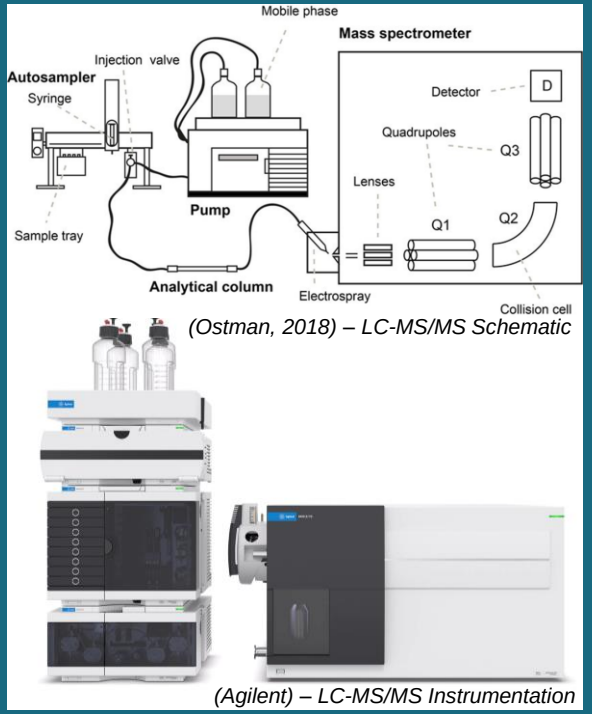
- Sampling Areas
  - Intercoastal (Biscayne Bay)
  - Coastal (Atlantic Ocean)
- Focus Areas
  - Transect 6 (T6) ~ Little River
  - Transect 8 (T8) ~ Downtown Miami
- Volume of each sample = 500mL

Sample Collection (N = 30)							
Area	Biscayne Bay				Atlantic (Nearshore and Offshore)		
Depth	Surface (1m)		Bottom (Max Depth)		Surface (0.3m)	Middle (3m)	Deep (10m)
Transect	T6	T8	T6	T8	T6/T8	T6/T8	T6/T8
# of Samples	4	5	4	5	2	2	2

Sample Preparation & Instrumental Analysis (Lab Work)

250mL of Sample + 19 - PFAS Internal Standard (IS) Mixture

Solid Phase Extraction (SPE) with Weak Anion Column

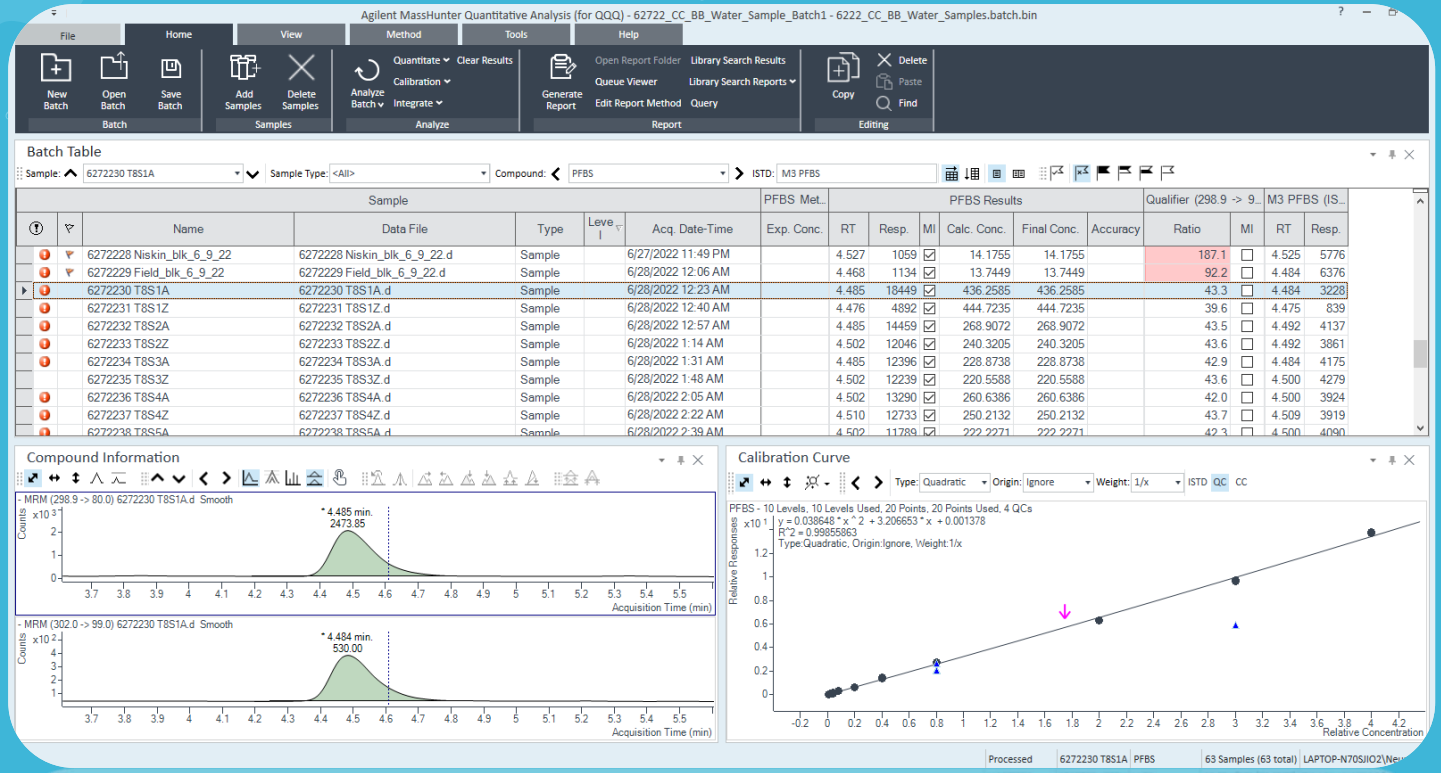


(Ostman, 2018) – LC-MS/MS Schematic

(Agilent) – LC-MS/MS Instrumentation

Liquid Chromatography Coupled with Tandem Mass Spectrometer (LC-MS/MS)

Data Processing

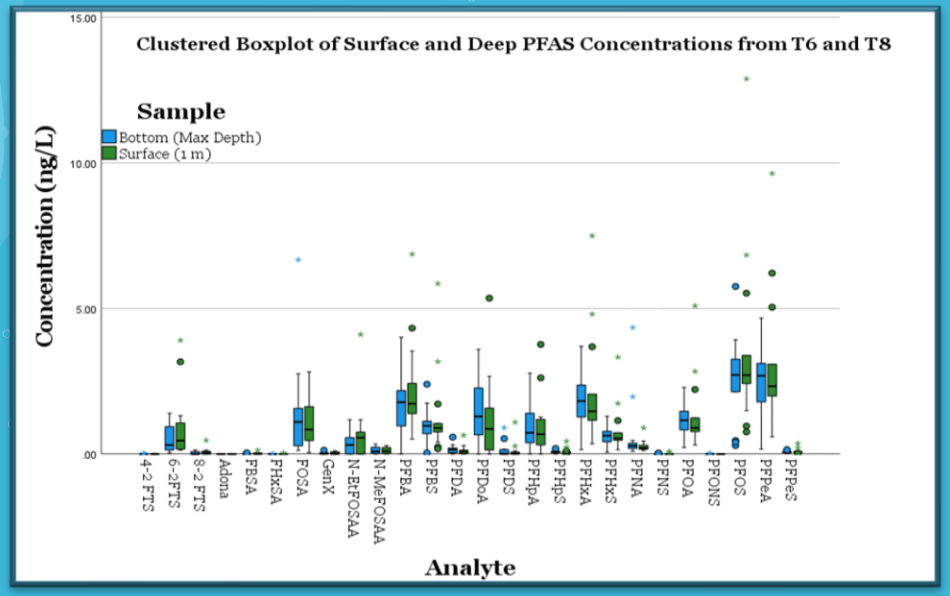


Agilent Interface (MassHunter Software) to integrate chromatograms

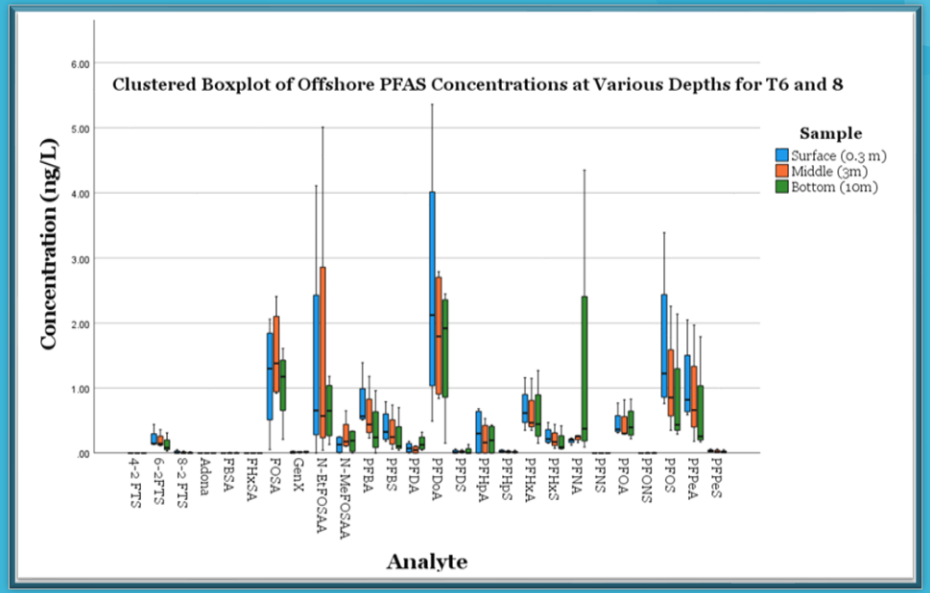
03
Results

Translated Data Providing PFAS Concentrations
For Sample Collection Area

Boxplots of PFAS Concentrations Across T6 and T8

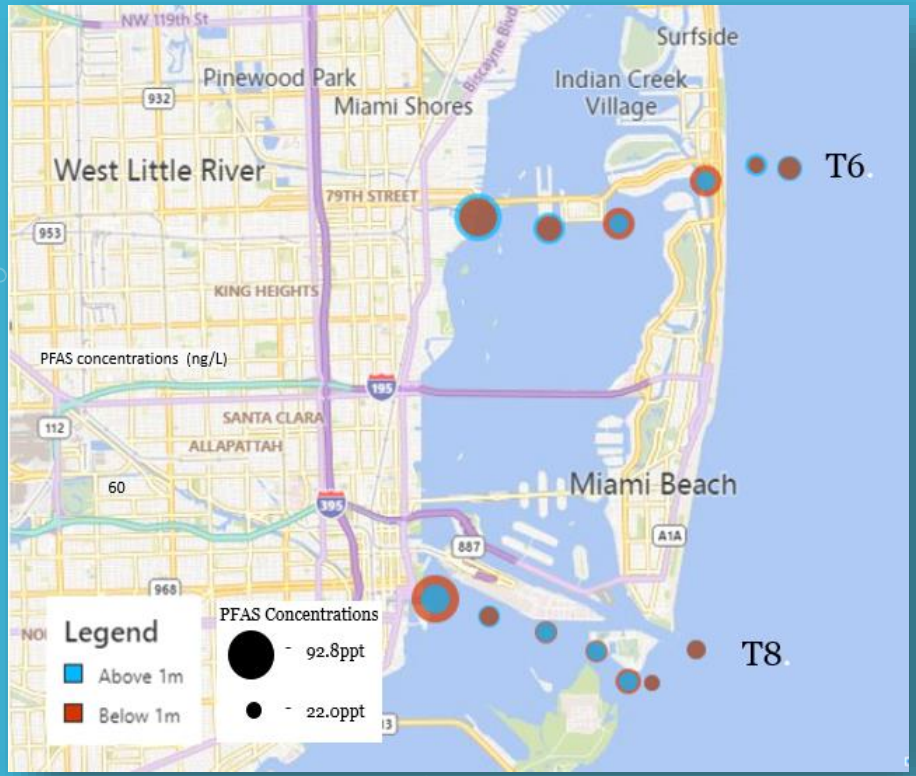


(Figure 1) - PFAS Surface vs. Deep water profiles in the Bay

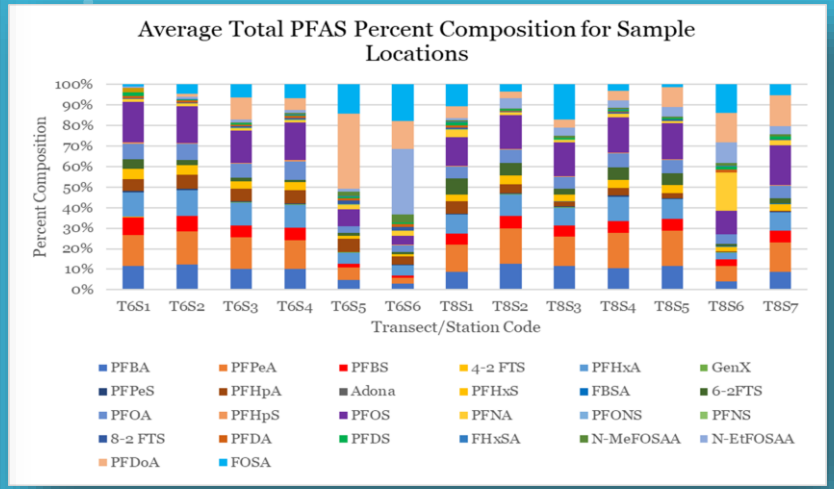


(Figure 2) - PFAS Surface vs. Deep Profiles of Offshore Samples

Total PFAS Concentration & Spatial Distribution



(Figure 3) - PFAS distribution in the Biscayne Bay



(Figure 4) - Total PFAS composition in surface and deep water of Biscayne Bay

04
Conclusions

Interpretation of the Data: PFAS Concentrations and Distributions

Major Conclusions

- Total PFAS ranged from 15.5 to 92.8 ng/L
- Major PFAS detected in Biscayne Bay:
  - PFBA
  - PFPeA
  - PFHxA
  - PFOS
- PFAS concentrations decreased from West to East (from closer to canals/coastal areas to offshore).

- Offshore PFAS concentrations
  - Average of Total PFAS: 10.6 ng/L
- Bay PFAS concentrations
  - Average of Total PFAS: 23.2 ng/L
- PFAS Levels
  - T6: Surface > Deep; for 4 out of 6 Stations
  - T8: Deep > Surface; for 4 out of 7 Stations
  - Higher PFAS levels (such as PFOS) in deep water from the Miami River are likely related to wastewater intrusion and septic tanks.

Thank You

Scan or Take a Picture To Learn More about the Research Conducted In The PFAS Lab!

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NSF

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