

Emerging Contaminant Surveillance: A Pilot of Evaluating PFAS at Cape Cod Waterbodies

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What are PFAS?

PFAS = Per- and polyfluoroalkyl substances

- In widespread use since the 1950s
- Resistant to water, grease, stains
- Have been used in:
 - Firefighting foam
 - Industrial processes
 - Consumer products (e.g., on-stick cookware)



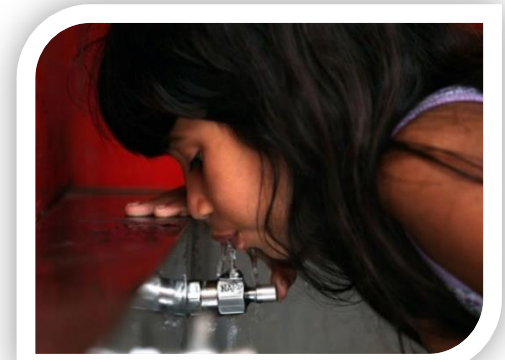
What are PFAS?

PFOS and PFOA most extensively produced and studied PFAS chemicals:

| Abbreviation | Chemical name |
|--------------|------------------------------|
| PFHxS | Perfluorohexanesulfonic acid |
| PFHpA | Perfluoroheptanoic acid |
| PFOA | Perfluorooctanoic acid |
| PFOS | Perfluorooctanesulfonic acid |
| PFNA | Perfluorononanoic acid |
| PFDA | Perfluorodecanoic acid |

How is PFAS Regulated?

- MassDEP regulates drinking water under the federal Safe Drinking Water Act.
- Enforceable level of PFAS in drinking water (MCL) established by DEP October, 2020
 - PFOS + PFOA + PFNA + PFHpA + PFHxS + PFDA = 20 ppt
 - ppt = parts per trillion (one part per trillion = one grain of sand in an Olympic-size swimming pool)
- MA Drinking Water Standard is more stringent than Federal EPA Guideline
- DEP also established standards for PFAS clean-up at hazardous waste sites



How are we exposed to PFAS?

- Nearly all people are exposed via food and consumer products
- Some are exposed from drinking water contaminated with PFAS
 - Local or site-related contamination near industrial facilities or where firefighting foam used (e.g., airports)

Since 1999, the National Health and Nutrition Examination Survey (NHANES) has measured PFAS levels in blood in the U.S. population. Most people in the United States have been exposed to PFAS and have PFAS in their blood.



DPH Activities to Address PFAS



- DPH Regulates PFAS in drinking water sold in Massachusetts
- Respond to individual and community concerns on health risks from previous exposure to PFAS contaminated water, including review, analysis and reporting of health outcome data
- **Conduct PFAS surveillance at recreational waterbodies**
 - Measure levels in surface water and evaluate risks to swimmers
 - Measure levels in freshwater fish and evaluate fish consumption risks
- Coordinate with MassDEP and DMF on approach to sample shellfish for site-related contamination in Bourne
- Development of PFAS educational materials for training primary care providers

Recreational Waterbody Focus

- Recreational waterbodies that are used for swimming as public and semi-public beaches are regulated by MDPH
- Two types of “beaches” are subject to MDPH regulations:
 1. Public — open to general public (e.g., town and state beaches)
 2. Semi-public — open to individuals through a common access (e.g., hotels, condo associations, camps)



Pilot Effort: Collection of Surface Water and Fish Samples on Cape Cod

- Permitted public or semi-public bathing beaches (n = 16)

Sampling Locations

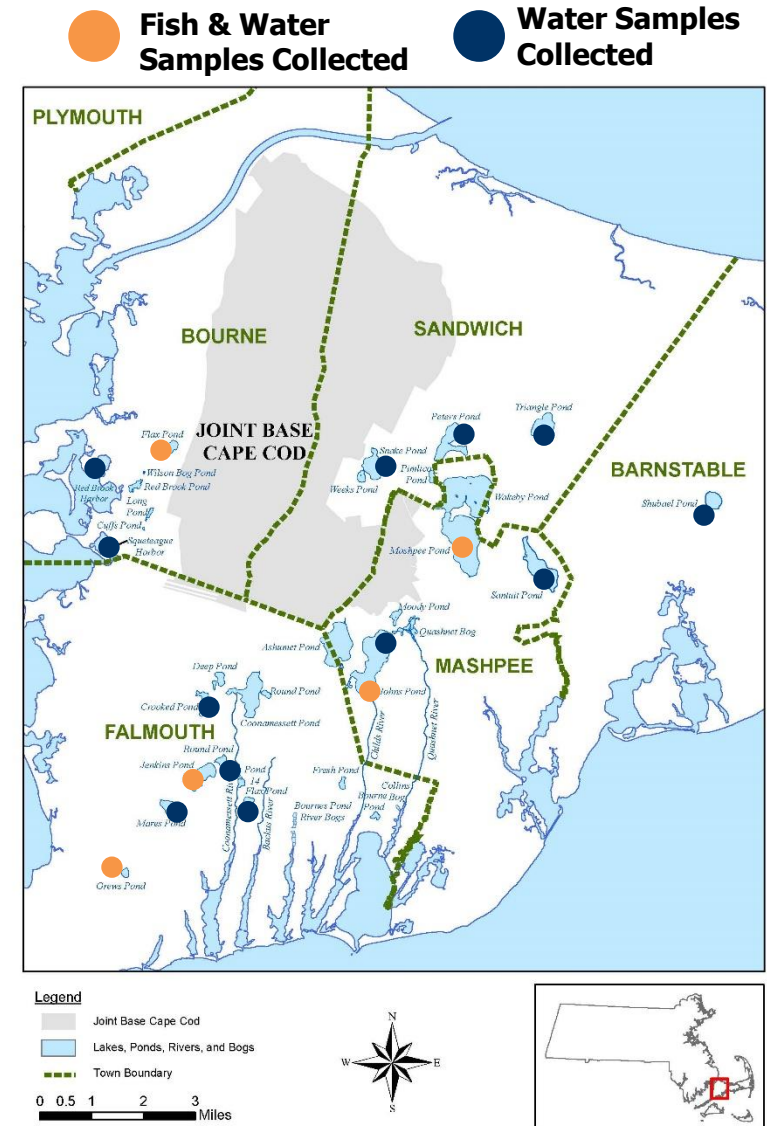
| Location | Waterbody |
|------------|--------------------------|
| Barnstable | Shubael Pond |
| Bourne | Squeteague Harbor |
| | Hen Cove |
| | Flax Pond (Picture Lake) |
| Sandwich | Snake Pond |
| | Peter's Pond |
| | Triangle Pond |
| | Santuit Pond |
| Mashpee | Mashpee-Wakeby Pond |
| | Johns Pond |
| Falmouth | Crooked Pond |
| | Round Pond |
| | Flax Pond |
| | Jenkins Pond |
| | Mares Pond |
| | Grews Pond |

Pilot Effort: Collection of Surface Water and Fish Samples on Cape Cod

- Permitted public or semi-public bathing beaches (n = 16)

Sampling Locations

| Location | Waterbody | # of Water Samples | # Fish Samples |
|------------|--------------------------|--------------------|----------------|
| Barnstable | Shubael Pond | 1 | - |
| Bourne | Squeteague Harbor | 1 | - |
| | Hen Cove | 1 | - |
| | Flax Pond (Picture Lake) | 1 | 9 |
| Sandwich | Snake Pond | 1 | - |
| | Peter's Pond | 2 | - |
| | Triangle Pond | 1 | - |
| Mashpee | Santuit Pond | 1 | - |
| | Mashpee-Wakeby Pond | 2 | 16 |
| | Johns Pond | 1 | 17 |
| Falmouth | Crooked Pond | 1 | - |
| | Round Pond | 1 | - |
| | Flax Pond | 1 | - |
| | Jenkins Pond | 2 | 5 |
| | Mares Pond | 1 | - |
| | Grews Pond | 1 | 4 |



20 PFAS Analytes Included in this Assessment

| | |
|--------------------------------------|--|
| Perfluorobutanoate (PFBA) | 6:2 fluorotelomersulfonate (6:2 FTS) |
| Perfluoropentanoate (PFPeA) | 8:2 fluorotelomersulfonate (8:2 FTS) |
| Perfluorohexanoate (PFHxA) | N-Methylperfluorooctanesulfonamidoacetic acid (N-MeFOSAA) |
| Perfluoroheptanoic acid (PFHpA) | N-Ethylperfluorooctanesulfonamidoacetic acid (N-EtFOSAA) |
| Perfluorooctanoate (PFOA) | Perfluorooctanesulfonamide (PFOSA) |
| Perfluorononanoate (PFNA) | N-Methylperfluorooctanesulfonamide (N-MeFOSA) |
| Perfluorodecanoate (PFDA) | N-Ethylperfluorooctanesulfonamide (N-EtFOSA) |
| Perfluoroundecanoate (PFUnA) | N-Methylperfluorooctanesulfonamidoethanol (N-MeFOSE) |
| Perfluorododecanoate (PFDoA) | N-Ethylperfluorooctanesulfonamidoethanol (N-EtFOSE) |
| Perfluorotridecanoate (PFTrDA) | Perfluoro-2-propoxypropanoate (HFPO-DA) |
| Perfluorotetradecanoate (PFTeDA) | 4-dioxa-3H-perfluorononanoate (ADONA) |
| Perfluorobutanesulfonate (PFBS) | 9-chlorohexadecafluoro-3-oxanonane-1-sulfonate (9Cl-PF3ONS) |
| Perfluoropentanesulfonate (PFPeS) | 11-chloroeicosafluoro-3-oxaundecane-1-sulfonate (11Cl-PF3OUdS) |
| Perfluorohexanesulfonate (PFHxS) | 3:3 perfluorohexanoic acid (3:3 FTCA) |
| Perfluoroheptanesulfonate (PFHpS) | 5:3 perfluorooctanoic acid (5:3 FTCA) |
| Perfluorooctanesulfonate (PFOS) | 7:3 perfluorodecanoic acid (7:3 FTCA) |
| Perfluorononanesulfonate (PFNS) | Perfluoro(2-ethoxyethane)sulfonic acid (PFEEESA) |
| Perfluorodecanesulfonate (PFDS) | Perfluoro-4-methoxybutanoate (PFMBA) |
| Perfluorododecanesulfonate (PFDoS) | Perfluoro-3-methoxypropanoate (PFMPA) |
| 4:2 fluorotelomersulfonate (4:2 FTS) | Perfluoro-3,6-dioxaheptanoate (NFDHA) |

**PFAS included in “PFAS sum6” regulation by
MassDEP**

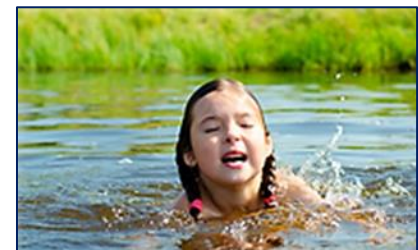
Fish Sample Collection

The field team collected a total of 51 fish samples from 5 waterbodies

| Waterbody | Location | Samples Collected |
|--------------------------|----------|---|
| Flax Pond (Picture Lake) | Bourne | 8 Bluegill 1 Yellow Perch |
| Mashpee-Wakeby Pond | Mashpee | 1 Largemouth Bass 3 Chain Pickerel 3 Yellow Perch 2 White Sucker, 3 Smallmouth Bass 3 Pumpkinseed Sunfish 1 White Perch |
| Johns Pond | Mashpee | 3 Largemouth Bass 3 Yellow Perch 4 White Perch 3 Bluegill 3 Pumpkinseed Sunfish 1 Chain Pickerel |
| Jenkins Pond | Falmouth | 2 Largemouth Bass 2 Smallmouth Bass 1 Yellow Bullhead |
| Grews Pond | Falmouth | 4 Bluegill |

Analysis of Surface Water Data

- PFAS concentrations in water will be evaluated using a three step process, where the measured level in surface water is compared to:
 1. The MassDEP Maximum Contaminant Level (MCL) for PFAS in drinking water. If exceeded (greater than), then:
 2. A “Screening Value” used to indicate when unlimited swimming by the most sensitive person would be unsafe. If exceeded, then:
 3. A “Risk Assessment” that uses specific “reasonable” and “maximum” estimates of exposure, based on realistic estimates of parameters such as time spent swimming, or amount of water ingested while swimming.



Analysis of Fish Data

- PFAS concentrations in fish tissue are evaluated to calculate a level of daily PFAS exposure for a hypothetical person, using:
 - *Reasonable Maximum Exposure*: based on someone who might consume locally caught fish, from the same waterbody, daily
 - *Average or Typical Exposure*: based on more typical values for recreational fish consumption (weekly or monthly consumption, from the same waterbody)
- Level of daily PFAS ingestion then compared to established levels for a safe amount of daily PFAS ingestion.
- Waterbody-specific fish consumption advisories are then issued to ensure an individual does not exceed the safe daily dose.



For Additional Information

MDPH Recreational Use of Waterbodies on or Near Joint Base Cape Cod

<https://www.mass.gov/doc/recreational-use-of-waterbodies-on-or-near-joint-base-cape-cod-jbcc/download>

MassDEP Background on Per- and Polyfluoroalkyl Substances

<https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas>

MDPH Public Health Fish Consumption Advisory Portal

https://eohhs.ehs.state.ma.us/dph_fishadvisory/default.aspx

MDPH Advice on Eating fish safely in Massachusetts

<https://www.mass.gov/info-details/eating-fish-safely-in-massachusetts>

For additional information, contact the Environmental Toxicology Program at the:

Massachusetts Department of Public Health (MDPH)

Bureau of Environmental Health

617-624-5757 - DPHToxicology@mass.gov

<https://www.mass.gov/orgs/bureau-of-environmental-health>